Investigating attributes that have an influence on the user acceptance of mobile applications

Christian Fourie

22833129

Dissertation submitted in *partial* fulfilment of the requirements for the degree *Magister Scientiae* in Computer Science at the Potchefstroom Campus of the North-West University

Supervisor: Prof HM Huisman

May 2017

ACKNOWLEDGEMENTS

Let us start by thanking the people that made all of this possible. This dissertation would not have happened were it not for the guidance and encouragement of my supervisor, Prof HM Huisman. She always knew just what was needed to deliver professional work and has proven that with the right mentorship, people can achieve something above their own capabilities.

I cannot but mention my parents, who in a way sponsored this whole process. Thank you very much for all the love, support and guidance that made me who I am! Thanks to my cousin, Ula van Zyl, who made my writing seem much more professional than it is.

And finally, thanks to my friends and the University for making this all great fun!

"PUKKE! Want dis die universiteit wat die naaste kom aan dié wat mens in die flieks sien."

ABSTRACT

Mobile applications (apps) have become hugely popular over the last decade. Millions of apps are available, and new apps are developed daily. Most of these are not very successful, and are uninstalled shortly after being downloaded, possibly due to low user acceptance. This study will investigate possible attributes that influence the user acceptance of mobile applications. It will also attempt to determine the importance of the attributes identified.

The user acceptance of newly-released apps was identified as a significant problem facing mobile application development. User acceptance of new technologies has been studied for quite some time now, but very few of these studies were applied to mobile applications. Previous studies that do focus on some aspects of user acceptance were not comprehensive, and did not cover *all* the relevant attributes that have an influence on user acceptance. The available literature regarding user acceptance was studied to gather a list of attributes, which may have a positive or negative influence on the user acceptance of mobile applications. These attributes formed the base for the remainder of the study.

During the research process, different types of smartphone users were identified and interviewed. The purpose of the interviews was to gather additional attributes that influence the user acceptance of mobile applications from the users themselves. After the interviews, a content analysis was performed to gather attributes from the interviews. New attributes identified from the interviews include: keeps me updated, clear descriptions, realistic, off-line usability, explanations, remember use, feedback, good-looking icons, too many updates, scaly permissions, affects the rest of the phone, unpredictable, and not aligned with computer version. These attributes were used in combination with those obtained from the literature to construct a questionnaire. A survey was performed using the questionnaire, and the results were statistically analysed.

The results were ranked in terms of importance to smartphone users, which revealed the most important attributes having a positive influence on user acceptance of mobile applications as being: functionality, ease of use, relevance, mobility, well-designed and organised interface, and the app being true to its title. Attributes having a negative influence on user acceptance of mobile applications included: bugs, slow apps, advertisements, affects the rest of the phone, and breach of privacy. Another part of the study indicated a preference for certain attributes when in conflict with others, for example users prefer a simplistic design rather than plenty of features, professional looking over colourful and happy, and quiet instead of notifications and reminders.

The different preferences of user groups were found to be as follows:
Women placed a greater importance on low costs than men. Fun was more important as groups spent more time on their phones. A steep learning curve was a bigger problem as the user's age increased. Appearance and positive ratings and reviews were more important to users who had a purchase history, and apps causing problems were also a bigger issue for these users. Platform consistency was more important to participants from the industry. iPhone users disliked apps that have a steep learning curve, and had a bigger probability of having purchased apps and app content.

Keywords

Mobile application development, smartphone, user acceptance of mobile applications, attributes influencing user acceptance, apps, app development

OPSOMMING

Mobiele toepassings (toeps) het in die loop van die afgelope dekade baie gewild geword. Miljoene toepassings is beskikbaar, en nuwes word daagliks ontwikkel. Die meeste daarvan is egter nie baie suksesvol nie, en word gewoonlik verwyder kort nadat hul afgelaai was, moontlik as gevolg van lae verbruikersaanvaarding. Hierdie studie sal die eienskappe wat moontlik ’n invloed op die verbruikers-aanvaarding van mobiele toepassings mag hê, ondersoek. Dit beoog ook om die belangrikheid van die geïdentifiseerde eienskappe volgens rangorde te bepaal.

Die verbruikersaanvaarding van nuutvrygestelde mobiele toepassings is geïdentifiseer as 'n groot probleem met die ontwikkeling van sagteware vir mobiele toestelle. Verbruikers-aanvaarding van nuwe tegnologie word al vir 'n geruime tyd bestudeer, maar min van hierdie studies is gerig op die aanvaarding van mobiele toepassings. Vorige studies wat wel fokus op sekere aspekte van verbruikersaanvaarding sluit gewoonlik nie al die relevante eienskappe in wat 'n invloed op die verbruikersaanvaarding het in nie. Die literatuur met betrekking tot verbruikersaanvaarding is bestudeer om 'n lys van eienskappe wat 'n positiewe of negatiewe invloed op die verbruikersaanvaarding van mobiele toepassings kan hê, vas te stel. Hierdie eienskappe het die grondslag gevorm vir die res van die studie.

Tydens die navorsingsproses is verskillende tipes slimfoonverbruiker geïdentifiseer, en onderhoude is met hulle gevoer. Die doel van die onderhoude was om bykomende eienskappe wat 'n invloed op die verbruikersaanvaarding van mobiele toepassings het te identifiseer uit die oogpunt van die verbruikers. Na afloop van die onderhoude is 'n inhoudsanalise uitgevoer om eienskappe vanuit die onderhoude te bepaal. Nuwe eienskappe wat geïdentifiseer is met behulp van onderhoude sluit in: hou my opgedateerd, duidelike beskrywings, realisties, bruikbaarheid sonder internet, verduidelikings, onthou my vereistes, terugvoer, mooi ikone, te veel opdatering, vreemde toegangsregte, beïnvloed die res van die telefoon, onvoorspelbaar, nie in ooreenstemming met die rekenaarweergawe nie. Hierdie eienskappe is gebruik in kombinasie met dié vanuit die literatuur om 'n vraelys te saam te stel. Daarna is 'n opname met behulp van die vraelys uitgevoer, en die resultate daarvan is statisties ontleed.

Die resultate is voorgestel na aanleiding van belangrikheid vir slimfoongebruikers. Die belangrikste eienskappe wat 'n positiewe invloed op die verbruikersaanvaarding van mobiele programme aangedui het, is soos volg: funksionaliteit, gemak van gebruik, relevansie, mobiliteit, goed ontwerpte en georganiseerde koppelvlak, en toepassings wat getrou is aan hul titels. Eienskappe wat 'n negatiewe invloed op die verbruikersaanvaarding van mobiele toepassings het, sluit in: foute, stadige toepassings, advertensies, beïnvloed die res van die slimfoon, en die

skending van privaatheid. 'n Ander deel van die studie dui op die voorkeur vir sekere eienskappe in teenstelling met ander, byvoorbeeld: verbruikers verkies 'n eenvoudige ontwerp eerder as baie funksies, ’n professionele koppelvlak eerder as kleurvolle koppelvlak, en stil in plaas van gereelde kennisgewings.

Verskillende voorkeure van verbruikersgroepe is ook ondersoek, en die volgende is bevind:
Vir vrouens is lae kostes belangriker as vir mans. Pret was belangriker vir verbruikers wat meer tyd op hul slimfone deurbring. 'n Stewige leerkurwe was 'n groter probleem soos die ouderdom van die verbruikers toegeneem het. Voorkoms en positiewe graderings en resensies was belangriker vir verbruikers wat 'n aankoopgeskiedenis gehad het, en toepassings wat probleme veroorsaak, was ook 'n groter probleem vir hierdie verbruikers. Platform-konsekwentheid was belangriker vir verbruikers in die industrie. iPhone-verbruikers het minder gehou van toepassings wat 'n leerkurwe het, en dit was ook waarskynliker dat hulle ’n aankoopgeskiedenis sou hê.

Sleutelterme

Mobiele toepassing ontwikkeling, slimfone, verbruikers aanvaarding van mobiele toepassings, eienskappe wat verbruikersaanvaarding beïnvloed, programme, ontwikkeling van sagteware

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

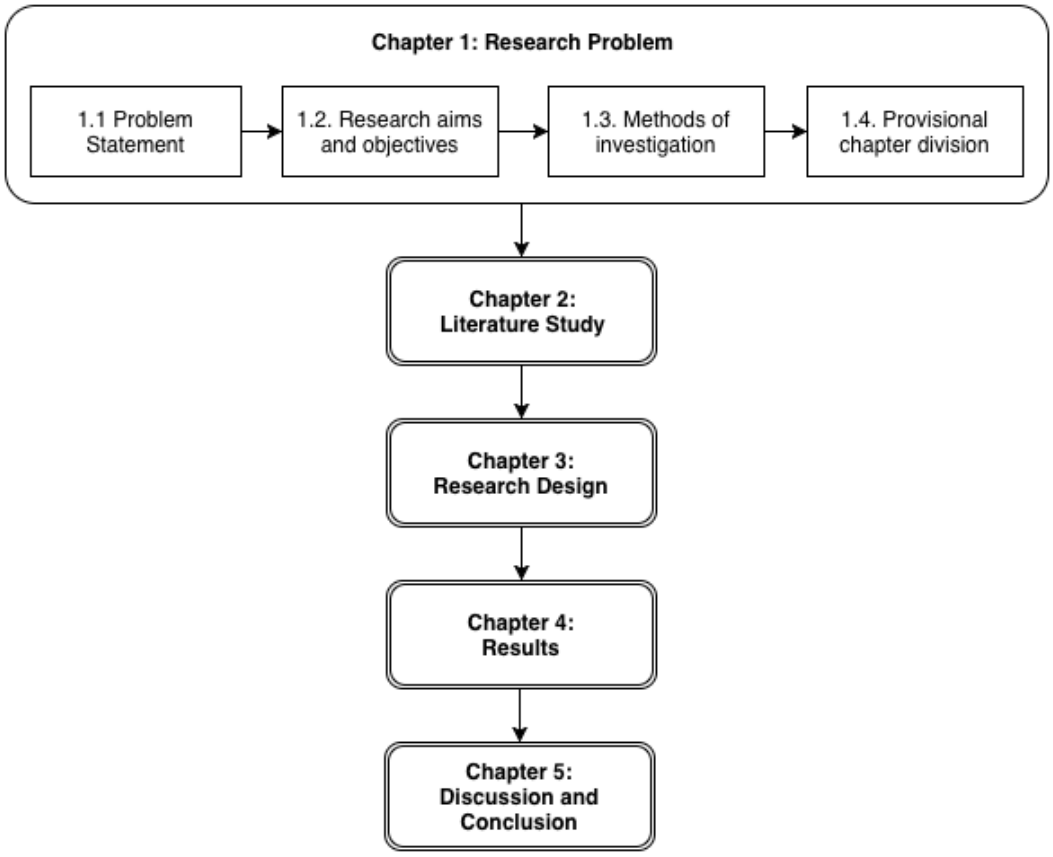
App - Mobile/smartphone application

SDK - Software development kit

IDE - Integrated development environment

ADT - Android development tools

CHAPTER 1 RESEARCH PROBLEM



In this chapter, the problem statement, followed by research aims and objectives, methods of investigations, and then the provisional chapter division will be discussed.

1.1. Problem statement and substantiation

1.1.1. Problem background

According to GSMA Intelligence (2014:9), mobile technology has grown significantly during the past decade, not only regarding device capabilities, but also in respect of varieties and the number of people using smartphones. Some common problems faced by developers of mobile applications include: user acceptance (Godoe & Johansen, 2012:39; Kaasinen, 2008:102), proper usability testing, dealing with limited user-input options (Wasserman, 2010:398), and security problems (Unhelkar & Murugesan, 2010:38).

According to Kaasinen (2005:1), the problem of user acceptance is currently addressed by applying alternative solutions, for example organisations are implementing their own checklists for applications being developed, and others are following some guidelines from the human-centred design approach to software development (Maguire, 2001:588).

Previous studies with suggestions on increasing the user acceptance of the mobile applications being created include Cyr *et al.* (2006), Isomursu *et al.* (2007) and Park and Kim (2013). Burton-Jones and Hubona (2006:706) stated that because of low user acceptance many technology-based products and services never realise their full potential, and some are simply rejected. User acceptance is extremely important to the success of new technologies, but is often very difficult to predict (Godoe & Johansen, 2012:39).

Kaasinen (2005:67) stated that when user acceptance is evaluated, the results will sometimes require developers to return to earlier phases of the development lifecycle, such as the user requirements or the usage context evaluation stage. If user feedback is negative, changes cannot be made as easily as in the earlier stages of development.

Existing research on the attributes that contribute to the user acceptance of mobile applications is very fragmented. For instance, there are studies that focus on the quality of experience (Ickin *et al*., 2012:52) and others on the usefulness of mobile applications (Hermansson *et al*., 2014:128). Resultant information could contribute to user acceptance, but it does not provide a holistic view of all the attributes that contribute to the user acceptance of mobile applications. The studies that do focus entirely on user acceptance, such as that by Davis (1993) and Kaasinen (2005), determined some of the attributes that influence user acceptance, but not necessarily a complete and comprehensive list.

In this study, the attributes of mobile applications, which tend to lead to higher user acceptance, will be investigated. The findings could, theoretically, be implemented when designing new mobile applications, leading to higher user acceptance (to be investigated), and eliminating the need to revisit earlier design phases, which is very costly in terms of time and resources (Schwalbe, 2012:4).

1.1.2. Research question

What attributes influence the user acceptance of mobile applications?

The study will investigate attributes that contribute to the user acceptance of mobile applications. These attributes will then be prioritised with reference to the importance to the users of mobile applications.

Creating applications conforming to the identified attributes should be considered by developers who wish to differentiate themselves from the ever-increasing competition in the mobile

application industry. Mobile applications with a high user acceptance could yield a great financial advantage to their developers.

1.2. Research aims and objectives

The aim of this study is to identify a complete list of attributes that might contribute to the user acceptance of mobile applications. These attributes will then be investigated and prioritised according to their importance as indicated by users of mobile applications. In order to reach the aims, the following objectives have to be met:

1. Examine the literature to find attributes that could contribute to the user acceptance of mobile applications.
2. Determine attributes that would contribute to the user acceptance of mobile applications according to mobile users.
3. Perform a survey to investigate identified attributes in objectives 1 and 2.
4. Perform a statistical analysis to rank the determined attributes regarding their importance to users of mobile applications.
5. Employ further statistical investigation to identify the difference between various user groups.

1.3. Methods of investigation

To complete this study, the QualQuant mixed method will be followed (Onwuegbuzie & Leech, 2005:383). Firstly, qualitative methods will be used to gain valuable insights from the participants involved. This will be followed by a survey that utilises quantitative data.

The study will be performed by starting with a literature study of attributes influencing the user acceptance of mobile applications. This will serve as a point of departure for relevant information on which the study can expand. Using contributions from the literature, an initial list of interview questions regarding positive and negative attributes of mobile applications will be constructed.

Interviews will be carried out to verify the relevant attributes as taken from the literature, and also to contribute any additional attributes that might be important.

To analyse the qualitative data, a content analysis will be performed. The information gathered from the interviews and literature will be used to construct a questionnaire to perform a survey.

This survey will supply the study with data on the relevance of the attributes identified as drivers or barriers to user acceptance of mobile applications, using a Likert scale from 1 to 4.

For the quantitative data, a statistical analysis will be performed to present the results in a factual form, which can then be prioritised. The techniques that will be used in the statistical analysis include: Descriptive statistics, Multi-direction frequency tables, Factor analysis, Reliability analysis, Pearson correlations and T-tests.

1.4. Chapter division

This dissertation will include the following chapters:

1. **Research problem** – In this chapter, an introduction to the world of mobile application development, its current practices, and certain issues will be presented, specifically the issue of user acceptance, which led to the problem statement.

