The commercialization of mHealth applications : Which factors drive purchase intentions and app usage among potential customers?

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ABSTRACT

Background: In recent years, the amount of mHealth (mobile health) based applications has been growing exponentially. However, these apps are mostly developed by companies instead of by health or medical institutes, such as the Ministry of health. This means that in many mHealth applications, commercial aspects are included, such as advertisements or a certain business model, to achieve the revenue-based goals set by the developers. Yet, these developers often lack the necessary psychological and health-based insights, in order to successfully tailor their applications towards their end users. The goal of this research is to find out which factors drive purchase intentions and app usage among potential customers of mHealth applications. In order to answer the RQ, the TAM, mTAM and Perceived value theory were used as a theoretical basis for this research.
Method: Semi-structured interviews were conducted to fully explore the topic in a qualitative manner. Participants were recruited on social media platforms and through the personal network of the researcher. All participants were users of mHealth applications who have experience in using mHealth applications. Data was analyzed with ATLAS.ti software. This study used open, axial and selective coding methodology.
Results: Several factors were identified to be important to potential customers of mHealth applications. From the TAM model, ease-of-use, trust, privacy concerns, influence of feelings and age differences were relvant factors. From the perceived value theory, performance value, social value, QoL improvements and the accessibility that mHealth apps offer were viewed to be important factors. Ultimately, younger participants also showed purchasing reluctance whereas older participants had no objections against paying for mHealth apps.
Conclusion: The wide plethora of mHealth apps has the potential to massively increase the quality of life and health of the general public. Although there are many free alternatives which get the job done, companies can still capitalize on the commercial potential of mHealth applications by adapting their business model towards subsidized financing. Not only do companies benefit from this approach, but mHealth app users also get apps that are better tailored towards their health.

1. INTRODUCTION

Health treatment has frequently been a point of interest in politics, the media and society for several reasons. The most frequent reason is that in the past decade, an increase in demand for (mental) health treatment has been identified all over Europe (Watkins et al., 2012; Schroth & Khawaja, 2007). In order to reduce this increasing demand, it led to the development of a wide variety of mobile health (mHealth) applications (Pijnen et al., 2013). The rapid growth of smartphone functionality has provided (mental health) professionals with opportunities to deliver more time-and cost efficient solutions to patients through the use of technology (Luxton et al., 2011). By making use of virtual reality, telemedicine or augmented reality, mHealth apps usually revolve around cognitive behavioural therapy, symptom assessment, psychoeducation and treatment process tracking (Luxton et al., 2011). For mental health clinics, hospitals, doctor's offices and many other health institutes, mHealth apps have the potential to drastically lower the extensive waiting times (Handel, 2011). Moreover, they are also able to offer (mental) health treatment at a low cost, with usage as simple as a few taps on the screen of a mobile phone (Pijnen et al., 2013). Currently, there are over 10.000 mHealth apps for iOS and Android, which means that users have a wide variety of mHealth services to choose from (Torous & Roberts, 2017).

Although mHealth apps are widely available all over app stores, there is currently not much known in academic research about mHealth usage. More specifically, what the factors are which drive people to use mHealth apps and potentially purchase such apps. There is plenty of literature about the potential technological applications of mHealth, but much less regarding the psychological and commercial factors (Ossebaard & Van Gemert-Pijnen, 2016). Consequently, this means that there are millions of users across the globe who make use of these apps on a daily base, but many companies still fail to develop their apps in a way which aligns with mHealth user behaviour (Pijnen et al., 2013). Not only is this obstructing the commercial success of those companies, but also the availability of mHealth services in general. Next to that, mHealth apps could be a solution for healthcare availability in developing countries as well (Patil, 2011). The fact that the general population is often not able to perceive the value

of mHealth, could be a result of unsuccessful implementation of mHealth services, primarily by the developers of these apps. (Ossebaard & Van Gemert-Pijnen, 2016). Furthermore, stakeholders or potential users are often forgotten to be included in the development process of mHealth apps (Petersen et al., 2015). Not making use of user-centered design greatly hinders the development and general commercial success of mHealth apps (Pijnen et al., 2013). Therefore, by emphasizing more on the insights in mHealth user behaviour, both users and companies can reap the benefits. For the sake of properly developed mHealth apps and commercial success for the developers, this means that stakeholders and potential users absolutely have to be part of the development process

However, most of the available mHealth apps are not necessarily developed by professionals in the field of psychology and medicine (Donker et al., 2013). Most of the developers are software engineers or programming hobbyists who try to solve a health-based problem they encounter themselves. Often, these developers lack the necessary commercial insights to properly tackle the business aspects of their applications (Liebenberg et al., 2014). Especially in the case of apps, it is of utmost importance to have a clear overview of what drives potential customers to perceive the value in an app and consequently make the final decision to purchase the app (Hew et al., 2017). Otherwise, not only the users do not achieve their mHealth based goals, but also the company will not reach its commercial goals. Primarily because not knowing what customers desire from applications, can be a fundamental threat to the commercial success of an app (Hsu & Lin, 2015) Therefore, knowing the factors which contribute to customer purchase intentions are an important part of the commercial business strategy of app publishers and developers (Singer-Oestreicher & Zalmanson, 2013). Previous studies have shown for example, that in order to attract potential customers, a wide plethora of app publishers offer a trial version of their app for free, so that they can experience what the application is like before making a purchase decision (Singer-Oestreicher & Zalmanson, 2013). Another typical business strategy is to make use of a freemium model in which the basic version of the app is free to use, but premium functions require microtransactions in order to work properly (Bresnahan et al., 2014). Next to that, it has even been found that the type of app store an application is showcased in can greatly influence the purchase desires of potential customers (Roma & Ragaglia, 2016). As a matter of fact, there is a wide variety of underlying factors that could ultimately make or break an app's commercial success.

Currently there is no information available in the existing literature on how mHealth apps can best be commercialized or designed in a way which leads to more app usage and purchases. Despite the fact that there is a lot of literature on regular e-Commerce, previous research has not investigated the commercialization of mHealth applications (Ossebaard & Van Gemert-Pijnen, 2016), nor has it identified any usage patterns of users that are of interest to mHealth ambassadors, developers and practitioners such as therapists (Pijnen et al., 2013). Given the aforementioned context, the emphasis of this study lays on discovering the factors that drive purchase intentions among potential customers of mHealth apps, in relation to the application usage behaviour of these customers. Unraveling the factors which drive purchasing intentions and usage of mHealth apps, can improve knowledge in the fields of psychology, business and information systems all together. By linking insights from these fields together, the domain of mHealth can further develop itself. Moreover, usage patterns of potential customers can reveal a great deal of what they find important to be included in a mHealth app (Schnall et al., 2015). Therefore, in order to tackle these phenomena, the insights of both existing literature on the topic of application purchase intentions (e-Commerce) and the perspectives of potential mHealth app customer will be combined. Practically, this paper further extends our knowledge in the domain of mHealth (commercialization). Specifically in the area of purchase intentions among potential customers and users of mHealth based apps.

