Perceptions on the influence of wearable devices on life and work satisfaction

Based on qualitative and quantitative research methods

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Affidavit

I hereby affirm that this Master's Thesis represents my own written work and that I have used no sources and aids other than those indicated. All passages quoted from publications or paraphrased from these sources are properly cited and attributed.

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Abstract

Technological development in the past decades led to productivity increases in various fields and cost decreases for firms by deploying them. But personnel of those firms was suffering from changes at their workplace and potential job losses due to that higher productivity. Less people had been able to do more by making use of the technological advances. Still fostering for further improvements in productivity companies constantly try to deploy new technologies at the workplace and wearable technology could be the next big technological leap.

With little knowledge in if wearable technology offers any effects on physical health or potential negative changes in psychological traits wearable devices started to spread in private as well as corporate spheres. Critical voices raised awareness on potential security issues which can evolve out of misuse of the technology at the workplace, but they are widely unheard. Research has unveiled that the use of wearable devices in a competitive set can even lead to psychological problems. Unfortunately, at the current time point there is a lack of research papers which elaborates on the impact of the technology at the workplace. Observing the current development, it is visible that research needs to be performed.

For this explorative research, a mixed methods approach was chosen. The first component is a quantitative analysis focusing on what factors influence the openness and acceptance of wearable devices at the workplace by looking on single factors as well as creating a linear regression model with multiple influences. The second component consists of a 4-week-long experiment where participants wear a wearable device over this period and report their perceptions. That part is dedicated to exploring what people perceive by wearing such a device for a short timeframe and if life and/or work satisfaction change in their opinion.

The outcome of this research paper is that wearable technology can meaningfully be implemented at the workplace and has a beneficial impact on life and work satisfaction as well as influences work-life balance positively. But employers need to be aware of different levels of openness and acceptance of their employees and that the characteristics on how wearable devices are implemented at the workplace play a major role in the success of wearable devices at the workplace.

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WD	Wearable Device
WLB	Work-Life Balance
WHO	World Health Organization
PwC	Pricewaterhouse Coopers

1. Introduction

The oldest company according to current documentation was founded in Japan in 578. Kongo-Gumi was a family run business which was specialized on the construction of temples and shrines for 1.428 years (Hutcheson, 2007; Takamatsu Constrcution Group, n.d.). Focused on expanding the supremacy of the Dutch, Dutch East India Company was found in 1602 as the first publicly traded company with limited liability, laying the base for future globally operating companies (Encyclopaedia Britannica, 2015; Taylor, 2013). They both have in common that they constantly innovated their business to stay in the market for a longer time-period. Driven by a specific type of innovation, process innovation of firms, Frederick Winslow Taylor presented a management philosophy called Scientific Management. The goal of this concept is to achieve maximum productivity by improving processes in the manufacturing process to generate higher profits (Enyclopaedia Britannica, 2009; The Economist, 2009). This management philosophy empowered Henry Ford to induce mass production for automobiles. He was the first who offered cars to the middle class by reducing production time from 12 to 2.5 hours per car (History, n.d.). A few decades later a further big step was achieved in revolutionizing the cost structure of companies. In the 1980s the computer started to increase its importance at the workplace, enabling companies to speed up processes (Rosow, 1984). The potential importance of artificial intelligence in future raises a high amount of questions, people are asking how likely their job could be replaced by a machine and when will this happen (The Economist, 2016). Actual development is not less worrisome, the idea of surveillance introduced in the concept of Scientific Management becomes more real and ubiquitous than ever. Current software allows employers to track the behaviour of employees by capturing what they do on their computers. Other technology firms go even further, they observe what people are doing and even eating by installing cameras or give them mobile phones to constantly track their position (The Economist, 2017). The newest products on the market which promote ubiquitous surveillance are wearable devices and they already found their way into private as well as business life. They occur in different formats such as badges, fitness trackers and smart watches depending on the prospected use case identified. What they all have in common is that they can easily be attached to the operator and constantly capture data: his or her steps, voice and heart rate. This gives operators

as well as employers with access to this data valuable information on the person who wear the device (Techopedia, n.d.; Investopedia, b, n.d.; Springer Gabler Verlag, n.d.).

In contrast to the widely promoted concept of Scientific Management an antagonist was provided by Elton Mayo presented as the Hawthorne effect. Mayo showed with his research conducted in the late 1920s and early 1930s that being concerned about someone's working conditions and corresponding adaptions has a significant effect on the generated output. The movement led to strong increases in improvement of work satisfaction over the last years and work-life balance became an important topic (Investopedia, a, n.d.; The Economist, 2008; Gallup, 2017). The acceptance of this concept in our society, which considers well-being of employees as a very important aspect, led to that producers of wearable devices focused their marketing activities on positioning their devices as means for a healthier life. They promote their devices as gadgets to monitor one's health and benefit from the collection and constant evaluation from the generated data leading to improved general well-being. In communication between businesses they take another approach, companies like Fitbit offer special software for employers only to give them a tool to monitor effectively the data collected from wearable devices worn by employees (Fitbit, 2015; Fitbit, n.d.a; Fitbit, n.d.b).

Observing the status-quo it is clear that objective research is rare. Current researches elaborated on long term health benefits by evaluating the step count over 1 year or longer, in private life as well as professional. These papers completely ignore the impact of the technology on two main points life and work satisfaction. As wearable devices intrude into the working space and start to become state of the art as computers did a few centuries ago it is important to elaborate on these two aspects. Therefore, this study is dedicated to creating knowledge by elaborating on the impact of wearable devices on life and work satisfaction. Secondly additional findings will be reported if discovered such as the potential effect of the technology on work-life balance and emotional traits.

2. Satisfaction with Life

The topic of life satisfaction can be perceived as one of the most important and most vague concepts according to literature. Ed Diener, a veteran in studies focusing on the psychology of well-being sees subjective well-being as an important influencer on life satisfaction, health and longevity. His satisfaction with life scale, where he evaluated satisfaction with life by using 5 factors set the base for further researches on this topic (Diener, n.d.; Diener & Chan, 2011; Diener, et. al 1985). Mariano Rojas (2005) on the other side promotes his model named Conceptual Referent Theory of Happiness stating that happiness influences the reality of an individual and so his or her satisfaction with life. In contrast, Kreitler Sulamith and Michal (2006) see life satisfaction as a topic which needs to be explained by 17 variables such as physical health, active living, sexuality, social functioning and meaningfulness of life. Their model was able to be factored in 5 groups: Physical Functioning, Emotional Functioning, Cognitive Functioning, Social Functioning and Perceived Coping, explaining the concept of multidimensional quality of life.

The evaluation of satisfaction with life can also be divided into subjective and psychological well-being. Subjective well-being, also known as hedonic point of view focuses on the individual judgement on life satisfaction (Schwarz, Diener, & Kahneman, 1999; Pavot, 2008). In order to evaluate subjective well-being Schimmack & Diener (1997) suggest comparing someone's life with a pre-defined standard by deducting experienced negative emotions from the number of positive ones, without taking their individual impact strength. The eudaimonic or psychological well-being represents "the striving for perfection that represents the realization of one's true potential" (Ryff, p.100, 1995). Ryff (1989) describes six variables to define this framework: self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life and personal growth. The research on personality traits made Costa and McCrae (1992) create the big five model, explaining a significant variance of psychological well-being based on following variables: Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness.

With the focus on variables influencing directly or indirectly life satisfaction this paper clusters these in personal and work-related variables. One prominent personal factor among many is the availability of human capital, which includes literacy, numeracy,

problem solving and reading skills. It is believed that these factors determine the level of subjective well-being, boost physical health and personal satisfaction (Cornali, 2015). The research performed by Krok (2015) presents that religiousness has also an effect on satisfaction with life by directly affecting meaning in life, which is one variable of the multidimensional approach of Kreitler and Kreitler (2006). Another variable affecting subjective well-being is the practice of gratitude. Researchers from New York have discovered that the motivation and variety of gratitude actions improves well-being on various scales and life satisfaction (Sawka-Miller & Miller, 2016). Frison and Eggermont (2016) performed a research on social media and its impact on life satisfaction and came to the conclusion that upwards comparison to other people negatively affects it and low life satisfactions alters upwards comparison on social media. Unveiling that their research presents longitudinal and reciprocal relations between these two factors.

As people spend a significant amount of time at work, variables derived from the workplace also influence general life satisfaction, they can occur as direct and indirect influencers of life satisfaction. The most commonly described are work-life balance and organizational commitment, which will be described in the following chapter in detail (Schilling, 2016).

Strengthening the statement in the beginning of this chapter that life satisfaction can be perceived as a vague concept. The sheer variety of directly and indirectly influencing variables as well as methods of research presented by this research increase the complexity of this topic. Depending on the focus of the cited researchers, approaches of measurement do not vary only in their methodology, completely different concepts with varying number of influencing factors are taken to explain satisfaction with life. For this reason, a questionnaire was constructed for this research by taking specific hedonic personality variables based on Kreitler Sulamith's and Michal's model of 17 explanatory variables with the aim to present the impact of wearable devices on life satisfaction and derived variables.

3. Satisfaction at Work

According to literature and online resources employees spend a fair amount of their life at the workplace. For example, Mexicans and people from Puerto Rico dedicate more than 25% of the year at their workplace and Europeans around 20%. This is a reason why research focusing on work satisfaction gained momentum over the last years. But this is not only done for humanitarian reasons, economists expect benefits like increasing productivity, cost reduction and lower workforce turnover out of creating a more satisfactory work environment (Lease, 1998; Smith, 2017). Referring to the Gallup (2017) survey on work and workplace satisfaction it can be assumed that the performed research has positively influenced people's satisfaction. In 1993, 46% of participants were completely satisfied, 33% somewhat satisfied and 11% completely dissatisfied. Positively, in 2017, 60% of the survey people where completely satisfied and only 3% completely dissatisfied.

One of the earliest definitions of Job Satisfaction was published by Locke (1969) stating that job satisfaction is the "pleasable emotional state that results from the appraisal of one's job as achieving or facilitating one's job values" (p.317). Job dissatisfaction is "the unpleasable emotional state resulting from the appraisal of one's job as frustrating or blocking the attainment of one's values" (p.317). Following the main idea of Locke, Lease (1998) describes satisfaction at work by focusing on attitudes. Attitudes towards work are developed through dispositional affectivity. Positive affectivity leads to a positive experience towards work, whereas a negative one lowers the level, the balance of these two influences satisfaction or work depending on the values. Weiss (2002) strengthens the idea of attitudes by stating that job satisfaction does not base on affective reactions, rather it does by making evaluations or evaluative judgements. Hackmann and Oldham (1975) payed attention on intrinsic motivation at work and developed a concept which states that core job dimensions: skill variety, task identity and task significance have a direct effect on psychological states such as meaningfulness, responsibility leading to positive or negative outcomes in work motivation, work performance, work satisfaction and absenteeism. One further influencing factor is organizational commitment, according to the concept of Allen and Meyer (1990) which was built on three commitment components: affective, normative and continuance. The affective component describes the emotional binding between employee and

employer, normative component reflects the work performed by being loyal and responsible, whereas continuance focuses on explaining the perceived need of staying in one company based on potential alternative outcomes. Positioning on the gains of measures taken, several authors did prove that satisfaction at work has a relationship between several factors such as organizational commitment, behaviour at work, general job performance and physical and psychological health. Vargas et. al (2017) have revealed thatthe affective commitment has a strong effect on vigor, a potentially more desired attitude perceived by employers.

In terms of evaluating job satisfaction there is a sheer variety of concepts which specialized on broader or more specific factors. To determine a global overview on satisfaction at work Spector (1997) created the Job Satisfaction Survey and an underlying evaluation of it. This method evaluates 9 job-related facets, each containing 4 subaspects, such as benefits, co-workers, operating procedures and pay as single and total outcomes revealing positive and negative aspects and potential improvements at the workplace. The most popular survey towards evaluating job facets was introduced by Smith, Kendall and Hulin (1969) – the Job Descriptive Index. In contrast to the more extensive survey from Spector the researchers considered 5 aspects only: Work, Pay, Promotion, Supervision and Co-workers containing between 9 and 18 items each. Further scales like the Minnesota Satisfaction Questionnaire and Job Diagnostic Survey were developed by various researches in order to give further insights or a more simplified view on the topic (Weiss, England, & Lofquist, 1967; Hackmann & Oldham, 1975).

As already described for life satisfaction there are personal and work-related factors which direct and/or determine job satisfaction. One factor which affects satisfaction at work is locus of control presented by Spector (1997), describing it as a phenomenon to which extend a person believes that his or her actions affect the outcome. Another factor with a significant influence on work satisfaction is negative affectivity, according to Watson, Pennebaker and Folger (1987) people who have a higher level of undesired affectivity perceive negative emotions more often leading to several unfavourable outcomes like depression or anxiety. The person-job fit is also discussed in literature to be a driver of job satisfaction due to its presence coming from person- and work-related factor. Referring to Edwards (1992), his research revealed that the person-job fit is a very important criterion in creating satisfaction at work. In his paper,

he published that a small gap between actual and wanted skill variety has a positive effect on satisfaction at work. The second influence on satisfaction at work comes from work related factors. One of the most discussed factors in current literature and media is work-life balance. According to Burner (2014) the definition of work-life balance can be seen as a concept where people balance steadily between work and private life satisfying his or her duties in both fields. Work-life balance does not only focus on the relationship between an individual and his family, rather all private activities need to be taken in account. The work-family conflict described by Spector (1997) differentiates heavily between these two concepts. He sees that term as a conflict arising by demand from family and work on simultaneous time horizons. In addition, he describes that the work family conflict has a correlation of -0.39 with job satisfaction, making it to an important variable in his research. Not only positioning on flexibility from the point of an employer, Qiu and Fan (2015) have developed a paper which states that family flexibility, the willingness to adapt family life towards work, has a strong positive effect on work-family conflict, meaning that it mellows the impact and stress arising from above-mentioned conflict. Further influencing variables on satisfaction at work are pay and job stress. Where pay is simply described by Spector (1997) with a mean correlation of 0.17 to job satisfaction, job stress has several facets which need to be considered. He sees that workload, control of work schedules, flexible schedules, long shifts and night shifts influence the perceived level of stress.

Summarising, this chapter captures the influential work performed in this field of research. A respectful number of researchers did elaborate on intrinsic motivation, extrinsic motivation, influencers of job satisfaction, work-life balance and the work-family conflict as well as methods of how job satisfaction can be measured. Despite that Spector's final view in 1997 was that job satisfaction and job performance do not have a significant relation, but he stated that indirect effects might occur. Nevertheless, job satisfaction soared within the last years to a peak of 60%.

4. Technological Development at Work

Galluch, Grover and Thatcher (2015) state that information and communication technologies are seen as one of the most necessary resources at the work place. More affordable technological equipment led to a worldwide deployment of computers with the goal to enhance companies' competitive advantage. This followed to the formation of large communication networks on the internet, enabling people to communicate by using different modes, such as conference calls or face to face mediation (Kim & Park, 2009). On the downside, our society became dependent on technological devices, they cause a high level of stress by constantly disturbing individuals and therefore lowering individual productivity (Galluch, Grover, & Thatcher, 2015).

Back in the 1950s the technological equipment at the desk of an employee was limited. Usually offices were equipped with a traditional typewriters and wired telephones. At the end of the decade early versions of the internet had been introduced to the military service for sharing data between nationwide computers (Heath, 2013).

The 1960s are known as time of economic prosperity, despite this fact people began to fear automatization and being replaced by technology. First computer-based storage systems were used in offices to enhance productivity. This system distributed every incoming and outgoing product and managed the inventory book on its own. Another big improvement for technology at the office was Fax, a system which allowed people to send documents by using a regular telephone connection (HuntleyFilmArchives, 2014).

In the 1980s computers became smaller, simpler to use, more affordable. Managers saw the potentials of the machines and helped them to become state of the art in offices (Rosow, 1984). At this time period employees were exchanged by machines, former highly qualified employees needed to give up their positions to machines. The usage of machines changed structure and processes of firms (Brown, 1989). Developments were communicated as positive, technology should have been able to:

- Remove hostile work, which harmed people and their health, for example working with excessive heat
- Upgrade skills and increase flexibility, by introducing job variety instead of specialization

The potential elimination of workplaces by replacing employees with machines was still mentioned as a potential threat, but literature stated that work in general must always exist, because of work transfer (Rosow, 1984).

The 1990s are known for the first steps in mobile computing, laptops became more common and in the end of the decade mobile phones were state of the art. A very important improvement for computer usage was the introduction of more intuitive user interfaces. The opening of the world wide web to the public happened in 1991. without knowing the possible future use-cases. Furthermore, this technological prosperous decade introduced a couple of nowadays influential technological devices. One year later the predecessor of the smartphone was introduced – the PDA, the personal digital assistant, a system which enabled users to manage their contacts, calendar, compose to-do lists, notes and much more (Business Dictionary, n.d.b; Forrest, 2015). In 1995, online retailing started to grow by the launch of Amazon and eBay, followed by Alibaba in 1999 (Forrest, 2015; Heath, 2013).

The following decade was known for improving existing technologies and exploring their applicability in various fields. In the telecommunications industry Blackberry focused on building smartphones, many firms followed this trend and in 2007 a touchscreen was paired with a smartphone and set a trend for future phones, the iPhone was introduced. In terms of internet accessibility Wi-Fi became ubiquitous, the hardware for this was built into every device to improve the connectibility of the operator (McCaney, 2009). In the early days of the decade first social networks were developed, Friendster was one of the first successful social networks having more than 3 million registered users. One year later LinkedIn, started building a social network for professional networking experience. Today it counts more than 500 million users and more than 10 million active job postings by 9 million companies (Darrow, 2017). In 2004, the nowadays successful social network was introduced in Harvard university as a local social network, opened 2006 for public usage – Facebook, which counts currently 2 billion active users (Shah, 2016; Constine, 2017).

Currently workplaces are flooded by laptops, mobile phones and constant access to the internet. The most up to date topic in technological development is the accessibility through social media. By its definition, it is a tool to share information on the internet or on mobile phones, where people can interact and engage within their networks (Business Dictionary, n.d.a). Social Media can be used for communication between employees or between corporations and customers. On the one hand, social media can have a positive influence on internal communication, by informing people through networks or private groups or giving them the chance to participate and raise their voice, which potentially leads to higher affiliation to the company. For customers, social media is an easy tool to interact with the company by following it and thus be kept up-to-date on the latest happenings. This form of communication does have some risks. Employees could mob colleagues on social networks, which leverages the impact of mobbing. In addition, age of the workforce influences the willingness of using this form of communication. Whereas generation X, Y and Z are willing to use modern technology, people of age 50+ prefer to speak face to face (Cairo, 2014).

Another very hyped development in our newest decade is wearable technology. According to the definition, the term comprises accessories or other electronic devices, which collect data of the operator by wearing the wearable device and exchange collected data by using the internet (Investopedia, b, n.d.). The five largest manufacturers in 2015 in this field were Fitbit, Xiaomi, Apple, Garmin and Samsung (Tonner, 2016). Critical media perceives the rise of wearable technology as a potential revival of Frederick Winslow Taylor's concept of work, known as Taylorism – focusing on optimising the firm's output by analysing their employees work attitude (Lobe, 2016; Wilson, 2013). Current wearables from all the above-mentioned companies can track, depending on the device, the operator's footsteps, sleep cycles and quality, pulse and the overall fitness (Fitbit, n.d.e; Xiaomi, n.d.; Garmin, n.d.).

Specializing on the business side, Hitachi developed a wearable embedded in employees' ID-Badges with the aim to enhance productivity by increasing the employees' happiness by measuring their physical movements (Hitachi, 2015). Media describes this technology as the perfect tool to track employees. The technology is able to listen to whom people are talking to, where they are going, track their hand gestures and their overall energy level, which could be good if the data is seen by the operator only. If privacy is ignored, employers receive valuable information from every employee in

real time – opening ways for misuse (Wilson, 2013; Greene, 2014). Hitachi has developed further devices to track people. The *WOT-100* and *ExBrain* measure cerebral cortex activities in daily-life environments, giving further insights on the brain fitness and how employees cope with stress (Hitachi, n.d.a; Hitachi, n.d.b).

Summarising, it can be seen that in the last decades technological equipment became more and more important. The introduction of the personal computer boosted the pace of technological innovation at the workplace. People needed and still need to adapt to new hardware and software continuously. On the one hand, it helps the workforce to manage their daily tasks, on the other hand, technological devices harm employees by outperforming them in several jobs and leading to a generally lower need of employees performing given workload.

5. Wearables – the Data Collectors

By definition a wearable device is a technology-based item which is worn on the body of the user and appear as accessories or are embedded in the material of clothing. They connect to the internet by using Bluetooth or Wi-Fi making it able to exchange data between the manufacturing firms and the object. Wearables grew in popularity as gadgets to enhance devices seen as Bluetooth headsets, smart watches or glasses. Wearable technology can be used to support activities by collecting information in form of data, the evaluation of it and by giving improvement potentials. There are currently several types of smart watches available on the market, which track various activities by using appropriate sensors. They are used for sourcing health and fitness data and in addition some devices track the location. Wearable technology does offer extensive opportunities for software developing firms. Companies who own the data of the devices operator can explore various implications based on the retrieved data, for example potential health concerns. The main criticism of wearable technology is based on the discussion of privacy issues. As firms collect data from their customers they have insights into the life of their buyers and they are responsible for how this information is treated (Techopedia, n.d.; Investopedia, b, n.d.; Springer Gabler Verlag, n.d.).

After presenting a short explanation on wearable devices this paper will focus on demonstrating further insights into areas of application for wearable technology, explain their functionality and differences amongst various types and brands and present the potential market.

5.1. Functionality and Devices

Smart Watches: A smart watch is a device which is paired with the operator's smart phone to extend its functionality. This smart wearable offers functions similar to the ones seen on smart phones. People can connect to the internet, make calls, run messaging apps, monitor their fitness and much more. These devices are produced by the leading firms in the smartphone industry: Apple, Samsung, LG and fitness tracker manufacturers. The manufacturer with the highest number of shipped devices is Apple. They currently have two devices in their portfolio. The Apple Watch 3 offers following functions: integrated GPS, heart-rate monitoring, water proof up to 50 me-

tres, activity tracking and coaching, messaging apps, voice command. It accepts telephone calls and extends its functionality by downloading further non-preinstalled applications. The company's biggest competitor, Samsung, offers the same functions. In addition, they were the first who offered to use the device as a stand-alone and mp3 player, this function was copied by Apple for Apple Watch 3.

Smart watches offer a bright variety of functions, nevertheless they are only enhancements of the operator's smart phone as they only communicate with compatible devices, which depend on the phone's operating system (Tanasychuk, 2017; Stroud, n.d.; Waltzer, 2017; Apple, n.d.; Samsung, n.d.).

Fitness Trackers are much cheaper ranging from € 24.95 to € 159.95 and offer usually a slimmer design then smart watches, due to lower hardware specifications. They offer a fair amount of functions to track the operator's health status and give suggestions from the information collected. Current leaders in the market are Fitbit and Xiaomi. Fitbit offers 5 options, whereas Xiaomi offers only one – the Mi Band 2. The market-leader's option, the Mi Band 2, works as a traditional digital watch, pedometer and heart-rate monitoring device. Out of this data the device gives insights on the user's activity level, health-status and provides a sleep cycle analysis. Fitbit's portfolio offers a greater variety of products with different functions from a pedometer up to a device which is very similar to Xiaomi's Mi Band 2 (Tanasychuk, 2017; Xiaomi, n.d.; Fitbit, n.d.a; Fitbit, n.d.c; Fitbit, n.d.d).