2. **Literature study** - In this chapter, current literature on mobile application development will be presented. The main sections of the literature will include:

    a. Mobile application development
    b. Current issues with mobile application development
    c. User acceptance of mobile applications
    d. Conceptual Model

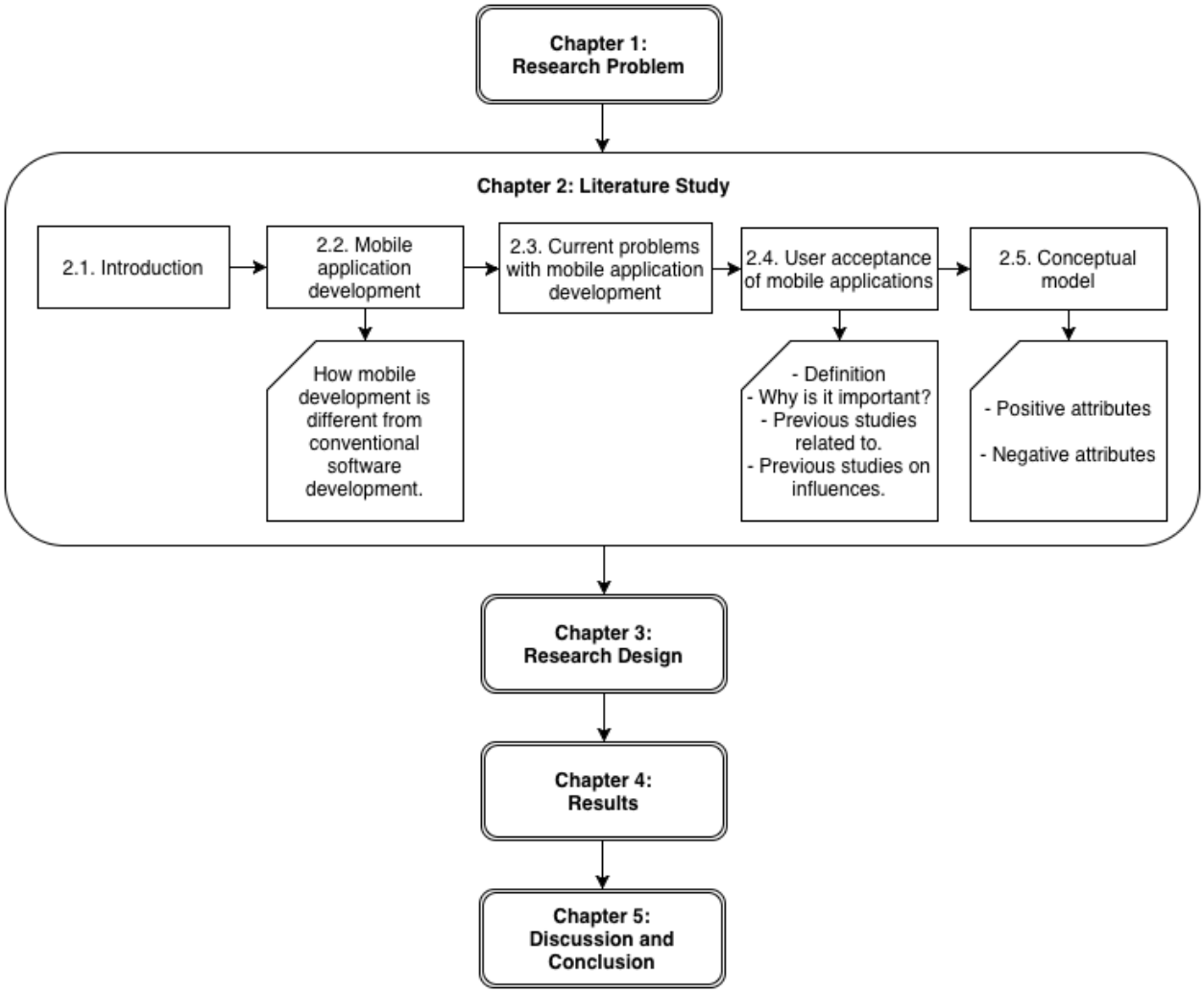
3. **Research Design** – In this chapter, a description of the mixed methods research paradigm that will be followed, as well as an explanation of procedures followed to obtain the data, including interviews and the questionnaire will be provided. The procedures followed to analyse the data, such as content analysis and statistical analysis will also be explained.

4. **Results** - The results of the study will be presented in this chapter, as well as a discussion of and an interpretation with reference to the initial problem statement.

5. **Discussion and Conclusion** - In this chapter, the concluded findings will be presented. These findings will take into account the literature study, data collected and the final results. Lastly, an indication will be given of whether the goals of the research were successfully met, and where improvements can be made.

The literature study will follow in the next chapter.

CHAPTER 2 LITERATURE STUDY



In this chapter, the literature study consisting of current literature on mobile application development is carried out. The main focus will centre on attributes that influence the user acceptance of mobile applications according to the literature.

2.1. Introduction

Mobile applications have become a major part of people's everyday lives. An article by Viswanathan (2016) indicated that with the millions of people using smartphone applications every day, it is a highly profitable business, and the companies using this to their advantage are reaping the benefits.

The mobile application (app) stores from different mobile platforms, such as the Apple App Store, the Google Android Market, RIM's App World and the Windows Phone App Store have

already made billions of dollars in profit over the last few years. Some of the most popular games in the Google Play store include: Flappy bird, Angry birds, 2048, Clash of Clans, 8 Ball pool and Pokemon GO. The top earners, Pokemon GO and Clash of Clans, made as much as $6 million and $10 million a day respectively during their peak periods.

Mobile apps are now being used as a way to advertise and sell products and services and encourage social sharing of information, while popular businesses are using the platform to develop and maintain brand loyalty. The new world of mobile app development is vast, and offers a great scope for independent app developers and companies to succeed beyond their expectation with very little initial investment (Viswanathan, 2016).

Since the introduction of mobile phones, devices have evolved from simple conversation tools to extremely advanced multifunctional devices that have a vast number of uses, such as internet browsing, media streaming, taking pictures or videos, playing 3-D games, social networking, etcetera. The basic functions, such as making calls or sending SMSs are still part of the package, but are no longer the only reason for purchasing a mobile phone, as shown in Fig. 2.1. In the image summarising the findings of InsightsNow (2012:5), it can be seen that smartphones have transformed from a business tool to a multipurpose communication and entertainment device for most people.

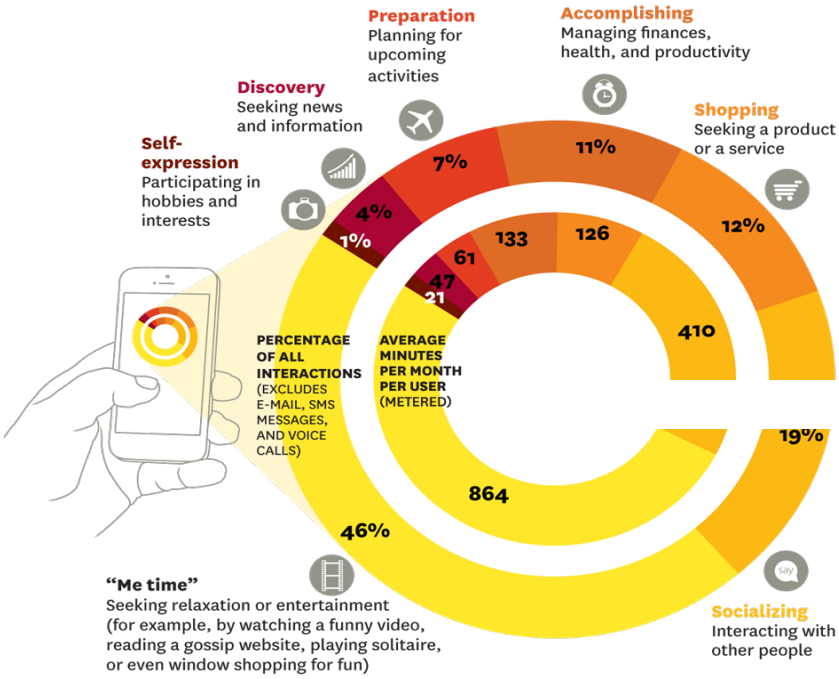


Figure 2.1: The Hidden Motivations of Mobile Users InsightsNow (2012)

According to GSMA Intelligence (2014:9), mobile technology has grown significantly during the past decade not only regarding device capabilities, but also as far as varieties and the number of people using smartphones are concerned. The study states that since 2008 there were 2 344 million unique smartphone subscribers globally. Forecasts on mobile phone usage indicate that smartphone owners for 2015 totalled more than 3 745 million unique subscribers, and that this number will continue to rise to 4 334 million in 2020. This shows a clear increase in smartphone activity and suggests that directing more attention toward the field of mobile application development is a worthwhile investment.

In this chapter, some shortcomings in the mobile application development field, specifically regarding methods for enhancing user acceptance of applications being developed will be examined. The focus will firstly be on points of difference between conventional software development and mobile application development. This will be followed by a discussion of issues not yet being addressed in the mobile development industry, and specifically the problem of user acceptance. Subsequently an attempt will be made to determine how to create successful mobile applications by determining attributes that cause smartphone users to accept or reject mobile applications. In conclusion a list and discussion of attributes influencing the user acceptance of mobile applications will be given.

2.2. Mobile application development

Mobile application development refers to the development of software applications for hand-held devices, such as smartphones and tablets. “The popularity of smartphones among end users has increasingly drawn software developers’ attention over the last few years. As with any new domain, mobile application development has its own set of new challenges” (Joorabchi *et al.,* 2013:15). Modern smartphones are paving the way for a new generation of business and consumer applications, giving rise to a whole new list of exciting challenges, such as new development skills requirements, moving toward fragmentation rather than unification, open/closed development platforms, keeping up with frequent changes, new methodologies, different security requirements and a whole new design approach (Joorabchi *et al.,* 2013:17).

Teng and Helps (2010:471) suggest that most companies are deploying mobile applications to help simplify some tasks for their clients or to create awareness and expand their client base. Other companies are using mobile applications as their primary source of income, and many independent developers are also trying their hand at earning an income through mobile application development.

According to Gasimov *et al.* (2010:74), the advances in mobile application development are fuelled by three factors, namely

- the maturity of mobile networks;
- advanced mobile hardware; and
- users' increasing demand for new and improved mobile applications.

These factors are still in play today, and millions of developers are trying their best to keep up with modern trends and requirements. Statistics provided by GSMA Intelligence (2014:9) suggest that the current economic and technological potential of mobile applications are still as big as ever and very profitable when exploited correctly.

Period	Android	iOS	Windows Phone	BlackBerry OS	Others
2015Q2	82.8%	13.9%	2.6%	0.3%	0.4%
2014Q2	84.8%	11.6%	2.5%	0.5%	0.7%
2013Q2	79.8%	12.9%	3.4%	2.8%	1.2%
2012Q2	69.3%	16.6%	3.1%	4.9%	6.1%

Source: IDC, Aug 2015

Figure 2.2: Smartphone market share

As shown in Fig. 2.2 by IDC Research Inc. (2015), Google and Apple are the market leaders in smartphone operating systems, covering 82.8% and 13.9% of the total market share. Businesses and independent developers usually choose one of the above platforms on which to focus, depending on their abilities and preferences. The ideal remains to develop for both platforms to ensure that the maximum target market is reached.

The two current leaders in mobile operating systems, Apple and Google, have taken very different approaches on sharing their software development kits with developers. Their core differences are as follows:

Google supports open source, and is disclosing all the source codes of its software development kit (SDK) and operating systems, which makes developing advanced software applications an easy task for experienced developers (Teng & Helps, 2010:473). The Android SDK includes a comprehensive set of development tools such as a debugger, libraries, a handset emulator, documentation, sample code and tutorials (Android Studio, 2016:a). Until around the end of 2014, the officially supported integrated development environment (IDE) was Eclipse, using the Android Development Tools Plugin, through IntelliJ (IntelliJ, 2016). As of 2015, Android Studio made by Google is the official IDE; however, alternatives are available.

Apple is restricting access as much as possible by using a closed platform and restricting developers from accessing the internal workings of their platform. All applications have to be approved by them before they are released to the market. This yields an error free and more clinical development environment, but can be somewhat restrictive to advanced programmers. Their development platform, Xcode, makes use of Cocoa Touch, and the primary development language is Objective C (Teng & Helps, 2010:473).

2.2.1. How mobile development is different from conventional software development

The development of mobile applications has some differences from and some similarities to computer software development. Development of mobile applications is still done using computers and computer programming languages, but testing and debugging is significantly different, and device limitations and new capabilities also need to be considered (Holzer & Ondrus, 2009:57).

Each development framework, for instance Android Studio (2016:c), contains an SDK that enables mobile developers to design software for their chosen mobile platform. These development kits consist of libraries with specialised functions for mobile devices and debuggers, along with virtual devices that allow the user to test software without having to use a physical mobile device. This allows the developer to test software for devices to which he/she does not always have access to ensure that the software performs universally across a different range of mobile devices. However, virtual testers cannot deliver an exact replication of mobile device capabilities, and sometimes real devices have to be used (Holzer & Ondrus, 2009:57).

Good mobile applications still have the same basic requirements as conventional computer software, such as a simple and user-friendly interface, minimal load on the device's memory, consistency in functions and appearance, and being easy to use for everyone. However, with mobile development there are some additional usability guidelines that contribute to the success of mobile applications (Ickin *et al.,* 2012:52).

According to Teng and Helps (2010:472), mobile development is different from conventional software development in the following ways:

- Remote development platform
- Debugging a remote target
- Pre-programmed libraries
- Limited hardware capabilities
- User interface

Remote development platform: While development is done on a desktop, the final product will run on a range of different hand-held devices using different hardware and a different operating system. Developers will have to anticipate and prepare for changes that might occur when running these applications in real-world conditions.

Debugging a remote target: This poses additional new challenges. Having to transfer the application to another device every time a new feature needs to be tested is very time consuming (Joorabchi *et al.,* 2013:21). Detecting errors is also significantly more difficult when debugging on external devices. This issue was addressed by creating clever debuggers such as Android's LogCat, which can direct you to the problem in the development environment (Android Studio, 2016:d). Emulator software has also improved greatly, for example Android developers can make use of an Android Virtual Device, which lets them define the characteristics of an Android phone or tablet, enabling them to create virtual devices to run and debug software on the computer without needing the physical device (Android Studio, 2016:b).

Pre-programmed libraries - The software development kits for mobile development contains libraries rich in functions and objects tailor-made for mobile devices, which saves a lot of development time when used appropriately. This includes special form elements adapted to function with touch input and limited screen space (Teng & Helps, 2010:472).

Limited hardware capabilities - Some hardware limitations of mobile devices that need to be considered when developing mobile applications are

- Storage space: When compared to computers, mobile devices have limited permanent storage because they do not have a hard drive. These devices make use of flash storage, which is faster than conventional hard drives, but also more expensive. Because of this, mobile phones have limited permanent storage space, and developers need to keep this in mind when creating mobile applications (Teng & Helps, 2010:472).

- Limited memory: This is a problem especially when the application will be running along with other active applications. Mobile devices have built-in systems, which close applications automatically when the memory occupied is required by another operation. To prevent being forced to close, mobile applications need to be very memory efficient (Teng & Helps, 2010:472).

- Battery life: At this time, battery life is still related to the physical battery size, and is thus an issue on small hand-held mobile devices. Understanding the energy consumption of

processes or hardware components should be an area of interest for mobile application developers (Yoon *et al.*, 2012:387; Wasserman, 2010:398).

User interface: The key differences in a mobile user interface include:

- Additional Sensors: Modern mobile devices have a range of additional sensors that can be exploited to add very exciting features to an application being developed. The sensors, which can be accessed, include: GPS, accelerometers, magnetic field sensors and sometimes fingerprint readers, heartbeat sensors and barometers (Wasserman, 2010:2; Teng & Helps, 2010:472).

- Screen size: Mobile devices have significantly less screen size than computers, which makes choosing what to display a complicated task. Some applications have a collection of information and tools that need to be distributed across the screen effectively and grouped in such a way that functionality will not be affected in a negative way. Requesting inputs from the user is also a challenging task since an on-screen keyboard will most likely be used, which uses a huge quantity of screen space on its own (Wasserman, 2010:398).

- Dynamic layouts: Instead of designing static forms, mobile development requires dynamic screen layouts that are able to adapt to the different screen sizes of the different devices that will be running the software. These layouts work in a different way than simply 'drag and drop', and developers will need to adapt to use it effectively (Joorabchi *et al.,* 2013:17).

Another big difference not mentioned in the list above is usage context. Unlike traditional software, which is used on a computer at home or the office, mobile applications are used almost anywhere, which generally also means on the move, or in random places, such as a bus stop or waiting for takeaways, or while being driven somewhere, etc. These places usually make for a noisy and distracting environment. The use of these applications is mostly task-orientated, and should thus be easy and straightforward (Unhelkar & Murugesan, 2010:35).

In conclusion, some of the general differences between conventional software and mobile development are: developing and debugging on a remote device, little room for multitasking on mobile screens, a variety of pre-programmed libraries and new sensory features to make use of, limited hardware capabilities on mobile devices, such as less available memory and processing power along with battery life that needs to be considered, new usage contexts in which devices

will operate and, lastly, a whole different user interface with touch screens as the main method of input, and much less screen space available than on computers.