This study addresses the following research question: *'What factors do drive potential customers' purchase intentions and usage of mHealth applications?".* To answer this research question, , we combined theories from IS and psychology to understand the factors driving purchasing behavior and usage of apps. More specifically, two versions of the TAM We conducted a qualitative study, using semi-structured interviews, in order to gather the data about usage patterns and purchase intentions among mHealth app users. These interviews were analyzed

and coded by making use of ATLAS.ti software. Ultimately, these results were thoroughly discussed and reviewed. This study contributes to the understanding of the factors which influence mHealth app user patterns and purchase intentions. The insights from this study reveal that there are several psychological and technological factors which can ultimately lead to successful app usage and purchase in the domain of mHealth. Finally, this study shows that appropriately designed mHealth apps not only have the potential to contribute to more commercial success of the developers, but also to an increase in a person's physical wellbeing and general health.

The paper itself is structured as follows. First, sections 2 and 3 cover necessary background information on e-Commerce and a few theoretical models on mHealth application usage. Second, the exact methodology that was applied to conduct this research will be explained thoroughly. This section can be described as a literature study that serves as the inspiration for the interview questions which will be showcased subsequently. Fourth, the interview findings will be reported in the results section. Last, the findings and implications of the study will be discussed and further elaborated upon in the discussion section.

2. BACKGROUND INFORMATION

2.1 mHealth application demand

Currently, in the Netherlands there are around 88.500 people on a waiting list for their mental health issues (NOS, 2018). On average, these people wait about 8 months to receive proper treatment. In the United Kingdom, the amount of time is even greater, as it takes the average patient around 18 months to receive adequate treatment (Independent, 2018). Next to long waiting times, other phenomena such as high treatment costs, mental barriers of seeking treatment and living in remote areas are reasons why health and mental health treatment is inaccessible to many people (Frueh, 2015). In some cases, such as when people have a communication disorder or a phobia, the insurance also does not cover the costs of treatment (Interpolis, n.d.). For these people, mHealth applications can be a solution.

Apart from mental health treatment, mHealth apps also allow for other health based problems to be treated properly. For example, the app called LibreLink supports diabetes patients in their monitoring and insulin dosing activities by providing access to their insulin pump through a mobile application (Freestyle, n.d.). Other popular instances of mHealth apps include gym-based applications, sports applications and even food information applications. However, many mHealth apps are used by persons who have limited experience with app usage or technology in general. This could imply that they will approach these apps differently, especially in comparison to more technologically adept people. Therefore, the aim of this section is to identify how mHealth apps are used and what users desire from these apps.

2.1.1 mHealth app usability

As many mHealth apps are used by people without significant experience with mobile apps or technology, usability becomes an important issue. Usability in mHealth can be described as the way in which a technological feature provides the user a solution to a health-related problem (Coursaris & Kim, 2011). According to international standards, usability in mHealth consists of the app's understandability, learnability, operability and attractiveness (Zeiss et al., 2007). Understandability consists of the princinciple that the app is easy to understand and use, as this is directly related to the general success of a mHealth app (Baharuddin et al., 2013). Learnability entails the concept of working towards a specific learning goal in the app itself, for example combating your fear of spiders (Bouchard et al., 2006). Operability means that the app should work properly and not have too many bugs or issues which could hinder usage (Baharuddin et al., 2013). Attractiveness is composed of the general visual and aesthetic attractiveness of the app (Baharuddin et al., 2013).

2.1.2 Desired mHealth features

MHealth app users have rigorous needs in terms of app functionality. Aligning with the usability, mHealth app users have stated to value an app which is simple and intuitive to use (Mendiola et al., 2015). Next, users value tailored information and a relevant plan of action with regard to managing their health condition (Jake-Schoffman et al., 2017). Finally, some users would like to have the ability to share data with other individuals to gain a sense of relatedness (Jake-Schoffman et al., 2017). More specifically, some users would like a competitive component in some of their sports-related mHealth apps. Additionally, users reported to value apps which had time saving features as well. Overall, paid mHealth apps were more positively rated (Mendiola et al., 2015). This is mainly because of the fact that the revenue stream of free apps primarily comes from advertisements, whereas advertisements do not occur as much in paid apps.

2.2 Commercialization of mobile applications

Commercializing mobile applications consists of several practices that companies use to attract customers and to drive the purchase intentions amongst them. These practices range from offering certain services for free (Hsu & Lin, 2015) to publishing articles in journals (Donker et al., 2018). Therefore, there is a wide variety of options to commercialize a mobile application. Several ways of driving purchasing intention for mobile applications will be briefly discussed in the following sections.

2.2.1 Trial versions

In order to drive sales numbers, many app publishers offer potential customers the chance to try out a basic demo/trial version of their app for free (Singer-Oestreicher & Zalmanson, 2013). This way potential customers have the option to try out basic functions of the app before making a purchase decision (Hsu & Lin, 2015). Customers experience mental transaction costs, which is represented as the effort a consumer puts in in the purchase consideration. Based on the experience that the potential customers have with the initial version of the app, they will decide whether or not they want to make the purchase. Therefore, trial versions are a method of diminishing the risk and uncertainty among users as it tends to remove these mental transaction costs and improves the speed of the purchase decision-making.

2.2.2 User reviews

The perceived value of an app can also be determined on the basis of other factors. For example, by judging the user reviews. User reviews were found to be important for user purchase decisions (Chen & Xie, 2008). App users were found to rely on dependable and functional information regarding a product, as online markets have a certain extent of uncertainty (Gu et al., 2013). Consequently, they tend to rely on the judgement of like-minded customers instead of information that is provided by the app retailer (Dellarocas, 2003). This phenomenon was confirmed by several meta-studies, which found that good user reviews and a high app rating positively correlated with product sales (Gu et al., 2013). Therefore, app retailers should put emphasis on getting positive reviews in order to boost app sales (Hsu & Lin, 2015).

2.2.3 Privacy and risk concerns

In addition to factors which positively influence app sales, privacy risks and uncertainties have a more negative influence on app sales and user purchase intentions (Hsu & Lin, 2015). The protection of personal data can be perceived as a risk among potential customers, which makes them hesitant in making the final purchase decision (Flavián & Guinalíu, 2006). Privacy concerns often arise when personal user data has to be filled in a transaction form, such as user location and identity information. Hence, sharing data can be seen as a condition that has to be

fulfilled before making a purchase (Luo, 2002). Next to this, the increasing amount of user data on the internet is also a perceived risk for online consumers (Flavián & Guinalíu, 2006). As the amount of online information about a person increases, there is a bigger risk of having their privacy violated (Culnan, 1993).

2.2.4 Application familiarity and trust

Directly related to privacy and risk concerns, a factor which contributes to the purchase intention is the familiarity users have with an app (Siau & Shen, 2003). In particular there seems to be a relation between familiarity and trust, as familiarity helps to create a sense of understanding of (in this case) an app (Luhmann, 2000). Being familiar with an app can help to reduce feelings of uncertainty and complexity among customers (Gefen, 2000). General concerns are in turn diminished by the trust which is built (Möllering, 2006). Next to that, research by Baumer (2004) indicates that the familiarity of users positively influences the general willingness to provide personal data to the app. Finally, it was found that familiarity with an app has a positive influence on user purchase intentions (Mauldin & Arunachalam, 2002). As a result, familiarity can be a decisive factor when it comes to user purchase decisions.