Smart Glasses raised awareness in 2012 by being introduced by Google as Google Glass. It was meant to be the state of the art device for information processing, where business should benefit from offering further information on their products to customers. After a three-year-long test phase of the program google glass was shut down. Surprisingly in 2017 Alphabet's X-Division Reintroduced Glass as an enterprise edition device. In the meantime, several firms have explored the potential of wearable glasses in the business to business field. Smartpick, a Belgian company, focused on process optimisation for order picking, offering customers an ROI of less than 0.6 years for their solution. It uses smart glasses for scanning products and gives employees directions where the picked object should be positioned. Vuzix, the current market leader uses their technology for process optimisation in the industrial and medical sector, for warehouse logistics, supply chain management and much more (Glass Almanac, n.d.; Smartpick, n.d.; Vuzix, n.d.a; Levy, 2017).

The newest solution on the market offered by Microsoft is called HoloLens. It enhances the idea of augmented reality and offers their customers a mixed-reality. Here the operator wears glasses, which cover the whole field of view and the projected holograms create a more immerse feeling. It can be used for communication via video calls, product visualisations in 3D and for exploring places or building projects. It can be seen that this technology is currently dominated by solutions offered for professional use. A potential cause is that these solutions are still in the early stage of development and that a lack of standardisation causes too high costs for traditional consumers (Robbins, 2012; Montgomery, 2015; Microsoft, n.d.c; Levy, 2017; Smartpick, n.d.; Vuzix, n.d.b).

5.2. Market

According to Hayward (2015) the market of wearable technology was expected to reflect a value of 70 billion US-Dollars by 2025. The former development rose critical thinking on these expectations. The study of strategic analytics elaborated on global wearable sales in the second quarter of the year, which shows that the market growth is levelling. There was a total growth of +8.0% in the market, compared to +21.2% the year before. Xiaomi, a Chinese manufacturer reported a growth in shipped units of +23.3%, whereas the former market leader Fitbit shipped -40.3% less products than one year before. The largest improvement was managed by Apple with a positive development of +55.5% (Debree, 2016; Kovach, 2015; Waltzer, 2017).

Moving away from the consumer market, business to business transactions offer a wide field of opportunities for firms like Xiaomi, Fitbit and Jawbone. Jawbone saw markets' potential in 2014 and Fitbit even earlier in 2010, they started offering their products to firms to provide insights on the employees' wellbeing. Based on current developments in the market, Jawbone's executive board decided to leave the consumer market due to its low growth and margins. They currently offer a specialised group plan where employees are tracked in groups, offering insights on engagement and overall health to employees and employers. For further motivation, group messaging and challenges are offered in order to motivate people even more to live a healthy lifestyle (P. Olson, 2014; P. Olson, 2017; Jawbone, n.d.).

Another potential field of operation for wearable technology apart from health and wellbeing lies within supply chain management, in this field the devices can appear as

wrist-wear, eye-wear, neckwear and body wear. Business-related media states that this market could rise from 2015 to 2021 by 2.800%. The most promising products in this field are smart glasses, they enable operators to work more efficiently and effectively. Vuzix, the most prominent manufacturer of smart glasses for the B2B market estimates a total usage increase of 3.300% from 2017 to 2025, in numbers by 2025 14.4 million people will use a device manufactured by Vuzix. According to Global Logistic Focus, third party logistic providers take a leading role in this field. They are used to reduce errors and enhance the picking process, which lead to a boost of 25% in productivity in a pilot program performed by DHL (Field, 2016; Vuzix, n.d.a).

It can be seen that wearable technology does not only offer a bright variety of opportunities in the consumer industry. Due to advancing technology, manufacturers are able to put more into small frames enabling vast opportunities to operate in the business to business market.

6. Wearables at Work

According to the research of Orlando (2015), it is estimated that 2 million employees will be required to wear wearable devices at work. Tractica (2015) goes even further and states that the market of wearable technology will be a $ 6.3 Billion market in 2020.

It comes to the question: why do firms buy huge amounts of wearable devices for their staff? To answer this, we need to distinguish between different types of wearable devices, which all should lead to a potential boost in efficiency. Blum (2014) divides wearable devices into three main groups.

- **Monocular-Devices** are spectacles with one small display, offering additional information to the user. In addition, operators' can search on the internet, take pictures and make voice calls, the most prominent device on the market is Google Glass.
- **Immersive Devices** are glasses, similar to monocular devices, with the exception that the display fully covers the field of view of its operator. This gives users the ability to have a clearer understanding of the project he or she is working on, for example by visualising 3D blueprints. In this field Vuzix is the current market leader, whereas Microsoft is tackling this area with its Microsoft Hololens.
- **Wrist-worn Devices** are the most available ones on the market, offered by major firms like Apple, Samsung, Xiaomi and Fitbit. Enabling the user to track his or her fitness-data, receive calls or text messages, paired with their smartphone.

6.1. Monocular Devices

One of the most prominent and discussed wearable was the Glass, introduced by Alphabet in 2012, with a seemingly negative outcome as it was abandoned by the company in 2015 (Glass Almanac, n.d.). Two years later Alphabet Inc. reintroduced the product within its X.Company line, with the difference that the company decided to focus on a B2B solution rather than on the B2C market (Levy, 2017; X.Company, n.d.). Another big player in this future multi-million-dollar market is Vuzix Corp.

providing solutions to professional clients (Field, 2016). These companies on the market offer solutions for manufacturing, logistics, healthcare, quality assurance and training (X.Company, n.d.; Vuzix, n.d.a). They count 48 partners, which use one or both products for their solutions, including main players on the market like DHL, Samsung, Volkswagen and Intel (Vuzix, n.d.b). What makes both products perfectly suitable for the B2B market is that they offer so called self-development kits, which can be used by companies and software developers to adapt software perfectly to their needs and receive the most value from this technology. Following use cases were identified by media and literature review:

- ***Manufacturing*** – Skylight, is a software developed by UpSkill to improve operational performance in the manufacturing sector. This is done by reducing assembly error, improvement of processes and safety at the workplace. It shows the process which needs to be performed step by step and can give deeper insights, if necessary, by using voice control. The software already helped firms to improve processes by 30%, their defect rate close to 0 or productivity by 15% (UpSkill, n.d.a; UpSkill, n.d.b; UpSkill, n.d.c; Upskill, 2017).
- ***Logistics*** – UBiMAX, a well-established software developer for monocular devices, based in Germany has worked on several projects from 2015 till now in cooperation with DHL to improve their logistical processes by using Google Glass and Vuzix M100 devices. Their first project in 2015, in a warehouse in the Netherlands managed to reduce errors within the picking process, leading to a 25 % increase in efficiency. The software offers information on progress; aisle number, location and quantity of the product which needs to be picked. In addition, the user receives information on the next pick and the distribution on the trolley. Finally, the software replaces handheld-scanners by using the camera of the wearable devices to perform the scan. Starting from 2016 DHL rolled this system out on a global scale in the U.S., UK and Netherlands with the actual perception that efficiency increased in total by 15% and further usage of Augmented reality is planned in other areas, like training or maintenance (DHL , 2015; DHL, 2017).

- ***Health care in two main sectors: emergencies and telemedicine*** – Current emergencies solutions give the emergency personnel direct access to their command centre to share what they see. This helps people, who give first aid to provide better service by improved decision making at the scene while employees at the hospital can prepare the necessary treatment before arrival of the client. The second potential field of use is telemedicine, which means that best-class medical treatment is available to everyone, without travelling. For example, nurses can receive valuable information from specialists, or be guided by them, while they are right in front of the client and performing the necessary steps, leading to better service to the treated person (Ama XpertEye, n.d.; Ama XpertEye, 2017).
- ***Quality Assurance*** – Under a project named *"Industry 4.0" BMW 2014,* BMW in the U.S. decided to team up with UBiMAX and Glass to start a quality assurance program, which improved testing of pre-series vehicles. This project was successfully realised and further quality assurance software was introduced in the companies' production facility in Leipzig. This firm is not the only one, Boeing Co., Daimler AG and United Parcel Service Inc. also worked with Ubimax and implemented its software with success, leading to higher efficiency and improved quality control processes (UBiMAX, n.d.; BMW Group, 2014; Tita, 2015).
- ***Training*** – The connectivity of the devices gives companies the ability to train their staff more effectively. At first, more experienced staff can have voice calls with multiple trainees and give ad-hoc assistance in specific cases, which improves every individuals' learning process. On the other hand, guides can be recorded helping employees solving previously faced challenges at the company (Apprentiece Field Suite, n.d.; Ama XpertEye, n.d.; Upskill, 2017).

6.2. Immersive Devices

Monocular wearables focus on supporting the user by offering additional information on a small screen on the side of the gadget. In contrast, immersive devices give the wearing person the chance to step into another world. The Epson Moverio is such a device, it brings augmented reality to the next level and mixes reality with virtual reality on the whole field of vision. Microsoft goes even one step further, but they do

not call it augmented reality. Their product, the HoloLens is a holographic computer which creates a so-called mixed reality (Microsoft, n.d.b; Epson, n.d.; Hansen, 2017).

A literature review revealed that this system can currently be used in following business situations: *Design and Manufacturing*, *Education and Training* and *Retail*:

- ***Design*** – Microsoft partnered up with Ford to help car-designers to visualize, enhance and develop future products faster. By using HoloLens, they are no more forced to create real-life concepts of cars to present them, Holograms create life-size products with the difference that adaptions or variation can be presented ad-hoc. Another crucial partner for Microsoft is Trimble, a multinational company operating in various fields and construction. The technology gives them and their architects the ability to show their sketches to customers as a physical model, to explain better how the cite will be integrated in the existing landscape and display potential adjustments, which can be performed. Even a 3-D rendering in life-size is possible by using the device, meaning that employees as well as customers can literally feel the impact of their construction on the landscape of the city. During construction work responsible employees can see the blueprints and immediately adapt them if problems occur (Trimble, a, n.d.; Trimble, b, n.d.; Microsoft HoloLens, 2017a; Microsoft HoloLens, 2017b).
- ***Education and training*** – Lecturers face the problem that they cannot give insights into topics by reading a book or drawing 2D models on a Chalkboard. Mixed reality enables teaching staff to create a world which enhances the learning process, by displaying interactive 3D visuals, which make it easier to transfer knowledge. Subjects like Physics, Chemical education, Geography, History and Biology would be the ones who would benefit, because they can explain knowledge better by visualizing the process, which occurs naturally, but cannot or are hardly be shown in class. For example, interactive organs to medicine students to enhance their experience (Microsoft, n.d.a; Microsoft HoloLens, 2017b).
- ***Retail*** – Microsoft collaborates with Lowe's, a company which focuses on home improvement, the HoloLens gives them the possibility to display different options to customers. This technology could further be used for a couple of custom-made products, like jewellery, shoes and tailor-made clothing to

demonstrate possible outcomes and eliminate undesired one's (Blum, 2014; Microsoft, n.d.b; ExpovistaTV, 2016).

6.3. Wrist-worn devices

A study conducted by Bothun & Liebermann (2016) unveiled that 27% of their sample owned a smartwatch and 45% a fitness band. The study claimed that the main motivator for using the device is improving personal health as well as monetary rewards for frequent usage and additional information gained through wearing the device. This could be formed into the company's corporate well-being program. Therefore, the following chapter is divided into three sub-chapters: improvement of health, improvement of efficiency and benefits for employers.

6.3.1. Health Improvement

One of the most crucial tasks of employers is to care for their employees. Health issues create direct costs to the company. For example, in form of absence payments and overtime performed by other colleagues as well as indirect costs. According to a study from the Centre for Mental Health (2011) the main driver for illness related costs in the UK is not absenteeism, 2/3 of the costs are caused by presenteeism. Ignoring the social aspect of helping employees to live healthy, the financial aspect on its own gives more than enough reason to engage in corporate wellbeing (Fit for Work team, 2015).

Following aspects should be considered by employers if they are interested in implementing wearable devices at their workplace:

- ***Additional information*** – The most general reason why people use and want to use wearables is that they receive additional information, which they would not know without owning the device (Bothun & Liebermann, 2016). Current technology does not only offer data collection, the gained data can help achieving fitness goals by giving insights into knowledge gained from tracked data. Furthermore, sleep tracking can help people and employers to track the occurrence of insomnia, which helps fighting depression and anxieties (P. Olson, 2016).
- ***Gamification*** – 45% of wearable users claim that gaming features have a positive effect on their motivation for using wearables. All the mayor players in the market like Xiaomi, Fitbit and Apple have applications to measure and

compare personal achievements. Fitbit offers Group Health, a service, for corporate partners, this enables them to give every employee the right tracker, form groups, set targets and compare their achievements (Fitbit, n.d.b).

- ***Monetary rewards*** – the most motivating factor based on the survey from Bothun & Liebermann (2016) are monetary rewards, users receive in exchange for using smart watches. The manufacturers and software developers themselves do not offer any kind of this reward, but employers could. From the perspective of current research, it would be meaningful to combine gamification with monetary rewards in form of charitable giving.
- ***Monitor sleep*** - As it was mentioned above knowing your employees personal sleep data can give valuable insights to improve health in general and to fight diseases (P. Olson, 2016). The division of Sleep Medicine at Harvard Medical School (2008) revealed within their research that insufficient sleep increases the risk of obesity, diabetes and cardiovascular diseases. As well as it affects negatively the immune function, which leads to common occurrence of having a cold. This research shows how important sleep monitoring is for people and companies, as health issues and absenteeism/presenteeism cause costs, which lead to lower profits.

6.3.2. Efficiency Improvement

The research from Bothun & Liebermann (2016) unveiled that 49% of owners of wearable devices use it because of expected efficiency improvements. They also presented that 2 out of 3 consumers are willing to wear wearable devices at work, if the company pays for them and that millennials have an acceptance of 71% on using the technology at the workplace. Based on this it will be presented how companies can improve foster their employees' efficiency by using wrist-worn wearable devices:

- ***Communication*** – the main benefit of a wrist-worn device is that people wear them unconsciously and that they are hard to lose. The constant wearing enhances first of all accessibility of the consumer. In addition, they are cost-effective and can be used in a wide range of environments (Blum, 2014). Wrist-worn devices are mostly connected to the operator's smartphone and can receive notifications, messages or calls by this connection. Apple goes even a step beyond and enables the user of their Watch 3 to communicate without the

connection to a Phone, enhancing the accessibility without limit to a smartphone (Apple, n.d.).

- ***Specialized Devices*** – Rufus Cuff is a wrist-worn device, which is specialized for operational use. In difference to other devices it has a much larger screen, enhanced connectivity software and offering video calls. In addition, companies can add checklists, alerts and additional data or the operator, which not only improves efficiency and safety, but it contributes positively to overall quality management (Getrufus, n.d.; Hegel, 2016).
- ***Indirect Effects*** – In general, the research performed displays that efficiency improvement does not base on communication improvement or specialized products. The improvement and maintenance of the employees' health status makes them happier and enhances their personal and professional productivity by constantly reminding them to do something for their health leading to indirect effects in various aspects (Freifield, 2015).

6.3.3. Further Benefits for Employers

Companies which implement wearable devices in the workspace do not benefit only from the primary effects like improved communication and specialised software for efficiency improvement. The most crucial factor is the health of their employees. People can participate for common greater goals, combat within competitions and to fight upcoming diseases. Moreover, it can foster team building, which can lead to better results at the workplace.

Emma Sinclair, co-founder of Enterprise Jungle goes one step further, she believes that wrist-worn wearables can and will have an immense impact on how personnel decisions are made. HR departments could track the activity of employees and predict the future development of the company's staff (Management Today, 2016; Fitbit, 2015; Fitbit, n.d.a). This would confirm the statement made beforehand in this paper: companies do not offer smart devices for corporate wellbeing, but for improving and tracking the workforce's performance, opening a door to potential misuse and posing a threat to employees.

7. Critical Assessment of Current Development

The previous chapters had been dedicated to explaining what life and work satisfaction is and the benefits from wearable technologies, for private users as well as on business level. This part reflects critical issues, which can evolve by implementing the gadgets in our private and work-life.

The problem arises that new technologies are in general more prone towards security risks and so they create potential new dangers in private and corporate life. In this part, the focus is set on corporate use of wearable devices. Some of the most common reasons for not using a wearable device were privacy and security issues, and according to Accenture (2014) 4 out of 5 people were afraid of privacy concerns (Acquity Group, 2014; Trend Micro, 2014).

These fears evolve from a vast number of influencing factors, but the following 3 can be described as the most influential one's: *risk of data theft; lack of employee awareness and lack of security policies in place*. A study conducted by Pricewaterhouse-Coopers (2016) revealed that users still did not feel comfortable with sharing data from wearable devices with their employers' due to missing trust. 58% of organisations which implemented or want to implement wearable devices do this for boosting staff productivity (Trend Micro, 2014). Further efforts are made by companies to extract as much information as possible from employees. Humanyze is one of those companies which creates rejection towards wearable devices at work. This device is a badge, which monitors employees' activities like: walking and speaking with other colleagues and evaluates group performance as well as inter-group performance (Humanyze, n.d.; CBS Pittsburgh , 2017).

The study of PricewaterhouseCoopers (2016) created first assumptions on if and how wearable devices could be implemented at the workplace and security issues were a crucial component. People were not in favour of being observed, but missing regulations on how data is treated correctly strengthens the uncomfortableness to devices which constantly collect personal data. The research conducted from Trend Micro (2014) demonstrates that organizations are aware that they will need to change their security policies on two main factors: limitations on data capture and more strict rules to lower potential risks. On the one hand employees need to be protected from misuse of gathered data, for example an employer could use wearable devices to observe

them. This could lead to potential misinterpretation of what was said and lead to consequences, without being able to understand why this happening or circumstance occured. On the other hand, employers could be abused too. Wearable devices are able to track heart rates. If a person would feel psychologically stressed at work he or she could use the captured data and show the impact of her current workload on his or her stress level. This could too capture only a small fraction of the micro-cosmos, where other influences also have an effect on stress. Current problems in someone's family could have a strong effect on stress but be misinterpreted as coming from the workplace. Policies need to be established to protect employees as well as employers from upcoming abuses.

On the other hand, a part of the risk does not come from inside the company, the data stored by the company could be accessed by unauthorized third parties. Depending on the aim hackers can connect to: data storage places and extract employees' stored data and create malicious apps and collect specific targeted data (Trend Micro, 2014). A connection between hacker and the device does not only bring the above-described risks. Direct connections could lead to spying on people, cameras and microphones could be turned on without the consciousness of the owner of the device. Location can be determined, private and sensitive data can be accessed by using the information stored on the device, hackers can gather information and spread it (CNBC, 2015; ITBusinessEdge, n.d.). Additional attention must be devoted to lack of data security, as current devices do not use authentication system procedures like pin codes or fingerprint sensors, making the hacked device even more vulnerable to data misuse (ITBusinessEdge, n.d.).

Besides potential security difficulties wearables can have a negative impact on physical and psychological health. Firstly, elaborating on physical health issues it can be assumed that the impact on human health is similar to the one of cell phones due to their technological similarities. Researchers from all over the world are working on projects to determine the effects of mobile phones on health, for example the WHO published that the use of such devices is possibly carcinogenic, other studies do not present statistically significant results (National Cancer Institute, 2016; World Health Organization, 2014). Despite the outcome of the research, media and people are afraid of potential health problems arising on long term and could develop a defensive attitude towards mobile devices. Out of this issue several ranking lists exist were created,

which measure the potentially dangerous radiation level of cell phones, raising awareness for the possible danger (ProCon.org, 2017).

On the other side, wearable technology can develop to a constant stressor which forces operators into a ubiquitous state of multitasking. Doing multiple actions simultaneously does not have a strongly desired effect on productivity. Generally, scientists support the theory that multitasking slows people down, raises the rate of mistakes, negatively influences creativity, diminishes the capacity of memorizing and causes stress. In addition, the Western Washington University discovered the effect of inattentional blindness in 2009, which unveils that users oversee strongly noticeable actions due to multitasking (Macmillan, 2016). This effect was also described by Don Norman (2013), a cognitive science professor and author, who focused on wearable devices. He states that there is for certain a positive side of wearable technology, but that devices can and have a distracting component. For example, an employee could have constant access to his emails by wearing a monocular or immersive device, displaying important or less important messages while the person is doing something else at work. This would reduce productivity, but does not create any harm. A more serious scenario could be that sales employees could walk or drive during accessing their mails or other data and cause an accident or be part of one, due to the lack of situational awareness. This is a reason why it is important that policy makers take this into consideration and limit the use of technology in certain situations and or limit their capabilities.

To combat fears of future users of wearable devices and arising security issues, companies and producers of the above-mentioned devices need to take several countermeasures to support the flourishing of the technology. As it was already described in this paper, users are threatened by possible privacy problems. An influencing factor is that people do not have the knowledge to evaluate upcoming effects on security, this is why on first level employers and manufacturers of wearables need to educate and convince them by presenting the benefits of the technology. Furthermore, employers should consult the future operators of the devices, discussing occurring matters and including them in the decision-making process. Another important component is offering full transparency to what and why something is measured. Fitbit group health recommends that companies should be willing to limit their access to data in order to engage people's positive perception towards the technology (Black, 2015; Martin,

2017). Referring to the unwillingness to share data Accenture performed a research on that topic and observed that consumers are up to 300% more willing to share data with brands if they receive an extrinsic motivator like coupons or discount codes. This can be converted to companies too, employers can offer motivators for participating in a corporate well-being program (Accenture, 2014). Even reaching the highest level of education on wearable devices it is impossible to eliminate the danger of data misuse, particularly from outside the company, where hackers enforce the access to the devices. CIO a magazine specially designed for Chief Information Officers and technology affiliates recommended to firstly implement multi-factor authentication for adding additional security layers and to be aware of upcoming privacy and security issues (Martin, 2017).

In addition to the potentially arising security breaches, current media and scientific literature doubt if wearable devices, focusing on fitness bands have any effect on the health of the operator. A group of 9 researchers conducted an experiment with 470 participants over a time-frame of 24 months to measure the effects of wearable technology on weight loss. Their research states that within the first 9 months wearables had a positive impact on weight loss. Unfortunately, this effect diminished over time and that there was no significant effect on physical activity and therefore on weight loss (Jakicic, et al., 2016). Researchers in Singapore tested if extrinsic motivation by receiving money in combination with a fitness tracker creates a higher physical activity over a 13-months period. On short term the device did have an effect on physical activity and the monetary reward in combination with it too, but after six months the effect diminished during the study (Finkelstein, et al., 2016). A study in Cureus in 2016 demonstrates the same effect on physical activity, there was no significant effect, whereas the researchers were able to find another significant effect. Wearable devices did improve the amount of sleeping hours steadily within a 9-months period (Crowley, Pugliese, & Kachnowski, 2016). Gierisch and Goode (2015) combined the knowledge of 14 unique studies among this topic and out of all this research they were able to prove that there is small increase in physical activity and small decrease in weight over a period between 3 and 12 months. Researchers who were dealing with questioning the general effect on physical activity demonstrated that there was none or a slightly significant positive effect on the variable. Nevertheless, a non-existent effect does not cause harm in general, only questions the utility of the device. Kerner and Goodyear

(2017) went a step further within their research and did question if there is a negative psychological effect occurring by wearing this type of devices. They conducted a short experiment with adolescents between 14 and 18 years old to test the effect of wearable devices on competence, relatedness, controlled motivation. To enhance pressure participants had to perform a minimum activity measured in steps and were able to see the activity of other ones. The outcome of the study was that people developed guilt and anger, for not achieving set goals or being surpassed by others. In general, the measures had a strong undesired effect on motivation for physical activity and the competition component caused a high amount of stress, which is an influences of life satisfaction.

Concluding it can be seen that a big stake of criticism arises from potential security breaches. This begins at the insecurity that employees can abuse the technology and gather private data and ends with the fear that hackers could access the devices and receive all the information captured by the devices. Further negative feeling stands up with the unknown physical damage caused by the technology and psychological threats coming from being constantly stressed by the device itself and its functions. A final aspect for criticism towards this technology is produced by the unknown gains, which cannot be scientifically proven on the long term. All these factors contribute to the discussion on the openness towards this technology.