In the next section, some of the current issues in the mobile application development field will be discussed.

2.3. Current issues in the mobile application development field

Since mobile application development is a relatively new field in the IT industry, there is still some room for improvement, with issues that still need to be ironed out. After a comprehensive search, it was found that some common problems with mobile application development include:

- Fragmented market, and different operating systems and devices to consider (Hammershøj *et al.*, 2010:2; Wasserman, 2010:400; Joorabchi *et al.,* 2013:17): The two leading operating systems, Google's Android and Apple's iOS, both earn an equal amount of revenue from their app stores. The choice regarding which one to develop for is up to the developer since either should be a good option. However, the actual problem lies in the number of devices all running these two operating systems. The two main categories are tablets and smartphones. Within these categories there is a variety of devices and manufacturers, each with different screen sizes, processing capabilities and varying hardware specifications. This clearly poses a challenge for developers who have to create apps that have the same look and functionality across the board.

- Discovery of an app in a pool of thousands (Cuadrado & Dueñas, 2012:162; Scharl *et al*. 2005:169; Hermansson, 2013:10): With the number of apps available since 2016 and both the leading stores reaching about two million as shown in Fig. 2.3, the chance for a new app to be discovered at random by a sufficient number of users is quite slim. App developers are facing a big challenge in reaching their target audience with new products when publishing them along with thousands of similar apps.

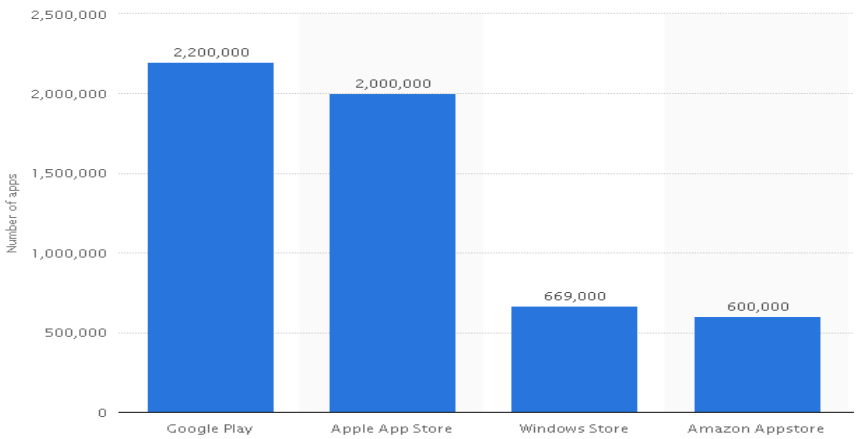


Figure 2.3: Number of apps in leading stores (Statista, 2016)

- Communication between development and design teams (Spataru, 2010:2; Joorabchi *et al.,* 2013:19): The age-old problem of good communication between different teams involved with the development process is still a problem with app development as well. This is especially true for larger projects with a large number of people having to cooperate in pursuit of a bigger end result.

- User acceptance (Mei *et al*., 2013:1; Hermansson, 2013:10**;** Kajanan *et al*., 2012:1857**;** Davis*,* 1993:475; Kaasinen, 2008:102): "Lack of user acceptance has long been an impediment to the success of new information systems" (Davis*,* 1993:475). Hermansson (2013:2) stated that learning to create mobile applications is easy, but developing an application that will be used extensively and continually is the actual challenge. Mobile apps are downloaded from the stores by the millions, but only a small percentage of those apps are ever opened more than once. This will be discussed in depth in the remainder of this chapter. With a very large number of options, users have become very picky as to what they accept as their apps to use on a regular basis.

- Proper usability testing (Betiol & Cybis, 2005:470; Joorabchi *et al.,* 2013:22): Usability testing of software applications developed for mobile devices is an emerging research area that faces a variety of challenges due to the unique features of mobile devices, for example limited bandwidth, unreliability of wireless networks, as well as the changing context (environmental factors). Traditional guidelines and methods used in the usability testing of desktop applications may not be directly applicable to a mobile environment.

- Dealing with restricted user-input options (Wasserman, 2010:398): With much smaller screen sizes than those of computers, and no mouse or keyboard present, developers face interesting challenges when creating software that was initially used on computers to function just as well on mobile devices.

- Security problems (Wasserman, 2010:398; Unhelkar & Murugesan, 2010:38): As with all software and operating systems, nothing is perfectly secure. The same applies to mobile applications. Mobile app developers face some new and interesting challenges on securing data that is available on these portable devices and transmitted wirelessly over all Wi-Fi and phone networks.

Of these problems, the user acceptance of mobile applications in an attempt to increase the user acceptance of future apps will be addressed in this study.

As is evident from the above discussion there are numerous problems in mobile development. These problems include, for example communication between the development teams, proper usability testing, a fragmented market, etc. Of special interest to this study will specifically be the problem of user acceptance. In order to understand the term ‘user acceptance’, it needs to be defined and what the literature says about it needs to be investigated. In the next section, the user acceptance of mobile applications will be discussed

2.4. User acceptance of mobile applications

The meaning of user acceptance, why it is important in regard to mobile applications, current research done on user acceptance, as well as the attributes that have a positive or negative influence on the user acceptance of mobile applications will be examined.

2.4.1. Definition

"User acceptance can be defined as the demonstrable willingness within a user group to employ information technology for the tasks it is designed to support" (Dillon & Morris, 1996:5). Thus, acceptance theorists are interested in understanding the factors influencing the adoption of technologies as decided by users who have a free choice in the matter. The idea is to develop models of the forces influencing user acceptance and to use them to influence the process of design and implementation to minimise the risk of resistance or rejection by users.

Kim *et al.* (2013:361) state that few studies have examined why and how mobile users are accepting mobile activities. The scientific concern with user acceptance is quite recent as developers can no longer rely on users having only one option or being forced to use a specific product. The current environment in which applications are used has enabled greater discretion among users, which has increased the need to determine the dynamics of acceptance.

2.4.2. Why is user acceptance important?

User acceptance is extremely important to the success of new technologies, but it is often very difficult to predict (Godoe & Johansen, 2012:39). This is especially difficult with emerging technologies, such as mobile devices, since the devices change at such a quick rate, that by the time their user acceptance has been thoroughly studied, there is already another model available. It seems that at the moment smartphones have reached a point where the new changes are mostly hardware-orientated, and the software parts are becoming constant in such a way that a user acceptance study is more feasible. In a study on user acceptance of mobile applications being created, the aim could be to determine the attributes that should have the biggest impact on user acceptance (Kaasinen, 2005:1).

Cyr *et al.* (2006:951) conclude that relatively little is known about the factors influencing mobile applications and their acceptance. In other words, the reason why people choose and keep using certain applications is still in some ways a mystery. Within the application markets, three categories can be found, namely: Top paid, Top free and Top grossing (Google Play, 2016). The question at hand is how those applications manage to reach those positions, and also manage to remain in them for quite some time. The exact science of the algorithms determining the positions of these applications is not disclosed, but it can be said with reasonable certainty that those applications are on those lists because they have a high user acceptance (Girardello & Michahelles, 2010:431).

When looking at downloads on Apple and Google's app stores, there are notable different levels of success achieved. Some of the most successful applications report downloads upwards of one million, while other applications are showing download numbers around 10 000 and even as low as just 100 downloads for some paid apps, which clearly illustrates the unstable nature of applications being found attractive by users (Hermansson 2013:2).

Louis (2013) indicated the average income for apps and their developers on different mobile platforms as shown in Table 2.1:

Table 2.1: Revenue for apps and app developers

	Google	**Apple**	**Microsoft**
Average revenue per App	$1125	$4000	$625
Average revenue per Developer	$6000	$21276	$2222

These seem to be very promising figures, however, in this case the word "average" makes a very big difference, since the highest and lowest incomes differ greatly. As noted earlier, not all applications are liked equally, and this contributes to not all apps being used equally, and thus not all developers being paid equally.

Currently there are many articles in technology news about the successes achieved by numerous mobile application companies or independent developers, for example the story of Supercell in Wired magazine by Cheshire (2015). In reality, it is only the winners that make the news, and for every one winner there are plenty of losers. App-Promo (2012:4) performed a survey on 102 app developers, and established the following statistics:

- 80% of them are not generating sufficient revenue with their app to support a stand-alone application development business.
- 59% are not even earning enough money to break even with development costs.

- 63% of the developers' apps were downloaded less than 50 000 times.
- 68% reported that their total revenue to date was $5 000 or less.

They identified 12% of the surveyed developers to be the most successful in terms of revenue earned. This group managed to

- make more than $50 000 in revenue with their most successful app;
- earn enough revenue to break even with development costs; and
- confirm that their app makes enough to be a stand-alone business.

The primary focus of this survey by App-Promo (2012:4) was on independent developers and start-ups, and did not include the major names earning the biggest part of app revenues. However, it still shows that far more developers are struggling than those prospering. The mentioned study claimed that marketing would be a solution to these problems. This, however, is not always that simple, as seen with the Wechat versus WhatsApp case (Mei *et al.* 2013). Wechat used major marketing outlets, such as television and on-line advertising campaigns, yet WhatsApp still remains the clear market leader without implementing these tactics. We can also assume that not every developer has access to a massive marketing budget.

In the statistics from the "current issues" section above, it can be seen that much of development resources are currently being wasted on designing and developing products that are neither wanted, nor accepted by the users. There should be a solution to minimise some of the work being done in vain. The ideal would be if we could assess the acceptance of new solutions beforehand, without actually implementing the products. The human-centred design approach to software development (Maguire, 2001:587) is already a commonly used solution to try and integrate user feedback into the design process of some popular mobile development methodologies. However, this process is not always sufficient, in the sense that user feedback often arrives when the product is in its final stages of development or completed, and it is no longer possible to change key design decisions. If the initial application design decisions do not factor in user acceptance, it could be costly when this does become a problem later on. Simply relying on acceptance tests to indicate user acceptance after the application has been created will only yield results at a late stage of development. At this stage, it may not be easy to change it even if the user feedback is mostly negative.

An illustration of system acceptability in Fig. 2.4 indicates acceptance as a result of certain factors, which already need to be addressed during early development stages. Since an

application can also be classified as a kind of 'small system', most of this should also be viable on the acceptance of mobile applications.

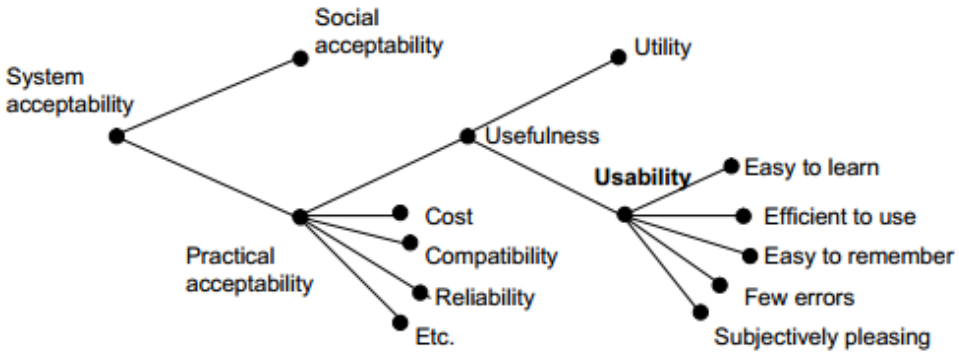


Figure 2.4: A model of the attributes of system acceptability (Nielsen, 1994)

In the next section, some research on user acceptance of mobile applications is provided, but little is said on how to improve it.

2.4.3. Previous studies related to user acceptance

Arhippainen and Tähti (2003:27) performed research on how to evaluate the user experience in adaptive mobile applications. They performed this research by holding interviews and observing users while they were using mobile devices with adaptive applications installed. They established that these methods were suitable for capturing the user experience, but said that more methods are needed to do this accurately. User experience is a very difficult aspect to measure because of the great number of variables at play.

Cyr *et al.* (2006:950) carried out a study on design aesthetics leading to m-loyalty in mobile commerce. They mentioned that the effect, which enjoyment had on the usage and commerce of mobile applications has not been researched sufficiently. In this study, the focus was primarily on design aesthetics within the mobile domain. Their research found that visual aesthetics of mobile applications had significant impact on the user's perception of the usefulness and ease of use of the app. This in turn had an influence on the user's enjoyment, and thus his/her loyalty towards a specific service.

Isomursu *et al.* (2007:404) did an experimental evaluation of five methods for collecting emotions in field settings with mobile applications. The study was aimed at identifying methods for collecting emotional responses of users to mobile applications. Their findings were that the methods were successful, but that several challenges, such as the dynamic nature of mobile interaction, usage situations and contexts, made it very difficult to obtain accurate results.

Park and Kim (2013:1353) proposed a Bayesian network approach to examining the key success factors of mobile games. They said that examining the key success factors in the mobile gaming industry should be of great interest, since it has become a very lucrative field. A Bayesian network research method was applied, and they found that there were three primary factors, which determined the success of a mobile game. These factors are targeting, awareness and the user's willingness to pay for the game or elements inside it. They concluded that if game makers knew what the drivers behind these features were, they could focus corporate resources more efficiently.

Fu *et al.* (2013:1276) performed a study on "why people hate your app", which revolved around making sense of user feedback in a mobile app store. They proposed a system that would be able to automatically summarise massive numbers of user interviews, and then be able to interpret them and sort them into categories of what users complained about or deemed important. The system was able to detect inconsistencies, and identify why given apps were liked or disliked by their users. The study proposed that such a system would provide valuable insights for app developers by pointing out important concerns or preferences by users.

From these studies it can be concluded that user acceptance towards apps is being investigated, and becoming more important by the day. Although each of these studies had clear goals set, there are still some gaps in this field of research. Many of them are quick to point out methods for determining user acceptance (Park & Kim, 2013:1353; Arhippainen & Tähti, 2003:27) or emotions (Isomursu *et al.,* 2007:404) towards apps; others have many suggestions regarding which factors contribute towards creating applications that are easy to use or useful (Hermansson *et al.,* 2014:128). However, studies have rarely offered practical solutions or methods for creating applications that will be accepted by their users. Of those that do point out some good or bad design principles (Ickin *et al.,* 2012:52), many are focussed on specific areas of improving some aspects of mobile applications, but do not cover a broad spectrum.

In this study, an attempt will be made to fill some of these gaps by gathering attributes influencing the user acceptance of mobile applications that can be found by examining different literary articles. Along with these attributes, some extra information from users will be gathered and a substantial list of influences on user acceptance of mobile applications will be created. Users will also be asked to rate these attributes in terms of importance to them, and in order to determine different preferences across different user demographics, such as gender, occupation, age, smartphone type and purchase history.

2.4.4. Previous studies on the user acceptance of mobile applications

Chou *et. al* (2013:2) performed a study on what causes users to continue using certain apps by proposing a theoretical model to investigate the users of smartphones. They wanted to know what influenced continued usage on some applications and mobile services, while other applications were abandoned shortly after installation. They identified that continued usage was as a result of user satisfaction experienced when using certain applications, and also because the use of some applications became a habit. The drivers of this were hypothesised as perceived usefulness, perceived enjoyment, and the confirmation of initial expectations of the product. They tested the proposed model by conducting a survey and collecting data from a group of smartphone users. The study was intended to identify the factors influencing people to become regular users of certain mobile applications and services. Chou *et. al* (2013:8) concluded that the following attributes can be viewed as determinants of user acceptance of mobile applications:

- Perceived usefulness: How good will the application perform, and will it serve the users' needs?
- Perceived enjoyment: Will the application fulfil the users' intrinsic motives? Do they like the application and enjoy using it?
- Confirmation on users' expectations: Does the application do what it promised?
- Satisfaction: Is the application as good as they thought when downloading it?
- Habit: Users starting to use mobile applications automatically when needing a specific task performed.

Park *et* al. (2014:3) presented a study on the player acceptance of social network games to investigate the psychological elements contributing to users' acceptance towards some of these games. The study introduced a model, which can be used to examine possible influences of users' acceptance attitudes toward mobile social network games. They proved the validity of the model with statistical results from an on-line survey completed by players of these games. This model effectively illustrates the following attributes as having an influence on the players' acceptance of mobile social networking games (Park *et* al. 2014:5):

- Attitude: The extent of positive feelings the user shows about playing the game
- Perceived ease of use: The degree of mental and physical effort a user feels comfortable giving to achieve a determined task

- Perceived control and skill: How challenging is a given activity, and how much skill is required from the user to complete it?
- Perceived enjoyment: How enjoyable a given activity is perceived to be
- Perceived mobility: The mobility value of the provided mobile services and systems to the user
- Perceived connectedness:- Users want to feel cognitively and emotionally connected with the world, its resources, and other people.