3. THEORETICAL MODELS

In this section, the theoretical models that were used to answer the research question will be further described. These models include factors that were described in section 2, but also factors which are more linked to the psychological elements of technology usage.

3.1 Technology Acceptance Model (TAM)

As purchase intentions of mHealth app customers are dependent on the way in which these customers make use of their applications (Hsu & Lin, 2015), it is necessary to pinpoint the relevant concepts of app usage. Therefore, the Technology Acceptance Model will be used as one of the foundations of this study. The Technology Acceptance Model (TAM) is a theory in the field of information systems, which explains how technology users will come to accept and make use of a certain technology (Davis, 1989). In the field of information systems, the TAM is one of the most influential models which describes the concept of technology acceptance (Legris et al., 2003). The reason TAM has been so influential in its field, is because it considers the human factors that are relevant for the way in which people accept or make use of technology (Lala, 2014). A study by Wu and Wang (2005) has previously shown that several factors within the TAM have been proven to be relevant for e-commerce as well. Over the years, the TAM has also received countless of revisions and newer versions (Venkatesh & Bala, 2008).

Nevertheless, the original TAM is centered around the notion that when people have the desire to make use of a technology, their decision is influenced by two main factors: perceived usefulness and perceived ease-of-use. Perceived usefulness can be defined as "the degree to which a person believes that using a particular system would enhance his or her job performance", whereas perceived ease-of-use refers to "the degree to which a person believes that using a particular system would be free from effort" (Davis 1989, p.320). These two factors in turn influence the attitude of the user towards using the technology in general, which is the basis for the behavioral intention to use the technology. However, the perceived usefulness also has a direct link to the behavioral intention, as demonstrated in Figure 1.

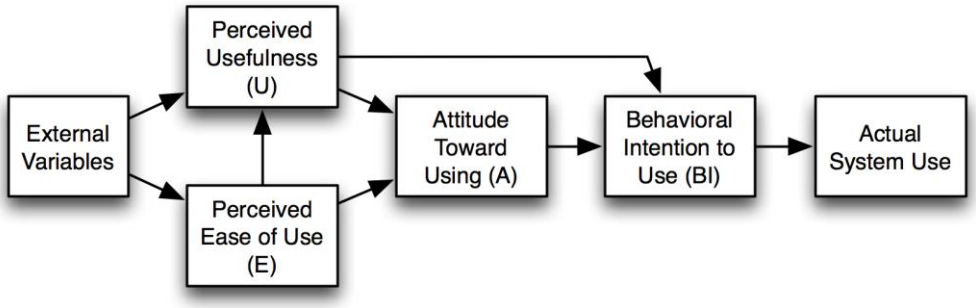

Figure 1. The original Technology Acceptance Model by Davis et al. (1989).

3.2 mHealth Technology Acceptance Model (mTAM)

On the basis of the previous version of the TAM, the domain of mHealth was addressed in a study by Schnall et al. (2015). In the mHealth TAM (mTAM) , the constructs are almost the same as in the regular TAM (Venkatesh & Bala, 2008): the behavioural intention to use mHealth technology (Figure 2). The mTAM was originally devised to demonstrate that there are more factors, next to the ones in the original TAM, which have an influence on technology acceptance in the domain of mHealth. The key constructs in the mTAM are perceived risk, perceived usefulness and perceived ease of use. Another factor in the model is trust. In the case of mHealth technology, perceived risk entails the risks that users perceive to be exposed to when using the app. Perceived usefulness is defined as the degree to which a person believes that making use of the app will improve their health circumstances. Perceived ease of use is the extent to which an app is easily used and free from additional effort to reach the app's learning goals. Trust is the belief that the mHealth app is designed in a responsible way and will not take advantage of the user in any possible way. The importance of trust is increased when the user is more uncertain about an app, since in many mHealth apps it is unclear where user information is stored and how it is being tracked.

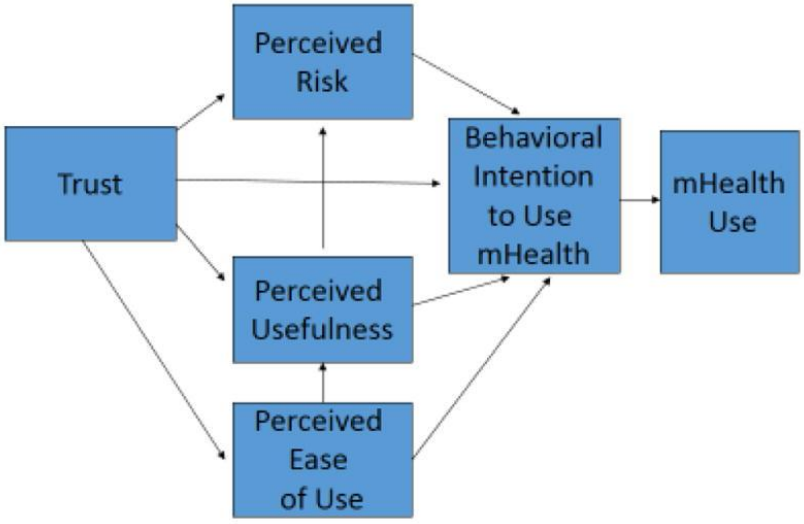

Figure 2. E-Commerce Acceptance Model applied to mHealth Technology Use (Schnall et al., 2015).

3.3 Perceived value theory

When it comes to purchasing apps, customers large make purchase decisions based on the extent of the perceived value of the app (Hsu & Lin, 2015). Perceived value entails the ‘‘the consumer’s overall assessment of the utility of a product (or service) based on perceptions of what is received and what is given’’ (Zeithaml, 1988, p.3). For example in e-Commerce, perceived value is considered to be the sum of the perceived cost of benefits of using a certain product or service (Wirtz & Lovelock, 2016). For an application, the perceived value increases when the benefits of using the app overbalance the costs. In many cases, a higher level of perceived value has shown to influence factors such as user satisfaction and loyalty (Pura, 2005; Lee et al., 2007), an increased intent to use the app (Turel et al., 2007) and higher levels of purchase intention (Chang & Tseng, 2013).

In the context of e-Commerce perceived value is a multi-dimensional construct (Sweeney & Soutar, 2001), which consists of performance/quality value, emotional value, value-for-money and social value (Walsh et al. 2014). Performance/quality value can be defined as the value of an app in terms of its perceived quality and performance abilities. This dimension also refers to the perceived usefulness of an app. Emotional value entails the feelings and affective states which are induced as a result of using an application. For instance,. one feels joy or fulfillment from using the app. Value-for-money value is the total amount of perceived benefits of the invested money. It is the cognitive state of being satisfied with the money that’s utilized for purchasing the app or making in-app purchasing to realize a certain goal within the app. Social value is the app’s capacity to increase an individual’s social self-concept. This refers to the way in which an individual perceives themselves in a social context.