8. The Impact of Technology and Wearables on Life and Work Satisfaction

The earlier chapters in the paper described the main idea along with the facets of life and work satisfaction, the aim of wearable devices and their use-cases at work. In the previous section this paper approached the topic and presented that the praised benefits of wearable devices in terms of intensifying physical activity were not significant by taking random participants. Even more frustrating is the fact that Kerner and Goodyear (2017) came to the conclusion that fitness trackers cause additional stress, instead of motivation. This chapter is dedicated to shortly review the current research on the impact of technology and wearable devices on the variables life and work satisfaction.

In general, it can be stated that in the past few years a couple of research on the influence of technology on different satisfaction parameters was published. Firstly, the aim of this research was to display a rather focused view on this topic. Elias, Smith and Barney (2012) carried out a study with the purpose to demonstrate the effect of technology on work motivation and job satisfaction by taking age as a predictor. The outcome of the work was that the attitude itself and not the proficiency towards technology had a significant effect on overall job satisfaction. A high attitude with regards to technology leads to higher job satisfaction independent from the participants age (Elias, Smith, & Barney, 2012). Korunka and Vitouch (1999) researched on the impact of technology and technological change on strain, causing psychosomatic complaints and job satisfaction as influencers of health, well-being and performance. Their conclusion had a similar view on the importance of attitude towards IT systems, whereas they attributed this variable a weaker importance than Elias, Smith and Barney. In their paper, they stated that the strongest negative effect on strain and satisfaction was caused by changes in user interfaces, caused by the strong need of adaptation. On the positive end of the spectrum, they showed that this effect can be mellowed by participation of employees who are affected by the technology in the near future. Taking the increase of availability for work matters into consideration by being accessible apart from regular working hours a study published by Wright (2014), dealt with the impact of this flexibilization. The scope was to see if there was any effect on work-life-conflict, burnout, turnover intentions and job satisfaction. The result of this study was that

modern communication technology used outside regular working hours had a negative impact on work-life conflict, stress and therefore increased the sensitivity for burnout.

Referring to literature elaborating the impact of wearable devices on life and work satisfaction there was no scientific literature at the time of this research. Nevertheless, it can be seen that out of former research, which was based on technology and its effect on people a strong impact on the researched variables can be indicated. Questioning that researchers were not able to find strong beneficial effects of wearable health devices on physical activity and their occurrence in current work relations, it is even more important to discover the effect on life and work satisfaction.

With regards to the possible effects wearable devices might have, this topic is divided into three components: general acceptance of wearable devices, work satisfaction and life satisfaction. These are reflected in research questions and hypotheses presented in the following chapter.

Quantitative hypotheses of this research focus on discovering general acceptance and perceptions on wearable devices and the openness towards this technology at the workplace. A sample hypothesis is: *There is a relationship between people's awareness on the security problems caused by wearable technology and potential job changes if employers force employees to wear wearable devices at work.*

Secondly, the attention is payed to work satisfaction based on the main purpose to provide employers with valuable information on if and how they should implement wearable devices in their employees' workday. Here in the first step a hypothesis was created, which will be accepted or rejected by the performed quantitative research. The qualitative component of this research and the composed research questions target work satisfaction with research questions and secondary research questions. With these questions, this research aims to receive in-depth insights into perceptions on overall work satisfaction and acceptability in the work environment.
The last variable on which this research sets a focus is life satisfaction, which has the same importance to this research compared with work satisfaction, caused by the fact that life satisfaction is of equal worth than work satisfaction due to the direct influence on it and vice versa. To discover influences of wearable devices on life satisfaction, hypothesis such as had been composed: *People who are more satisfied with their life would rather share personal data captured by wearable devices with other people.*

The qualitative component, the research aims to elaborate if and how strongly wearable devices impact emotional traits and overall life satisfaction.

The above-described approach aims to create a base for answering the hypotheses and research questions in chapter 9.2 and understanding the effects of wearable devices on life and work satisfaction. It is the goal of this research to discover new knowledge such as if wearable devices create further stress to employees, decrease perceived life satisfaction or foster competitiveness between people. Out of all received information it is aimed to present and discuss the results and create a recommendation for employers on how wearable devices could be implemented at the workplace.

9. Methodology

This research aims to answer following general research question: *"How do wearable devices influence life and work satisfaction?"* As this research enters a not very well elaborated field of study an explorative qualitative component is needed to discover new knowledge. An indication for the type of research can be found by examining the openness of the general research question (Given, 2008). This scientific paper aims to assess the overall attitude towards wearable technology by performing a survey in a quantitative setting to elaborate the general opinion on the technological devices. The major goal is to create a general research on components influencing the acceptance of wearable devices at the workplace and the effects coming from wearable devices on life and work satisfaction. Firstly, attitudes of people will be discovered by the quantitative research and secondly verified and adapted by making use of a qualitative research method (Creswell, 2014). Deductively, for this paper a mixed methods research design was chosen to elaborate the above-described topic.

The mixed methods research is often accompanied by a pragmatic worldview, where the author combines two research methods and picks tools from both of them to establish a research construct with the main goal to find a solution for the set research question. For doing so for this paper it was decided to take a convergent parallel mixed methods approach, a quantitative research will be conducted as a first step and further rationalised by considering qualitative research findings (Creswell, 2014).

In the first phase of the research, focused on finding adequate literature on satisfaction with life and at work. Furthermore, historical findings on implementation of new technology was presented, as well as current technology and occurrence of wearable devices critically elaborated. After deduction of knowledge, multiple hypotheses and research questions were developed, which can be found in this chapter. Illustration 1 shows the plan to structure this research in order to discover new findings on the topic.

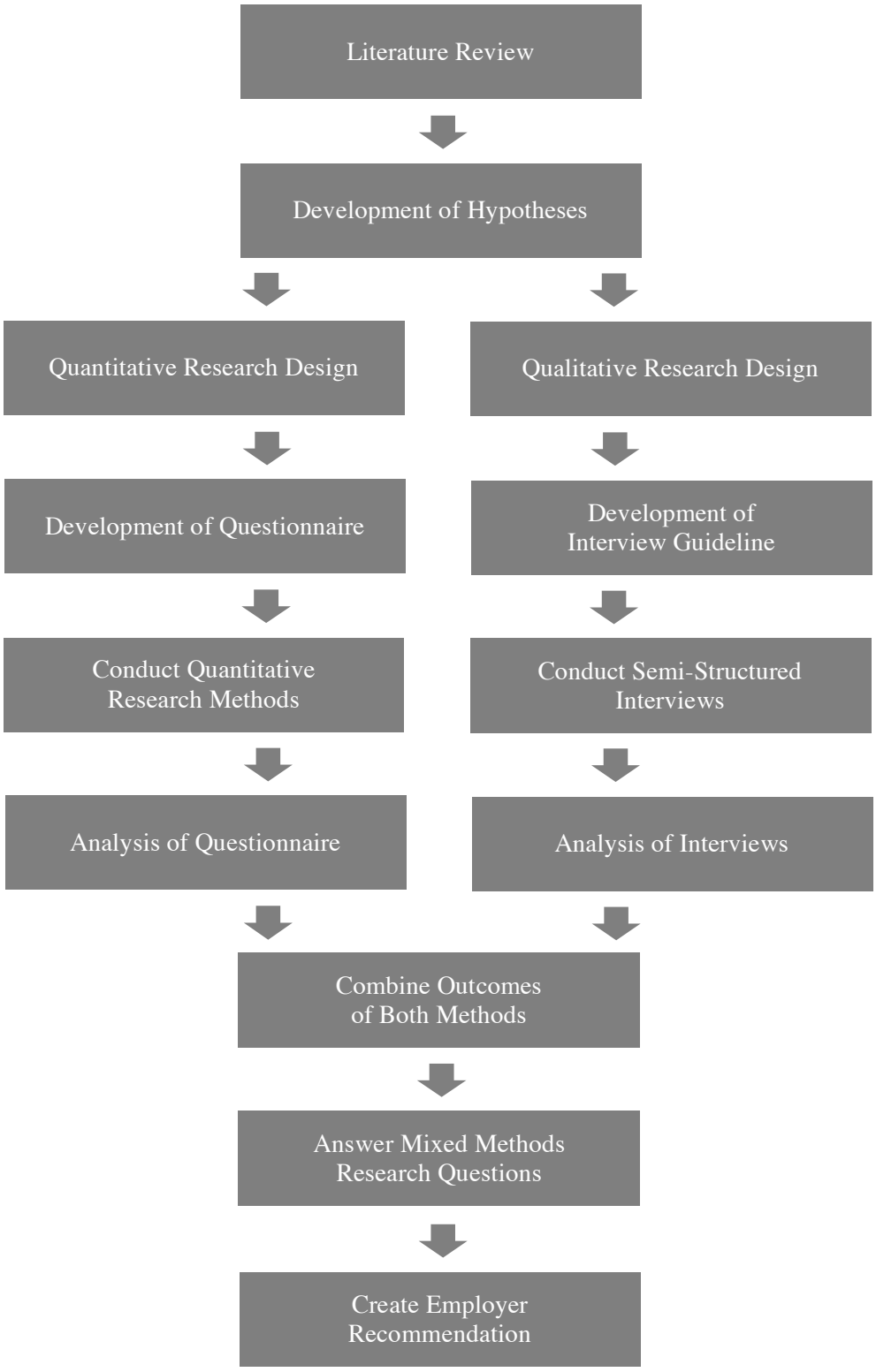


Illustration 1: Methodology, Research Steps

9.1. Hypothesis and Research Question Development

Creswell (2014) states that researchers who choose to make use of a mixed methods approach, need to provide a research question for the qualitative component of the research and further research questions or hypotheses for the quantitative part. The main difference between a research question and a hypothesis is that the hypothesis is based on prior literature and aims to predict an outcome, whereas the research question itself is influenced by actual literature, but has a wider perspective, leaving room for exploration on the proposed topic (Given, 2008).

9.1.1. Research Methods

9.1.1.1. Quantitative Methods

The aim of quantitative research is to accept or reject a prior-set hypothesis, experiments occur in two different types: true experiments and quasi-experiments. In general, they make use of the same analysis methods, with the small difference that in true experiments participants are randomly assigned and in quasi-experiments not. Depending on the scope of the research and the availability of group members the researcher has to determine which approach he or she will follow (Getliffe, 1998; Creswell, 2014). According to Creswell (2014), researchers who choose to perform a quantitative experiment need to focus on 4 focal points: participants, materials, procedures and measures. Firstly, after deciding if a quasi- or true experiment will be carried out the inquirer needs to think of equating groups by matching participants with the use of a pre-test to avoid unwanted outcomes and to support validity positively. Furthermore, he or she needs to cope with appropriate sample sizing to accomplish a statistical significance and a desired power of the study. In addition, the researcher needs to be aware of dependent and independent variables to be able to target specific ones. Concerning instrumentation and materials the person conducting the research needs to set which materials will be used to influence dependent variables and instruments for evaluating the significance, before conducting the experiment. Finally, researchers need to deal with various experimental designs, which differ in structure and length.

In the following chapter a more detailed view on the method of surveying is presented, as this one will be used for performing this research.

9.1.1.1.1. Surveying

Creswell (2014) summarizes the components of a survey into 4 main groups: survey design, population and sampling, instrumentation, and variables. In the first part the researcher has to deal with the question of why a survey is needed and why it is preferred to other research tools. Furthermore, a part of the survey design is to set the length of the study, is it cross-sectional or longitudinal? Also, he or she should define which media will be used for data capturing. Secondly, the researcher needs to deal with the topic of sampling to identify the needed participants for the study and choose between single stage and multistage clustering, random sampling or stratification. Random sampling had the main characteristic that people were selected by chance and that this type of sampling can be generalized due to a potentially high variability in types of people. Creswell (2014) suggests that researchers should mention which tool was used to generate and evaluate the survey as well as performing a prior pilot test (Given, 2008). In addition, composers of scientific papers need to be aware that the method of surveying is accompanied by a high number of aspects in favour of using it, but does have some disadvantages which need to be considered. The main advantage of performing a survey in a quantitative research is that it is a method which offers a great structure, facilitating further analysis. In addition, the method is not difficult to use, less expensive and time-consuming than other tools. Researchers who conduct a questionnaire will potentially have to fight with low response rates and no chance to follow-up due to anonymity. Furthermore, misunderstood questions, or too superficial ones could lead to less useful data and a less representative outcome of the research (Getliffe, 1998).

9.1.1.2. Qualitative Methods

Another way to collect data is qualitative data collection. Differently to quantitative methods, qualitative tools focus on collecting knowledge, attitudes, perceptions from people in a more intense setting. This means that researchers ask open questions and participants give unbiased answers and the interviewer is able to ask for further explanation if needed (Creswell, 2014; Given, 2008).

Researchers have a high number of tools to collect valuable data for their research. These tools have to be chosen to suit perfectly the needs of the topic. Persons who

make use of qualitative methods can choose from: observations, interviews, multimedia documentation, cultural elicitation, site mapping and ethnographic surveys. Qualitative research does not only consist of appropriate design types and methods, the researcher him- or herself plays a crucial role in qualitative research. Creswell (2014) confirms the above-mentioned statement by stating that "inquirers explicitly identify reflexively their biases, values and personal background, such as gender, history, culture and socioeconomic (SES) that shape their interpretations formed during a study" (p.115). Oates and McDonald (2014) did their research on the researcher's role on interviews and came to the conclusion that qualitative researchers need to focus especially on the way they design their research, because an inappropriate design can lead to unwanted data collection and not obtaining the aimed information.

9.1.1.2.1. Qualitative Experiment

According to Bernard (2012) "there are several ways to categorize experiments. First of all, there is the distinction between randomized, and nonrandomized assignment of participants, or true experiments versus quasi-experiments ... Another way to categorize experiments is in terms of where they are done: in the laboratory or out in the world." (p.91). Depending on the scope of the research there are different ways of how a researcher can find valuable data for his research, and every tool has positive and negative impacts on the outcome. The person him- or herself is the one who decides according to the needs of the research which type of experiment suits best. The classically designed experiment requires a random assignment of participants in order to measure dependent variables before and after the treatment aiming to confirm a hypothesis or to prove wrong. Whereas in quasi-experiments people are selected, not randomly assigned. Also, the researcher has to define if the experiment will be conducted in a laboratory or in the field. On the one hand field research gives researchers a real-life environment, where on the other hand effects can happen by chance caused by unwanted effect in the environment of the member of the experiment. All these aspects play a role when it comes to internal and external validity. Randomized experiments in the laboratory have a strong internal validity, caused by the high control of researchers on the subjects, external effects can hardly influence the research, but potentially lack in external validity. Also, field experiments have a problem representing

perfect external validity, if researchers want to generalize outcomes of the study, questioning to which extent a generalization is appropriate and valid (Bernard, 2012; Given, 2008).

9.1.1.2.2. Qualitative Interview

The differentiation between 3 types which vary in structure and openness is necessary. The most structured interview is the standardized interview, where every member will be asked the same questions and has a set of possible answers, leaving a small amount of free space for the subject to develop his or her answer and the future development. Whereas this method generates data, which can be easily coded into data and compared. On the other side of the spectrum there is the unstructured interview. In this interview form the leading is done by the interviewee, meaning that the interviewer asks a general question and the interviewed person will answer this question upon his or her wishes. A benefit from this form of interviewing is that the researcher can gain valuable information he or she would not even ask for, building a good base for further research. A potential threat is that participants could feel uncomfortable in this setting and provide less valuable information or none at all, if they refuse to answer the questions to a wider scale (Bernard, 2012; Misosch, 2015).

Another important aspect which needs to be considered when performing an interview is that interviewers need to ensure that contextual features are recognized and mellowed. For doing this the researcher acting as interviewer needs to know his or her position in the interview. According to Brinkmann and Kvale (2015) the interviewer can take following positions: pollster, prober or participant. Depending on research topic and needs for accomplishing a valuable research the researcher should be able to make use of these 3 forms.

Furthermore, researchers should be aware of potential ethical concerns. Analysing data also offers space for unethical behaviour, researchers need to be sure that transcriptions contain 100% correct information and nothing from the interview is eliminated or added to ensure quality standards and correctness of information. In addition, the person conducting the study has to question how far the participants can be included in further data processing and understanding. Lastly, the researcher is responsible for what he or she publishes and that wrong or harmful information can have negative effects on them. (Creswell, 2014; Misosch, 2015).

9.2. Hypotheses and Research Questions

This chapter is dedicated to present the scope of the research. Based on the type of research – mixed methods, this section presents separate hypotheses and research questions for quantitative and qualitative components as well as two mixed methods research question, which include research from both perspectives.

The main purpose of this paper was to elaborate on the impact of wearable devices on life and work satisfaction, therefore the mixed method research questions were the following:

Mixed Methods Research Question 1: *How do demographic criteria, life and work satisfaction, as well as knowledge on wearable technology impact the acceptance of wearable devices at the workplace?*

Mixed Methods Research Question 2: *How do wearable devices influence life and work satisfaction?*

The research questions themselves were intentionally very broadly constructed to capture all possible outcomes of this explorative research. To explore the unknown effect on both variables coming from the wearable device. Furthermore, the research questions were based on two components: the data on attitudes received from quantitative analysis and the qualitative field experiment, where participants wore the devices over a time-frame of 4 weeks and shared their perceptions in a semi-structured interview.

The base of this research was set by a quantitative analysis gathering perceptions on wearable technology and their occurrence in work and private life, therefore following hypotheses, presented in chapter 9.2.1. and 9.2.2, were composed.

9.2.1. Hypotheses

Hypothesis 1: Age is a determinant of people's openness on wearable devices at the workplace.

Hypothesis 2: There is a relationship between people's awareness on the security problems caused by wearable technology and potential job changes if employers force employees to wear wearable devices at work.

Hypothesis 3: There is a relationship between perceived life satisfaction and the willingness to share data with other people

Hypothesis 4: People who are more stressed at work are less willing to wear a wearable device at work and share the captured data with their employer.

9.2.2. Secondary Hypotheses

In contrast to regular hypotheses these were not observed as a primary goal, they arose during the phase of data analysis. Therefore, they did not have a major role in this thesis, but findings were reported to contribute to additional gains in knowledge.

Secondary Hypothesis 1: People who own wearable devices are rather willing to use wearable devices at work than people who do not.

Secondary Hypothesis 2: People who do not own one or more wearable devices would welcome the technology in work-life if the employer would provide it.

Secondary Hypothesis 3: People who own one or multiple wearable devices perceive the technology to have a rather positive effect on work-life balance than people who do not.

Secondary Hypothesis 4: There is a relationship between people who exercise on regular basis and their willingness to share their data with other people.

Secondary Hypothesis 5: People with a higher perceived economic state are more likely to quit their job if their employer forces them to wear a wearable device at work.

Secondary Hypothesis 6: People who feel a lack of security at their workplace are less willing to wear a wearable device at work and share the captured data with their employer.

Secondary Hypothesis 7: There is a relationship between people's job satisfaction and willingness to quit if employers force them to wear wearable devices at work.

After evaluating the relevance of single components on factors such as the acceptance of wearable technology at work and others, a linear regression model will be created, where the influence of variables such as perceived health, life satisfaction and job satisfaction and openness towards wearable technology at work will be presented.

Lastly, the qualitative research questions which were based on the performed experiment and the following semi-structured interviews to discuss perceived impressions of participants are presented in two separate groups: research questions and secondary research questions.

9.2.3. Research Questions

Research Question 1: How do wearable devices influence life satisfaction?

Research Question 2: How do wearable devices influence overall work satisfaction?

Research Question 3: How is perceived work-life balance impacted by wearing a wearable device at work?

Research Question 4: To what extent do employees feel open towards wearable devices at the workplace?

9.2.4. Secondary Research Questions

Secondary Research Question 1: How is the general perception of wearing a wearable device within a work environment when knowing that the researcher can access data anytime he wants?

Secondary Research Question 2: How do wearable devices impact the perceived physical health of people?

Secondary Research Question 3: How do wearable devices impact perceived productivity?

Secondary Research Question 4: How is the perception on fostering competitiveness between people wearing wearable devices?

Secondary Research Question 5: How do wearable devices at work impact emotional traits like being joyful/relaxed/sad/nervous/angry/stressed?

9.3. Mixed Methods – Detailed Research Plan

As proposed, a Mixed Methods approach was performed in this paper, where quantitative and qualitative components were combined to offer a wider range of tools to discover new findings on the impact of wearable devices on life and work satisfaction.

9.3.1. Quantitative Research Method – Survey

In the beginning of this research the base for creating a questionnaire was set by performing a literature review on the elaborated topic. Formerly current literature gave a rough overview on people's attitudes towards wearable technology and that companies focused majorly on selling the technology rather than presenting real scientifically proved benefits. A handful of researchers took it to a further level by discovering that wearable devices in fact have low effects on physical activity and can cause stress to the operators.

Participants for this research were recruited by making use of the private and professional network. In addition to this, persons were asked to share the questionnaire of this study to increase its range.

Based on the research aim, the survey was structured in 4 parts. The first part was dedicated to receiving demographic data from the people who took the questionnaire. The next step was an examination of life satisfaction and work satisfaction. The last part was dedicated to gather information on wearable devices and attitudes towards them. Sample questions for receiving information on life satisfaction were: *In most ways, my life is close to the ideal. How would you rate your weekly stress level? How would you rate your work-life balance?* People who were employed, self-employed, freelancers or take part in the military service were asked about their work satisfaction. In this section participants were asked questions like: *Are you overall satisfied with your work? Does your work stress you? Do you feel appreciated at your workplace?* The very last section is dedicated to wearable devices and the perceptions of the participants towards this technology. Here they will be asked questions like: *Do you think that wearable devices have an impact on work-life balance? Do you think that employers would abuse employees based on captured data? How likely is it that you quit your job if your employer forces you to wear a wearable device at work?*

Out of this questionnaire this research aimed to be able to accept or reject the prior-set hypotheses. *The full questionnaire for the quantitative research can be found on page 122, Appendix 1.*

9.3.2. Qualitative Research Method – Experiment and Semi-Structured Interview

In the second phase of this research, an experiment over a time-frame of 4 weeks was performed. 10 employees from different industries were asked to wear a provided wearable device.

With respect to the conduction of the experiment on the first day, the devices were set up and their main functionality explained. There was no communication between the researcher and the participants from the beginning to the end of the experiment. The only exceptional case would have been if the device had malfunctions and therefore threatened the research.

On the final day of the planned timeframe the devices were collected and a semi-structured interview to gather information on how participants felt during the experiment and their opinion regarding future applicability was conducted.

The semi-structured interview was performed on the research members last day, after 28 days of participation. For this, a guideline on topics which need to be covered during the interview was prepared. Questions were asked such as: *Do you perceive that the worn wearable device impacted your competitive thinking?* In addition to asking open questions, several questions from the survey, like: *Overall, are you satisfied with your work?* were asked again to assess changes. *The guideline for the semi-structured interview is enclosed in this document on page 135, Appendix 3.*

9.3.3. Sampling and Sample Sizes for Quantitative and Qualitative Components

Based on the plan to represent a broad spectrum on the applicability of his research, this research addressed a variety of people.

The quantitative research did not have any limitations in terms of sampling. Persons who got in contact with the survey were able to be part of the study. For being able to distinguish between different characteristics the survey collected information on factors such as age, gender and occupation.

For the qualitative component, a quasi-experiment was performed and the participants were selected by following characteristics:

- Age: 23-40
- Working in: Austria
- Industry: Diverse
- Type of Job: Employed, mainly working in an office, no or low amount of manual work
- Company Size: Minimum 10 employees

The table below shows details on the interviews and the positions held by people who were interviewed. The reason why numbers are used is to ensure anonymity of the participants.

Table 1: Interview Overview

Interview	Position	Group
1	Captain, Military Service	Test-Group
2	Costing Specialist	Test-Group
3	Project Manager	Test-Group
4	Public Relations Employee	Test-Group
5	Consultant	Test-Group
6	Human Resource Manager	Test-Group
7	Personal Trainer	Test-Group
8	Quality Manager	Test-Group
9	Quality Manager	Test-Group
10	Junior Revenue Consultant	Test-Group
11	Assistant to the CEO	Control-Group
12	Captain, Military Service	Control-Group
13	Credit Analyst	Control-Group

9.3.4. Qualitative Research Method – Measurement Overview

In this section, the interface of the used application from the manufacturer and software developer Fitbit is presented. The images exhibit actual captured data and the appearance of the application on iOS and Android.