- Perceived usefulness: If the user thinks that using the application or service improves his/her performance at a given task
- Satisfaction: If a user is satisfied with an application initially, it should positively affect the continued intention of the user to keep using the application and its services.

The study contributed a theoretical framework explaining a decision-making process followed by the users, and then examined the proposed model by employing a structural equation modelling method to analyse user behaviour (Park *et* al. 2014:3). The findings of the study were consistent with previous studies on internet games in its findings mentioned above. These findings can also be valid for the mobile applications, which fall under the category of social network games and other social apps with similar content.

Mei *et al.* (2013:1) carried out a study on factors affecting a mobile application's acceptance; more specifically, the user acceptance of Wechat, a competitor from China who tried to take on the instant messaging giant WhatsApp. They focused on the questions: What are the factors that affect the user's acceptance of Wechat? and How could other instant messaging applications created in the future improve their user acceptance? The study indicated that the following features acted as primary drivers for user acceptance of the instant messaging app:

- Effort expectancy: How much effort will it take from users to accomplish a given task?
- Social influence: Do many people known to the user also use the specific app?
- Facilitating conditions: Conditions making the application ideal in a given context or circumstances
- Cost: The overall cost of using the application to the user
- Privacy: Respecting users' privacy and sensitive information

Verkasalo *et* al. (2010:242) performed an analysis of users and non-users of smartphone applications. The study was carried out on users and non-users of three different mobile

applications to determine the drivers behind the users' intentions to use or not to use some mobile applications. The actual usage of 579 smartphone users was measured using in-device measurements to determine users and non-users. An extended technology acceptance model was used to explain intention to use, and a web survey was performed to test the validity of the model. The findings of the study were that the following attributes can affect the acceptance of mobile applications negatively or positively (Verkasalo *et* al. 2010:253):

Negative attributes

- difficulties in finding and installing the application;
- difficult configuration; and
- poor performance.

Positive attributes

- Behavioural control: Easy to use or to learn, no help needed
- Perceived enjoyment: Fun to use, brings enjoyment or relaxation
- Perceived usefulness: The service is useful, improves efficiency and saves time.
- Social norms: Used by friends and recommended by them.

Xu *et* al. (2015:171) examined mobile application recommendations from a customer value, satisfaction, and loyalty perspective. They found that little research has been performed on interpersonal recommendation of mobile applications, and that it is a very important driver for promoting mobile applications and their acceptance. A research model was proposed, based on customer value satisfaction and loyalty, to fill this gap. It is suggested that while previous research usually treated customer value as a concept on its own, this study would try to identify the separate drivers behind it. In the study, the data of 347 mobile application users was collected, and it was found that the main influences on users' intention to recommend applications are: satisfaction, users' continuance to use, and hedonic benefits. The drivers and barriers behind these attributes were

Positive attributes

- Application's utility: The variety of tasks for which the application could be used
- Application's quality: A high quality application with high functionality and low error rates
- Enjoyment: How much the users enjoyed the experience of interacting with the application
- Applications aesthetics: Professional and good-looking applications

Negative attributes

- Perceived price: The point at which users think they are paying too much
- Knowledge of alternative quality: Better alternatives already available
- Technicality: How difficult users find it to operate the application and perform desired tasks

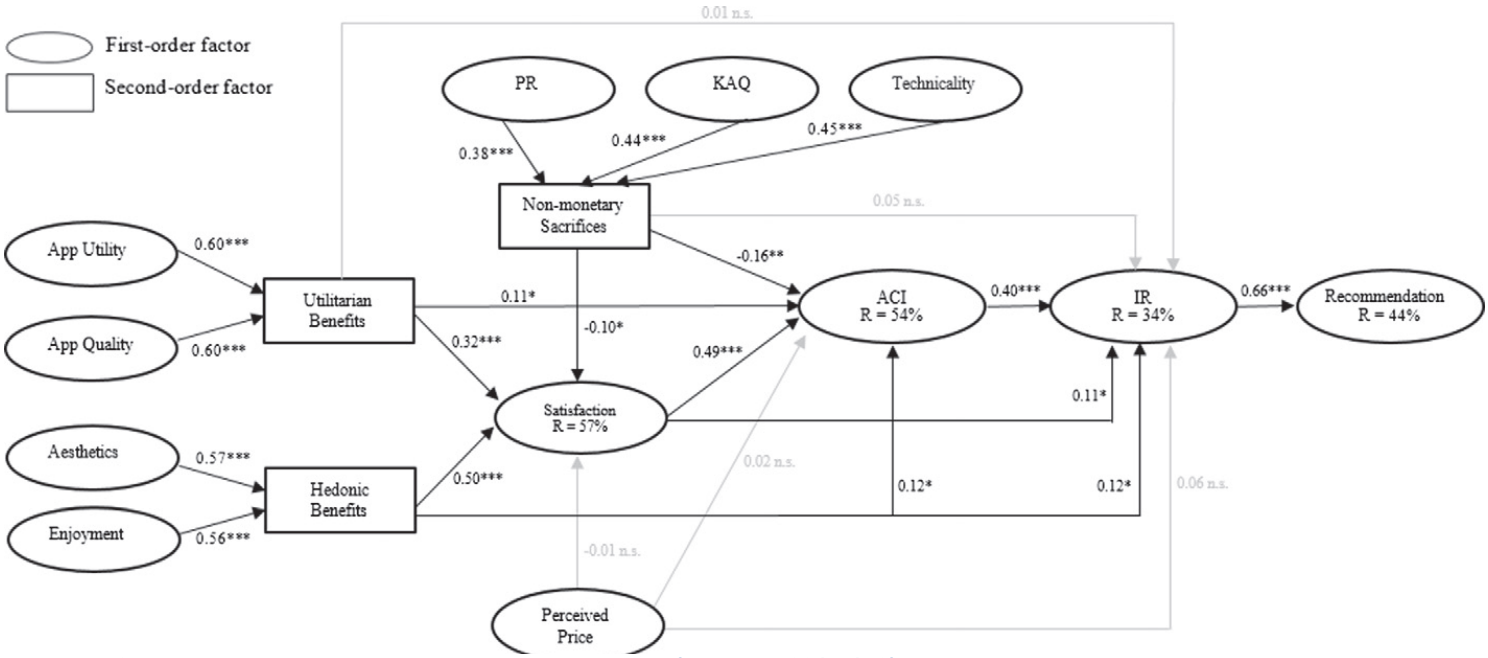


Figure 2.5: What motivates users to recommend an app (Xu *et al.*, 2015:178)

Fig. 2.5 presents an illustration of the test results by Xu *et al.* (2015:178) as to what motivates users to recommend an application to their peers. The abbreviations were indicated as: "AU (App Utility), AE (App Aesthetics), PE (Perceived Enjoyment), KAQ (Knowledge of Alternative Quality), PP (Perceived Price), T (Technicality), PR (Privacy Risk), S (Satisfaction), R (Recommendation), IR (Intention to Recommend), ACI (App Continuance Intention)".

Xu *et* al. (2015:181) identified two utilitarian and two hedonic benefits. Developers should stress the benefits of utility, quality, aesthetics and enjoyment. Also given the big influence of aesthetics on perceived value, developers should focus on interface design to ensure applications are visually pleasing by making use of appropriate colour schemes and background choices and using appealing images. Lastly, there are some factors, which can damage an application's tendency to be recommended, and should be minimised as far as possible. Some of the standout detracting aspects are technicality, privacy risk and knowledge of alternative quality.

Kim *et al*. (2013:361) performed a study on engagement motivations, perceived value, satisfaction, and continued engagement intention regarding mobile users. It was found that user-friendly and intuitive features are drivers of user value and satisfaction. These features then further motivate and drive mobile user engagement. For the purpose of their study, they wanted to focus specifically on mobile user engagement. In their study, a model for mobile user engagement was created in an attempt to explain user engagement intentions by looking at user motivations, perceived value and satisfaction. In their findings, the following were found to be influences on the users' intentions to engage in mobile applications (Kim *et al*. 2013:363-366):

- Utilitarian motivation: What the user needs to accomplish by using the mobile application
- Hedonic motivation: Does the user have a pleasant experience when using the application?
- Social motivation: The application provides some kind of social benefit.
- Perceived value: The value that is provided to the user by using the application
- Satisfaction: The user feels he/she has received what he/she initially expected.
- Mobile engagement intention: The intention behind the use of the application, namely to accomplish something, completing a task, or simply killing some time.

Lee *et al*. (2012:1590) studied the factors influencing usage intention toward mobile financial services. The study suggested some factors that could have an influence on users' intention to use mobile financial services. Usage intention can be viewed as a precursor to the actual decision of user acceptance (Rogers, 1995), which provides a valid reason to examine this study. In the study they tested the validity of each attribute in order to determine the key drivers for the usage intentions of mobile financial services. These key drivers were found to be

- Task-fit: If the service was deemed fit to support the task at hand
- Monetary value: If the service was perceived as a valuable asset
- Connectivity: The ability of the service to connect seamlessly with accounts and other services
- Personal innovativeness: If the user is in favour of new and revolutionary services
- Absorptive capacity: If the user is able to quickly adapt to new ways of doing things
- Perceived usefulness: How useful the user perceives the service to be
- Perceived ease of use: If the user thinks that the service will be easy to make use of

As also mentioned in the study, these attributes usually have a positive impact on one another; if one of them might increase, so might the other. For example, perceived ease-of-use can be

positively influenced by connectivity. A perceived high monetary value could have a significant effect on perceived usefulness. If done correctly, personal innovativeness could influence perceived ease-of-use. The examples continue. This should mean, in theory, that simply addressing one or more of these positive drivers behind user acceptance could have a domino effect and improve applications' acceptance overall.

2.4.5. Studies examining specific attributes that may influence user acceptance of mobile applications

The following is material gathered from articles investigating factors that may affect the user acceptance of mobile applications. Oinas-Kukkonen and Kurkela (2003:5) said that "The development of mobile applications should not be about reducing content and functionality but about creating new, innovative ways of using information technology in place". The user acceptance of a mobile application depends on at least two conditions: the application's perceived experience, and the appropriateness of the application to the user's context and needs (Ickin *et al.* 2013:48). However, these are not the only conditions, and in this section other studies on specific influences of user acceptance are investigated.

User value

Park and Han (2013:274) identified that value has become a very important component of user experience of mobile devices. According to the study, user value can be regarded as a subsection of life value, and an association with a certain product or service. This led to different factors contributing to value association with a product being studied. User value elements of a smartphone were extracted from the list of life-value elements through a case study using an observational approach. The results could be used to provide insights into research in users' value.

Park and Han (2013:278) also explained user value as the value that is satisfied when a user interacts with a product or service. User-value elements are a subset of life-value elements, depending on the type of product or service.

This study specifically investigated user value when the product in discussion is a smartphone, and found the following influences on value, in the most relevant order:

- Convenience

- Pleasure
- Money (Cost)
- Friendship (Social)
- Beauty (Aesthetics)
- Curiosity
- Relaxation
- Comfort
- Privacy
- Happiness
- Excitement

The proposed value elements can be used when designing a new smartphone or applications to investigate how new alternatives may satisfy user value.

Quality of experience

Ickin *et al.* (2013:52) stated that quality of experience is very important for mobile applications. They identified the following attributes that could improve the user acceptance of a mobile application:

- Application interface design: Some or other form of this problem is usually mentioned in articles about mobile development as this is the biggest change when developing software for mobile devices. Users have significant issues with mobile applications having too little room for input, or they do not like the small-sized elements, which they have to interact with. Another complaint from users is that pages are squeezed too much when fitted inside the screen. The challenge for developers is thus to create application pages that will contain sufficient elements to be useful, but also give enough space for it to be usable.

- Application performance: Users are used to PC software, which at this stage has very few issues processing large volumes of data. This is not the case with mobile applications, a system that necessitates unrefined software running on devices with limited processing power compared to computers. Developers must pay special attention to creating mobile applications that take limited processing power into account, yet still run smoothly and effortlessly.

- Battery efficiency: Applications that are not very resource intensive concerning battery power are preferred to power-hungry software that drains the battery and runs the mobile device hot. Users are always trying to save the battery power on their devices to be able to use them for important tasks until they can be charged again. Applications that are not power efficient will be avoided by users as far as possible.

- Phone features: There are many features and settings on phones and in applications that are taken for granted by users. If an application lacks certain basic features, for instance volume adjustments, it will cause users to dislike it. Developers must understand what basic requirements users will expect from certain application types.

- Data costs: This is a very big problem for users with little access to Wi-Fi hotspots and people in countries with expensive data rates. An application that causes excessive data traffic on mobile devices is disliked, and users tend to disable their network access or uninstall it. Mobile applications should minimise the use of data as far as possible.

- User lifestyle: Applications should be able to fit in with a user's lifestyle choices. Applications that help the users perform their everyday tasks more easily are achieving huge success. Smartphones are highly portable, and are with their owners almost all of the time. This creates the perfect opportunity for developers to create useful tools to support the user with activities, such as sports, exercise, shopping, or just entertainment.

Goal-driven

Kangas and Kinnunen (2005:59) said that no features should be added to mobile applications just because they are easy to implement and might be nice to have.

A very important aspect of applications' value is to provide the user with actual valuable and directed context. An application should focus very strongly on what it promised to deliver, and be able to accomplish those tasks with ease. Goal-driven applications excel at the following:

- Mobility: Services should be able to provide information to users who are on the move and require quick access.
- Usefulness: Applications should help users with performing a task or achieving a goal.
- Relevance: Application functionality should be reserved for only relevant information and features.
- Ease of use: Easy to figure out and accomplish the desired tasks

- Fluency of navigation: The most important features should stand out and be the easiest to reach.
- User-centred: Applications should use terminology known to users and be organised relevant to their users' thoughts.
- Personalisation: Applications must be customisable to their different users' individual needs.

Useful

Hermansson (2013:11) says that useful applications should adhere to the following specifications:

- Low error rates: Constant errors ruin the experience and frustrate users, which causes them to stop using the application.
- Size matters: Consider the different devices available and their different screen sizes. Applications, which look good on one screen size might not even fit on another screen. Keep this in mind when placing screen components.
- Clean and informative design: Focus on what needs to be present in the application and exclude irrelevant information.
- Know your user: What are the age, gender, culture and country of the majority of your users? Adapt the application to suit their unique needs.
- Different contexts: Will your application be used for entertainment in a relaxing environment, or as a business tool in a productive environment, or simply as a time killer?

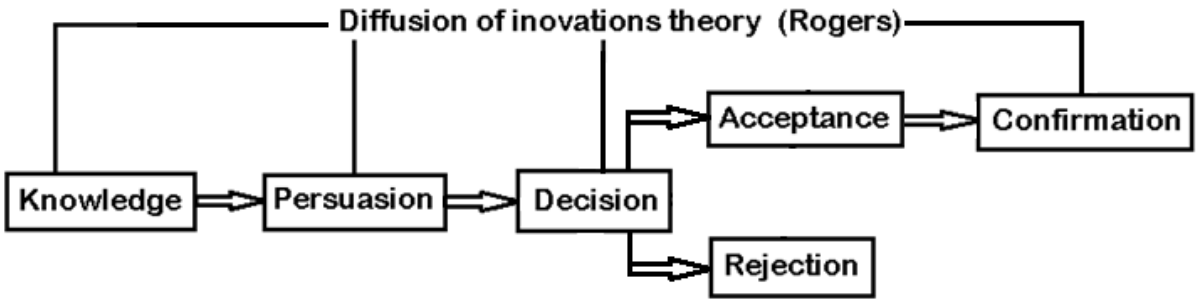
The challenges for user acceptance of mobile services arose because of the increasingly complex technical and business environments in which they have to function today. Mobile applications have changed from simple utilities to complex software applications that are not as easy and user-friendly as their predecessors. Since these applications have evolved to such an extent, users have also come to expect much more from them. At the same time, the pressure for faster development cycles does not allow extensive usability studies, and the services may end up on the market with severe usability and technical problems, as well as inadequate content. Kaasinen (2005:44) stated that in this challenging design environment, there is a need to extend the focus of current usability-oriented design guidelines to better cover the design decisions that affect user acceptance.

2.5. Conceptual Model

The conceptual model was built on the diffusion of innovations theory by Rogers (1995), which is a very popular theory being used in research regarding computer science.

Diffusion is the process of communicating an innovation through specified channels over a certain period of time among the members of a social system. An innovation can be seen as an idea, service or object that is perceived to be something new and unique by an individual or group of adopters. Fig. 2.6 below demonstrates the process through which users become aware of a new service or product (innovation), try it, and then decide on whether to accept or reject the product for continued usage.