4. INTERVIEW METHODOLOGY

4.1 Research design and data collection methodology

This study features an exploratory, qualitative analysis of the factors that drive purchase intentions and usage among potential customers of mHealth applications. We conducted interviews with users of mHealth apps to identify their needs and purchase intentions. The interviewees were all non-paying or paying users of mHealth based apps. In order to find participants, recruitment was carried out on social media platforms, such as LinkedIn and Facebook, and the personal network of the researcher. Therefore, convenience sampling methodology was utilized to recruit participants (Verhoeven, 2007). This sampling method was chosen mainly for its ease of availability, as it allows the researcher to quickly get in touch with people who are eligible to participate in the research. Furthermore, convenience sampling is useful for exploratory studies because it helps to easily gather initial data and knowledge about a research topic (Verhoeven, 2007). As a result, time and money efficient decisions can be made in order to decide whether a topic deserves to be researched more in depth (Acharya et al., 2013).

The participants in this study are all current users of mobile (health) applications, with a specific focus on health support and improvement applications such as a diabetes or menstruation cycle support app. Potential customers of apps such as MyFitnessPal were also interviewed, as these apps also have a health improving function. For replicability purposes, it was important for this study to have a relatively homogenous population in terms of the apps they utilize. Otherwise, biases could occur and replicability of the study could be endangered (Aspendorpf et al., 2013). Finally, participants should not suffer from any visual or physical impairments that could hinder their accessibility towards app usage. For the sessions with participants, semi-structured interviews were done to gather data on their needs and purchase intentions towards mHealth applications. Furthermore, the interview questions were based on the components from the theoretical models in section 3. The interview scheme can be found in Appendix C. In turn, the data that was gathered from these interviews was analyzed through content analysis methodology, which will be further explained in section 5.2. As some interviews were conducted in Dutch, the original transcripts were also in Dutch. However, the findings and the coding process were ultimately addressed in English.

The research was designed in this particular way in order to be best able to capture insights from both existing literature and the perspectives of potential mHealth app customers. Exploratory research is a profound way of extending the knowledge of a topic that has not been properly researched before (Chenail, 2011). Therefore, this research designs fits the premise of the study, as there currently exists a gap in the literature on mHealth app customer purchase intentions.

4.2 Interview data analysis

As a method of coding analysis, content analysis was chosen as it allows one to systematically analyze the trends in the data and make clear distinctions between relevant findings that stem from the interviews. In order to code the data, ATLAS ti software was used during the coding process. First, open coding was used due to its ability to highlight important quotes in the interviews. Given the exploratory character of the research, open coding is also useful to identify new and relevant concepts of mHealth commercialization and usage. Second, axial coding was used to interrelate the codes to each other by identifying common patterns, similar phrases and themes in the interviewees' answers (Auerbach & Silverstein, 2003). Finally, selective coding was conducted in order to define clear theoretical concepts. Subsequently, these codes were interpreted as sets of answering patterns and relevant answers. Ultimately, no calculated reliability tests were utilized in this study, as the study has an explorative nature and aims to discover new insights rather than testing facts. The complete coding book which contains all codes, code categories and code families can be found in Appendix D.

4.3 Participant characteristics

11 participants took part in this research: 8 were men and 3 were women. The mean age of the participants is 28 (*SD*= 12,27). 7 participants were Dutch, while 4 participants had other nationalities. Finally, 8 participants reported to be a full time student, whereas the other 3 were either working or already retired from working. It is noteworthy that the students were between 21 and 24 years old, whereas the working sample had an age range between 31 and 62. A more detailed description of each participant, albeit anonymized, can be found in Appendix E. The inclusion criterium to participate in this study was that participants were users and/or potential customers of mHealth apps which have specific functionality to improve someone's health, for example by providing health treatment or monitoring. Finally, all participants in the sample reported to have experience with using mHealth apps in the past and/or the present.

4.4 Application characteristics

In the current sample, there were are total of 13 different apps that were being used by the participants. These apps had functions which ranged from disease support to food monitoring possibilities. Most apps however, fit in the category of health support or monitoring apps. Ultimately, some of these apps were grouped together in table 1 as they had completely similar functionality and/or goals.

Table 1

Sample application characteristics

Name	**Amount of users**	**Genre**	**Function**
Freestyle LibreLink	1	Disease support	Arm sensor which measures glucose for diabetes patients.

Flo	2	Health support/monitoring	Supports women during their menstruation cycle. Shows when the menstruation period is supposed to come and provides information regarding f.e. sex and illness.
LifeSum/Yazio/WeightFit/MyFitnessPal/GezondheidsCentrum	7	Food monitoring	Calculates calories in someone's diary and keeps track of it.
Stepcounter	1	Health support/monitoring	Counts steps
GarminConnect	2	Wearable health support/monitoring	Tracks performance on certain activities, monitors sleep & heartrate and counts a person's steps.
Googlefit	1	Health support/monitoring	Counts steps, but also has connectivity with GarminConnect.
FitBit/Samsung Health	3	Health support/monitoring	Monitors sleep activity, meal calories and physical activity.
Kardia	1	Heart support/monitoring	Monitors heart activity such as heart rate and other information related to the heart. Can send this information directly to a cardiologist.

4.5 Coding outcomes

After applying open coding methodology, in total 29 codes, 4 code groups and 2 code families were identified. The code families each have a relatively similar amount of codes. Based on the findings that are displayed in table 2, several theoretical concepts from both the background information and the two theoretical models were verified to be important for the mHealth users in the sample. Furthermore, a significant amount of previously unmentioned affective, physical and mental factors that influence mHealth users were mentioned frequently in the interviews. The full codebook can be found in Appendix D.

Table 2

Identified code groups and families

Code families	Psychophysical factors (13)	Application factors (16)
Code groups	Affective states & Physical and cognitive factors	App functions & Usage factors

5. RESULTS

5.1 TAM based findings

Ease-of-use: The ease-of-use is an incredibly important factor and one of the most frequent topics in the interviews. Apps that are easy to use and understand were reported to be used more frequently than those that were not. More specifically, apps that had no clear goals or a lack of user friendliness, were almost always deleted instantly after the first usage. The following quote by participant Boot (M, 22) is an example of the general message that can be taken out of the interviews:

''These apps are used on the daily by people. Therefore, it is rather comfortable if they are also easy to understand and use so you can do the things you want to do with just a few clicks. Otherwise, you would spend a few hours a day to achieve what you want to achieve. That would render these apps useless, as the goal of these apps presumably is to also be a bit time efficient in terms of your health.''

Age differences: This finding itself can be seen as a new component to the TAM, as it has not been included in either the TAM or mTAM before. Four participants specified that there are differences in terms of age when it comes to mHealth usage. Younger users were reported to be more adept at using mHealth technology, due to the fact that they are more likely to have been in touch with technology. The older users in the current study reported to be adept at using technology in general as well, but they did state that they know many peers who are not. It could be a concern that older users of mHealth apps do not fully understand how they work, since they are not as adept at using technology. Participant Jorge stated the following:

''Currently it is still a problem that older people suffer from a generation gap when it comes to technology. However, in the future the older population grew up with technology in their lives and therefore will not face this problem.''