Personal Profile

The basic function of a fitness tracker is to collect data from the user and transform it into valuable information. The first image, Image 1, present the user-interface. The participant is confronted with information on steps taken, kilometres taken, calories burnt and active minutes per day. In addition, operators receive an overview on the amount of exercises done within the current week and their sleep analysis. As it can be seen in Image 1, current movement, heartbeat and weight changes within a certain period is presented too. In addition to this, users can log their water and food consumption to monitor them.

Image 1: Fitbit App, Personal Profile Overview

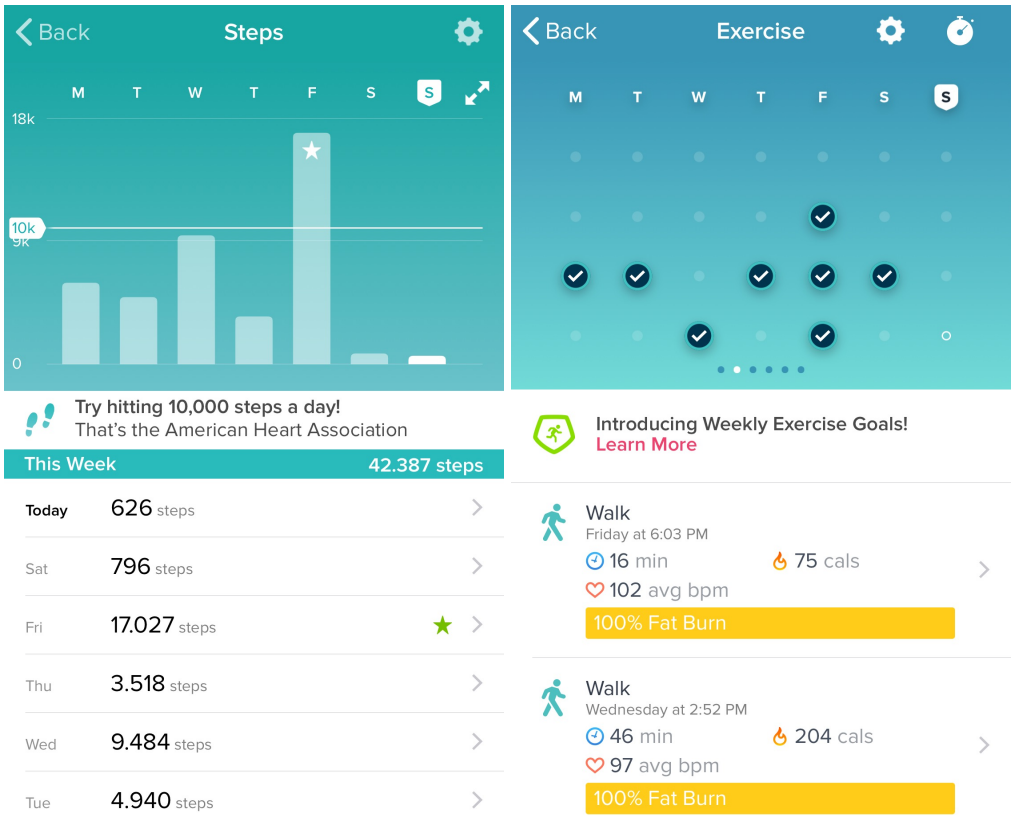


Image 2: Fitbit App, Activity Overview

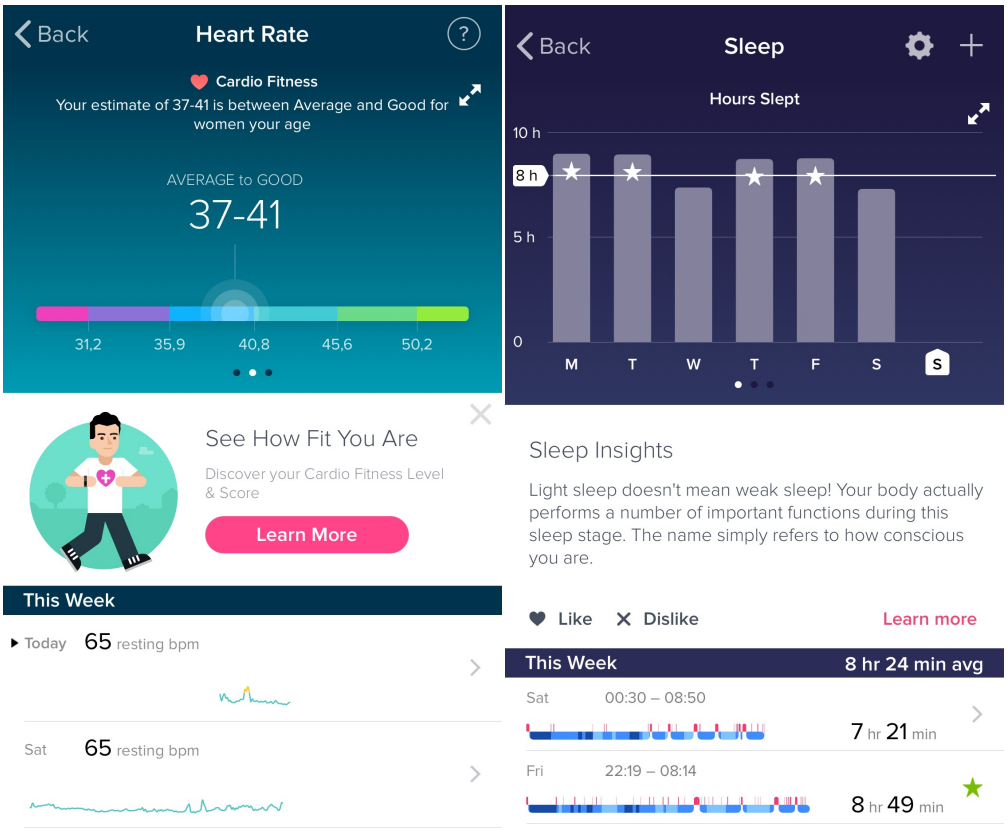


Image 3: Fitbit App, Sleep and Heart Rate Overview

Further in-depth insights can be received from the software, which are presented in Image 2 and Image 3. Steps can be observed within a weekly overview, displaying daily and weekly achievements, as well as average steps taken. Image 2 shows the exercise screen which present the workouts done within a week and offers a calendar based monthly overview.

Operators are able to receive further information based on the measurement of their heart rate during rest, sleep and workout. As an example, Image 3 presents the computed cardio fitness level of the participant and the users' sleep analysis, demonstrating sleep cycles, hours slept per day and averages for the current week.

Competitor View

The second component which is valuable for the research and offered by the software developer is the function to compete against other people. Operators who use the devices were able to connect with others and compare their steps taken.

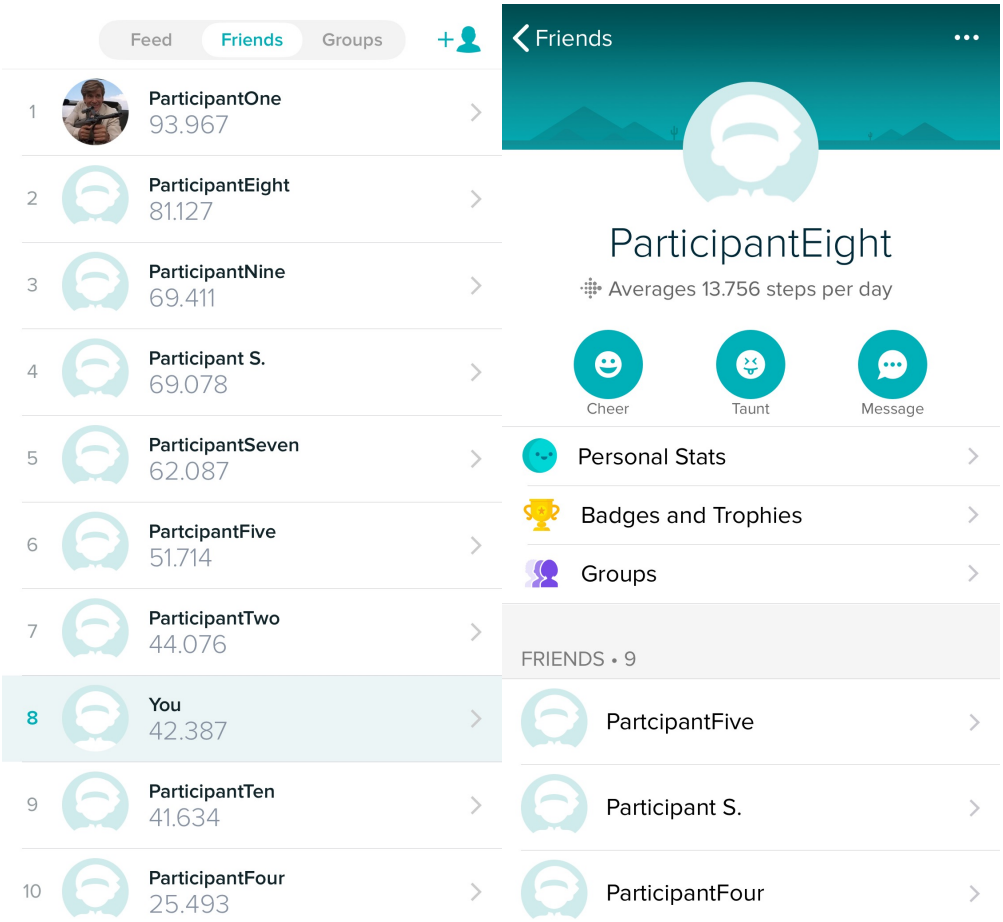


Image 4: Fitbit App, Competitor Overview

Image 4 is the overview presenting all the members with whom a user is connected with the steps taken within the last 7 days and the current ranking. People are also able to receive further insights on the users they are connected with. They can see their achievement and friends, contact them and send cheers and taunts.

9.4. Mixed Methods: Prospected Models of Influences

In addition to the research questions a hypothetical linear regression model (Illustration 2) was created, where the expected influences on the acceptance of wearable technology at work is presented. It was created to pre-determine expectations on the research to structure which information should be retrieved from making use of qualitative as well as quantitative research tools. The concept will be accepted, rejected or re-shaped by creating a concept based on gathered data from the conducted survey and the findings from the experiment.

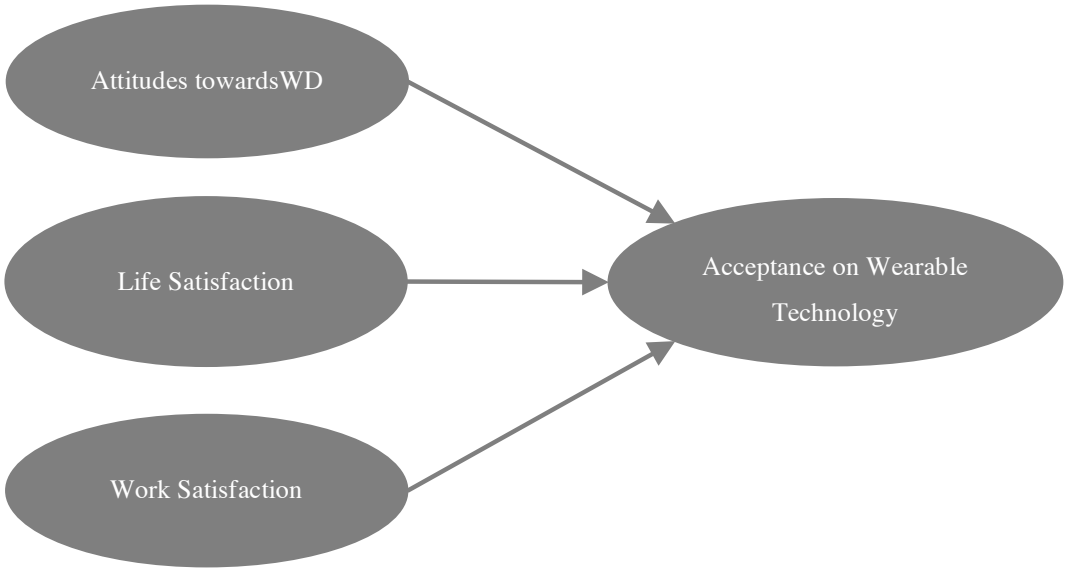


Illustration 2: Prospected Model of Influences I: Influences on the Acceptance on Wearable Technology

In the second step, this paper will evaluate the semi-structured interviews from the experiment to see the effect of wearable devices on life and work satisfaction. Therefore, the prospected model looks as presented in Illustration 3:

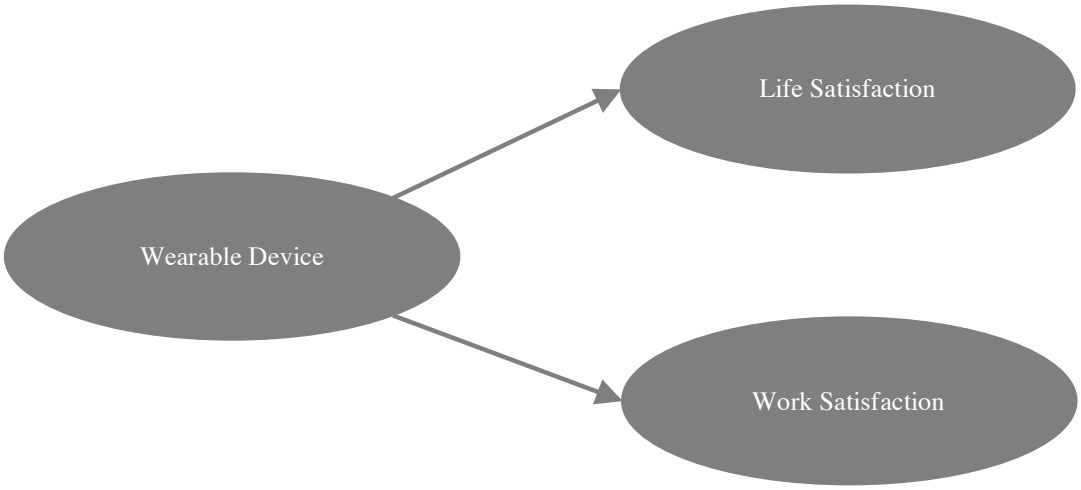


Illustration 3: Prospected Model of Influences II: Influence of Wearable Devices on Life and work Satisfaction

Depending on the outcome of this research the concept shows potential cross-influences, which will be further examined. If the qualitative research explores positive effects on life and work satisfaction, openness to wearable devices could improve over time. If the opposite comes to light a negative spiral could appear, meaning that wearable devices at work impact the openness to wearable technology and potentially further factors in an undesired manner.

10. Quantitative Research: Results

The following analysis are clustered in three main groups: hypotheses, linear regression model and secondary hypotheses. Every hypothesis was tested with the entire dataset, in addition analysis had been performed on two main groups: employees and students, because these groups are or will be the most affected from this technology. If strongly deviating findings were discovered in one group they were reported separately in this paper.

10.1. Data Description

10.1.1. Dataset

The dataset used for the quantitative analysis was collected from 21.01.2018 to 11.02.2018. In total 158 people participated in the survey and 157 of the responses were included in the actual research. In terms of gender participation 59.8% of the participants were female. 142 out of 157 respondents were between 18 and 29 years old the rest ranges between 30 and 48. Referring to education 40.7% stated that they have finished their A-levels or equivalent, 43.3% hold a Bachelor's degree and 13.4% a Master's degree. The two main groups of occupation captured in the questionnaire are students (65.6%) and employees (25.5%). The annual gross income of most of them is below 18.000€ (107 participants), the second biggest group earns between 18.000€ and 34.999€ (30 participants), the rest earns more.

10.1.2. Variable Description I – Measuring Openness on Wearable Devices at the Workplace

The variable measuring the openness on wearable devices was generated by extracting the information gained through asking following questions to the participants: *If your employer asks you to wear a wearable device at work and he/she is able to see your data (anonymised), would you agree? (multiple answers possible)*. 2 out of 5 answers represent absolute disagreement or agreement to wearing wearable devices at work. The other 3 reflect that generally people would accept wearing a wearable device at work with limitations such as: limited access of the employer to the data and no influence on job security and provision of the device. These 3 answers were partly responded in various combinations. Therefore, the variable was created to capture gen-

eral acceptance with limitations. Caused by the near absence of absolute positive values, they are clustered with positive answers with limitations. Which leads to two main groups: would not agree to wear wearable devices at work and would agree to wear wearable devices at work with or without limitations.

10.1.3. Variable Description II – Provision of Wearable Device by Employer

The variable reflecting the provision of a wearable device by the employer was generated out of the information captured collectively by asking participants if they would agree to share data with their employers with or without limitations. One limitation in the question is that people are willing to share data generated by wearable devices only if employers would provide them. To answer Secondary Hypothesis 2, questioning if someone who does not own wearable devices would be more open to them if provided by the employer this information was separated from the data.

10.1.4. Variable Description III – Difference between Openness on Wearable Devices at the Workplace and Acceptance of Wearable Devices at the Workplace

To eliminate potential uncertainties given by the fact that the above-mentioned variables could contain the same information this section is dedicated to express their differences in terms of meaning and show that they do not capture the same information by performing a Mann-Whitney U-Test between both variables.

The rest demonstrated that there is a significant difference between those two groups ($p<0.01$). People who are less open to WDs at the workplace are more likely to quit their job if they were forced to wear a WD at the workplace equalling their acceptance to their technology. The median value of people who stated them as not open to the technology rated their likelihood to quit within a scale from 1 to 7 is 4 whereas the ones open to the technology display a median value of 3.

Nevertheless, it can also be observed that there is room for additional interpretation. The information in the variable measuring the openness to WD at the workplace was captured in the questionnaire by asking participants if they would agree that employers would be able to see personal data and to which extent. In numbers, 54 out of 157 respondents stated that they would never agree to share data with their employer, whereas 103 would be willing to do so with, or without limitations. In contrast, the other variable captures the extreme situation that people would quit if they were forced to wear a wearable device at work, leading to an outcome that 47.77% of participants

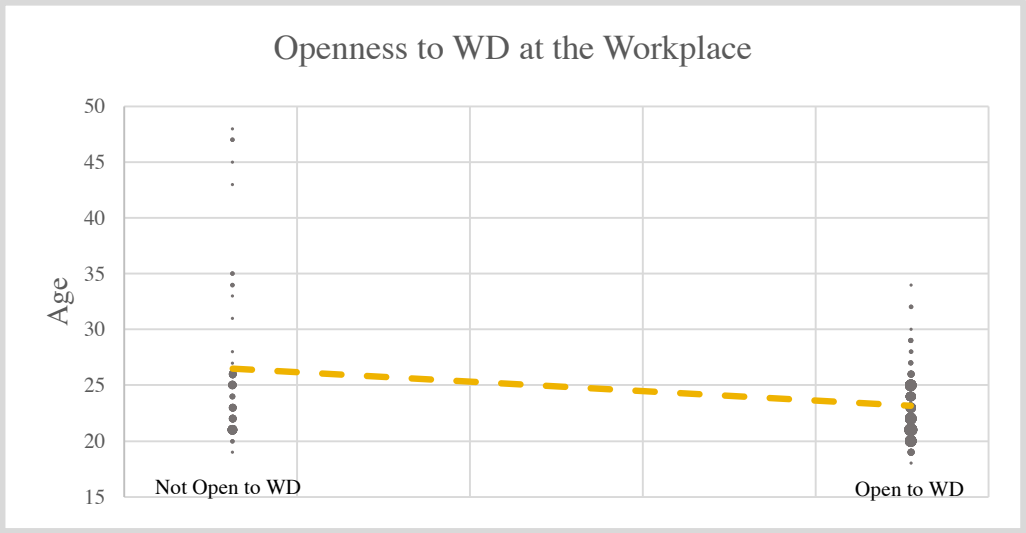
would rather quit their job and only 26.75% would rather stay at the actual workplace. Out of this analysis it can clearly be seen that the variables capture two different, aspects which need to be seen as separate.

10.2. Quantitative Research - Hypotheses

The aim in this section is to present how the sample of 157 people perceived wearables in general. The questionnaire refers to topics such as openness on wearable devices at workplace or perceived work-life balance.

Hypothesis 1: Age is a determinant of peoples' openness on wearable devices at the workplace.

For answering this question, a non-parametric test for 2 groups was performed. According to the p-value of Mann-Whitney U-test there was a significant difference ($p<0.01$) with regards to age determining the openness to wearing a wearable device at work. The median age of people who were open to WD at the workplace was 23 whereas the other groups median was 24. This leads to the conclusion that H1 can be accepted and that age determines the openness to wear wearable devices at work.

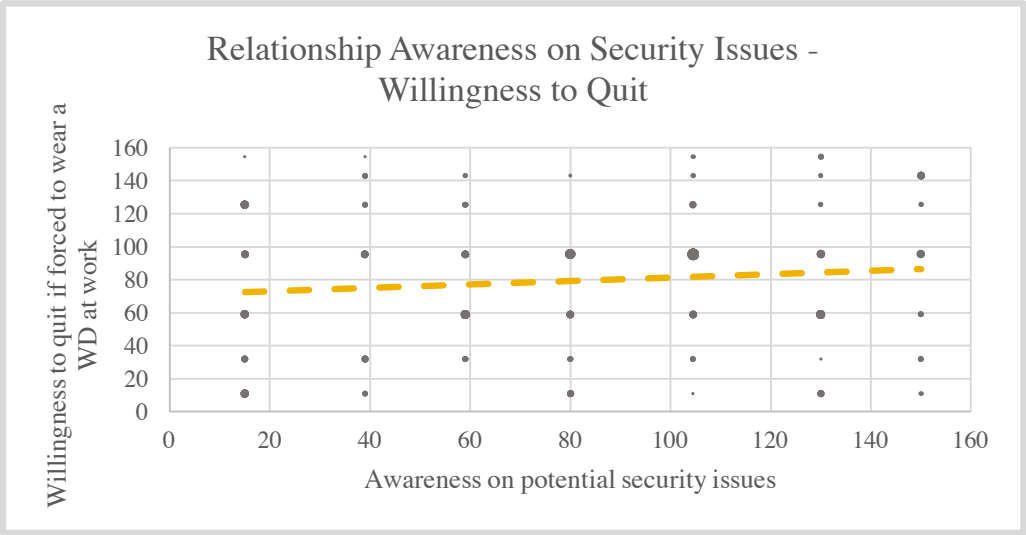


Graph 1: Scatterplot, Openness to WD at the Workplace

Examining the scatterplot (Graph 1) between age and openness to wearable devices at the workplace the information gained from the Mann-Whitney U-Tests can be reflected visually. The graph confirms that age influenced significantly the openness to wearable devices at work negatively. Older people tended to be more reluctant towards wearing the above-mentioned devices at work.

Hypothesis 2: There is a relationship between people's awareness of the security problems caused by wearable technology and potential job changes if employers force employees to wear wearable devices at work.