Figure 2.6: Diffusion of innovations theory (Rogers, 1995)



Looking at the four primary blocks around which the process occurs, we can see four important stages:

- **Knowledge:** The user becomes aware of some new product or service or innovation and gets a general idea of what it is about and how it functions.
- **Persuasion:** The user begins to form a good or bad opinion about the innovation.
- **Decision:** While engaging the innovation, the user is eventually led to a choice to either accept or reject it.
- **Confirmation:** The user evaluates his/her choice to accept or reject the innovation and comes to a permanent decision regarding his/her usage of the innovation.

In this study, the main focus will be on the third block, namely what influences the decision process to move towards acceptance or rejection of the innovation; the innovation in this case being new mobile apps developed.

When looking at Fig. 2.7, it is suggested that the current mobile applications can be improved when it comes to the aspect of user acceptance. User acceptance has been slightly overlooked and was mostly addressed as an afterthought when applications were already completed. This study proposes creating a priority list consisting of attributes that are most important to the

people who will be using the applications created. This list can be implemented to provide a jumpstart for the user acceptance that the application requires just after launching.

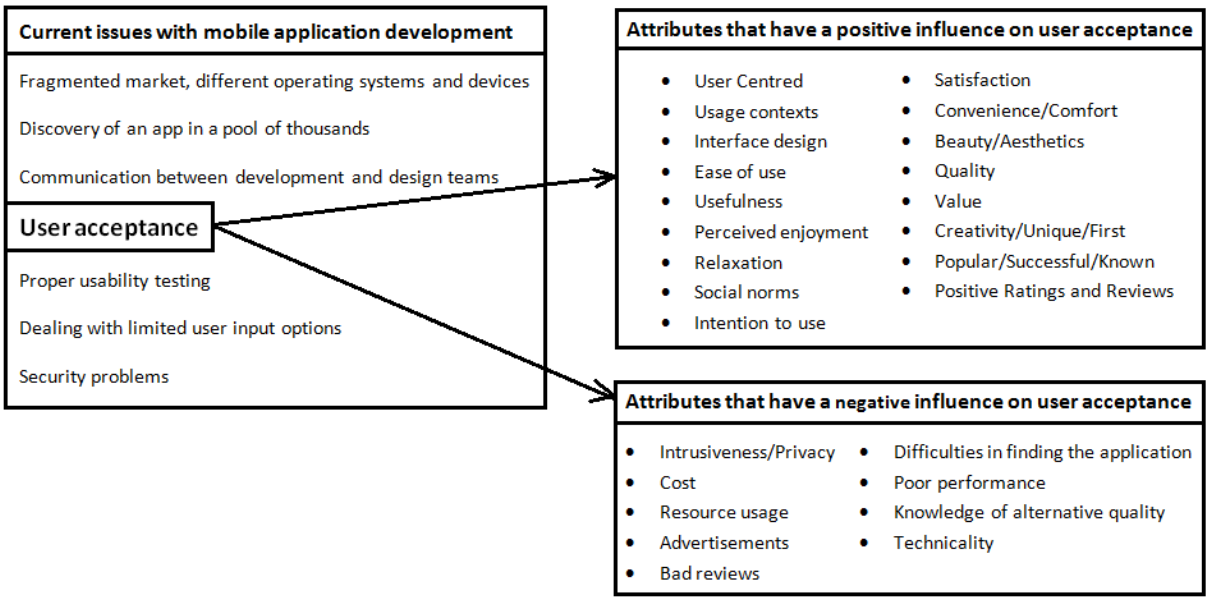


Figure 2.7: Conceptual model

By identifying and prioritising the attributes that have a positive and negative effect on the acceptance of mobile apps, future developers could be more efficient by creating apps that are not simply deleted after only being opened once. This should significantly increase the success rate of newly created applications when considering research being done on current problems in the mobile application development field.

What follows is a detailed composition and discussion of positive and negative influencing attributes found in the literature.

2.5.1. Attributes that have a positive influence on user acceptance

According to these studies, it can be concluded that user acceptance of apps is being investigated and becoming more important by the day. Some attributes influencing user acceptance of mobile applications were found in the studies reviewed. These attributes were taken and categorised in groups for use later on in this study. A presentation showing a general overview of aspects that could have an influence on the user acceptance of mobile applications is as follows:

User centred: Mobile applications should ideally be designed with their users in mind if the developers wish to satisfy the users' needs and achieve a high degree of acceptance (Kangas & Kinnunen, 2005:59). Hermansson (2013:11) also stressed the importance of knowing the user

in the article discussed earlier. Attributes that can be seen as user-centred according to Kangas and Kinnunen (2005:59), include the extent of personalisation allowed by the mobile app, as well as its relevance to the user. Apps that fit in with the users' lifestyles and help out with everyday tasks (Ickin *et al.,* 2013:53) will also be classified under user-centred.

Usage contexts: Mobile applications should be able to serve their users in all the different usage contexts (Hermansson, 2013:11), for instance when looking at perceived mobility mentioned by Park *et al.* (2014:3) and Kangas and Kinnunen (2005:59), mobile application developers need to pay special attention to the fact that these apps will sometimes be used on the go, or in other different contexts than simply the comfort of the users' homes. One of the key advantages of mobile devices and applications is the fact that they offer connectivity to various services and multiple people to the user, which should also be considered when looking at the contexts in which the applications will be used (Lee *et al.,* 2012:1590; Park *et al.,* 2014:3).

Interface design: Application interface design is extremely important to add to the perceived quality, according to Ickin *et al.* (2013:52). Professional-looking applications tend to have a higher acceptance percentage than half-made, cheap-looking apps. Hermansson (2013:11) mentioned that a clean and informative design is important when creating goal-driven apps. He also said that size matters, and developers have to keep in mind that they need to make efficient use of the limited screen space available on mobile devices. Another attribute that can be included under design is fluency of navigation when using apps, as mentioned by Kangas and Kinnunen (2005:59).

Ease of use: Easy to use or to learn, no help needed; the user already has the skills and knowledge to operate such applications (Verkasalo *et al.,* 2010:242; Park *et al*., 2014:3). This seems to be a very important issue to mobile users, especially the older or less tech-savvy users. Applications that are easier to start using right away are simply more likely to be accepted by users as their application of choice. Similar attributes from other studies that fit this category include:

- Absorptive capacity (Lee *et al.,* 2012:1590)
- Perceived control and skill (Park *et al*., 2014:3; Lee *et al*., 2012:1590)
- Effort expectancy (Mei *et al*., 2013:17)
- Personal innovativeness (Lee *et al.,* 2012:1590)

Usefulness: How well will the application perform? Will it serve the users' needs or help them achieve something (Kangas & Kinnunen, 2005:59)? The service is useful for tasks that need to be completed, such as work or studies, or other everyday tasks. It improves efficiency and saves time. There are not many other applications that can do the same (Verkasalo *et al.*,

2010:242; Hung Chou *et al.*, 2013:8; Park *et al.,* 2014:3; Lee *et al*., 2012:1590). Certain subsections of perceived usefulness were also mentioned in these studies:

- Applications utility (Xu *et al*., 2015:171)
- Utilitarian motivation (Kim *et al*., 2013:361)
- Task-fit (Lee *et al.,* 2012:1590)
- Phone features (Ickin *et al.,* 2013:52)

Perceived enjoyment: Another contributor to user acceptance was how much fun was associated with the use of the device or application (Cyr *et al.,* 2006). Will the application fulfil the users' intrinsic motives? Do they like the application and enjoy using it (Chou *et al*., 2013:8)? Kim *et* al. (2013:361) also mentioned the importance of hedonic motivation, in other words, if the user has a pleasant experience when using the application. This attribute can still be viewed as "mysterious" or "elusive", as, unlike the other attributes, it is very difficult to predict what application users might enjoy. It is also not expressly known how developers can affect or improve the enjoyment of mobile applications. Few developers know beforehand if their games or apps will be liked by their users. The perceived enjoyment is extremely important, because its influence can expand and affect other aspects of user acceptance as well.

Relaxation: Sometimes apps are used purely for their entertainment value. Applications with some exciting features that are completely unnecessary, but fun nonetheless can receive much positive feedback for allowing enjoyment or relaxation. Park and Han (2013:278) mentioned attributes, such as pleasure, happiness, excitement and curiosity to be motivators for users to enjoy using some apps or games. Users like using certain applications or games simply as a time killer (Verkasalo *et* al. 2010:242; Park *et* al. 2014:3; Xu *et* al. 2015:171).

Social norms: People like using applications that are also used by their friends or people that are important to them (Park & Han 2013:278). If friends recommend an application, users are more likely to give it a try (Verkasalo *et* al. 2010:242). In the modern age of technology, most communication has shifted to mobile devices instead of being face to face. Applications that can use this to their advantage usually reap the benefits. Even if developers can only use the social aspect for promotion, it is still something to keep in mind. Other findings in studies encouraging the social aspects of apps include:

- Interpersonal recommendation (Xu *et al*., 2015:171)
- Social influence (Mei *et al.,* 2013:17)
- Social motivation (Kim *et al*., 2013:361)

Intention to use: How long does the user intend to use the service? Is it, for example for the next few months or the next year? How long will it be necessary to use the service or application (Verkasalo *et al*., 2010:242; Park *et al*., 2014:3)? Intention to use could also mean that users are starting to use mobile applications automatically when needing a specific task performed as they begin to associate the application with the task. Attributes that closely resemble usage intentions as shown in other studies include:

- Mobile engagement intention (Kim *et al*., 2013:361)
- Facilitating conditions (Mei *et al.,* 2013:17)
- Attitude (Park *et al*., 2014:3)
- Habit (Chou *et al*., 2013:8)

Satisfaction: Does the application do what it promised? Is the application as good as users thought it would be when downloading it (Chou *et al*., 2013:8; Park *et al*., 2014:3; Kim *et al*., 2013:361)? Confirmation of users' expectations will in most cases cause the application to be accepted because users are basically getting what they wanted (Chou *et al.,* 2013:8)

Convenience/Comfort: Users love mobile applications that help make their lives comfortable (Park & Han, 2013:278). Innovative apps that allow for on-line shopping or giving live weather updates or simply making everyday tasks easier by giving you access to services on your smartphone are in high demand.

Beauty/Aesthetics: One of the most common problems found by Ickin *et al.* (2012:52) was a lack of attractiveness. Xu *et al*. (2015:171) also mentioned the importance of an application's aesthetics. Good looking and neatly designed applications are generally favoured, as can be seen by Apple's very successful design approach. Mobile users are people and people tend to like pretty things. Developers should know this. Effort and detail can also play an important role in achieving this (Park & Han, 2013:278). The amount of effort poured into making an application special and detailed should capture the attention of users. When using some applications, a user can easily determine whether it was just developed to get it over and done with, or if the developers put their heart and soul into it.

Quality: Xu *et al.* (2015:171) implied that conforming to the guidelines provided in their study should have a good impact on the quality of the resulting product and thus the user acceptance by users. People tend to favour things of high quality in general and the same can be said for mobile applications.

Value: Lee *et al.* (2012:1590) said that users accepted an app that they thought was a valuable asset for them to have. Kim *et al.* (2013:361) stated that perceived value (value that is provided

to the user by using the application) can be a positive influence on the users' tendency to accept the app.

Creativity/Unique/First: When there are not many other applications that can fulfil the same function (Lee *et al*., 2012:1590). Hermansson (2013:1) concluded that in order to create a useful application, a good starting point would be to find a problem, which can be solved by creating a directed application. Secondly, the users need to be notified as to why the proposed solution to the problem should be of value to them. Being the first application directed at solving a specific problem or delivering a new and unique service gives a massive advantage because people tend to be loyal to the service they used from the beginning.

Popular/Successful/Known: Hermansson (2013:1) said that appreciated applications may create a domino effect, with users recommending the application to friends and on web sites. Once applications become popular and start growing rapidly, users tend to adopt it more easily. Some of the best marketing methods are word of mouth, and this causes substantial growth when the application reaches a certain level of success.

Positive Ratings and Reviews: Users tend to look at ratings and reviews when they are on the fence about trying out a new application. Good ratings can be an important decisive factor regarding whether some users would move from just considering an application to downloading it. Bergvall-Kåreborn and Howcroft (2013:11) mentioned that many developers are putting in increasing effort to gain loyalty from their users, and talked about a developer who maintained a contact list of regular clients and notified them when important updates or new features were released. Responding to user reviews and requests in a positive way is another good method for gaining loyalty amongst them.

As mentioned in this section, some of the mobile applications that achieve the best user acceptance are apps that are user-centred, easy to use, enjoyed, considered to be useful or valuable, etcetera.

Subsequently a review of attributes that have a negative influence on the user acceptance of mobile applications will be given.

2.5.2. Attributes that have a negative influence on user acceptance

It is very common in this era of free apps available for consumers to download a far larger number of applications than they actually use every day. Often users will download a number of the same types of application and then simply keep the one they like the most. It has also

become very easy for consumers to delete apps from their devices, which contributes to this behaviour (Kajanan *et al.,* 2012:1854). Looking at what upsets users is a good way for applications to avoid being deleted just minutes after installation. Some common aspects that are disliked by users are discussed below.

Intrusiveness/Privacy: Some articles on user engagement suggest that apps should send notifications to remind users about rewards, or to use them more frequently. This might sound like a good idea at first, but Lee *et al.* (2013:563) found that constant reminders or notifications irritate the user much more than causing any good. Mei *et al.* (2013:15) also stressed the importance of the users' perceived privacy. Intrusive apps are usually removed very quickly. If users feel that their information or files is/are at risk, they will most likely not accept an application for regular use (Park & Han, 2013:278).

Cost: Be careful when putting a download cost on an application; people will only pay upfront if they really feel they need the application. The price is not always the problem. For some new users it is just too much effort to get registered to make an on-line payment in the first place, and they might look for a free alternative. Fu *et al.* (2013:8) did a study on what bothers people about applications, and, amongst other problems mentioned previously, they pointed out that cost could be a problem if not managed correctly. If an application is not priced according to its value, it will cause user dissatisfaction. Users will also expect optimal performance and customer service from paid applications (Xu *et al*. 2015:171; Mei *et al.* 2013:11). With so many free apps available, premium apps can pay the price with too high a cost. Users are much more likely to download apps that are free, sometimes regardless of the cost, because making a payment is already seen as added effort. Park and Han (2013:278) also mentioned money or cost to be factors in how much value users found in apps.

Resource usage: Data costs are extremely important to users of smartphones, and applications should use as little data as possible to complete tasks or achieve their goals. Two types of important resource usage indicated by Ickin *et al.* (2012:52) are data costs and battery efficiency. The battery usage of mobile applications is another aspect for developers to consider, since mobile users are not likely to put up with apps that use too much of their available battery power.

Advertisements: The same study has also shown that too many advertisements can be a big irritation for users. Advertisements can be in the wrong places and cause users to open them when they did not intend to. They can sometimes be on top of something being displayed, or simply be in your face everywhere you go. Advertisements use mobile data to update, which is another problem for cost-sensitive users (Fu *et al.*, 2013:8).

Bad reviews: This is especially a problem for new applications entering the market, as a few very bad ratings can have a bad impact on the overall rating displayed. Posting ratings is very easy, and it only takes a few missteps for an application to upset some users. When entering the public domain, bad ratings can prevent some future users from ever getting to know the application (Bergvall-Kåreborn & Howcroft, 2013:11).

Difficulties in finding and installing the application: This is a very big problem in the world of app development, since there are already thousands of applications available in almost all categories. When an app is released in the market, it vanishes into a pool of thousands of alternatives (Verkasalo *et al*., 2010:242).

Poor performance: Glitches, errors and bugs tend to irritate users, usually to the extent where they feel that using an app is not worthwhile (Verkasalo *et al*., 2010:242), especially if alternatives are available. Ickin *et al.* (2012:52) also indicated the importance of ensuring that mobile applications perform properly and as expected when creating quality apps. Hermansson (2013:11) said that low error rates are a very important attribute when creating useful applications.

Knowledge of alternative quality: If users are informed regarding the different apps available to perform their tasks, they will be more difficult to impress (Xu *et al*., 2015:171). Developers should try to differentiate themselves from the competition to remain the application of choice, and, if possible, prevent users from feeling the need to search for alternatives.

Technicality: Technicality is somewhat of a contrast to easy to use, and is thus considered to be bad. Users want applications that they can install and jump in and use. Difficult configuration and complicated settings will be an instant turn off; however, it can be difficult to balance this with a wide variety of utility (Verkasalo *et al*., 2010:242; Xu *et al*., 2015:171).