Positive feelings: Several feelings and affective states were discovered to be relevant for mHealth usage. Fourparticipants reported that, depending on the information they received from the app, they began to develop certain positive or negative feelings during or after using mHealth apps. Most of the positive feelings were developed when people found out they had made progress in terms of their health. This quote by participant Malyka (F, 31) is an example of this concept:

''To me it was a real eye opener to see how little movement I had in a day. Now I take the stairs more often or go for a walk in the park. That is my biggest gain from using these apps. I find it nothing but positive to see how you're physically active and making progress.''

Negative feelings: On the other hand, negative feelings usually came when participants noticed that they had not made any progress. For example, annoying push messages often caused feelings of irritation among participants and in some cases even caused app deletion. Next to that, one participant noted that mHealth apps can also be dangerous for young girls. According to her, young girls are often insecure about themselves and are at risk of taking the information that these apps provide too seriously. This could be detrimental to their mental health, as it possibly can lead to a negative self-esteem. Moreover, negative feelings were also able to manifest as a consequence of obsessive usage. The following quote by Fiets (M, 24) perfectly demonstrates this phenomenon:

''If you use these apps too often, you will get obsessed by counting calories for example. You will start seeing certain meals or snacks as enemies. This can cause you to be very rigid in your calorie intake and diminish certain food, albeit the fact that these things don't necessarily have to be bad for your health. Even worse, it can cause people to lack certain vitamins.''

Trust: As mHealth apps apparently have can have a daunting influence on somebody's feelings, participants have noted that trusting mHealth apps is also an important matter. Another important component of trust in this case is having trust in the developers that they won't abuse the personal data that is being generated by the users. Whereas four participants voiced their concerns regarding privacy, most participants were indifferent about the possible dangers. Common reasons for being unconcerned were that they already accepted the fact that their data is accessible by everyone nowadays, that they received valuable information about their health in exchange for some privacy and one older participant noted that their career was over anyway. Therefore, privacy related trust is a divided topic.

Privacy concerns: In some cases, this was a reason to not purchase an app. The most common concern has to do with the fact that insurance companies could benefit greatly from all the health information that people distribute on these apps. According to two participants, insurance companies could use this data to their benefit by increasing your insurance costs if you fill in your daily snack on a calorie counting app, as this could possibly mean that you are more at risk of getting health issues. One participant also greatly expressed his dissatisfaction with the fact that many apps force you to accept the terms & conditions, which in turn allows the app to send personal data to third parties. According to him, the level of anonymity is at risk when using mHealth apps in general. Therefore, they expressed that this was a frequent barrier for them of using or purchasing a mHealth app.

5.2 Perceived value theory findings

Next to the factors which were related to the TAM and the Perceived value theory, several other factors were stated by the participants to be important or desirable. These factors did not fit in the currently existing models, therefore they are treated separately in this section.

QoL (Quality of Life) improvement: First and foremost, participants often stated to have noticed massive improvements in their quality of life. More specifically, participants generally indicate to feel healthier as a consequence of using mHealth apps. Participant Jorge (M, 22) also demonstrates how his life got easier after using mHealth apps:

''Before, I always had to make a small hole in my finger to measure my blood sugar. Now I can just easily scan it with the help of an app on my phone.''.

mHealth apps can have a positive addition to one's health. However, the QoL improvements are a consequence of

the habits one develops while using mHealth apps. Most participants claimed that after a while they started to use mHealth apps on a habitual basis. One participant specifically gave the example that using mHealth apps becomes the same as brushing your teeth at some point.

Performance value: Another point of interest that came up often in the interviews was the performance value (the value of an app in terms of its perceived quality and performance abilities) of mHealth apps. As it is important for mHealth apps to be user friendly, it is just as important to deliver the expected results. Participants indicated that it is a burning issue for them if the app does not work in the way that they expect it to work. Some participants have specified that they have deleted certain apps that did not meet their expectations in terms of performance. Participant Alicia (F, 21) noted the following:

''It's useful for me when it actually gives me the results or does what I expect it to do. It's also useful for me if it's necessary for the long term, because sometimes I download apps and only use them once and then forget about them.''

Correct information: In terms of performance value, it was also noted that the information provided by the applications should be correct and well defined. Especially in the case of fitness or calorie counting mHealth apps, participants noted that there were often issues with information provision. Many apps are optimized in a way that they display information which is relevant for the absolute mean average of its user base. This can however be problematic for the very same user base, as people who slightly deviate from the average user could already encounter incorrect information. It is important to know for users what using certain apps could mean for their bodies, as incorrect information can have serious consequences if not treated carefully. For instance, participant Heinz (M, 23) demonstrated the following issue with incorrect information:

''What occurred to me, is that the standard goals or information in these apps are often way too complicated for beginners. I think that when you are not sporty or have physical issues, the odds are very much there that you will go too far and injure yourself in the process. For example when you will start running when you're obese, your knees will flap at some point.'

Social value: Another topic that popped up during the interviews, specifically when participants were asked when they would recommend a mHealth app, is social identification. People often try to relate their experiences to those of others, which is apparently also relevant for mHealth apps. Several participants noted that they would definitely recommend mHealth apps to people who are in similar situations or who are similar to themselves. One participant even stated that everyone who does not make use of mHealth apps, is missing out in life.

Acessibility:. Five participants mentioned that this is one of the core reasons for their mHealth app usage. Especially the fact that nowadays almost everybody carries a phone with themselves all the time, makes it very easy and rewarding to use mHealth apps. Combined with the fact that it can replace a visit to the doctor every once in a while, makes accessibility an important contribution to the success of mHealth. Finally, participant Sam noted that he was happy to always be able to access his calorie counting at any given time, as it is simply available on a digital server and not on f.e. a paper sheet that could get lost.

5.3 Desired mHealth functionality

Next to the factors which were related to the TAM and the Perceived value theory, several other factors were stated by the participants to be important or desirable. These factors did not fit in the currently existing models, therefore they are treated separately in this section.

Health monitoring: Users of mHealth apps have demonstrated several reasons as to why they specifically choose for an app instead of a medical service at, for example, a hospital. The most frequent reason for usage of mHealth apps is health monitoring. In all of the different mHealth apps that exists, many possess the ability to monitor one's health in one way or another. Many participants have demonstrated for example that they monitor their general health by using calorie counters, sleep trackers or even a menstruation cycle support app. These functions were specified by six participants to have a significant impact on their health as a whole, as they were able to track and measure things that they were previously unable to. Next to that, it was also noted by two participants that they received significant support for monitoring in terms of their disease. With the use of mHealth apps, they have noted that an app can simply replace a physical visit to a doctor, with also a clear economical incentive. To clarify, participant Joran (M, 62) and Fiets (M, 24) stated the following:

''I am not able to afford professional apparatus or visit the doctor every day. However, the apps that are out there are still quite professional and also many times cheaper, if not free. The way in which we are able to monitor our own health, reduces the barrier for people like me to get access to healthcare. If not for this app, I would have to go to a doctor all the time. Many people get back control over their own lives and health. You get feedback immediately and that can help you a lot.''