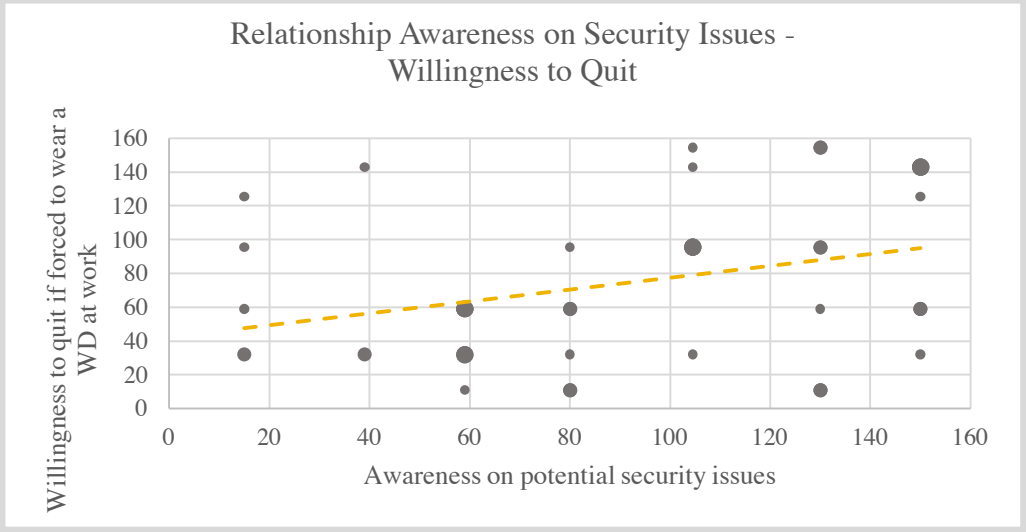
For testing the significance of this hypothesis, a correlation between the ranked variables of willingness to quit if employees would be forced to wear WDs at the workplace and the perceived awareness on potential security issues arising from wearable technology was carried out.



Graph 2: Scatterplot, Relationship - Awareness on Security Issues to Willingness to Quit

The Spearman correlation and the scatterplot for it (Graph 2) displays a very weak (r=0.10) and non-significant (p=0.195) correlation between the acceptance of WD at the workplace and the awareness arising from potential security issues. Which leads to the conclusion that there was no significant or strong relationship between people's awareness of the security problems caused by wearable devices and potential job changes if people would be forced to wear wearable devices at the workplace.

Further testing was done for employees only to unveil a relationship on the variables, which is presented in Graph 3.



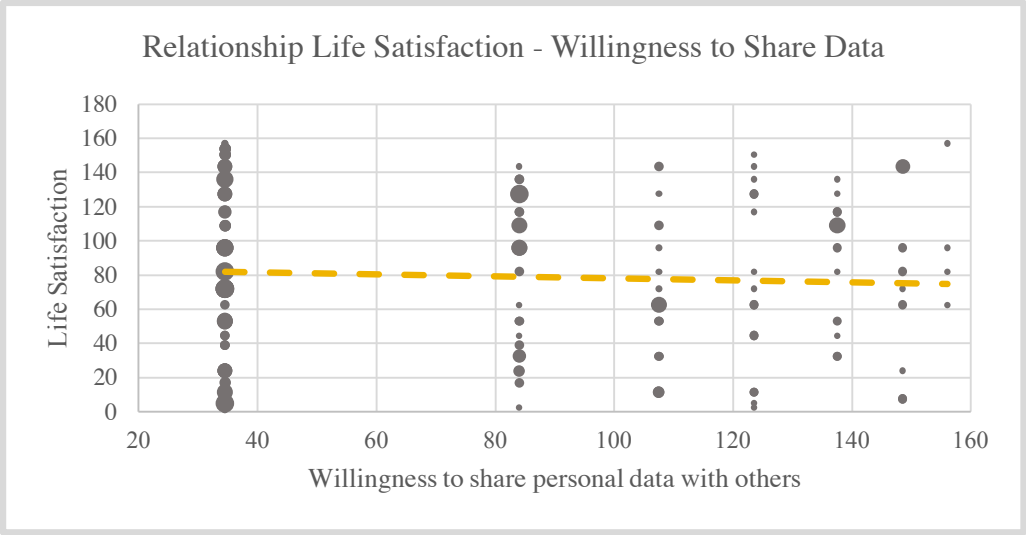
Graph 3: Scatterplot, Relationship - Awareness on Security Issues to Willingness to Quit, Employees only

Referring to the dataset containing employees only it can be observed that for this group a significant (p=0.035) and moderate (r=0.33) Spearman correlation was detected and is visualized in Graph 3. This means that people who were more aware of potential security issues of wearable devices would be more likely to quit if their employer would force them to wear an above-mentioned device at work.

Therefore, the hypothesis needed to be rejected for the whole data set, but could be reframed to following hypothesis: *There is a relationship between employed people's awareness of security problems caused by wearable technology and potential job changes if employers force them to wear a wearable device at work.*

Hypothesis 3: There is a relationship between perceived life satisfaction and the willingness to share data with other people

The research aimed to find if there was a significant correlation between the variables capturing average life satisfaction and willingness to share data.



Graph 4: Scatterplot, Relationship Life Satisfaction to Willingness to Share Data

As can be seen in Graph 4, the correlation shows a slightly negative Spearman correlation (r=-0.06), non-significant relationship (p=0.481) between those two variables. The hypothesis was rejected, more in-depth analysis on employees and students did not reveal any significant findings regarding perceived life satisfaction and the willingness to share data with other people.

Hypothesis 4: People who are more stressed at work are less willing to wear a wearable device at work and share the captured data with their employer.

For performing this evaluation, a Kruskal-Wallis test was chosen.

Table 2:Influence of Stress at Work on Willingness to Share Data

	Value	Mean Rank
Not Stressed at the workplace	1	11.00
	2	37.00
	3	20.75
	4	29.20
	5	23.25
	6	29.57
Very stressed at the workplace	7	37.00

The test demonstrates (Table 2) that there is a slightly non-significant outcome (p=0.068). It can be seen that people with a higher stress level of 2, 4, 6 or 7 were more open to wearable devices at their workplace than others. Despite the scientifically non-significant output several Mann-Whitney U-Tests with Bonferroni correction had been performed to receive in-depth insights. None of the groups presents a significant difference between each other.

A significant result (p=0.049) presented in Table 3 was discovered by exchanging the variable measuring the openness to wearable devices at the workplace by acceptance of wearable devices at the workplace. The evaluation of the outcome with individual Mann-Whitney U-tests displayed that accepting the hypothesis would lead to a Type 1 error because the pair of groups did now show a significant difference individually.

Table 3: Influence of Stress at Work on Willingness to Share Data, Employees only

	Value	Mean Rank
Not Stressed at the workplace	1	41.25
	2	21.10
	3	33.00
	4	14.70
	5	31.50
Very stressed at the workplace	6	25.50
	7	21.67

There was no significant difference between people who are more or less stressed at work and their openness and acceptance to wear a wearable device and share the captured data with their employer.

10.3. Linear Regression on Acceptance to Wearable Devices at Work

The base for this research was set by the previously drawn and presented model in the Methodology section. Due to non-significance of the linear regression based on the previous assumption new ones were created, which focus on distinct variables to predict the acceptance of wearables devices. In addition to that a reduction of the number of variables was executed by performing a factor analysis but without interpretable outcome due to low reliability of the variables. For this research, a Cronbach's α of 0.7 or higher was set and a dimension reduction would lead to an unsatisfying reliability. The following linear regressions base only on single variables, 4 models had been created: one on the whole dataset, one for employees and two for students.

10.3.1. Linear Regression Model - General

The model, presented below in Table 4 is based on 5 variables, 1 each comes from the section of the questionnaire capturing life and work satisfaction and 3 cover attitudes towards wearable devices.

Table 4: Linear Regression, 5 Component Model

	Unstandardized Coefficient	Standardized Coefficient	Significance
Constant	3.17	0.00	0.104
Appreciation at the workplace (v1)	0.42	0.30	0.037
No. of Workouts per week (v2)	0.51	0.29	0.039
Awareness on WD security issues (v3)	0.25	0.27	0.057
Perceived Impact of WD on WLB (v4)	-1.12	-0.48	0.001
Provision of WD by employer (v5)	-1.23	-0.27	0.061

The linear regression unveils that 5 variables: being appreciated at work (v1), the amount of exercising per week (v2), awareness to security issues (v3), perceived impact on work-life balance of wearable devices (v4) and the provision of wearable de-

vices by the employer (v5) can predict acceptance to wearable devices at the workplace (r=0.67) with a significant outcome of 0.002. Those variables together stand for 45% of the explained variability. The regression equation for this particular model is:

$$\text{Acceptance of Wearable Devices at the Workplace} = 3.17 + 0.42*\text{appreciation} + 0.51*\text{exercising} + 0.25*\text{awareness on security} - 1.12*\text{impact on WLB} - 1.23*\text{provision of the device} + \varepsilon$$

The equation states that the amount of exercising, the higher the appreciation at the workplace and the higher the awareness with respect to potential security issues the likelihood to quit increased if employees were forced to wear a wearable device at work. The provision of a wearable devices at the workplace and the perception on the positive impact of wearable devices on work-life balance increased the likelihood to quit.

10.3.2. Linear Regression Model – Employees

Table 5 presents a very significant model ($p<0.01$) for employees ($r=0.87$), which explains 75% of the explained variability by evaluating 9 components. Each 3 out of these variables capture life satisfaction, work satisfaction and attitudes towards wearable devices.

Table 5: Linear Regression 9 Component Model, Employees Only

	Unstandardized Coefficient	Standardized Coefficient	Significance
Constant	-1.09	0.00	0.674
Conditions of Life (v1)	1.23	0.66	0.02
Economic State (v2)	-0.75	-0.37	0.037
Stress in Life, General (v3)	0.52	0.33	0.042
Meaning of work at the workplace (v4)	-0.43	-0.31	0.034
Planned WP change (v5)	0.47	0.55	0.002
Appreciation at WP (v6)	0.61	0.42	0.003
Awareness on WD security issues (v7)	0.41	0.41	0.004
Perceived Impact of WD on WLB (v8)	-1.03	-0.41	0.003
Provision of WD by employer (v9)	-1.93	-0.37	0.007

This model comes closer to the general idea that 3 components, namely life satisfaction, work satisfaction and attitudes towards wearable devices have a stake in explaining acceptance of the above-mentioned technology at the workplace. For this model, the regression equation is presented below:

$$\text{Acceptance of Wearable Devices at the Workplace} = -1.09 + 1.23*\text{life conditions} - 0.75*\text{economic state} + 0.52*\text{stress} - 0.43*\text{meaning of work} + 0.47*\text{planned WP change} + 0.61*\text{appreciation at WP} + 0.41*\text{awareness on security} - 1.03*\text{impact on WLB} - 1.93*\text{provision of the device} + \varepsilon$$

The equation uncovers that life satisfaction components negatively as well as positively impacted the acceptance of wearable devices at the workplace. Employees with higher perceived life satisfaction were more reluctant to the technology. Lower stress and higher economic state were beneficial for the acceptance of wearable devices. Examining work satisfaction participants who perceived their work as more meaningful were more open to implementing wearable devices at their workplace. In contrast, more appreciated people and employees who are more likely to change their job within the next months were more reluctant. Referring to general attitudes on wearable devices there were no major changes compared to the previous model, security awareness had a negative impact and the perceived impact on work-life balance as well as the provision of the device by the employer increased the acceptance of wearable devices at the workplace.

10.3.3. Linear Regression Model – Students

The general idea for this research was to create 2 focused models one each for students and one for employees. It can be seen in Table 6 that the usage of the variables for the general dataset cannot be used for this group due to non-significance of them.

Table 6: Linear Regression, 6 Component Model, Students Only

	Unstandardized Coefficient	Standardized Coefficient	Significance
Constant	5.80	0.00	0.03
Conditions of Life	0.00	0.00	0.990
Economic State	-0.22	-0.16	0.258
Stress in Life, General	-0.18	-0.16	0.257
Awareness on WD security issues	-0.01	-0.01	0.918
Perceived Impact of WD on WLB	-0.15	-0.11	0.448
Provision of WD by employer	0.22	0.06	0.667

The linear regression based on variables containing life satisfaction and general attitudes on wearable devices computed a weak (r=0.22) and non-significant model (p=0.83). Further ones based on different variables had been computed and no significant outcome on the linear regression was observed. The expelling of life satisfaction

from the model, meaning that only attitude variables on wearable devices were covered led to a significant (p=0.038), but still weak for students (Table 7), presenting an r of 0.31 and r^2 of 0.10.

Table 7: Linear Regression, 4 Component Model, Students Only

	Unstandardized Coefficient	Standardized Coefficient	Significance
Constant	5.23	0.00	0.000
Currently owning a WD (v1)	-0.71	-0.20	0.045
Interesting in buying a WD (v2)	-0.13	0.15	0.145
Willingness to share personal data (v3)	-0.16	-0.17	0.086
Provision of WD by employer (v4)	-0.52	-0.14	0.156

The model consists of 4 variables, one is significant and 3 non-significant. It displays that students who owned a wearable device and were interested in buying one were less willing to quit than people who did not. In addition to that the provision of a wearable device by the employer and the openness to share data with others impacted positively the attitude to stay at the job. The presented linear regression can be stated as below:

$$\text{Acceptance of Wearable Devices at the Workplace} = 5.23 - 0.71 * \text{owning a WD} - 0.13 * \text{Interested in Buying a WD} - 0.16 * \text{Willingness to share data} - 0.52 * \text{provision of the device} + \varepsilon$$

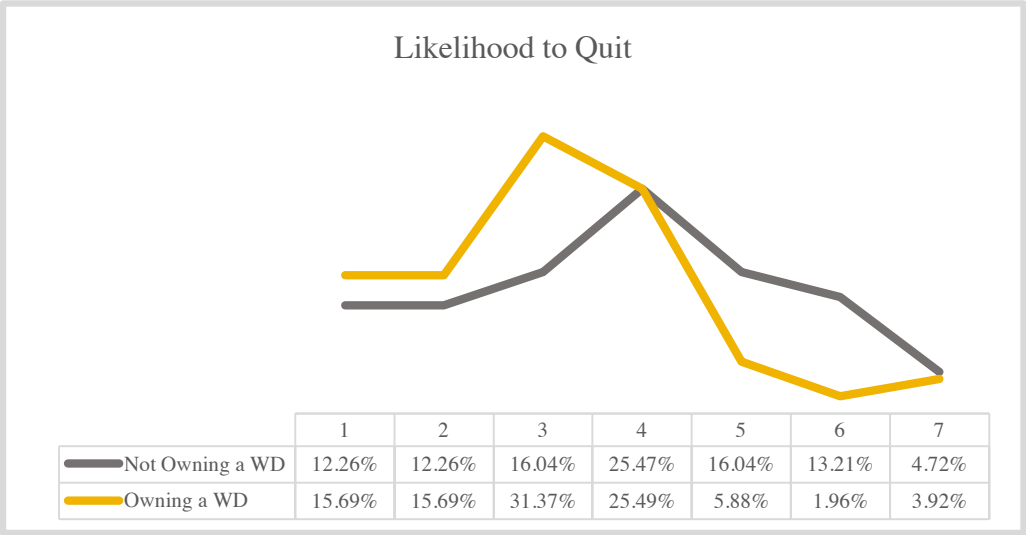
It is obvious that the presented model only captured a specific part of influences affecting the non-acceptance of wearable devices at the job leading to terminate the employee-employer relationship. No pattern explaining the different outcome between employees and students was found. The reason for not being able to construct a predictive model is that potentially important influences were not captured in the questionnaire. Components which could have an impact on the willingness to quit a job are: missing growth potential, no trust in the companies' leaders, work hours and pay (Grund, 2013; Branham, 2012). Their interaction with openness to WD is left to future research. In addition to literature the dataset revealed that the median age of the 94 participating is 23 and that 94 of them had no income or earn less than 18.000€ per

year. It is assumed that the sample could hardly empathize with quitting a job without being already on the job market or having a full-time employment. Therefore, the information captured could be blurred and no significant model can be created based on these data.

10.4. Quantitative Research - Secondary Hypotheses

Secondary Hypothesis 1: People who own wearable devices are rather willing to use wearable devices at work than people who do not.

Due to not normally distributed data, a Mann-Whitney U-Test was performed to examine if there is a significant difference between persons who owned wearable devices and those who did not with regards to using WD at work (p=0.010). Participants who owned one or more wearable devices were more likely to accept wearing a wearable device at work if their employer would force them compared to than people who do not.



	1	2	3	4	5	6	7
Not Owning a WD	12.26%	12.26%	16.04%	25.47%	16.04%	13.21%	4.72%
Owning a WD	15.69%	15.69%	31.37%	25.49%	5.88%	1.96%	3.92%

Graph 5: Influence of owning a WD on the likelihood to quit

It can be seen in Graph 5 that the group not owning a wearable device was rather willing to quit if their employer forced them to use a wearable device at work with a total percentage of 33.97%, whereas owners of wearable devices only occupy 11.76% in the area from 5 to 7.

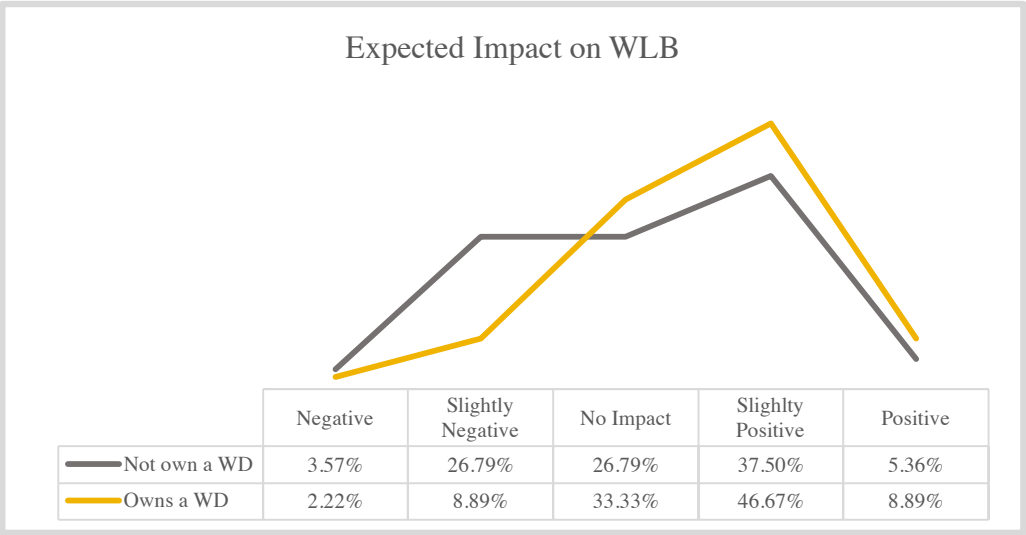
Participants who owned wearable devices were rather willing to use wearable devices at work than the ones who did not.

Secondary Hypothesis 2: People who do not own one or more wearable devices would welcome the technology in work-life if the employer would provide it.

The Mann-Whitney test showed a strongly non-significant difference (p=0.764) with nearly equal mean ranks, therefore the hypothesis was not confirmed.

Secondary Hypothesis 3: People who own one or multiple wearable devices perceive the technology has a rather positive effect on work-life balance than people who do not.

The Mann-Whitney U-Test revealed a tendency (p=0.063) that people who owned one or more wearable devices perceive that the technology had a rather positive effect on work-life balance. Graph 6 demonstrates that the strongest difference can be observed in the perception that wearable devices negatively influenced work-life balance. 30,36% of the participants in this questionnaire who did not own wearable devices believed that the device influenced work-life balance unfavourable. In contrast only 11.11% of people who owned wearable devices perceived the same.



	Negative	Slightly Negative	No Impact	Slighlty Positive	Positive
Not own a WD	3.57%	26.79%	26.79%	37.50%	5.36%
Owns a WD	2.22%	8.89%	33.33%	46.67%	8.89%

Graph 6: Influence of owning a WD on the expected influence on Work-Life Balance

The hypothesis was rejected due to no statistical significance, but a tendency was discovered that owners of wearable devices would rather rate the technology affirmative on its impact on work-life balance.

Secondary Hypothesis 4: There is a relationship between people who exercise on a regular base and their willingness to share their data with other people.

This hypothesis questions if one variable of life satisfaction containing information on the quantity of exercising per week has a significant relationship with the willingness to share data in general. Therefore, the ranked variable of quantities of exercising was put into correlation with the willingness to share data with other people to show the following output.

Graph 7: Scatterplot, Relationship Exercise Quantity to Willingness to Share Data

Graph 7 displays a very fragmented output with a nearly non-existing correlation (r=0.06) and a non-significant output (p=0.448). It can be concluded that the initial hypothesis did not reflect the captured reality and therefore it needed to be rejected. According to the analysis there was no relationship which reflects the quantity on exercising and the willingness to share personal data.

Secondary Hypothesis 5: People with a higher perceived economic state are more likely to quit their job if their employer forces them to wear a wearable device at work.

With the aim to gather findings on this research question an ANOVA test was performed. The variable containing information on the likelihood to quit was grouped by the economic state of the participants. The output offers insights into the effect of the economic state on the acceptance of wearable devices at the workplace.

Table 8: Perceived Economic State to Willingness to Quit Current Job

	Value	Mean Values
Low economic state	1	4.00
	2	3.25
	3	3.71
	4	3.76
	5	3.58
	6	3.22
Excellent economic state	7	3.75

The analysis presented in Table 8 displays that there is no significant difference (p=0.197) between people with various perceived economic states and their willingness to quit if their employer forces them to wear a wearable device at work. Further analysis was performed on employees and students only, none of these groups showed a significant difference. It can be seen that the rated economic state between 2 and 7 presented similar mean values between 3.25 and 3.75 The hypothesis was rejected and therefore it can be concluded that people with various perceived economic states have no significant difference in their likeliness to quit if their employer forces them to wear wearable devices at work.

Secondary Hypothesis 6: People who feel a lack of security at their workplace are less willing to wear a wearable device at work and share the captured data with their employer.

This analysis shares the same base as the one performed for the previous research question with the difference that the grouping variable contains information on how secure the workplace is in terms of not being replaced in the near future.

Table 9: Security at the Workplace to Willingness to Share Data with Employer

	Value	Mean Rank
Low workplace security	1	-
	2	37.00
	3	11.00
	4	30.50
	5	21.40
	6	31.00
High workplace security	7	26.89

The Kurskal-Wallis test (Table 9) revealed a strongly non-significant difference ($p=0.265$). Further analysis on variables containing information on the likelihood to quit if people were forced to wear a wearable device at the workplace was performed with similar outcome, which is not presented in this document. Concluding that the perceived security at the workplace did not impact the willingness to share data with employers significantly and H0 needed to be maintained.

Secondary Hypothesis 7: There is a relationship between people's job satisfaction and their willingness to quit if their employer forces them to wear a wearable device at work.

In order to analyse the potential relationship between those two variables a correlation between variables containing information on the willingness to quit if people were forced to wear a WD at the workplace and work satisfaction was executed.

Graph 8: Scatterplot, Work Satisfaction to Willingness to Quit

The scatterplot (Graph 8) reflects the nearly non-existent, negative (r=-0.030), non-significant correlation (p=0.832) between those two variables. Summarizing that there was no relationship between the willingness to quit if people were forced to wear wearable devices at work and general work satisfaction, therefore H0 was maintained.

11. Qualitative Research: Results

This chapter is dedicated to unveiling findings based on the qualitative research component. 10 participants, 4 males and 6 females between the age of 23 and 40, wore a fitness tracker for 4 weeks to contribute to this research. All of them had been employed at this time and worked in various fields of occupation. 4 members had been working in the hotel industry, 2 in the food manufacturing industry, 2 had been employed by the government and one each had worked in the health industry and in consulting. To examine the effects on groups where people know each other a partnership with a known hotel in Vienna was established, 3 out of 4 people coming from the hotel industry worked with each other. In addition to the group which was tested, a control group was established containing 1 female and 2 male participants in the previously set range of age. The members of the experiment had to participate in a standardized questionnaire before and after the treatment. In addition to that, a semi-structured interview was conducted to explore potential knowledge gains. A third research component was established by extracting the data captured by the wearable device to compare the outcome of the qualitative interview with data. The result of the questionnaire and data from the wearable device are only reported if they meaningfully contribute to the information captured in the interviews. The interviews are not published in this research due to confidentiality reasons.

Generally speaking the participants were overall very satisfied with wearing the wearable device. They stated that it was very interesting, but partially odd to wear it and the insights created by the device had been perceived as motivating. Special focus was received by the function to track personal sleep by nearly all of them. To show all the findings in a structured manner and in-depth the following two sub-chapters will be devoted to work on prior-set and secondary research questions which came up during the research.