These are only a few attributes that may cause people to dislike an application. Some of the attributes that can have a negative impact on user acceptance include technicality, poor performance, breach of privacy and a high resource usage. However, ignoring some of the previous recommendations in the section about making good mobile applications could have just as big a negative impact.

In this section, user acceptance of mobile applications was the primary focus. Useful information could be retrieved from the literature studied. User acceptance is definitely something to consider because of its influence on the success of mobile applications.

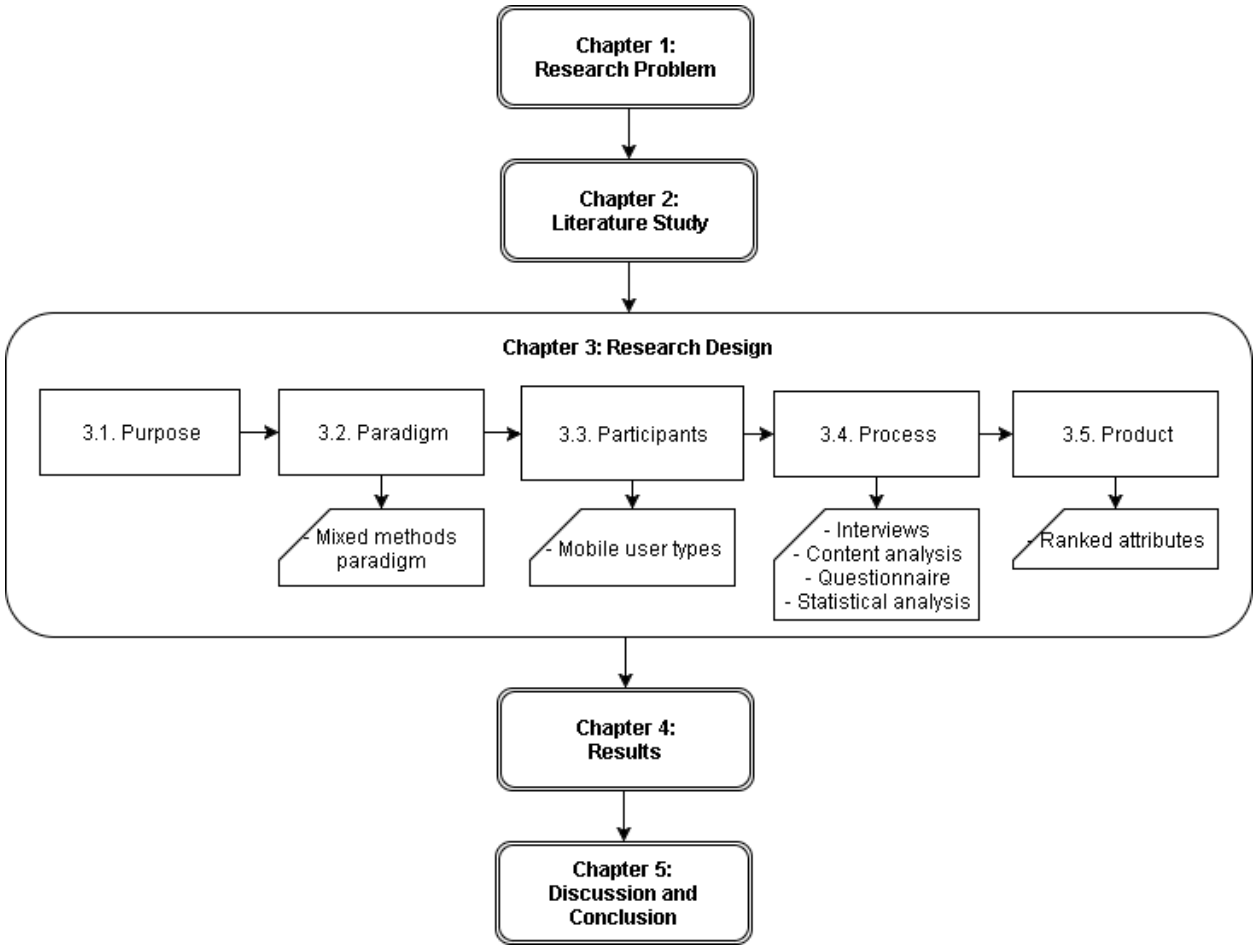
2.5.3. Conclusion

Until now, studies on "Developing Successful Mobile Applications" (Oinas-Kukkonen & Kurkela, 2003) meant conforming to guidelines, such as easy service, fast and comfortable usage, clear navigation structure, simple and easy to understand, requiring minimal input, and including only relevant features or information. Abandoning these design principles is not an option for any good developer. However, in the hypercompetitive environment of mobile applications, creating good quality apps is not enough to ensure success anymore.

For new mobile apps to be distinguished from the competition, we have to start looking at alternative sources of competitive advantage. As noted by Isomursu *et al.* (2007:417), emotion is a very powerful aspect of human computer interaction; it cannot be disregarded in a design process. We need to start improving our current understanding of developing methods, taking user emotions into account during the design process. Emotions are the core of user acceptance, and designing software with it in mind will become a necessity to succeed in the future.

In the next chapter the research design for this study will be discussed.

CHAPTER 3 RESEARCH DESIGN



In this chapter, the initial purpose of the study will be revisited. This will be followed by a brief overview on research paradigms, including mixed methods, which was used to complete this study. Thereafter a description of the participants of the study will be given. The (process) research method, data-collection techniques and data-analysis techniques will be explained in theory before detailing their application in this study.

3.1. Purpose

As stated in Chapter 1, the aim of this study is to determine what attributes influence the user acceptance of mobile applications and which of those attributes are the most important.

Attributes that have an influence on the user acceptance of mobile applications will be identified. The validity of these attributes will be investigated. These attributes will then be prioritised according to the ratings received from the participants in the study.

In order to reach the aims, the following objectives have to be met:

1. Examine the literature to find attributes that could contribute to the user acceptance of

mobile applications.

2. Determine attributes that would contribute to the user acceptance of mobile applications according to mobile users.
3. Perform a survey to investigate identified attributes in objectives 1 and 2.
4. Perform a statistical analysis to rank the determined attributes in terms of their importance to users of mobile applications.
5. Employ further statistical investigation to identify the difference between various user groups.

Various studies suggest improvements on mobile applications through some design model or process to be followed, but very few provide answers to what the users of these applications deem important. This study will attempt to fill that gap by providing a comprehensive list of attributes that app developers need to be aware of. After completion of the study, the findings could be used as a guide towards creating mobile applications with a higher user acceptance.

3.2. Paradigm

Research paradigms are concerned with guiding the researcher when carrying out research within a specified area in a particular manner. According to Oates (2006:282), a research paradigm can be defined as a "set of shared assumptions or ways of thinking about some aspect of the world", and is used to guide a researcher's perspective. There are three main research paradigms that researchers could choose to follow. They are referred to as positivism, interpretivism and critical social studies. A new development is the mixed-methods paradigm. Each paradigm has a different view of the nature of the world, which is referred to as its ontology, and also the ways in which the knowledge is acquired, referred to as epistemology.

A brief discussion on the different paradigms and their attributes is given next. This will be followed by a description of the research paradigm that will be used in this study.

3.2.1. Positivism

Positivism focuses only on knowledge obtained from facts, experiments and evidence. Positivists aim to generalise a whole population, based on the analytical findings of the sample under investigation. Positivism assumes that the research environment is studied objectively, and that the world or research setting is not random, but usual and ordered (Oates, 2006:283). This defines positivism as the position that holds that facts and values are distinctive, and scientific knowledge consists only of facts.

In order to classify studies as positivist research, Orlikowski and Baroudi (1991:5) identified criteria, such as formal propositions, quantifying and measuring of variables, testing of hypotheses, as well as drawing inferences from a population.

The positivism paradigm focuses on positive data or facts that should remain true and survive attempts at falsification (Tribe, 2001:443). In this type of study, the researcher has a theory or hypothesis that needs to be tested in order to understand more about a specific phenomenon.

Positivism is the oldest research paradigm, and is structured for the original purpose of studying the natural world, such as magnetism, atoms and gravity (Oates, 2006:288). Because positivism has been in existence for hundreds of years, it can be assumed that there will be some criticism against it, although it is normally used as the benchmarking paradigm for other research paradigms. According to Oates (2006:288), the criticisms include:

- Reductionism is sometimes not possible.
- Repetition is not always possible.
- Generalisation is not always desirable.
- Not everyone sees the world in the same way.
- Regular laws and patterns in the social world appear to be observable, but are the construction of people.

Positivism is not perfect, and because of its shortcomings described above, alternative research paradigms were developed, for example interpretivism and mixed methods. Interpretivism will be discussed in the next section.

3.2.2. Interpretivism

Interpretive research does not start with a theory that needs to be proven, such as the positivistic approach. The goal of this research is to understand something, and not necessarily to prove something.

Interpretive studies assume that people create and associate their own subjective and inter-subjective meanings as they interact with the world around them. Interpretive researchers thus attempt to understand phenomena through accessing the meanings participants assign to them (Orlikowski & Baroudi, 1991:5).

Cooper and Schindler (2011:17) suggested that interpretive research consists of three basic principles:

- People construct and give meaning to the world around us.
- Research is a part of what is observed, and thus cannot be neutral.

- Research is being driven by the interest of the people conducting it.

The analytical goal is to make sense of the situation and the relationship between people, the organisation and technology (Myers & Avison, 2002:3).

While the positivistic paradigm was the norm for the initial scientific research conducted, interpretive research has come to show the scientific community a new way of looking at research. Since positivism aims to prove theories, it is not necessarily applicable to all types of research, and interpretivism is there to provide an alternative.

Critical social research will be discussed in the next section.

3.2.3. Critical social research

Critical social research is concerned with matters of power, rights, and the different ways in which social settings and cultural dynamics work together in forming a social system.

According to Oates (2006:296), critical social research can be defined as research where the main issue is identifying relationships of power, conflict and contradictions, and then seeking to empower people being suppressed.

On the ontological level, critical social theory is focussed on resistance, conflict and contrasts in everyday life. Its main goal is to try and remove suppression and domination from society. It aims to deliver social criticism and reveal circumstances that are limiting people (Myers, 1997:5).

Understanding a situation is not enough. Critical social researchers seek to identify and challenge the conditions of domination, and the restrictions and the unfairness of the norm, which people can change to convey harmony (Kim, 2003:10). Basically, critical social research is concerned with identifying power relations, conflicts and contradictions, and with this knowledge empowering people and eliminating them as sources of alienation and domination.

The critical research assumption is that a positivist approach to research fails to address issues of social justice and marginalised peoples (Creswell, 2013:9). It could be argued that it plays an important role in directing the attention of researchers toward the idea of bringing change or having a positive influence on society instead of just promoting advancement.

Those with power and vested interests often shape research projects, but this paradigm succeeds in challenging the norm and providing us with an alternative.

Mixed-methods research will be discussed in the next section.

3.2.4. Mixed-methods research paradigm

Mixed methods is a relatively new paradigm for conducting research when compared to the others of which some, like positivism, have been around for centuries. Authors have defined mixed-methods research as the combination of both quantitative and qualitative methodologies within the same study in order to address a single research question. (Hewson, 2006:179). The most appropriate definition for this study might be the one phrased by Creswell *et al*. (2004:7) as the collection or analysis of both quantitative and/or qualitative data in a single study in which the data have been collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research.

The idea of mixed methods comes down to merging quantitative and qualitative research methods in a single study to create a research method that provides a more conclusive result or more reliable data.

There are two types of mixed-methods research:

QuantQual would start with a positivist approach by gathering quantities of factual data and then analysing the data gathered in an interpretive setting to gain additional insights from real-world conditions.

QualQuant starts out with qualitative methods to gain insights with an interpretive perspective. The focus then shifts to positivistic research methods that attempt to structure the data to continue the research in a fact-driven approach. Combining these research methods will result in a QualQuant method being followed (Onwuegbuzie & Leech, 2005:383).

The following are strengths of mixed-methods research, according to Johnson and Onwuegbuzie (2004:21):

- It provides more comprehensive evidence for studying a research setting than using simply quantitative or qualitative methods because it can answer a more complete range of research questions.
- It can provide better evidence for a conclusion by supporting the results or findings of the other methods used.
- By combining the results of qualitative and quantitative research, a more comprehensive outcome can be reached to support theory and practice as many different demonstrations can be used to add meaning to numbers, while on the other hand, numbers and statistics can be used to add precision to qualitative data.
- The strengths of one method can be used to address the weaknesses of another method by using both research approaches.

- Some additional insights that may be overlooked when a single method is used can be gained.
- Different data-collection tools can be used as the researcher is not restricted to the types of data-collection approach normally reserved for qualitative or quantitative research respectively.
- Analysing findings at multiple levels gives a more in-depth understanding than when obtained from analysis at a single level.

No research methodology is perfect, and according to Johnson and Onwuegbuzie (2004:21), the following criticism against mixed-methods research should also be kept in mind:

- Mixed-methods research could require more time and effort, as well as financial resources, as it tends to take longer than applying a single method.
- Some research purists still believe that a researcher should only conduct research within either a quantitative or a qualitative paradigm.
- Mixed-methods research is still a very new research approach, which means that there is not as much information available on it, and also some difficulties in conducting it that need to be ironed out.
- The researcher has to learn to combine multiple research methods appropriately without much guidance or information on it.

According to Chen (2006:82), the mixed-methods paradigm is viewed as superior to the normal quantitative or qualitative paradigms by researchers, and is viewed as the new research paradigm with the ability to replace older research approaches.

3.2.5. Research paradigm applied in this study

The qualquant mixed-methods research paradigm was used in this study as it combines interpretivism and positivism, and can therefore make use of both these research methods. All the aspects of the paradigms, including data-collection and analysis techniques, are used in a single research plan that should prove to be richer and more reliable. The individual strengths of the research paradigms and methods can be used selectively, and their respective weaknesses can be addressed by the strengths of the other.

The following points by Greene *et al.* (1989:258-259) indicate some motivators on why to use the mixed-methods paradigm to complete a study:

- Triangulation: The aim is to converge, corroborate and validate findings or results from different research methods. Triangulation would theoretically provide more valid results than the other methods could yield independently.

- Development: The aim is to use the results or findings from one research method to develop the other research method.
- Complement: The idea is to strengthen, enhance, elaborate, illustrate and classify the results or findings from one research method with the results or findings from another research method.
- Expansion: In order to broaden or extend the scope of the investigation, different research methods must be applied to the different components of the investigation.
- Initiation: To discover possible contradictions or paradoxes in one research method, the results or findings from the other research method are used.

This paradigm will be ideal for this study because three of the reasons mentioned above, namely development, complement and expansion support its requirements. This paradigm will allow for the study to make use of multiple data-collection methods, in this case interviews and a survey. The strengths mentioned previously prove to be ideal for the study, and will far outweigh the potential weaknesses.

The initial focus will be on qualitative methods, which will be used in conjunction with the literature to gain valuable insights from approximately 20 interviewees, each with additional perspectives on mobile apps. The focus will then shift to positivistic research methods, which will make use of a survey to utilise quantitative data, and continue in a fact-driven approach.

3.3. Participants

The first part of the study will consist of interviews, conducted by the researcher.

A total of 20 participants will be interviewed. The study will make use of a convenient sample group and only interview people who met the following selection criteria:

- Smartphone users
- Different genders
- Different age groups
- Different user types
- Different smartphone types
- Different occupations

Anon (2012) performed an analysis on different types of mobile user. They determined four different categories of smartphone user, namely routine users, selective users, enthusiastic users and experienced users. These user types can be described as follows:

Enthusiastic users: This group describes 18% of mobile users. It consists of men and women between the ages of 14 and 39 who use their smartphones frequently. This group of users uses mobile services and apps for most tasks, replacing its personal computers to a certain extent. Specific uses can be anything from social media to shopping.

Experienced users: This group describes 24% of mobile users. It consists mostly of men between the ages of 30 and 49 who use their smartphones at work and in their private lives. This group of users uses its smartphones to save time and complete tasks more easily or efficiently.

Routine users: This group describes 28% of the mobile users. It consists of users between the ages of 20 and 29. This group uses its smartphones primarily as a form of entertainment. This can include games, social media or web-browsing activities.

Selective users: This group describes 30% of the mobile users. This group is over 40 years of age and only just starting to discover the possibilities provided to it by its phones. These users own smartphones, but do not really take advantage of all the possibilities these devices offer. They are mainly accustomed to using their phone as a device for making calls and sending messages.