''In my opinion, the insights you gain from using health monitoring functionality are priceless. For example you can track the way you consume meals and drinks, which is undoubtedly of great importance for your general health and wellbeing. If people get sick, it can mostly be traced back to their diary. The health you can improve with these features, is incredible.''

Other features: The second desired feature that was mentioned among participants can be seen as an extension of health monitoring, as it involves personal advice on the basis of the gathered data. Several participants have noted that if they were to pay for premium functionality or an app as a whole, they would like to have some sort of personal coaching in the app. This could then be advice that's tailored towards their physical condition or even a professional who is linked to them through the app. Third and next to that, app personalization as a whole is being valued by the participants. For example, an individual training program or cosmetic functions were said to be worth paying for. Fourth and finally, a competitive aspect of these apps was noted to be a fun addition by some of the more sporty participants. In certain mHealth apps, mainly targeted towards sports, there already exists a competition element. Participants noted that having certain rewards you can get by achieving a goal could make an app more fun to use. This concept was also called gamification by one participant. Moreover, two participants stated it would also be nice to see how their friends and peers are doing on comparable exercises or tracks.

5.4 Purchasing reluctance

Another element that emerged primarily from the interviews, is the general purchasing reluctance among mHealth users in the sample. This was previously unidentified in the literature.

Purchasing reluctance: The fact that factors such as user friendliness or privacy issues can easily make or break an app's commercial success, makes it rather common that people are a bit reserved when it comes to purchasing mHealth apps. Many participants, especially those who reported to be students, showed reluctance to the concept of purchasing mHealth apps. The most frequent reason for this was that there is a wide plethora of free alternatives available. Most apps that cost money were said to have an alternative which does exactly the same, albeit for free. However, for those who did express willingness to pay, there were several things that were considered to be important. First, the value-for-money ratio should be considerate. Participants noted that when they pay money for an app, it should work better and have more functionality than free alternatives. A certain sense of exclusivity was also noted to be a part of this concept. Second, the reviews have to be good. Apps with bad reviews were, according to one participant, an instant turn-off and not considered purchase worthy. Third, removing irritations such as advertisements was also specified to be a benefit of purchasing a mHealth app.

6. DISCUSSION

This study aimed to explore which factors can drive purchase intentions and usage among potential customers of mHealth applications. Consequently, the following research question was formulated: ''What factors do drive potential customers' purchase intentions and usage of mHealth applications?''. On the basis of this question, multiple factors were identified that seem to be relevant for mHealth customer purchase intentions and usage by conducting an exploratory qualitative study, where semi-structured interviews served as the primary data.

6.1 Conclusion

The results of this study have shown that there are several factors which are relevant for mHealth app customer purchase intentions and usage. From the (mHealth TAM), numerous components were confirmed to be of importance to potential customers of mHealth applications. First, perceived ease-of-use was the most mentioned factor which influences app usage. Second, trust was found to be relevant for both providing correct information to the user and the way in which the app handles privacy-related matters. Perceived risk was also taken into account in the trust component. Third, privacy concerns were noted to be a pressing matter to some participants, as they noted that it could lead to deletion or abandonment of an app. Fourth, participants stated that feelings were able to influence their attitude about an app, both negatively and positively. Positive feelings arose from making progress, whereas negative feelings mostly stemmed from not making any progress. Finally, age differences were seen as an influence on the attitude as well.

Next to that, several Perceived value theory factors were also identified in the interviews. First, performance value was seen as an important factor for most participants, as they would not make use of apps that do not work correctly. Correct information is related to this principle. Second, social value came up several times in the interviews, especially when being asked when they would recommend an app to somebody else. Third, many participants saw immediate value in mHealth apps because they believe it improves their QoL. Finally and related to QoL, the accessibility that mHealth apps provide is an important consideration for potential customers to use or purchase a mHealth app.

6.2 Links to past research

In this study, there were a number of factors that have been identified in past research as well. For example the ease-of-use component that was taken from the mHealth TAM (Schnall et al., 2015). Ease-of-use is considered as one of the pillars of information systems research (Gefen & Straub, 2000). When a digital system such as an application is not easy to use, many people stop making use of it after a few times (Hsu & Lin, 2015). In past studies, ease-of-use was also found to be an incredibly important factor for the general usage and commercial success of mobile apps in general (Hsu & Lin, 2015; Baharuddin et al., 2013; Zeiss et al., 2007; Davis, 1989). During the

interviews, it was frequently stated that participants had deleted mHealth apps in the past that were not considered to be easy to use. This was not only demonstrated further by the answers that participants gave in this study, but also by past work in the field of mHealth apps (Petersen et al., 2015; Pijnen et al., 2013). Apps which score low on the ease-of-use components were often deleted after using them just a few times. Therefore, the ease-of-use factor is extremely relevant for both developers and users of mHealth apps.

Second, the privacy concerns that were stated by several participants are relevant in a modern context. With the recent coverage on the Chinese Social Credit System (Forbes, 2019) and campaign activities by political parties all over Europe, people are getting more aware of privacy risks. Moreover, the data hoarding practices by software companies are also getting more exposure (West, 2019). Taking these developments into account, it is obvious that some of the participants were concerned about their privacy rights. Nevertheless, some participants were still ignorant about the potential privacy risks of using mHealth applications. An explanation for this could be that the younger generations have more experience with technology and therefore have a more positive attitude regarding technology usage (Smutny et al., 2019; Guo et al., 2015). The rise of privacy concerns are not new in research on (mHealth) apps. Several studies have shown that people in general are often skeptical about privacy related matters when it comes to using technology (Schnall et al., 2015; Smutny et al., 2019; Guo et al., 2015; Luo, 2002; Flavián & Guinalíu, 2006). Therefore, participants in this study have confirmed the fact that privacy concerns regarding mHealth apps are justified and relevant.

Third, the findings regarding performance value can be traced back directly to the perceived value theory (Hsu & Lin, 2015). In this case, performance value implies that an app works in the way people expect it to work and also does not have too many complications, such as slow usage or bugs. However, when an app does not meet these standards it inevitably leads to app deletion (Schnall et al., 2015). The fact that some participants indicated that they had deleted an app after it did not work properly, confirms that this is also relevant for mHealth apps. Performance value is also quite common in information systems literature (Pura, 2005; Lee et al., 2007; Turel et al., 2007; Walsh et al. 2014). Dysfunctional systems or apps are easily dropped by its users, in exchange for a superior product (Turel et al., 2007). This is tied to the previously mentioned concept of app deletion by Hsu and Lin (2015), as apps that do not meet the expectations of its users are deleted more frequently. Hence, performance value is an integral part of every successful app.