11.1. Qualitative Research – Research Questions

This section presents the findings focused on the prior-set research questions. The following main chapter will afterwards make use of this knowledge, combine information of the quantitative and qualitative research component and contribute to the main scope of this mixed methods research.

Research Question 1: How do wearable devices influence life satisfaction?

People participating in the qualitative research component mostly stated that they did not perceive any influence coming from the device on their life satisfaction, each 2 out of 10 had recognized slightly positive or negative changes in life satisfaction. Participants who perceived a beneficial impact stated that overachieving the daily challenge and reflecting the step count as well as the sleep analysis positively impacted their overall life satisfaction. A participant who perceived a positive effect described it as following:

"… it gives you somehow a good feeling, not only that you sleep good for yourself, but rather you have it black on white. I think it always has a positive effect. You know that you move, but when you see it in numbers, this is something else. I believe that it is like this in many areas, which is also true in this case" (Participant 10).

With a closer look on the interview it was detected that the quantification of numbers was perceived as positive for this person. Observing contradictory perceptions that wearable devices had a negative influence on life satisfaction following statement was made by one participant:

"…My conscience was impacted negatively twice, firstly because I'm waiting to be able to do again sports because my body starts to decay and in addition the device shows that you have done 0 out of 5 sports activities for the week…" (Participant 5).

It is observable that this person perceived a very strong negative change in life satisfaction. The first influence was that the person was not able to do sports and the second one came from the alerts the device was emitting. It can be assumed that the person was strongly motivated to exercise, because even pausing on short period was described as decaying of the body. Another participant stated nearly the same: a constant conflict between work and doing sports, which stressed the person. Out of these interviews it can be seen that the reflection of activity was perceived as positive as well as negative, assuming that the personal expectations on their activity level and the percentage of achievement led to the perceptions. The unwanted feelings came only from the issue that participants were not able to meet their goals. Members of the research who did not perceive any effects, 6 out of 10, stated that consciousness was impacted,

but that they did not see why such a device should have an impact on their life satisfaction and 2 stated that the period was too short to answer this question with full reliability.

The interviews presented that life satisfaction for most participants was not impacted. Each 2 had been confronted with positive and negative changes in life satisfaction which was directly related to wearing the device. These changes were caused by the fact that people achieved or did not achieve their prior set goals or activity standards. Observing that the technology itself acts a reflector of peoples' activity and depending on their expectations life satisfaction can be impacted in both directions. It can be assumed that the two participants who did not feel an impact due to the short period could perceive negative as well as positive ones depending on what they expected from themselves and if the expectations were met, which was reflected by their captured data.

Research Question 2: How do wearable devices influence overall work satisfaction?

Commonly to the outcome of the previous research question most of participants did not perceive any changes in their work satisfaction, but again 4 out of 10 perceived conversions of the component. 2 group members had been impacted in a beneficial manner by wearing the device, one of the members of the research coming from the industry partner was very positively affected by being able to compete with colleagues stating that: *"You are satisfied when you know you took enough steps, you had been more active…"* (Participant 9). On the opposite side of the spectrum peoples' work satisfaction was negatively impacted by reflecting that they were not able to meet the exercise demand. A participant expressed that seeing how inflexible someone is due to actual workloads impacted the measured component. The other one who perceived negative impacts had similar perceptions, the conflict arose from high amount of work and the inner need to exercise creates a undesired attitude towards work.

*"In contrary, it could rather cause a negative effect that you are even more stressed. For example, on one day like last Thursday, I was the whole day occupied by work … it was not possible due to lack of time because I had a lot of appointments on this day stupidly, and I was not able to do sports. In the evening, I thought s***, now I was not able to do sports today…And if I would not have a tracker it would not*

*matter to me…" (*Participant 1). Describing perfectly the stress caused by the technology. But as it was already detected for life satisfaction the negative effect comes from quantifying unwanted outcomes/habits. Even though 2 participants commented that they did not perceive any influence on work satisfaction they were interested by the number of steps counted during their work. One person stated following:

"From time to time it was interesting, because on some days I was sitting only and on other days I helped everywhere where I was needed at the moment and in this case, I help in the kitchen from time to time, observe everything in the building, have meeting and this was interesting to see that I deviate between 3.000 and 10.000 steps per day." (Participant 8) 5 of the participants, even if they did not perceive any impact on work satisfaction referred to their step count at work or their general workout schedule.

Observing the outcome of the experiment it can be seen that the majority did not perceive any changes on work satisfaction, but still 4 out of 10 expressed some developments. 2 out of 6 people who did not perceive any changes mentioned that they had been interested by their step count at work. People who perceived positive effects did so because they were happy with their activity at the workplace, negative effects had been caused by work-sports conflict, members of the experiment were not able to meet their activity goals based on high workloads.

Research Question 3: How is perceived work-life balance impacted by wearing a wearable device at work?

The majority of participants expressed that their work-life balance was impacted by wearing the device over the period of 4 weeks. 6 out of 10 perceived a positive impact on their work-life balance, but nobody was confronted with a negative change in their work-life balance. People stated that they were more likely to walk instead of taking public transport, the knowledge gained out of sleep analysis reminded them to take more time for oneself and that the device generally motivated them to improve their work-life balance in general. One person commented following:

"…I believe that it impacts it, because you are focused to achieve at least the step count of 10.000. You are willing to achieve this small daily goal and for that I consciously went for a walk 2 or 3 times. I took my friend and said let's go…" (Participant 9). Observing the constant need of people to meet the set goals of 10.000. Participants perceived it as necessary to walk more in order to achieve this goal on a

daily basis. Another person who perceived beneficial changes made following statement:

"Yes, I need to say that based on that, that I work in an office I sit a lot on the computer and it was influenced for sure because I looked on my step performance and said to me that I need to move a little bit to boost my performance…" (Participant 2). Examining the statement in detail it is reflected that the step count did motivate to take more activity to meet the step demand. One person reported that the changes in work-life balance came from the awareness on her sleep activity. The group member said that it was terrifying to be confronted with bad sleep quality and that it could be arising from stress at work (Participant 3). Also, here it can be seen that being confronted with something undesired can cause changes in specific aspects in life. It can be assumed that the person did not have information on sleep activity before the experiment and the expectations on sleep quality were higher than the information presented by sleep activity analysis.

The device itself did not show any negative effect on work-life balance and 6 out of 10 participants did report a positive change coming from general as well as specific origins. The assumption can be met that the quantification of peoples' lives firstly helps in terms of having insights in actual level of activity, sleep and more. Secondly, because participants tended to change their habits in a desired manner increasing their perceived work-life balance by striving to meet various types of goals.

Research Question 4: To what extent do employees feel open towards wearable devices at the workplace?

The participants were confronted with two questions firstly: *Would you feel comfortable using this tool in a professional environment? Meaning that your employer offers you the device and has full insights to your statistics?* and *Would you agree to stay at your job if you were to be forced to wear the device?*

On the first question, all of the people in the experiment expressed a negative sentiment, feeling uncomfortable to wear a device similar to the one worn for 4 week at the workplace. Following statements had been made:

"…I would say rather not if the employer observes you, I think that they would be definitely interested on it, but what is the added value?, I could not imagine any

added value by now." (Participant 3); *"… I just would not want it, not because I feel uncomfortable, more because I do not see any point in that."* (Participant 8);

"… it is hard to judge, it depends on the type of work you do. The employer could be able to spot that I move too much during the working hours and do not spend enough time on my desk and that is somehow like real surveillance, I'm not sure if I would perceive this as good…" (Participant 10) and

"… if I imagine that my employer sees when I sleep and what I do at my time off … I do not perceive this as cool, because at a certain time point you want to have your private life and the employer has not to be there…" (Participant 9).

These 4 examples demonstrate general openness to wearable devices at the workplace. Participant 3 and 8 specify why they are not in favour of using the technology at the workplace because they did not see a personal added value for them. Referring to this, 4 participants stated that external motivation such as money would be a motivator for them. *"For money you do a lot, if my employer would give me 300 € more per month then I would agree."* (Participant 7) was said by one of the members. Surveillance was also a critical point for Participant 3 and 10, they expressed that it could be assumed that companies would have a benefit from it, but that the insights could harm employees. Participant 9 worried about being constantly observed by the employer even in private life and that this was not acceptable.

Despite a negative general feeling 4 out of 10 participants said that they would be willing to accept wearing a device coming from their employer with full insights.

A sub-question asking for limited accessibility of data by the employer revealed further findings. Most of the participants, 8 out of 10, would have agreed to share their step count with their employer without any external motivation like money. In addition, it was said that they needed to know the framework conditions and what would be done with the data. The information which was most private for members of the research was their sleep analysis. This was the type of information they would share the least. Following expressions had been made*: "… sleep, what does that concern my employer as long as I can do my job…"* (Participant 10); *"… especially how long I sleep, that's the worst of one."* (Participant 4), stating the general reluctance on sharing this very personal data with the employer. It can be assumed that this type of data is the most valuable for most of the participants. This could be based on the invasion

of their private sphere and possible consequences on factors they can hardly control, like quality of sleep.

The second question targeted the willingness to quit if people would be forced to wear a device at work and here similar findings had been presented like in the quantitative research components. Despite a negative sentiment people were not that likely to quit. Participants were asked to comment on the likelihood to quit if they were forced to wear such a device during their work times. The median value within a scale from 1 to 7 where 7 is very likely to quit the median value was 2. One person expressed the *following:*

"I do not think that I would quit immediately only because my employer says: "Here this is a device you need to wear … but I would definitely have a close look in it to see what it is really about…" (Participant 10). It can be seen that participant 10 had an open view on this point, even if the employer would force the person to wear it during hours of work. Nevertheless, a critical component was still observable based on part of the statement that a closer look will be made. *"… I would not understand it and I would perceive it as weird, but I would wear it if it needs to be worn."* (Participant 8). This statement shows that the person would just accept it. Critical questioning and further observation of the development of this project is completely missing. Whereas another member of the group made a law-based expression: *"To me it is not a decision on life or death… the employee is anyway bound to the data protection ordinance."* (Participant 3). It can be assumed that this person had a general trust in companies and that they behave based on current law. Unfortunately, current happenings in the world do not contribute positively to trusting companies and their behaviour with data. On the beneficial spectrum, the European Data Protection Board dealt extensively with this matter and in May 2018 new laws protecting peoples' data will become effective (European Data Protection Board, 2016).

Asking the group members how likely it would be that they quit if the employer forces them to wear the device at the workplace and in their leisure time a negative tendency was observable. The median value soared to 4 and a Wilcoxon test revealed a strongly significant outcome ($p=0.007$). Comments were captured such as: *"No, I would not accept this at all …Absolutely not"* (Participant 4) stating an absolute non-compliance to this and *"It is not about the data it is that my employer forces me to do something*

at my time off work…" (Participant 8) expressing that the personal opinion of the participant was that the employer should not be allowed to intrude into private life. In contrast to most of the opinion one participant expressed following: *"I think it only makes sense to wear it in time off work and at work, because otherwise you would not have exact data capturing…"* (Participant 3). This person revealed the challenges people would be confronted with if they would not wear the devices all the time. The technology and software benefits from constant data capturing and interpretation. If users decide to wear it only for specific reasons information which bases itself on several components such as general fitness level ca not be displayed correctly. Furthermore, interpretation of data can suffer. The cause of changes in for example sleep quality can hardly be detected if they are coming from lack of activity and this data was not captured, because people did not wear the device.

This extensively discussed question in the semi-structured interview gave insights on the general openness and acceptance of wearable devices at the workplace. Participants in the experiment were generally reluctant to using this type of device and serving all their data to their employers. But all the entries have a different importance level for all of the members of this research and data on sleep was the most valuable one. In terms of likelihood to quit this research shows that there was a low chance that people would quit if they would use the technology during their working time, but it significantly increased by expanding the observation to private life. It needs to be concluded that people are not open to the technology, but limitations and additional information contributes to their openness on wearable devices at the workplace. Referring to influence on life and work satisfaction changes in both spheres had been observed, as well as partially positive developments on work-life balance. The changes can be derived from the quantification of various activities and that people's expectations on these were met or not. Participants who did not meet their personal expectations suffered from negative changes in life and work satisfaction.

11.2. Qualitative Research – Secondary Research Questions

Secondary Research Question 1: What is the general perception of wearing a wearable device when knowing that someone can access data anytime he or she wants?

Most of the participants stated that they did not feel observed at all or they did not care a lot about it. Only one person expressed that a constant surveillance was perceived.

"…you are completely transparent. You wear it all the time and the one who… if someone had access this person would know when you go to bed, how long you need to awake, when you wake up. And not only this, the person would know when you get up from your desk… and if you combine this with a GPS connection … similar to the mobile phone, but slightly more intruding the intimate sphere." (Participant 1). By an observation of this comment in detail it can be seen that this group member was really concerned on this topic. A potential access to data was perceived as complete surveillance of the personal activity and a GPS connected device would even strengthen this perception. Interestingly the person compared the wearable device with a traditional mobile phone which is also able to collect data. Another person said that the missing connection with major social networks like Facebook is perceived as positive, otherwise a undesired perception on observation would be noticed. 3 out of 10 members of the group mentioned that the notifications to walk sent by the device were reminding them on being observed, but did not contribute negatively to the technology.

It can be concluded that people were aware of the fact that they can be observed by anyone within the group or the researcher himself, but only one person perceived this as worth mentioning, the rest of the participants had no major problem with that. Nevertheless, it can be assumed that the openness in terms of data provision to others can deviate depending on current political situations. If companies misbehave people will more likely be reluctant to sharing data then when they meet the privacy demand of their users.

Secondary Research Question 2: How do wearable devices impact the perceived physical health of people?

Most of the participants perceived positive changes in their physical health. Only 4 out of 10 people did not perceive any changes on this matter. Users who perceived a beneficial effect responded such as following:

"… I perceive myself as fitter… I tried to sleep more as I saw that my sleep cycles were completely differing and shockingly really low in the end of the day." (Participant 9); *"…Based on my sleep cycle analysis and seeing that I do not sleep enough the device acted as a motivator to spend more leisure time on myself or go to bed earlier…"* (Participant 3). The expressions made by Participant 9 and 3 shows that sleep monitoring was a major component for monitoring and improving their physical health. Both perceived the technology or at least the information from it as a motivator to sleep more and therefore positively influence their physical health. Another focused more on the general performance displayed by the software: *"… with the increasing amount of data collected I was able to see how my statistic and performance change over time…"* (Participant 2). It is interesting to see that the person mentioned the change over time as important. The accumulation of data is crucial for offering information on various activities. It can be assumed that over a longer timeperiod especially this participant will perceive more and more effects on various aspects like work-life balance or life and work satisfaction.

The evaluation of the data captured from the questionnaire with a Wilcoxon test revealed a significant difference before and after the treatment ($p=0.025$). 5 out of 5 people stated that their physical health increased and no negative changes were captured by the questionnaire. The average value of 4.9 increased to 5.4 within the period of 4 weeks. Taking the step count and sleep quality as two crucial components, a forecast was computed for both factors revealing that only 3 out of 10 participants have an increasing step forecast and 5 out of 10 an improved sleep forecast. 2 out of 4 who did not perceive any effect on physical health had both forecasts on the negative end of the spectrum, whereas one person who expressed positive changes suffered too from undesired forecasts on both components, leaving room for further interpretations.

It can be observed that people tend to perceive positive changes based on wearing a wearable device. Most of these changes were captured from the development in quantity of sleeping time. Combining data from the device and the interviews 8 out of 10 people were affected by a positive change in one or both factors which is expressed in illustration 4.

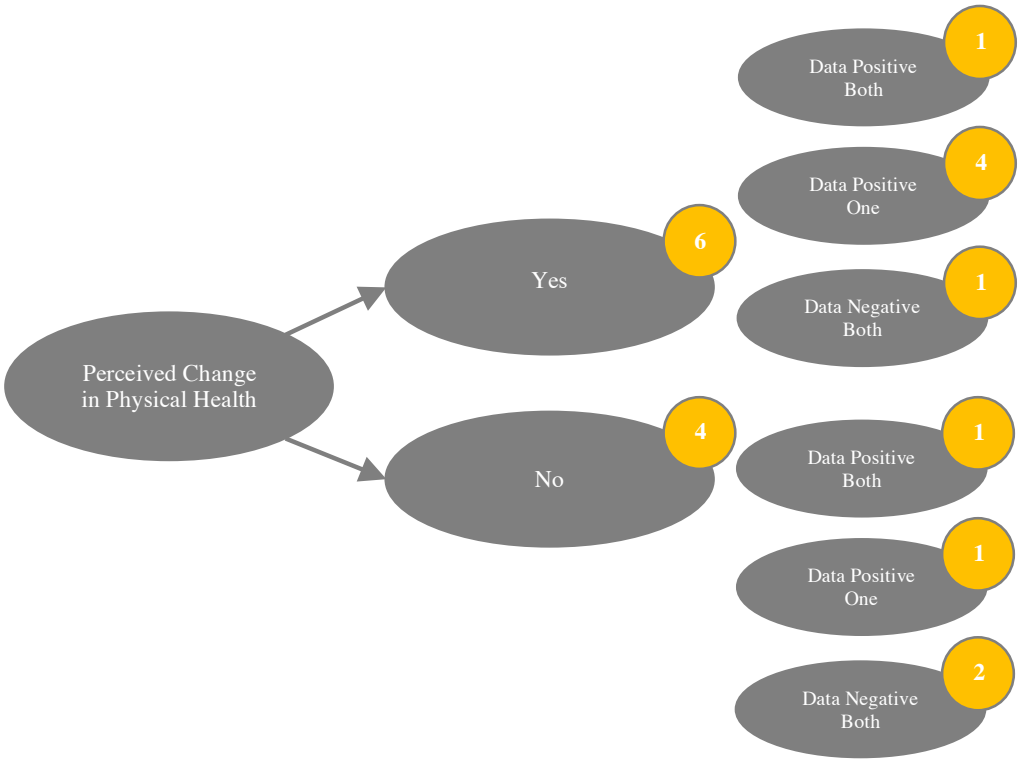


Illustration 4: Changes in Physical Health Perceptions vs. Data

Two participants who stated that they were not affected perceived changes based on captured data, one showed a positive increase in steps and the other in both components. 4 out of 6 who stated that they perceived beneficial changes in physical health improved their sleeping habits. One member of the group experienced a positive change in both factors and one suffered from negative changes based on data, interestingly this person is still confident that physical health has been increased within this period. Despite the findings received from the captured data two participants had undesired developments in step count and sleep activity over time of the period, but this was not reported by them. They stated that they did not perceive any effect on their body. It can be assumed that the effect is not perceived as very strong or that people did not see the device as an influence for this and therefore did not express it.

Secondary Research Question 3: How do wearable devices impact perceived productivity?

The interviews revealed that productivity gains can only be associated in sport related fields, not at work. 6 people who decided to participate in the project expressed that they did not perceived any productivity gains in the period of 4 weeks caused by the device. The ones who did feel a change in productivity stated that it was positive. Participants tended to walk longer or more often, or be slightly more active. Only one

person described a generally strong gain in productivity at sports, in specific it was mentioned that the longer a person wear a wearable device the more productive he or she gets.

Regardless that most of the participants did not perceive any effect on them, 8 out of 10 believe that such a device can impact the productivity of others in a positive manner. The interviewees described it as the first step to influence personal productivity in a positive way. People made very contradicting comments such as:

"… if you are lazy in general I cannot imagine that it will get better on the long term. On short term, a motivational boost could be experienced, but latest in two weeks the person will fall into old habits…" (Participant 1) which reflected the opinion of the person that a short-term motivation could be experienced but saying that lazy people would fall into old habits. Assuming that the technology only helps the ones, who are willing to change their behaviours or be more productive and that the device itself does not offer the necessary motivation.

"For sure, people who are generally inactive and do not do a lot, especially in the work environment where a community is established and you can see who is who this can possibly impact the habits of people that they do more." (Participant 7) This statement contradicts the opinion of participant 1. The member of the group believed that establishing a community is from an especially strong value for people who are less productive than others. This person referred to the effect that persons who are low performers would rather adapt to the group activity than to stay behind. This was also observed in the experiment people tended to walk more or longer and most of the participants expressed that they would not like to fall behind in the ranking. Another group member made following comment which strengthens the previous one:

"… if I am the type of person who is bad in following personal goals then it can for sure be meaningful to wear such a device, which reminds someone continuously and where you can compare your prior set goals with the actual status…" (Participant 5). Only one person expressed disbelief in the power of wearable devices on impacting productivity.

Despite the fact that people in general believe that productivity can be improved by wearing a wearable device on various levels the outcomes of the individual interviews unveiled that only 4 out of 10 people perceived any effect. 4 had been positive 0 negative. All of the improvements were detected on a fitness level none of the participants

described any changes at their personal productivity at work. It can be concluded that productivity gains were noticed by 4 participants, but only on activity and not at work.

Secondary Research Question 4: How is the perception on fostering competitiveness between people wearing wearable devices?

Questioning if wearable devices influence competitiveness between people a section of the interview was dedicated to elaborating on this aspect. Only one person stated scornfully that something like this doesn't matter to her. All the other participants perceived an increase in competitiveness. 3 out of 9 expressed that this effect decreased over time, but the rest did not. A participant with one of the highest daily average step count made following statements: *"In the beginning a slight amount of competitiveness was there..."* (Participant 8). It can be assumed that over time the effect could diminish for this participant. This assumption is also strengthened by the step development, despite being on top of the step count the number of steps taken decreased over the period of 4 weeks. Another one stated: *"… it was a competitive situation and I was always striving not to be the last one, but rather that I'm number 1."* (Participant 1). This group member showed the most pronounced level of competitiveness in the group. The person decided to change regular sports routine from weights lifting to running to increase the step count and therefore lead nearly all the time in the ranking. A further statement was made by this participant which underlines the perceived level of competition in life in general which was received by asking if the person talked to someone else about his or her scores: *"…From time to time, I did so … "before breakfast already 10.000 what did you do?" Of course, you do that from time to time and brag a little bit…"* (Participant 1). Observing that the person had the need to express personal achievements to others while being confronted with the conflict that bragging could be negatively perceived by others.

A second question was asking the participants if they perceived an inner need to adapt their steps based on the performance of others. Interestingly only 3 out of 10 stated that they adapted their steps depending on the step count of the other members and one person would have increased it if a certain negative level would be reached. The other 5 participants did not express any feeling that they needed to improve their steps based on the achievements of others despite their perceived increase in competitiveness.

Concluding that the technology and the software behind it generally fosters competitiveness within a group. People perceive changes and tend to strive for more. But only 4 out of the 9 members of the group who perceived changes in competitiveness were motivated to adapt their step count based on the achievement of others the rest did not. Seeing that it can foster competition, but can't motivate all people to take action to improve their position in the competitive set.

Secondary Research Question 5: How do wearable devices at work impact emotional traits like being happy, relaxed, sad and competitive?

This question was dedicated to exploring if wearable devices impact emotional traits. In this section, statistically significant as well as non-significant outcomes with specific tendencies are reported. It was expected that the feeling of being observed, uncomfortableness, competitiveness and comparativeness will change strongly, before the analysis was performed. Following variables displayed differences in median values, which are expressed in the table below:

Table 10: Influence of Wearable Devices on Emotional Traits

	Mean Value Before Treatment	Mean Value after Treatment	Difference
Feeling of Being Observed	2.0	2.0	0.0
Uncomfortableness	2.0	2.0	0.0
Competitiveness	4.5	5.0	0.5
Comparativeness	5.0	4.5	-0.5
Further Differences			
Relaxedness	5.0	5.5	0.5
Anger	3.0	2.0	-1.0
Selfishness	2.5	2.0	-0.5
Being Confident	5.5	5.0	-0.5
Adventurousness	6.0	5.5	-0.5
Enthusiasm	6.0	5.0	-1.0

As it can be observed in Table 10 only 2 out of 4 expected changes had been observed. The level of competitiveness did increase slightly as it was expected. Comparativeness did not develop the way it was assumed to be, a negative change was detected. Revealing that the initial concept needs to be rejected and only one out of 4 emotional

traits change the way it was expected, participants were more competitive, but less comparative after the treatment.