To ensure that all perspectives are covered, participants will cover different age groups, genders, and occupations. The participants will also cover the four different types of user. Table 3.1 presents the information on the participants who were interviewed:

Table 3.1: Profiles of interviewees

	Gender	Age	Occupation	Smartphone	User Type	Time on Phone
Interview 1	Male	23	Student, Masters in Economy	Android	Selective user	1 hour
Interview 2	Male	55	Industry, Real Estate Agent	Android	Experienced user	2 hours
Interview 3	Male	21	Student, B.A. Communication	Android	Routine user	2-3 hours
Interview 4	Male	24	IT Specialist NWU	Android	Routine user	5 hours
Interview 5	Male	28	Lecturer in Computer Sciences	Android	Enthusiastic user	3-4 hours
Interview 6	Male	26	Gold Smith	Android	Selective user	2 hours
Interview 7	Male	25	Student, Masters in IT	Android	Experienced user	2-3 hours
Interview 8	Male	23	Student, Honours Risk Management	Android	Routine user	2 hours
Interview 9	Female	25	Student, Masters Pharmacy	Android	Routine user	3 hours
Interview 10	Male	25	Electronics Engineer	Android	Selective user	1 hour
Interview 11	Female	17	Learner	Android	Routine user	4-5 hours
Interview 12	Male	25	Junior Lecturer NWU	Android	Enthusiastic user	1-2 hours
Interview 13	Female	21	Student, Dietician	Android	Routine user	2-3 hours
Interview 14	Female	51	Real Estate Agent	Android	Experienced user	3 hours
Interview 15	Male	39	Lecturer Computer Sciences NWU	iPhone	Enthusiastic user	1-3 hours
Interview 16	Female	77	Retired	Android	Selective user	3-5 hours
Interview 17	Male	23	Manager at Delhi	Android	Experienced user	6 hours
Interview 18	Male	36	Subject expert NWU	Android	Enthusiastic user	4 hours +
Interview 19	Female	15	Learner	Android	Routine user	6 hours
Interview 20	Male	23	Masters in Computer Engineering	Android	Experienced user	1 hour

A survey will be performed in the second part of the study. The survey will make use of a questionnaire to collect information. The questionnaire was created after completion of the literature study and interviews. The questions were based on the information gathered from the literature and a content analysis performed on the interviews. After the questionnaire had been compiled, a link to it was sent out via email. The email went out to a list of addresses from professionals in the industry, as well as a selected group of honours students at the North-West University. A total of 3 500 emails were sent, and 227 responses received, yielding a response rate of 6.5%. The survey was performed during September 2016.

The group of participants consisted of different varieties of smartphone users, including people of different age groups, genders and occupations. This will ensure that the data covers a wide perspective.

3.4. Process

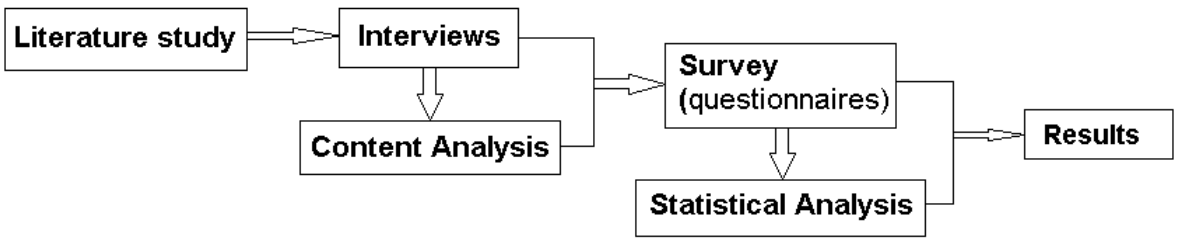


Figure 3.1: Diagrammatic representation of the research process followed in this study

As demonstrated in Fig. 3.1, the study will be performed by firstly undertaking a literature review to serve as a guideline on relevant information as a baseline. Using contributions from the literature, an initial list of interview questions will be constructed. Interviews will be carried out to verify the relevant aspects as taken from the literature, and also to contribute any additional points that might be important. To analyse the qualitative data, content analysis will be performed. The information gathered from the interviews will be used to enrich the questionnaires with some real-world inputs.

A survey will follow the interviews by distributing the questionnaire created. This survey will supply the study with data on the relevance of the attributes identified as drivers or barriers to user acceptance of mobile applications using a ranking scale in the questionnaire. For the quantitative data, a statistical analysis will be performed to present the results in a factual form, which can then be prioritised according to the results. The data will be analysed in order to indicate certain drivers and barriers as more relevant than others.

3.4.1. Interviews

In the interpretive part of the study, interviews will be conducted. Interviews will be ideal in this case as they can obtain real-world inputs from the targeted individuals, as required by the study. The goal of this interview is to gather some insights into what mobile users like about the apps they use, and what they think would have a positive or negative effect on the user acceptance of mobile applications.

According to Oates (2006:36-37), an interview is a conversation held between people where the researcher controls the direction of the conversation and asks most of the questions. The researcher then records the responses, and in this way data is collected. It is possible to conduct both one-to-one and group interviews.

Interviews can be divided into three types: structured, semi-structured and unstructured interviews, as discussed below (Oates, 2006:187-188):

Structured interviews: These use pre-determined, standardised and identical questions for every interviewee. The questions are in the hands of the interviewer and the responses rest with the participants.

Unstructured interviews: Here the researcher has less control. The interviewer only introduces a concept and then the interviewee is left to develop his/her ideas, talking freely about his/her own beliefs, views and behaviour while not being interrupted.

Semi-structured interviews: These are more focused than unstructured interviews. The researcher schedules interviews with people who possess relevant information, and follows a particular structure. Semi-structured interviews also use a set of open-ended questions. The interviewee is free to add to the list of questions, or to change the order of the questions, but the interviewer ensures that he/she still stays true to the original theme.

Semi-structured interviews are preferable for this research as their main objective is to allow the researcher to know the interviewee's perspective on mobile applications, as well as whether the interviewee can confirm insights and information from literature that the researcher already holds.

The protocol followed for interviews:

The researcher compiled questions beforehand by basing them on the initial goals of the study as shown in Table 3.2 below.

Table 2.2: Protocol to generate interview questions

Research Objective	Research Variable	Question	Type of question
Determine attributes that would contribute to the user acceptance of mobile applications according to mobile users.	General positive attributes	Why do you like certain apps, and what causes you to accept them on a permanent basis?	Open question
	General negative attributes	What causes you to dislike or reject certain mobile apps, and why?	Open question
	Accepted mobile apps	Please provide examples of your favourite mobile apps, and why.	Open question
	Specific positive aspects of apps	Please provide some positive aspects of these apps, and why.	Open question
	Specific negative aspects of apps	Please provide some negative aspects of these apps, and why.	Open question
	User Profile • Type • Time • Money	How much time do you spend on mobile apps, and which ones?	Open question
		How much money do you spend on mobile apps, and which ones?	Open question

The interviews were conducted in a quiet place to prevent interference with the recordings. A sample of 20 different people was interviewed individually. Their profiles were described previously in Table 3.2 in the participants' section. As can be seen when viewing the profiles of participants, at least one user of every user type was interviewed. Participants also covered different age groups, genders and occupations.

Each interview lasted approximately 20 minutes. The purpose of the interview was discussed with the interviewees to provide them with the necessary context in which to answer the questions. A smartphone was used to record the interviews in a format that could be played back on a computer.

3.4.2. Content analysis

Content analysis is a widely used qualitative research technique. Research using qualitative content analysis focuses on the characteristics of language as communication with attention to the content or contextual meaning of the text (Lindkvist, 1981:23). Rather than being a single method, current applications of content analysis show three distinct approaches (Hsieh &

Shannon, 2005:1277):

Conventional content analysis: Conventional content analysis can be used with a study design where the aim is to describe a phenomenon. This type of design is used when there is a shortage of theory or literature on the existing research. Researchers avoid using preconceived categories, instead allowing the categories and names for categories to flow from the data (Hsieh & Shannon, 2005:1279).

Summative content analysis: This study starts by identifying and quantifying certain words or content in text in order to understand the contextual use of the words or content. This quantification is not necessarily an attempt to infer meaning, but rather to explore the usage (Hsieh & Shannon, 2005:1283).

Directed content analysis: Directed content analysis can be used with a study where existing theory or prior research already exists about a phenomenon, for instance if the study is likely to be incomplete or if it could benefit from further description. The qualitative researcher might choose to use a directed approach for content analysis. The goal for a directed approach to content analysis is to conceptually validate or extend a theoretical framework or theory. Existing theory or research can provide predictions about the variables of interest or about the relationships among variables, thus helping to determine the initial coding scheme or relationships between codes (Hsieh & Shannon, 2005:1281). This study will make use of directed content analysis because the goal of the content analysis is as mentioned in the previous sentence.

Content analysis entails studying and analysing text in order to understand the meaning and relations between different aspects of the text under investigation. The data collected during the interview sessions was stored and then reviewed and analysed to identify key points of information. In order to perform the content analysis, all the interviews were transcribed into Microsoft Word documents.

The documents were printed and reviewed thoroughly. Important pieces of information relating to the study were indicated with markers. A spreadsheet was created containing attributes previously gathered from literature and then used to compile a list of codes gathered from the interviews. The marked documents were studied, and positive or negative attributes were taken and added to their corresponding codes. If something did not fit in with the existing categories listed from the literature, a new category was created.

A profile of each interviewee was created in the spreadsheet, and the positive and negative attributes gathered from them were listed under their profile entries. The complete spreadsheet has been included as Appendix B. The second phase of data acquisition will be carried out using the final product of the questionnaire. The questionnaire was constructed using the information gathered from the interviews.

3.4.3. Survey

Fink (2003:1) defines a survey as a system for collecting information from or about people to describe, compare, or explain their knowledge, attributes and behaviour. The main idea of a survey is to obtain the same data from a large group of people in a standard and systematic manner. The data is subsequently analysed by searching for patterns in the data and drawing conclusions (Oates, 2006:93). To carry out a successful survey, the study will have to determine the following steps:

Sampling frame

Oates (2006:95) says that a sampling frame is a list or collection of the whole population of people that could be included in the survey. The sampling frame for this study should ideally consist of people who have a high probability of being regular users of mobile applications. It will therefore target two main groups of possible participants:

University students: This group represents the Millennial (Bull, 2010:28) generation that grew up with technology and mobile devices already available. They are more comfortable with accepting new applications or trying out new developments in the technology space. They represent a large portion of modern smartphone users, largely from the enthusiastic and routine user types. This group will likely be more focussed on having the most recent or unique applications on their phones that can entertain them for a while or help them interact with their friends (Shaw & Fairhurst, 2008:12).

Professionals in the industry: They will represent the remaining population of smartphone users with their own preferences and possibly some differences when compared to the first group. This group will consist largely of the experienced and selective user types. They will likely be focussed on the practicality and usability off applications, as well as its ease of use.

Sampling technique

The sampling technique refers to how the people to be targeted were selected from the sampling frame (Oates, 2006:96). The different sampling techniques available have been listed Oates (2006:96-98), and include techniques, such as random sampling, cluster sampling,

snowball sampling, convenience sampling, etc. This study used the purposive and convenient sampling techniques as the primary interest was to gain the insights of active smartphone users.

Convenient sampling: Researchers simply select respondents who are convenient for them because they are easy to reach and willing to help (Oates, 2006:98). This sampling technique applied to the students that were targeted at the university. This was ideal because students fit the profile of regular smartphone users required for this study.

Purposive sampling: Researchers deliberately hand pick the sample, choosing instances that are likely to produce valuable data to meet the purpose of the research (Oates, 2006:98). This technique was used to target the professionals in the industry, who are likely to be the paying users of mobile apps.

Data-generation method

The data generation method of the survey will occur via a questionnaire, commencing once all interviews are completed. The questionnaire was constructed using Google Forms, and a link to the questionnaire was sent out via email to reach as many people as possible. The purpose of the study was explained in the email to ensure each participant had a good understanding of what they were contributing.

Questionnaires

A questionnaire can be defined as a survey instrument used to generate data from individuals or a group (Kelly *et al.,* 2008:122). It consists of a pre-defined set of questions organised in a pre-determined order (Oates, 2008:219). Questionnaires are most useful when requiring varied feedback on the same questions from a large number of random participants.

Questionnaires mostly consist of two types of question:

Open-ended questions: This type of question gives respondents the ability to answer by providing the type of response that best suits them (Kelly *et al.,* 2008:123).

Closed questions: This is a fixed type of question that controls the feedback from the respondents by providing them with a pre-defined set of answers from which they can select (Kelly *et al*., 2008:123).

The questionnaire for this study will be structured in a form that would allow for quantitative analysis. This will cause most of the questions to be closed to simplify data analysis afterwards and ensure relevant feedback.

Some of the advantages of using a questionnaire for this study are:

- Questionnaires are economically feasible (Oates, 2008:186).
- Distribution is easy and flexible (Oates, 2008:186).
- Questionnaires can be easily completed and analysed (Kelly *et al*., 2008:127).
- Questionnaires allow for the collection of large volumes of data in less time (Kelly *et al*., 2008:126).

Some disadvantages of a questionnaire for this study may be:

- No opportunity to correct misunderstandings (Oates, 2008:186).
- Open-ended questions may be difficult to answer or analyse (Krosnick, 1999:539)
- It demands effort and time from respondents, and most people do not like completing forms (Krosnick, 1999:539)

The disadvantages of questionnaires may limit research results, but since this study uses a mixed-method paradigm, most of the disadvantages are cancelled out by enriching the content with information gathered from interviews. The high non-response rate can be overcome by making the questionnaire as short and interesting as possible.

To construct the questionnaire, a baseline was created by conducting a literature survey. The interviews were used to confirm the attributes gathered from the literature and add additional points provided by the participants. A Likert scale (1-4) was then assigned to each attribute according to which they could be ranked when completing the questionnaire. The different attributes listed in the questionnaire, along with their origins, can be seen in Table 3.3 and Table 3.4.

Table 3.3: Attributes that have a positive influence on user acceptance

Positive influences on user acceptance	
Attributes	**Source**
Comfort/Convenience	Literature: (Park & Han, 2013:278) Interview: 2, 7, 9, 11, 12, 13, 14
Keeps me updated	Interview: 9,12,13,14
Comprehensive	Literature: (Xu *et al.,* 2015:171; Fu *et al.,* 2013:8) Interview: 3, 18, 20
Productivity	Literature: (Kim *et al*., 2013:361; Kangas & Kinnunen, 2005:59) Interview: 2, 14
Speed up tasks	Literature: (Verkasalo *et al*., 2010:242; Chou *et al*., 2013:8) Interview: 1, 7, 11, 12, 16
Portability/Mobility	Literature: (Park *et al.,* 2014:3; Kangas & Kinnunen, 2005:59) Interview: 6, 14, 16
Goal-driven	Literature: (Kangas & Kinnunen, 2005:59; Lee *et* al. 2012:1590) Interview: 1, 3, 5, 10, 12
Relevant	Literature: (Kangas & Kinnunen, 2005:59; Kim *et al*., 2013:361) Interview: 2
In line with target market	Literature: (Hermansson, 2013:11) Interview: 3, 11, 12
True to its title/description	Literature: (Chou *et al*., 2013:8; Park *et al*., 2014:3; Kim *et al.,* 2013:361). Interview: 5, 12, 15, 20
Clear descriptions	Interview: 3, 8, 14, 16
Functionality	Literature: (Xu *et al*., 2015:171; Ickin *et al.,* 2012:52) Interview: 3, 7, 10, 15, 20
Constant improvements	Literature: (Xu *et al*., 2015:171) Interview: 6, 17
Entertainment	Literature: (Chou *et al.,* 2013:8; Kim *et al*., 2013:361; Park & Han, 2013:278) Interview: 12
Time killer	Literature: (Verkasalo *et al*., 2010:242; Park *et al*., 2014:3; Xu *et al*., 2015:171) Interview: 7, 8
Social/Sharing	Literature: (Kim *et al*., 2013:361; Park & Han, 2013:278) Interview: 4, 7, 9, 11, 13, 17, 18, 19
Positive ratings and reviews	Literature: (Bergvall-Kåreborn & Howcroft, 2013:11)
Popular	Literature: (Hermansson, 2013:1; Mei *et al.,* 2013) Interview: 13
Realistic	Interview: 3
In line with my interests	Literature: (Hermansson, 2013:11) Interview: 2, 9, 16
Exploration/Educational	Literature: (Park & Han, 2013:278) Interview: 17, 16
Personalisation, Settings	Literature: (Kangas & Kinnunen, 2005:59) Interview: 20
Innovative, Unique	Literature: (Chou *et al*., 2013:8; Lee *et al*., 2012:1590) Interview: 12, 20
Off-line usability	Literature: (Park *et al*., 2014:3) Interview: 4, 8,1 0, 15, 20
Explanations	Interview: 17
Affordable	Literature: (Park & Han, 2013:278; Xu *et al*., 2015:171; Mei *et al.* 2013) Interview: 2, 5, 6, 7, 9, 10, 11, 13, 16, 19
Integration of accounts	Literature: (Lee *et al*., 2012:1590; Park *et al*., 2014:3) Interview: 5, 18
Cross platform	Literature: (Lee *et al*., 2012:1590) Interview: 5, 20
Remember use	Interview: 5, 15, 17
Fluency of navigation	Literature: (Kangas & Kinnunen, 2005:59)
Clear instructions, Obvious tutorials	Literature: (Park *et al*., 2014:3; Lee *et al*., 2012:1590) Interview: 3, 14, 18
Feedback	Interview: 14
Ease of use	Literature: (Kangas & Kinnunen, 2005:59; Verkasalo *et al*., 2010:242; Park *et al*., 2014:3) Interview: 2, 4, 7, 8, 12, 14, 18, 1, 3, 11, 13, 15, 17, 20
Simplistic	Literature: (Hermansson, 2013:11; Verkasalo *et al*., 2010:242) Interview: 4, 5, 8, 10, 14, 16, 18, 19
Well-organised information/layout	Literature: (Kangas & Kinnunen, 2005:59) Interview: 8, 15, 18
Well-designed interface/layout	Literature: (Hermansson, 2013:11) Interview: 1, 3, 4, 5, 7, 8, 10, 11, 12, 14, 15, 18
Consistent	Literature: (Fu *et al.,* 2013:8)