Finally, what differs from most normal applications is that mHealth apps have a QoL improving function (Pijnen et al., 2013). It was reported by most participants that mHealth apps improve their general health and thus their QoL. However, it could be that this effect is overestimated by the participants. For example if one makes use of a weight tracker, but still gains weight beyond their goals, it is questionable whether the weight tracker app actually improves the quality of life or not. Nevertheless, past research has confirmed that mHealth apps do improve one's QoL if used properly (Pijnen et al., 2013; Torous & Roberts, 2007; Luxton et al., 2011). The concept of QoL improvement hasn't specifically been stated to be important for app usage or purchase intentions, but perceived value theory findings are in line with what the participants stated about QoL improvement (Walsh et al. 2014).

6.3 Theoretical and practical contributions

This study offers two major theoretical contributions. First, this study contributes to a better understanding of the factors which influence the purchase intentions and usage behaviour of potential mHealth customers. Before, most studies in the field of mHealth ignored the commercial aspects of mHealth apps (Pijnen et al., 2013). Whereas there are numerous studies on app commercialization or mHealth app usage, no existing study combined both perspectives into one. It is of great importance for the field to combine insights from business administration and psychology, as these two overlap in the creation of mHealth applications (Torous & Roberts, 2017). Taking insights from e-commerce into account is necessary for a successful app (Hsu & Lin, 2015), but not all that is needed for a successful mHealth app. It is absolutely essential to consider the psychological aspects of these apps, as not doing

so inevitably leads to users deleting their app after a few uses. Second, it was shown that users of mHealth apps do not often consider paying as a necessity in order to have a profoundly working app. Many even showed reluctance towards purchasing, which could indicate that the emphasis of mHealth apps should not be put on being a cash cow, but on improving the quality of life of the general public.

Next to the theoretical contributions, this study also offers several practical implications. For example, better designed mHealth apps are not only beneficial towards app developers and entrepreneurs, but also to the quality of life of the general public (Schnall et al., 2015). Applications that are better tailored towards their user base lead to more satisfaction and more usage (Petersen et al., 2015). Consequently, when users are more satisfied while using mHealth apps, it could lead to a healthier lifestyle as they use these apps more frequently. Next to that, when they are better optimized for their individual profile, they are also more able to better their own health (Patil, 2011; Pijnen et al., 2013). It is important for the field of mHealth to consider these implications, as they are crucial for its success (Luxton et al., 2011).

Furthermore, the findings of this study are directly applicable in the development of mHealth apps. The factors that were found to be influential in the decision to use or purchase an app are mostly tied to the way an app is developed. Companies should use pilot studies for the development of mHealth apps, in order to find out whether an app meets the expectations of potential customers or not. This pilot study could be measured on the basis of phenomena such as f.e privacy protection, ease-of-use and affordability. Consequently, app deletion and purchase reluctance can be prevented. However, not only companies and entrepreneurs benefit from better designed apps. As stated by most of the participants and previously researched in several studies (Pijnen et al., 2013; Luxton et al., 2011; Petersen et al., 2015), mHealth apps have the ability to improve one's QoL, make healthcare accessible and massively reduce the costs of healthcare. Therefore, the general public also benefits from apps that are better tailored towards their usage behaviour. Taking into account that many mHealth users don't pay or don't want to pay for apps, a different approach could be used by companies. An option would be to make mHealth apps free for general users, but paid for institutes such as hospitals. Consequently, the developed mHealth apps will still be used, users don't pay and the developers still earn money through subsidized programs. Another option for companies to test whether their app works or not, is applying for government/research subsidy.

6.4 Strengths and limitations

This study has a number of strengths which make the conducted research more credible. To start, the diverse selection of mHealth apps in the study, ranging from fitness to disease support, allowed for different views and insights on mHealth usage and purchase intentions. For an exploratory study like this, it is important that the results are at least somewhat generalizable towards a larger population. Then, it is possible to highlight these findings in further research. Next to that, this study was in no way related to a company or an organization which offers mHealth apps themselves. Participants were informed beforehand that the researcher carries the research out independently and anonymizes their data afterwards. This was an important measure to reduce socially desirable answers and thus limit the amount of social desirability bias. Moreover, the fact that all of the participants had already used mHealth apps in the past or were still using them, helped a great deal in gathering data. Additionally, the study has both scientific and practical merit. Well developed and marketed mHealth apps are not only in the best interest of software developers, but also of the general public. The benefits which mHealth apps offer can be of great value to a person's health. Finally, this applies literature from psychology and business administration into mHealth marketing and usage. which has not been done before. This study opened up possibilities for further research on mHealth customer behaviour and usage, as the field has plenty of room for scientific exploration. The fact that the interview scheme was based on scientific models from previous studies also causes the results of this study to be more credible, considering that these theories stem from influential peer reviewed papers.

However, this thesis has several limitations. First, the generalizability of the results suffered from the fact

that this study did not make use of any reliability or validity tests to test the interview scheme. The interview data differed among participants, as semi-structured interviews were conducted to fully explore the research question. This is a limitation in the sense that the reliability of the answers cannot be guaranteed, since reliability tests such as Cohen's Kappa were not utilized in the data analysis. Although the interview scheme was necessary to guide the semi-structured interviews, it could have also framed the participants about certain topics. In the interview scheme, the questions were based on the findings from the theoretical models. However, it could be that there are different theoretical models that would have led to different answers and results. There was a scarcity of useful mHealth related literature when searching for theoretical models, so the two models that were used in this study mostly stem from psychology research. Second, another phenomenon that arose during the interviews is that many participants specified that they were not willing to pay for mHealth apps. Most free apps were seen as competent enough and therefore paid applications were mostly ignored. However, non-students had less problems with the concept of paid mHealth apps. Consequently, the overrepresentation of non-paying students could have led to a biased view on mHealth customer purchase intentions. Third, another issue with the sample is the fact that the majority (8 out of 11) was 24 years old or younger. There was already a clear difference in the answers between the older and younger participants, so it could be that an older sample would have produced different results as well. Especially when it comes to paying for mHealth apps, as the students have shown to generally be reluctant towards purchasing apps. Finally, it is likely that the results have been influenced by the composition of the sample. It can be viewed as a limitation that only existing customers of mHealth apps have been interviewed, since they have an experienced perspective on mHealth apps. Potential users with no experience in using mHealth apps could have brought up interesting new perspectives on mHealth apps, which could be valuable for the development process of new mHealth apps. Moreover, their insights could also reveal potential functions that might be relevant for existing users as well.

6.5 Future research

Several things should be taken into consideration when further tackling the topic of mHealth usage and purchase intentions. The results in this study were heavily based on two theoretical models and thus could have steered the outcome of this study in a certain direction. Therefore, more research should be done where different theoretical models propose new perspectives on the topic. However, assuming that the models that were used in this study did present a clear overview of the topic, quantitative methodology would be the next step. For example, researchers could set up an experiment where participants would make use of two different apps. One app has incorporated the desired features of the current sample, whereas the other one has not. Consequently they could fill in a survey where they express which app they liked better. This way, the results of this study can be further tested and quantified, as this study merely had an exploratory nature. Finally, a recommendation for future research would also be to have a clear distinction between paying and non-paying users of mHealth apps. A better understanding of the difference between those two would be valuable, as it could be that there are different motives in each group.