Further differences were explored, but most of them probably do not have an origin by wearing the wearable device for 4 weeks. Only relaxedness and anger could potentially be implied by the fact that people's sleeping habits have improved over the experiment as well as work-life balance and therefore both of these traits can develop positively, namely relaxedness increases and anger decreases.

Concluding it can be seen that the impact on emotional traits could not be revealed by this work as they were previously expected. Regardless of the seemingly unsatisfying outcome, the data from the questionnaire confirms the expressions in the interviews on the feeling of being observed, uncomfortableness and competitiveness. Participants did in general not perceive any changes on being observed and uncomfortable, and an increase in competitiveness was correctly stated.

12. Mixed Methods: Results

This chapter is dedicated to summarising all findings from Chapter 10 on quantitative and Chapter 11 on qualitative research and answer the previously composed mixed methods research questions:

Mixed Methods Research Question I: *How do demographic criteria, life satisfaction and work satisfaction, as well as knowledge on wearable technology impact the openness and acceptance of wearable devices at the workplace?*

Starting with demographic criteria and general perception the research shows that age significantly determines the openness to wearable technology at the workplace. Younger people tended to be more open-minded, whereas older ones were more reluctant. Further significant findings were detected by examining if owning a wearable device impacted the willingness to wear a wearable device at the workplace. Owners of one or more wearable devices were less likely to quit if they were forced to wear such a device at the workplace than the ones who didn't. In addition, the paper gives information on tendencies concerning the perceived impact of wearable devices on work-life balance. People who own a previously-mentioned device stated that their perceived impact of the devices on work-life balance is higher than the one from non-owners. Exploring the impact of knowledge on potential security issues caused by wearable devices a Pearson correlation unveiled a significant outcome. Employees who were more aware of potential security issues would rather quit their job if they would be forced to wear a wearable device at the workplace than people who don't.

The chapters elaborating on hypotheses and secondary hypotheses had been dedicated to exploring findings on the impact of life and work satisfaction on the openness and acceptance of wearable devices at the workplace. With respect to both components they cannot present any significant outputs by analysing the data based on previously set hypotheses. Therefore, whether life nor work satisfaction have a significant impact on openness and acceptance of WD at the workplace. The performed linear regression revealed that only 1 variable each of life and work satisfaction have a significant impact on the model: appreciation at the workplace and the number of workouts per week. The remaining 3 variables can be described as not related to both satisfaction

components. A more in-depth analysis for employees only reveals that each 3 components from life and work as well as general attributes contributed to a strong ($r=0.87$; $r^2=0.75$) and significant model ($p<0.01$).

Age and already owning a wearable device significantly impacted the openness and acceptance of the technology at the workplace. Older participants tended to be less open to wearing a wearable device at the workplace and owners of on or more wearable devices were rather accepting the technology at the workplace than the ones who didn't. Furthermore, this paper shows that the additional knowledge on potential security issues with regards to such devices impacted the acceptance of employees to the technology at the workplace negatively. For employees, the paper reveals that life conditions, economic state, stress in private life, meaningfulness at work, likelihood to quit, appreciation at the workplace, awareness on related security issues on WD, perceived impact of WD on WLB and the provision of the device explained most of the variability and the likelihood to quit if an employer decides to implement the mentioned technology by force.

Additional findings were explored supporting this model by analysing the conducted interviews. People stated that the characteristics of the way how the wearable technology would be implemented at their workplace plays a major role. Forceful implementation with full insights into captured data received more reluctance than a cooperative way where companies include their employees in this process and the device in only worn on voluntary basis with limited insights for employers. Based on this the initial 3-component model which includes attitudes towards wearable devices, life satisfaction and work satisfaction needs to be complemented by the variable: Project Characteristics.

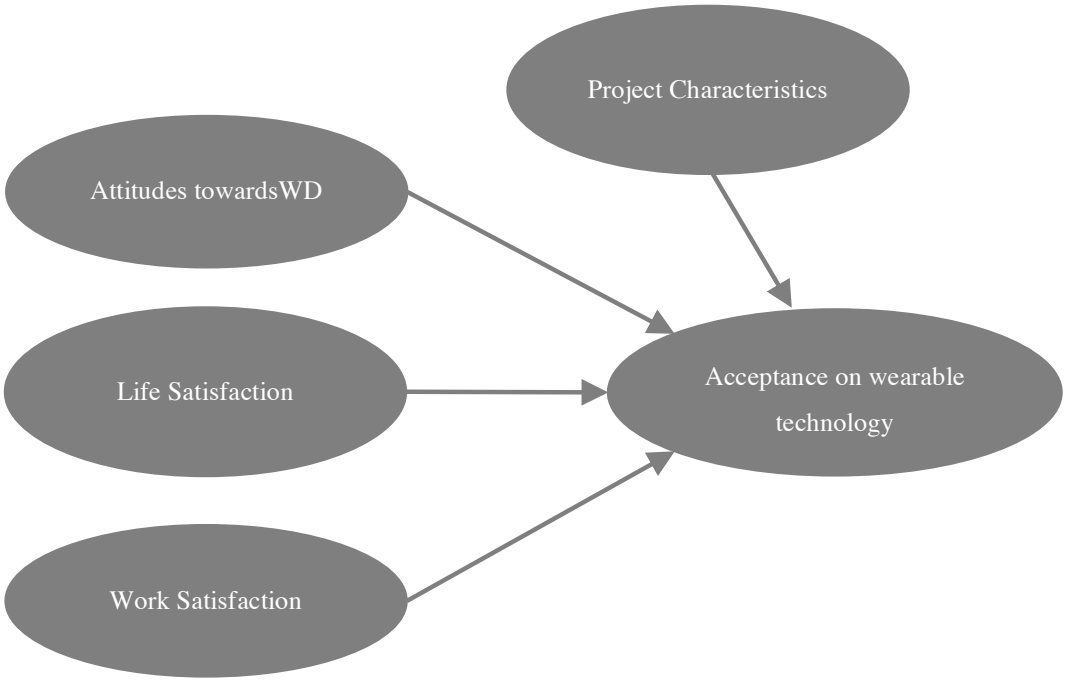


Illustration 5: Model of Influences I: Influences on the Acceptance on Wearable Technology

Illustration 5 displays the new, enhanced model combining the information from both research components. The first 3 components were presented in the linear regression created for the whole dataset as well as a specific one for employees. The additional component is derived from the conducted interview after the experiment and can be seen as one further majorly influencing variable on the acceptance of wearable devices at the workplace.

The previous chapter elaborated on presenting the outcome of the qualitative research component and presented it with a visualisation. In this section, further adaptions on the model will be performed by referring to information out of the interviews and answer the second mixed methods research question:

Mixed Methods Research Question II: *How do wearable devices influence life and work satisfaction?*

The initial concept of this paper was built on the idea that wearing wearable device does impact life and work satisfaction and the goal was to explore to what extent those are influenced. Therefore, following model was created:

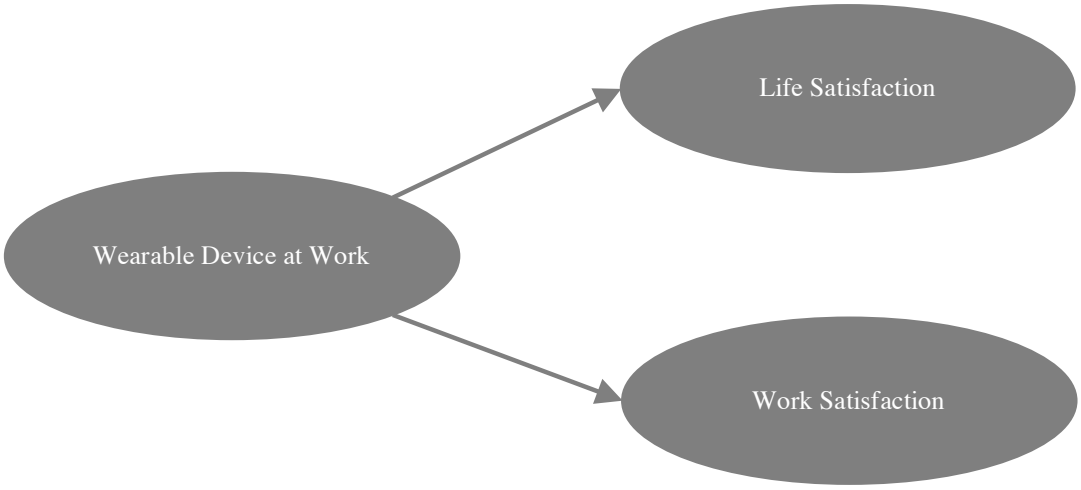


Illustration 2: Prospected Model of Influences II: Influence of Wearable Devices on Life and work Satisfaction

Presenting the initial idea of the influence of wearable devices (Illustration 2). The previous chapter analysing the conducted interviews already showed the results on the perceived effect of the technology on the satisfaction variables. A further visualisation below demonstrates the distinct perceptions experienced by the participants:

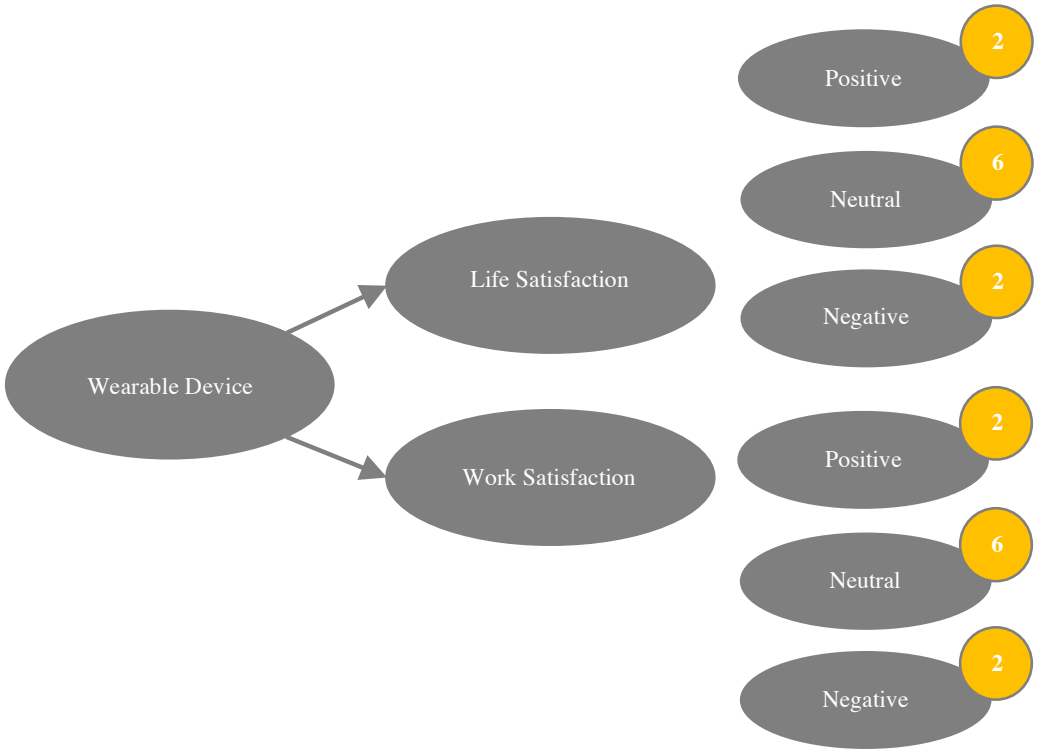


Illustration 6: Perceived Changes in Life and Work Satisfaction

Illustration 6 uncovers that each satisfaction variable was affected 2 times each negatively and positively and that a majority of the participants did not perceive any effect on one or both variables. By further observation on the interviews it was discovered that a majority of people, 6 out of 10 perceived at least one change and the other 4 did

not perceive anything in both variables. The positive perceptions on life and work satisfaction come from 4 different participants, meaning that people felt a beneficial effect on one variable only, not on both. Negative effects on life and work satisfaction it could be observed, group members experienced effects in both variables.

It cannot be ignored that the wearable device worn by the participants did not show any effects on one or both variables. The majority of the members of the experiment reported some changes in the measured criteria. Positive changes had been reported by 4 individuals seeing that only one variable was affected and not both together. Negative changes were experienced by two participants only, but therefore in both satisfaction measures increasing the negativity level of the effect. Literature states that life satisfaction and work satisfaction are interconnected and negative developments on one factor affect the other one with an intermediary effect, this development as it was observed could lead to a negative spiral (Spector, 1997). Summarising 4 participants perceived a positive effect on one variable, 2 undesired effects on both variables and 4 did not perceive any changes in one or both satisfaction categories.

Sharpening the model, it could be observed that people perceived changes in their work-life balance in addition to the effects on life and work satisfaction. This is from strongl value for this research because work-life balance influences life and work satisfaction according to literature. Which can cause potential intermediary effects that can influence both satisfaction variables. This concept is strengthened by the interviews which revealed that 5 out of 6 who perceived any changes experienced positive changes in their work-life balance. A second factor which should not be set aside is the general openness to the technology at the workplace. Participants were in general very reluctant to using the device if their employer would give this to them, but it was also unveiled that limitation of insights and prior presentation of the scope of this measure positively influences the sentiment of the potential users. Further information on this topic can be found in literature presenting project management. Nevertheless, chapter 14 presenting recommendations for employers will include these concepts to make it a useful adviser to employers who want to incorporate this technology at their workplace. Therefore, a model was created to present all the influences which had been experienced by performing the experiment:

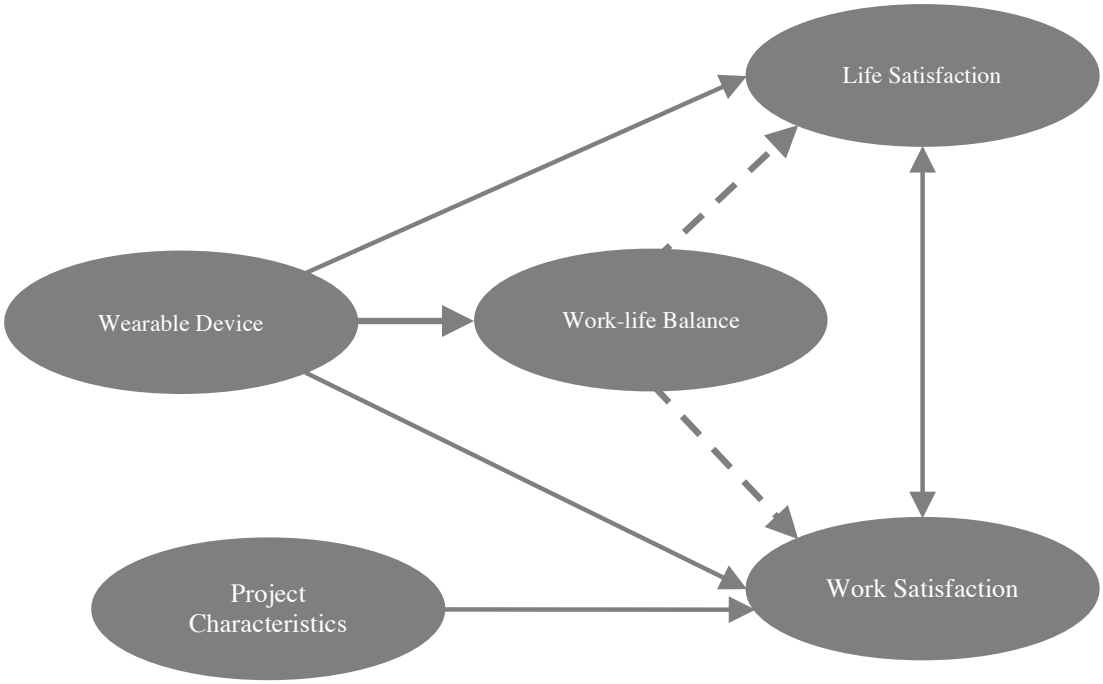


Illustration 7: Model of Influences 3, Direct and Indirect effects on Life and Work Satisfaction

The above-presented model (Illustration 7) demonstrates the measured influences as well as the ones which are described in literature. It was expected that the effect on work-life balance will cause intermediary effects on both satisfaction variables. This was also validated by a Structural Equation Model, which states that the direct effect on Work-Life Balance is stronger than the one life and work satisfaction. The intermediary effect from Work-Life Balance was also reflected by the analysis and had the same power as the direct effect of wearable devices on Life Satisfaction and Work Satisfaction. Details of the model are not reported due to small sample size. Furthermore, the characteristics of the project impact work satisfaction. If employers decide to introduce the technology gently, voluntary, with extensive explanation and limited insight they will for sure be confronted with less negative sentiment than if they would introduce it by forcing employees to wear it without explaining anything to them. Even if employees would not quit directly their work satisfaction would drop.

Additional benefits from conducting a mixed methods research were gained in several factors. The interviews reflected the general sentiment on the openness and acceptance of wearable devices at the workplace. Further knowledge was gained on why people have a negative sentiment on wearable devices at the workplace. The participants of the interviews stated that after wearing the device for 4 weeks they partially see the benefits for employers, but they are demanding detailed descriptions of the aims. Also, what type of data is from crucial role, member from the qualitative research expressed

that for example sleep data is very private to them and this is the type of data they are least likely to share. A strongly significant difference on acceptance of wearable devices at the workplace was discovered when participants were asked their likelihood to quit if the device would be worn at work only or also in private life. The information from the interviews was valuable to explain the data from quantitative research. This helps to understand the drivers of openness and acceptance of wearable devices at the workplace and this is a crucial element to incorporate technologies such as this one on the workplace.

Concluding it can be stated that the models expressed in this chapter present both, firstly what variables influence the acceptance of wearable devices at the workplace, secondly the effects and intermediary effects of the technology on life and work satisfaction. Presenting two which combined together can help to find the right way to implement such a technology at the workplace.

13. Discussion of the Results

This chapter deals with all the knowledge gained from testing previously set hypotheses, secondary hypotheses, research questions and secondary research questions which came up during the work.

On the previous pages of this paper it was shown that the examination of specific factors is from crucial importance if tendencies want to be predicted. Age is an information which is easy to receive and general openness on the technology can be assumed. Younger participants of the research tend to be more open to wearable technology at the workplace than older ones. Especially examining employees, a certain pattern is observable. Persons who think that they are aware of potential security issues are more reluctant to the technology at the workplace. This is at first sight a factor which does not benefit potential implementation of the technology at the workplace, but it can be seen as one. The awareness on potential security issues caused by wearable technology can be used to understand people's fears and to take measures before presentation of the wearable technology to employees. For example, the inclusion of people who have a knowledge in the field could be included in the pre-introduction phase of the project and their negative sentiment could develop to a helping tool. Because these ones potentially represent the fears of others in future and they can be detected before they come to light.

Observing if people already own or more wearable devices is also a helpful information on predicting how well wearable technology could be accepted at the workplace. The results revealed that participants who did not own a wearable device are nearly 3 times more likely to quit if they were forced to wear such a device at the workplace than the ones who did. Demonstrating that people who are in contact with the technology have generally a more open sentiment than others. A positive development was also observed in the experiment. After 4 weeks 7 out of 10 group members asked if they can extend the period of wearing the device, because they have perceived it as a very beneficial tool to quantify their health. In terms of impact on work-life balance the people who contributed to the quantitative research who did not own a wearable device expected to have a more negative sentiment on this, than persons who did. Furthermore, positive values deviated slightly, participants who owned wearable devices rather expect a beneficial influence than others. The qualitative research shows

very positive influences on work-life balance. None of the participants felt a negative impact, and each 5 perceived the opposite. Comparing the outcome of both research components it is clear that the expected impact on work-life balance meets the expectations of owners of wearable devices more than the expectations of non-owners.

Further findings were detected that did not meet the expected outcome. It was expected that components from life and work satisfaction would have a significant effect on openness to share data and wear wearable devices at the workplace, but this assumption was disproved. The initial idea was that people who are satisfied with their life are more open to sharing their data with others. This assumption was rejected based on a Spearman correlation. This means that persons who are more satisfied with their life are not more willing to share their data. The major part of the responses positioned themselves on the very edge of not sharing the data, only a few respondents were willing to. Another assumption which was disproved is that the ones who are more stressed at work are less willing to share their data with their employers. The test unveiled that there is a tendency that people who are more stressed at work are more open to the technology, but no significant relationship was discovered. Secondary hypotheses had been set to explore if exercising on regular basis and sharing willingness correlate. This idea was created based on the assumption that people who work out want to present what they do to other ones more than others, but this was disproved. Seeing that whether life satisfaction nor sports activity lead to a higher willingness to share personal data. As well as the missing effect of work satisfaction components on the willingness to use wearable devices at the workplace.

The combination of variables coming from life satisfaction, work satisfaction and general attitudes on wearable devices was displayed to be a reliable tool to predict the acceptance of wearable devices at the workplace. Seemingly non-relevant aspects like appreciation at the workplace and number of workouts per week showed to be a very reliable tool in the performed linear regression. For employees, the model is more reliable, life conditions, stress and economic state, as well as meaning of work, appreciation at the workplace and planned change of the workplace were discovered as main influencers coming from life and work satisfaction. On the side of components from life satisfaction the number of workouts as well as the security at the job and work stress did not play a major role for predicting the acceptance of wearable devices at the workplace, which was initially thought to be important.

The second research component revealed that life and work satisfaction are impacted by wearing a wearable device to a certain extent. In each category 2 positive and 2 negative changes had been perceived by 6 out of 10. Further findings were explored on the effect on work-life balance. It was discovered that potential intermediary effect could arise from the characteristics of the project and its implementation. Work satisfaction could be influenced directly and life satisfaction indirectly due to the interconnection of those two factors. It can be questioned if these effects on life and work satisfaction will remain on an improved level or will level to the previous state based on accustoming to the technology. Participants reported at various parts of the interview that over the course of the project initial problems like unpleasant feeling and motivational boost diminished. It can also be assumed that people could use the devices more in-depth with prolonging time. Most of the members asked if they could use the device after the project seeing that a general motivation is still available and one participant even stated that the positive effects just started to come and now the real phase begins. Despite the open sentiment to the technology in general, members of the tested group mostly had a strong reluctance on wearing a wearable device at the workplace. This had various origins, some considered it as unethical, other didn't like to be spied, but most of them did not see the value for companies to invest in such a monitoring tool. This displays that clear information on the created added value by observing personal data needs to be provided. Every employer should decide for him or herself what benefits people could receive from the device, but the interviews in this research revealed that one crucial element should not be missing, fostering social cohesion in the company with common challenges and goals. This does not only affect positively the interaction between people, it could also improve physical health.

It can be questioned if the wanted effects will be fully utilized by employers, increasing competitiveness can benefit to the willingness to exercise more and form new social groups, but negative potentials should not be overlooked. In terms of competition persons who are not able to benchmark themselves with others can fall behind and even be excluded from the group. An elite group could be formed in every competitive situation and outperform everyone else leaving no room for others. The positive achievements from this group of users could be remunerated with various measures by the employer or the management strengthening even more the gap between different groups. This could lead to negative tensions between people and their willingness

to work with others could decrease. On the other hand, if groups were to be formed with a more or less equal level of competitiveness it could possibly provide healthy competition (Liening, Mehta , & Josephs, 2012).

Another point which should not be set aside is potential security problems. As already described in this paper there are 3 sources where this type of issue can arise from: employees, employers and hackers. Beginning with the largest group, but less harmful employees could harm employers by wearing such devices. Data can be used and misinterpreted, heart rate monitoring could show that employees are stressed at work, or in general and psychological problems could be linked to the changes in heart rate, but the origin of it is not captured. For example, if an employee would have problems in private life and this stresses him or her during work time too an external evaluation could interpret that it is coming from working, but actually its origin is in private life. It seems to be more stressful for employees if the employer would be hacked and personal data captured from the device would be available to someone else, who can decide what will be done with the data. Weight, fitness level, activities at day and night could become public within a short time period and people all over the world could access this type of data. Nevertheless, it is questionable if the personal value of this data is the same for another person.