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8. APPENDICES

8.1 Appendix A: Informed Consent

Informed consent: *The commercialization of mHealth applications : Which factors drive purchase intentions and app usage among potential customers?*

Purpose of the Study

This research is being conducted by Tim Bussmann. I am inviting you to participate in this research project about The commercialization of mHealth applications. The purpose of this research project is to investigate how mHealth applications can drive the purchase intentions of potential customers of mobile health based applications.

Procedures

You will participate in an interview lasting approximately 25 to 30 minutes. You will be asked questions regarding your mHealth needs and challenges, purchase intentions and how you make use of mHealth apps.

Potential Risks and Discomforts

There are no obvious physical, legal or economic risks associated with participating in this study. You do not have to answer any questions you do not wish to answer. Your participation is voluntary and you are free to discontinue your participation at any time.

Confidentiality

Your privacy will be protected to the maximum extent allowable by law. No personally identifiable information will be reported in any research product. Moreover, only trained research staff will have access to your responses. Within these restrictions, results of this study will be made available to you upon request. At the start of the research your name will be replaced by a pseudonym; your name will be coded. As indicated above, this research project involves making audio recordings of interviews with you. Transcribed segments from the audio recordings may be used in published forms (e.g., journal articles and book chapters). In the case of publication, pseudonyms will be used. The audio recordings, forms, and other documents created or collected as part of this study will be stored in a secure location with the University of Twente or on the researchers password-protected computers and will be destroyed within two years of the initiation of the study.

'I hereby declare that I have been informed in a manner which is clear to me about the nature and method of the research as described in the aforementioned information brochure. My questions have been answered to my satisfaction. I agree of my own free will to participate in this research. I reserve the right to withdraw this consent without the need to give any reason and I am aware that I may withdraw from the experiment at any time. If my research results are to be used in scientific publications or made public in any other manner, then they will be made completely anonymous. My personal data will not be disclosed to third parties without my express permission. If I request further information about the research, now or in the future, I may contact t.bussmann@student.utwente.nl'

Signed in duplicate:

…… ……

Name subject Signature

I have provided explanatory notes about the research. I declare myself willing to answer to the best of my ability any questions which may still arise about the research.'

…… ……

Name researcher Signature

8.2 Appendix B: Invitation letter

Dear Sir or Madam,

My name is Tim Bussmann and I am a Master's student in the Faculty of Behavioural, Management and Social sciences (BMS) at the University of Twente. I am working on a research project under the supervision of dr. Anna Priante and Igors Skute MSc.

I am writing to you today to invite you to participate in a study entitled "*The commercialization of mHealth applications : Which factors drive purchase intentions and app usage among potential customers?*". This study aims to identify which factors influence the purchase intentions of potential customers of mobile health based applications. An example of these factors is customer trust.

This study involves one 10-15 minute interview that will take place in a mutually convenient, safe location. With your consent, interviews will be audio-recorded. Once the recording has been transcribed, the audio-recording will be destroyed.

While this project does not involve some professional and emotional risks, care will be taken to protect your identity. This will be done by keeping all responses anonymous and allowing you to request that certain responses not be included in the final project.

You will have the right to end your participation in the study at any time, for any reason, up until june 15th. If you choose to withdraw, all the information you have provided will be destroyed.

All research data, including audio-recordings and any notes will be encrypted. Any hard copies of data (including any handwritten notes or USB keys) will be kept in a locked cabin in a remote location. Research data will only be accessible by the researcher and the research supervisor.

If you would like to participate in this research project, or have any questions, please contact me at +31683944498 or t.bussmann@student.utwente.nl

Sincerely,

Tim Bussmann

8.3 Appendix C: Interview questions scheme

General questions
''How old are you?''
''What is your gender?''
''What is your current occupation?''
''What is your nationality?''
''Which mHealth apps do you use?''
''Can you describe what the app is about?''
''How often do you use these apps?''

Theoretical concept	**''In what way do potential customers make use of mHealth apps?''**
Intentions	*''Why do you use mHealth apps?''*
Perceived usefulness	*''What are absolutely necessary functions of any mHealth app that you would like to use?'*
Ease of use	*''In what way is the ease of use of an app important to you?''*
Trust	*''In what way are feelings of trust regarding a mHealth app, relevant for its use?''*
Perceived risk	*''In what way do you perceive the use of mHealth apps to contain some sort of risk?''*

Theoretical concept	**''What are the wishes and needs of potential mHealth app customers, with regard to mHealth apps?''**
Perceived usefulness	*''What features does a mHealth app need to have, in order for you to perceive it as useful?''*
Perceived usefulness	*''In relation to the needs, what are possible barriers for you in terms of using or purchasing mHealth apps?''*
Perceived usefulness	*''What makes, according to you, a mHealth app useful or not?''*
Performance/quality value	*''What is, according to you, the biggest value of mHealth apps?''*
Emotional value	*''How do you usually feel after using a mHealth app?''*

Value-for-money	*"What are features of a mHealth app that you would be willing to pay for?"*
Social value	*"What would make you recommend a mHealth app to a friend?"*

8.4 Appendix D: Complete codebook

Affective states (10)
App dependency
App irritations
App overusage
Fun factor
Intention to use
Negative feelings
Positive feelings
Privacy indifference
Social identification
Trust

Usage factors (12)
Accessibility
App reviews
Ease of use
Effort barriers
Exclusivity
False information
Free alternatives
Lack of functionality
Performance value
Privacy issues
Usefulness
Value-for-money

Application functions (4)
App coaching

App personalization Health monitoring User competition

Physical & cognitive factors (3)
Age differences App habits QoL improvement

8.5 Appendix E: Sample characteristics

Respondent 1 to 4

Name	Jorge	Lana	Boot	Django
Age	22	21	22	24
Nationality	Spanish	German	Dutch	Dutch
Occupation	Graduating student	Student	Student	Student
mHealth app(s)	Freestyle Librelink	Flo	LifeSum	Excel sheet, self-developed weight tracker & MyWellnessApp
Sex	Male	Female	Male	Male

Respondent 5 to 8

Name	Samet	Alicia	Heinz	Sam
Age	21	21	23	36
Nationality	Dutch/Turkish	German	German	Dutch
Occupation	Student	Student	Student	Employee
mHealth app(s)	Samsung Health/MyFitnessPal	Flo, Stepcounter, Yazio & Weightfit	GarminConnect & GoogleFit	FitBit & MyFitnessPal
Sex	Male	Female	Male	Male

Respondent 9 to 11

Name	Malyka	Joran	Fiets
Age	31	62	24
Nationality	Dutch	Dutch	Dutch
Occupation	Employee	Retired employee	Working student
mHealth app(s)	Samsung Health, FitBit & MyFitnessPal	Kardia & GarminConnect	Gezondheidscentrum app
Sex	Female	Male	Male