It was already expressed in this paper how data can be misinterpreted. The data displays only values, but does not present their origin. For example, step count: people who are doing more cardio workout would have a higher step count than the ones who focus on strength training, because the device measures movement and not intensity. Operators could be perceived as less athletic and therefore imply a lower physical healthiness despite their potentially more intense workout routine. This was also validated by the qualitative interviews. Especially one participant was affected strongly by this phenomenon, because the personal workout routine did not include running or similar, but 5 times weight lifting per week. Despite the number of workouts, the person was only average in step count and therefore in the ranking. Another participant even decided to change the workout routine from combined weight lifting and running to running only to be able to compete in the ranking and maintain first position over 4 weeks. Sleep analysis can lead to misinterpretation, employers could monitor how long their employees sleep and the quality of it. But depending on various factors sleep length and quality can deviate and therefore an interpretation could be hard in general,

individual observations are necessary. Furthermore, the experiment showed that this is the type of data people are least willing to share with employers because this is very valuable to them. Capturing this type of data could lead to negative effects on work satisfaction and increase the feeling of employees of being uncomfortable.

Despite laws which try to regulate the collection and use of personal data misuse can never be abolished for 100%. With the collection of data over the whole employment relationship a specific profile is created as well as positive developments and changes have been quantified. If employees decide to quit this relationship it is very questionable what should happen with this data and who the owner is. Law regulation in the European Union had tackled this topic and a new law will become effective on the 25th of May 2018. It strengthens the rights of employees that they can ask their employers to erase the data captured and hand them over all the data which is related to them (European Data Protection Board, 2016). This decreases the chance that employers treat personal data without respect, or at least this could be prosecuted based on the new law.

14. Recommendation for Employers

The following pages are dedicated to offer employers and decision makers a short guide on how wearable technology can be implemented at their company. These suggestions are based on the findings presented in this research and traditional concepts from change management based on literature from Düren (2013) and Team Publications (2006).

The recommendation is based on a 6-step plan (Illustration 8), the steps are described as following: Identification, Involvement, Inform, Initiate, Implement, and Inspect. These 6 can be clustered in the traditional 3 groups known from change management theory: Unfreezing, Changing and Refreezing. The Image below shows how the project should be planned:

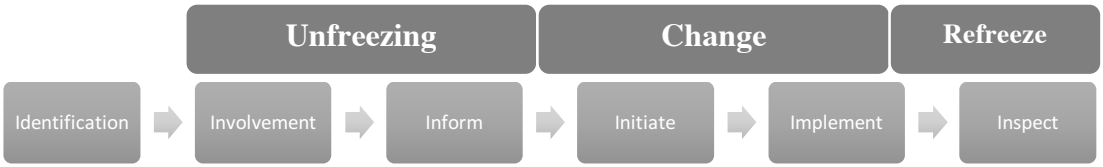


Illustration 8: Recommendation for Employers for Implementing Wearable Devices at Work

Guided by the above-demonstrated model the crucial steps for implementation of wearable devices ae structured that way:

1. Identification: The first component of the research presents what components significantly influence the openness and acceptance of wearable devices at the workplace. Referring to these findings an easy way for an employer/manager to identify general openness to the technology is to look at the age of their employees. This is based on the significant result of the research that younger people tend to be more open to wearable devices than older ones. Furthermore, they can identify prospected acceptance by examining if employees already own wearable devices, because owners of wearable devices tend to accept the technology more at the workplace. A slightly more complex, but potentially more reliable tool to identify the acceptance of wearable devices at the workplace at the current company would be to execute a short questionnaire. This questionnaire should contain the 9 parameters shown in the linear regression

for employees. The explained variability of 75% could definitely lead to valuable information on how the company should tackle the project.

2. Decision makers should distinguish between 4 groups who differ in their preparedness to change: Pioneers, Early Adopters, Followers and Resistors. Pioneers are most open to changes and Resistors do not like to be confronted with change. In addition to knowing the age and if people already own wearable devices it is beneficial to know where they are situated within the four groups reflecting the preparedness to change. Firstly, support should be gained by including Pioneers and Early Adopters and ask them about their opinions and fears. It is suggested to relate to the information gained out of the experiment of this research. The detailed characteristics should be defined, for example: what is the scope of this project? What information will be tracked? What are personal gains? Will it be voluntary?
3. Inform: Based on this plan people in the company should be informed about all that was decided and commitment should be secured from the employees.
4. Initiate: The first phase on implementing the project is according to literature strongly dependent on leadership of the company. The leadership should be clear, strong and unequivocal.
5. Implementing: This is the point where the technology starts to be part of the company and people get confronted with the change. It is very important to help affected employees managing this change. Initial fears should be addressed and see what short term effects are experienced. Out of the interviews from the research it can be recommended to start motivating operators with daily step challenges and team goals. Companies like Fitbit offer special software for professionals helping them to create groups which can compete between each other. There are several ways to form these groups, the easiest one is to make groups by departments, which has the positive aspect that managers can oversee how people are doing in different sections of the company. The monitoring of peoples' steps as well as sleep quality can help to detect extensive work overload easier within the departments. For the reason of competition, it is more recommendable to create heterogeneous groups with members with various physical levels to create a fair competition environment and fight

potential strong over or underrepresentation of fit people. An additional beneficial effect of making groups is that individual persons are not presented and the stress of competition can be mellowed in a desired manner.

6. The final phase known as refreezing or inspection phase deals with asking the people how they perceive the technology after a certain time period. Based on the research it is recommended to make short term inspections after 4 weeks and one after 3 months to see how adaption is progressing.

But managing these 6 phases is the first step on implementing the technology at the workplace. Due to expected diminishing effects it is of importance to constantly involve employees in common challenges. If this is done people could benefit not only from better physical health. This research shows that work satisfaction, as well as life satisfaction can be impacted directly and work-life balance can cause intermediary effects on both satisfaction variables, but potential negative effects should not be ignored, such as decrease of work satisfaction, which can be caused by badly managed implementation of the technology. The research presents that a strong majority of participants in the experiment where reluctant using the technology at the workplace and if this is not taken seriously their work satisfaction could drop. Even if the participants of the experiment would generally not quit if they would need to wear a wearable device at their workplace a negative work satisfaction could be assumed because most of them stated that they would feel uncomfortable. Completely not recommended is a forceful implementation of the technology with the characteristics that users need to wear the device at work and in private. The likelihood to quit the current job soared significantly from a median value of 2 to 4 on a scale from 1 to 7. An extension on capturing data is only recommended after people adapted to the technology at the workplace and by asking for their permission (Düren, 2013; Team Publications, 2006; Fitbit, n.d.b).

Summarizing the implementation of the technology at the workplace is accompanied by a vast number of critical aspects which need to be considered. But these initial efforts could foster social cohesion at the workplace, increase work-life balance and change life and work satisfaction positively.

15. Conclusion

Concluding the work offers insights into what factors influence the acceptance of wearable devices at the workplace. The impact of wearable devices on life and work satisfaction and gains as well as potential problems arising from the use of this technology at professional level.

The research gives information on the acceptance of wearable technology at the workplace and its impact. It gives insights into a field which is currently not well examined by researchers and sets a base for future research.

Age can be determined as one main factor on the openness to wearable devices, younger people tend to be more open to them. Already owning a wearable device has an effect on the acceptance of wearable devices at the workplace. Components reflecting general attitudes on wearable devices as well as current life and work satisfaction influence the acceptance of wearable devices at the workplace, this was presented in Chapter 10.3.

The qualitative research component unveiled that a majority experienced at least a change on work and/or life satisfaction, revealing that the technology has an effect on these factors. Further findings had been generated by exploring the influence on work-life balance and the importance of the characteristics of the project on the acceptance of it, both could influence life and work satisfaction directly or indirectly.

The penultimate chapter presents how this type of technology could be implemented at the workplace meaningfully and what benefits could evolve. Increased social cohesion, healthy competitiveness, improved physical health as well as positive effects on work-life balance, leading to potential desired changes in general life and work satisfaction. This can be achieved by a successful implementation of the technology.

All the findings in this paper show that there are positive as well as negative characteristics arising from the use of the technology. People can benefit from it or suffer. The research displays that wearable devices give operators a tool to quantify their lives and this data and insights can raise the awareness on physical health and have various beneficial effects on it. In groups, it can even be encouraging to live a healthier life and to compete with others by doing it. And at the workplace it can create further social cohesion and strengthen work satisfaction and therefore the affiliation to the

company. But employers should be cautious that all these positive effects can turn to negative ones if employees do not feel comfortable with the implantation of the technology at the workplace. In the end, everything can be summed up that successful change management by detecting the needs, fears and wishes of employees is crucial and implementation for every company is individual.

16. Limitations and Future Research

Despite choosing a mixed method research approach this paper is confronted with limitations from quantitative and qualitative instruments.

Firstly, the qualitative research component has the general critique from literature that it can hardly be used to generalize due to small sample sizes. As well as further negatively impacting the reliability is the issue that samples cannot be selected on a random base (Creswell, 2014; Boyce & Neale, 2006). For tackling this issue, it was decided to take people from various industries to represent a broad spectrum of people. 4 participants worked in the period of the experiment in the hotel industry, 2 in the food manufacturing industry, 2 had been employed by the government and one each was working in consulting and health industry. Also in terms of gender the representation the female to male ratio from the quantitative research component of 6:4 was maintained for the experiment. A crucial point which can be criticized in this research paper is the length of the experiment. Due to the fact that the observation was only performed for 28 days long term effects cannot be represented in this study. A further challenge which is faced for such experiments is that information can vanish between the interaction of the interviewee and the interviewer. To handle this potential problem every interview has been recorded and fully transcribed. This does not eliminate the chance that probing, language and asking individual sub-questions as well as slightly changed main questions influence the answers and leave room for interviewer bias (Creswell, 2014; Boyce & Neale, 2006). Further challenging the reliability is that members of the experiment participated on a voluntary base to explore potential effects on the measured satisfaction variables. It should not be underestimated, that if people were to be asked to wear the devices by their employers or managers other perceptions could occur.

For the quantitative research component reliability is threatened by strong representation of students, 65.8% of the participants were not employed by the time of being surveyed.

This research was established to set a starting point for further research which focus on a more in-depth analysis and benefit from a longer observation period. Based on the quantitative research component it would be beneficial to conduct a questionnaire for a larger sample size and include information on the cultural background.

In addition, future research could focus on one specific group of people such as employees or students to give valuable information for these groups. For the qualitative research component, it is recommended that similar experiments should be conducted with larger sample sizes and different cultural environments. Lastly, the research component should not be obvious to the members of the experiment, meaning that employers should ask their employees to wear the device over a longer time period and that short, middle and long-term effects should not be reported knowingly to a researcher rather to one person from the company and this information could be delivered to an external analyst. Of course, this gives room for potential ethical problems which should be considered before starting the project.

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Appendix 1: Questionnaire Quantitative Research

Impact of Wearable Devices on Work and Life Satisfaction

*Required

1. **What is your gender?** *
   Mark only one oval.
   - ◯ Male
   - ◯ Female
   - ◯ Other

2. **What is your age?** *
   _____

3. **What is the highest level of education you have completed?** *
   Mark only one oval.
   - ◯ Compulsory education
   - ◯ College/High School (A-Levels or Equivalent)
   - ◯ University - bachelor's degree (or equivalent)
   - ◯ University - master's degree (or equivalent)
   - ◯ University - phd degree (or equivalent)

4. **Marital Status** *
   Mark only one oval.
   - ◯ Single
   - ◯ Married or domestic relationship
   - ◯ Widowed
   - ◯ Divorced
   - ◯ Seperated
   - ◯ Other: _____

Life Satisfaction

5. **In most ways my life is close to my ideal** *
   Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

6. **The conditions of my life are excellent** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

7. **I am satisfied with my life** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

8. **So far I have gotten the important things in life** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

9. **If I could live my life over, I would change almost nothing** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

10. **How would you rate your physical health?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Very Unsatisfying	◯	◯	◯	◯	◯	◯	◯	Excellent

11. **How often do you exercise per week?** *
Mark only one oval.

- ◯ No workout at all
- ◯ 1 Times
- ◯ 2-3 Times
- ◯ 4-5 Times
- ◯ More than 5 Times
- ◯ Less than 1 times per week, but a couple of times per month

12. **How often do you take activities outside your home per week?** *
Mark only one oval.

- ◯ No outside activities
- ◯ 1 Time
- ◯ 2-3 Times
- ◯ 4-5 Times
- ◯ More than 5 Times
- ◯ Less than 1 times per week, but a couple of times per month

13. **How do you perceive your economic state?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Very Unsatisfying	◯	◯	◯	◯	◯	◯	◯	Excellent

14. **How would you rate your weekly stress level?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Low (no stress at all)	◯	◯	◯	◯	◯	◯	◯	Very High

15. **How would you rate your work-life balance?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Very Unsatisfying	◯	◯	◯	◯	◯	◯	◯	Excellent

16. **Which 2 emotional states describe you best?** *
Tick all that apply.

- ☐ Joyful
- ☐ Relaxed
- ☐ Sad
- ☐ Nervous
- ☐ Angry
- ☐ Stressed

Actual Working Conditions

Actual Working Conditions

17. **What is your current occupation?** *
Mark only one oval.

- ◯ Pupil *After the last question in this section, skip to question 26.*
- ◯ Student *After the last question in this section, skip to question 26.*
- ◯ Military Service
- ◯ Employed
- ◯ Self-Employed
- ◯ Freelancer
- ◯ Out of work and looking for work *After the last question in this section, skip to question 26.*
- ◯ Out of work and not looking for work *After the last question in this section, skip to question 26.*
- ◯ Homemaker *After the last question in this section, skip to question 26.*
- ◯ Retired *After the last question in this section, skip to question 26.*
- ◯ Unable to Work *After the last question in this section, skip to question 26.*
- ◯ Other: _____

18. **Gross-Income, Annually** *
Mark only one oval.

- ◯ No income
- ◯ Under € 18.000
- ◯ € 18.000 - € 24.999
- ◯ € 25.000 - € 34.999
- ◯ € 35.000 - € 44.999
- ◯ € 45.000 - € 54.999
- ◯ € 55.000, or higher

Work Satisfaction

19. **Are you overall satisfied with your work?** *
Mark only one oval.

	1	2	3	4	5	6	7	
No, not satisfied at all	◯	◯	◯	◯	◯	◯	◯	Yes, very satisfied

20. **How meaningful is your work?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not meaningful	◯	◯	◯	◯	◯	◯	◯	Very meaningful

21. **How challenging is your job?** *
Mark only one oval.

- ◯ Not Challenging
- ◯ Slightly Challenging
- ◯ Challenging
- ◯ Perfectly Challenging
- ◯ Slightly too challenging
- ◯ Way too challenging

22. **Does your work stress you?** *
Mark only one oval.

	1	2	3	4	5	6	7	
No, not at all	◯	◯	◯	◯	◯	◯	◯	Yes, it causes tremendous stress

23. **How likely is that you will change the workplace in the next 6 months?** *
Mark only one oval.

	1	2	3	4	5	6	7	
very unlikely	◯	◯	◯	◯	◯	◯	◯	very likely

24. **Do you feel appreciated at your workplace?** *
Mark only one oval.

	1	2	3	4	5	6	7	
No, not at all	◯	◯	◯	◯	◯	◯	◯	Yes, I do

25. **Do you feel a lack of security in your job?** *
If you feel that you can loose your job
Mark only one oval.

	1	2	3	4	5	6	7	
Yes, I think my workplace is not secure	◯	◯	◯	◯	◯	◯	◯	No, I am happy with the current job security

Wearable Devices

26. **Do you own a wearable device?** *
Mark only one oval.

- ◯ Yes, multiple
- ◯ Yes, one
- ◯ No *Skip to question 31.*

27. **Which wearable device/s do you own? (multiple answers possible)** *

Smart Watch is an extension of a smartphone and further apps can be downloaded e.g. Apple Watch // Fitness Tracker is a stand alone device, which focuses on fitness use only (track heart rate/steps/sleep)

Tick all that apply.

- [ ] Smart Watch
- [ ] Fitness Tracker
- [ ] Smart Glasses
- [ ] Smart Clothing
- [ ] Other: _____

28. **How many days of the week do you use it?** *

Mark only one oval.

- ◯ Less than 1 Day
- ◯ 1 - 2 Days
- ◯ 3 - 4 Days
- ◯ 5-6 Days
- ◯ The whole week

29. **What do you currently use your wearable device for? (multiple answers possible)** *

Tick all that apply.

- [ ] Fitness & Health
- [ ] As a regular watch
- [ ] Extension of mobile phone
- [ ] Other: _____

30. **If you use it for fitness & health what exactly do you use?** *

Tick all that apply.

- [ ] Monitor Activity
- [ ] Monitor Weight
- [ ] Monitor Sleep
- [ ] Monitor Nutrition
- [ ] Other: _____

Wearable devices

31. **How likely will you buy one in the next 12 months?** *

Mark only one oval.

	1	2	3	4	5	6	7	
Not Likely	◯	◯	◯	◯	◯	◯	◯	Very Likely

32. **Are you aware of potential security issues?** *
Mark only one oval.

	1	2	3	4	5	6	7	
No, not at all	◯	◯	◯	◯	◯	◯	◯	Yes, I am very educated about them

33. **Do you think that wearable devices have an impact on work life balance?** *
Mark only one oval.

- ◯ Yes, they do impact it negatively - people spend more time at work
- ◯ Yes, slightly negative
- ◯ No, they do no impact work-life balance
- ◯ Yes, they impact it slightly positively
- ◯ Yes, they do impact it very positively, they improve your work-life balance
- ◯ I am not sure

34. **Would you like to share your data, captured from wearable devices with other people?** *
Mark only one oval.

	1	2	3	4	5	6	7	
No, my data belongs to me	◯	◯	◯	◯	◯	◯	◯	Yes, no problem

35. **If your employer asks you to wear a wearable device at work and he/she is able to see your data (anonymised) would you agree? (multiple answers possible)** *
Tick all that apply.

- ☐ No, I would never agree
- ☐ Yes, I would agree if my employer provides me the device
- ☐ Yes, I would agree if my employer has limited access
- ☐ Yes, I would agree if my performance has no influence on my job security
- ☐ Yes, I have no problem with sharing my data

36. **Do you think that employers would abuse employees based on captured data?** *
Abusement means that employees would have negative consequences at work reasoned for the data captured and evaluated by wearable devices and relevant software.
Mark only one oval.

- ◯ Yes, I definitely think more than 90% would do it
- ◯ Yes, around 60-89%
- ◯ Yes, 20-59%
- ◯ Yes, but lower than 20%
- ◯ No, employers will not abuse employees

37. **How likely is it that you quit your job if your employer forces you to wear a wearable device at work?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Very Unlikely	◯	◯	◯	◯	◯	◯	◯	Very Likely

Impact of Wearable Devices on Work and Life Satisfaction

*Required

1. **Please tell me your full name**

2. **What is your gender?** *
   Mark only one oval.
   - Male
   - Female
   - Other

3. **What is your age?** *

4. **What is the highest level of education you have completed?** *
   Mark only one oval.
   - Compulsory education (Pflichtschule)
   - Compulsory Education + Apprenticeship (Lehre)
   - Commercial School (Fach - & Handelsschule)
   - College/High School (A-Levels or Equivalent/Matura)
   - University - bachelor's degree (or equivalent)
   - University - master's degree (or equivalent)
   - University - phd degree (or equivalent)
   - Other:

5. **Marital Status** *
   Mark only one oval.
   - Single
   - Married or domestic relationship
   - Widowed
   - Divorced
   - Seperated
   - Other:

Life Satisfaction

6. **In most ways my life is close to my ideal** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

7. **The conditions of my life are excellent** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

8. **I am satisfied with my life** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

9. **So far I have gotten the important things in life** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

10. **If I could live my life over, I would change almost nothing** *
Mark only one oval.

	1	2	3	4	5	6	7	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

11. **How would you rate your physical health?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Very Unsatisfying	◯	◯	◯	◯	◯	◯	◯	Excellent

12. **How often do you exercise per week?** *
Mark only one oval.

- ◯ No workout at all
- ◯ 1 Times
- ◯ 2-3 Times
- ◯ 4-5 Times
- ◯ More than 5 Times
- ◯ Less than 1 times per week, but a couple of times per month

13. **How do you perceive your economic state?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Very Unsatisfying	◯	◯	◯	◯	◯	◯	◯	Excellent

14. **How would you rate your weekly stress level?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Low (no stress at all)	◯	◯	◯	◯	◯	◯	◯	Very High

15. **How would you rate your work-life balance?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Very Unsatisfying	◯	◯	◯	◯	◯	◯	◯	Excellent

Work Satisfaction

16. **Are you overall satisfied with your work?** *
Mark only one oval.

	1	2	3	4	5	6	7	
No, not satisfied at all	◯	◯	◯	◯	◯	◯	◯	Yes, very satisfied

17. **How meaningful is your work?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not meaningful	◯	◯	◯	◯	◯	◯	◯	Very meaningful

18. **How challenging is your job?** *
Mark only one oval.

	1	2	3	4	5	6	7	
Not Challenging	◯	◯	◯	◯	◯	◯	◯	Perfectly Challenging

19. **Does your work stress you?** *
Mark only one oval.

	1	2	3	4	5	6	7	
No, not at all	◯	◯	◯	◯	◯	◯	◯	Yes, it causes tremendous stress

20. **Do you feel appreciated at your workplace?** *
Mark only one oval.

	1	2	3	4	5	6	7	
No, not at all	◯	◯	◯	◯	◯	◯	◯	Yes, I do

Emotional Traits

How dominant are following emotional traits in your life.

21. **Feeling of being observed** *
I constantly feel observed by someone else.
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

22. **Uncomfortableness** *
I do not feel comfortable in many situations
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

23. **Relaxedness** *
I see myself as a relaxed person.
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

24. **Anger** *
I have an inner feeling of anger.
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

25. **Sadness** *
There is a high level of sadness in my life
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

26. **Competitive** *

I see my life as a competition, competing against others.
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

27. **Selfishness** *

I perceive myself as a selfish person
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

28. **Comparativeness** *

I often compare myself with others
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

29. **Being Confident** *

Most of the time I feel very confident
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

30. **Adventurousness** *

I am driven by experiencing something new.
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

31. **Anxiety** *

I am often anxious in my life
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

32. **Friendliness** *

I am friendly most of the time
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

33. **Enthusiasm** *

I see myself as very enthusiastic
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

34. **Happiness** *

I perceive myself as a very happy person
Mark only one oval.

	1	2	3	4	5	6	7	
very weak	◯	◯	◯	◯	◯	◯	◯	very strong

Appendix 3: Interview Guideline

1. **How did you feel wearing the wearable device for 4 weeks?**
    a. Do you see it as a meaningful device to improve health/fitness
    b. Do you feel any positive influence on your physical health? If so what exacty?
    c. Did you feel spied?
    d. Did you wear the wearable device all the time?
2. **Did you feel any increase in competitiveness?**
    a. Did you have an inner need to increase your steps based on the competitors?
    b. Did you talk with someone else about results/people?
3. **Did you perceive yourself as more productive?**
    a. Do you think that the device increases productivity?
4. **Do you think that the wearable device had a positive effect on your work-life balance?**
    a. Did you perceive any negative impact on work-life balance?
    b. Do you feel any positive impact on life satisfaction?
    c. Do you feel any negative impact on life satisfaction?
    d. Do you feel any positive impact on work satisfaction?
    e. Do you feel any negative impact on work satisfaction?
5. **Would you feel comfortable using this tool in a professional environment? Meaning that you employer offers you the device and has full insights to your statistics?**
    a. Would you rather agree if your employer would only have limited insights?
6. **Would you agree to stay at your job if you would be forced to wear the device at work only?**
    a. If so, how likely would it be that you quit from a scale from 1-7, 7 is high?
    b. What would be if you would be forced to wear the wearable device also in private life?
    c. How likely would it be that you quit from a scale from 1-7, 7 is high?