	Interview: 4, 18, 20
Aesthetically pleasing	Literature: (Ickin *et al.,* 2012:52) Interview: 13, 15, 19, 20
Good-looking icons	Interview: 13, 19
Features	Literature: (Ickin *et al.,* 2012:52; Xu *et al*., 2015:171) Interview: 17, 20

Table 3.4: Attributes that have a negative influence on user acceptance

Negative influences on user acceptance	
Attributes	**Source**
Notifications	Literature: (Lee *et al.,* 2013:563) Interview: 7, 10, 17
Too many updates	Interview: 7,10
Breach of security/ privacy	Literature: (Mei *et al.,* 2013:15; Park & Han, 2013:278) Interview: 6, 11, 17
Scaly permissions	Interview: 4, 5, 17, 20
Advertisements	Literature: (Fu *et al.,* 2013:8). Interview: 1, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 18, 20
Learning curve	Literature: (Verkasalo *et al.,* 2010:242; Xu *et al.,* 2015:171) Interview: 2, 8, 18
Poor design	Literature: (Ickin *et al.,* 2012:52) Interview: 3, 5, 7, 11, 13, 15, 18
Slow app	Literature: (Ickin *et al.,* 2012:52) Interview: 3, 11, 12, 13, 15, 20
Bugs	Literature: (Hermansson, 2013:11; Verkasalo *et al*., 2010:242) Interview: 5
Battery consumption	Literature: (Yoon *et al*., 2012:387; Wasserman, 2010:398) Interview: 2, 11, 13, 18, 19
Data usage	Literature: (Ickin *et al.,* 2012:52) Interview: 1, 2, 8, 9, 13, 19
Resource intensive	Literature: (Ickin *et al.,* 2012:52) Interview: 3, 9, 18, 19
Affects the rest of the phone	Interview: 2, 9
Unpredictable	Interview: 20
Not aligned with computer version	Interview: 14, 15
Limited functionality	Interview: 1, 3, 14
In-app purchasing	Interview: 1, 3, 8

The final version of the questionnaire is attached as Appendix A. A description of the statistical analyses performed on the data obtained from the survey follows.

3.4.4. Statistical analyses

Statistical analysis and techniques are used to assist researchers in analysing data collected from a study and to present findings in a universally-understandable manner. The data tendency can be determined by applying statistical measures, such as mean, median, mode and standard deviation (Oates, 2006:254-258).

The data was processed and analysed using SAS Version 9.4 (SAS Institute Inc, 2016) to provide useful information. The techniques that were used in the statistical analysis included:

Descriptive statistics: These statistics are used to describe the profiles of participants and the general outcome of the attribute rankings. This method used simple calculations to determine the mean and standard deviation of participants' information in order to present it graphically. Thereafter, the means and standard deviations of the different attributes were taken and sorted on the means in descending order to demonstrate the attributes in terms of most important to least important.

Contingency table analysis: This analysis is a joint frequency distribution of cases based on two or more categorical variables. Displaying a distribution of cases by their values on two or more variables is known as contingency table analysis. The joint frequency distribution can be analysed with the chi-square statistic to determine whether the variables are statistically independent or if they are associated (Michael, 2016:1). Also known as cross-tabulation, it was used in this study to compare user profile data based on different user groups, such as age, occupation and purchase history.

Factor analysis: Factor analysis is a statistical technique for analysing the correlations between a large number of variables in order to reduce them to a smaller number of dimensions, called factors (Colman, 2014). It is used to group similar attributes to make it easier to handle the data from many different attributes. This was accomplished by performing an exploratory factor analysis. These values were used to determine the degree to which some attributes grouped together. Hair *et al.* (1998) stated that an MSA of 0.6 or higher can be considered statistically significant. Attributes with such values are thus strong enough to be grouped together. After the constructs were formed, the remainder of the calculations were performed on the constructs instead of on individual attributes.

Reliability analysis: Reliability in statistics indicates the overall consistency of a measure. A measure is said to have a high reliability if it produces similar results under consistent conditions (Anastasi & Urbina, 1997:84). Reliability analysis is used to determine the reliability of the constructs. Cronbach alpha values are generated to indicate if the grouped attributes from the factor analysis can be seen as meaningful (Ellis & Steyn, 2003).

T-tests: These tests are used to indicate differences between the different participant profiles, for instance if a significant difference can be found between male and female participants regarding the importance of certain attributes. To accomplish this, the effect sizes were calculated for the groups of attributes when divided according to gender or age, etc.

Cohen (1988) gives the following guidelines for the interpretation of the effect size in the current case: (a) small effect: d=0.2, (b) medium effect: d=0.5 and (c) large effect: d=0.8.

According to these specifications, the groups of attributes with a medium or higher effect size were indicated and discussed further.

Pearson correlations: Often several quantitative variables are measured on each member of a sample. If we consider a pair of such variables, it is frequently of interest to establish if there is a relationship between the two to see if they are correlated (Ellis & Steyn, 2003). We can categorise the type of correlation by considering the effect, as one variable increases what happens to the other variable (Statstutor, 2016:1):

- Positive correlation: the other variable has a tendency to also increase.
- Negative correlation: the other variable has a tendency to decrease.
- No correlation: the other variable tends not to increase or decrease.

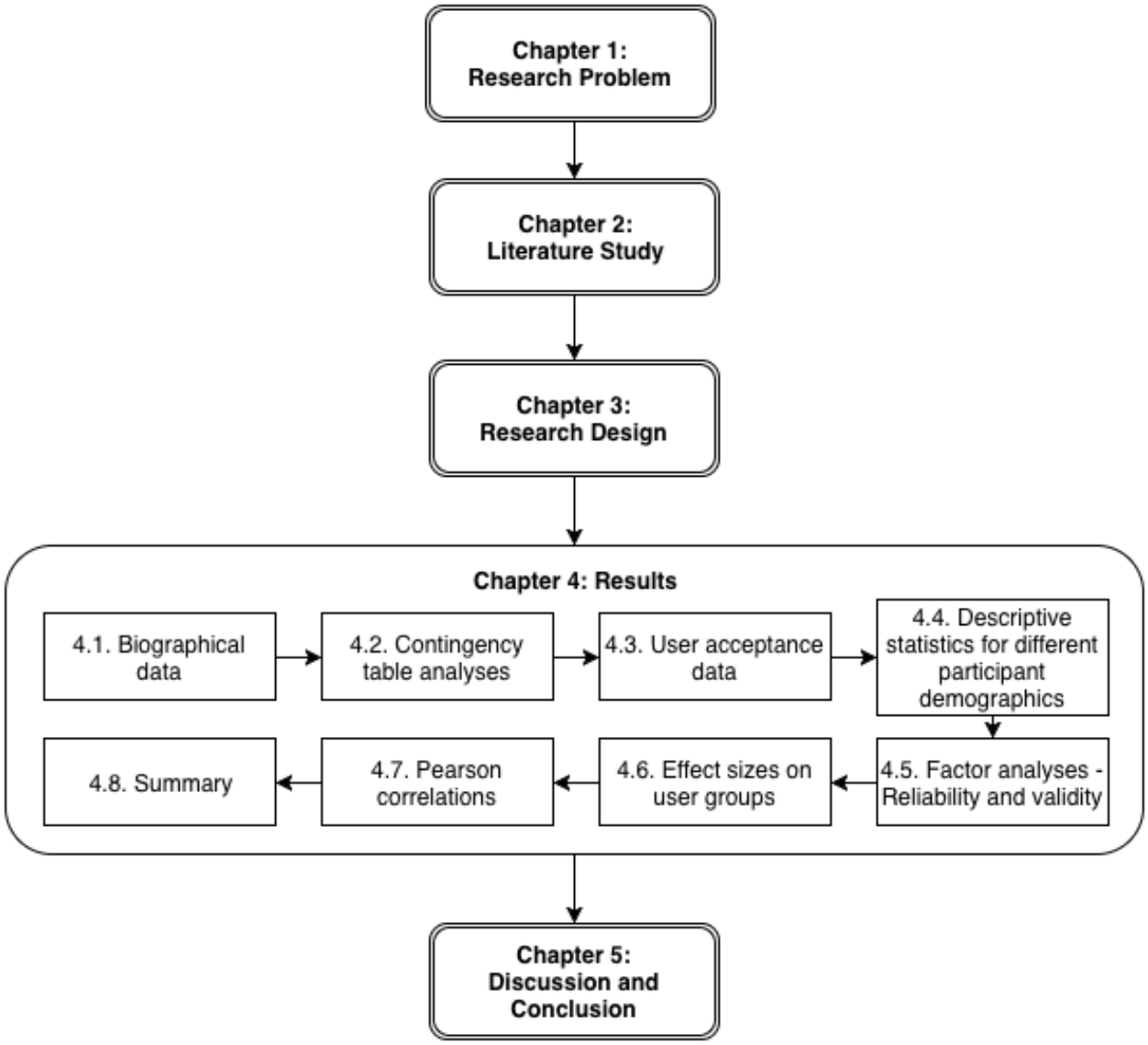
These correlations are measures in values of R, which have a medium significance when bigger than 0.3, and a large significance when bigger than 0.5. It was used in this study to determine the influences of attributes on each other.

3.5. Product

The final product of this study is the dissertation which will include a ranked list of attributes influencing the user acceptance of mobile applications.

In the following chapter, the results of this study will be presented.

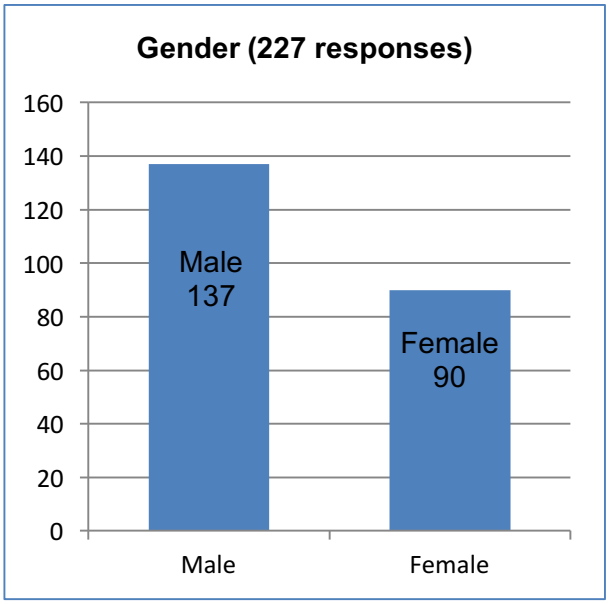
CHAPTER 4 RESULTS



In this chapter, the background information of the participants and the results of the data analysis are presented. These results include a contingency table analysis, descriptive statistics and a factor and reliability analysis, followed by tests for effect sizes and Pearson correlations.

4.1. Biographical data

The questionnaire was created on-line, and a link sent to email addresses of people in the industry and students from the NWU Potchefstroom campus. The data used came from a total of 227 respondents. Overall, the data received was complete. Of the participants, 137 were male and 90 female, providing a 60/40 gender distribution as shown in Fig. 4.1.



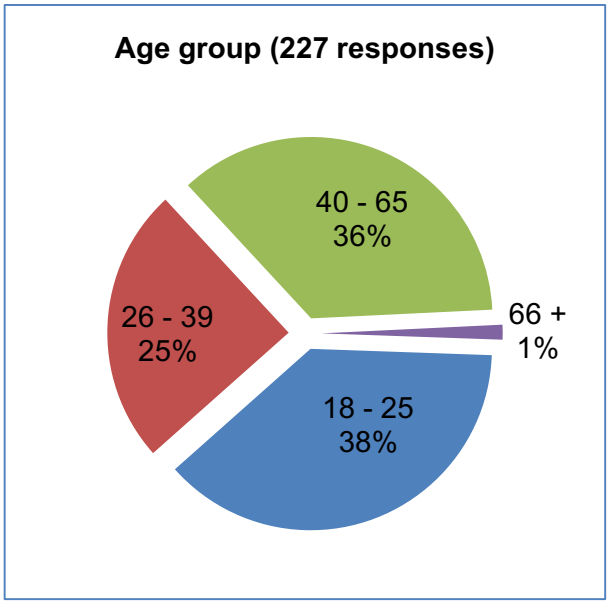


Figure 4.1: Respondents' gender

Figure 4.2: Respondents' age group

The first question established the participants' age groups. This was divided into four main groups in Fig. 4.2, and the responses consisted of 38% students new to the industry (18-25), followed by 25% young working individuals (25-39) and 36% senior professionals (40-65). Only three of the respondents were aged 66 or older, yielding just over 1%.

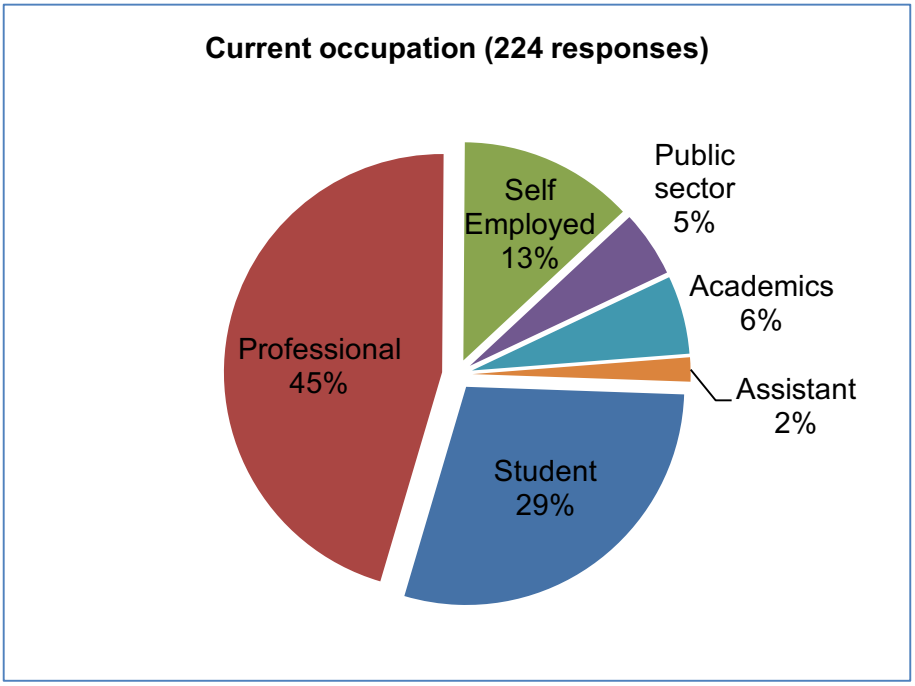


Figure 4.3: Respondents' occupation

Professionals and self-employed individuals made up more than half of the participants at 45% and 13% respectively, shown in Fig. 4.3, with the remainder comprising mostly students (29%)

and academics (6%). The remaining participants were employed in the public sector (5%) or as assistants (2%). Three respondents chose not to answer the question.

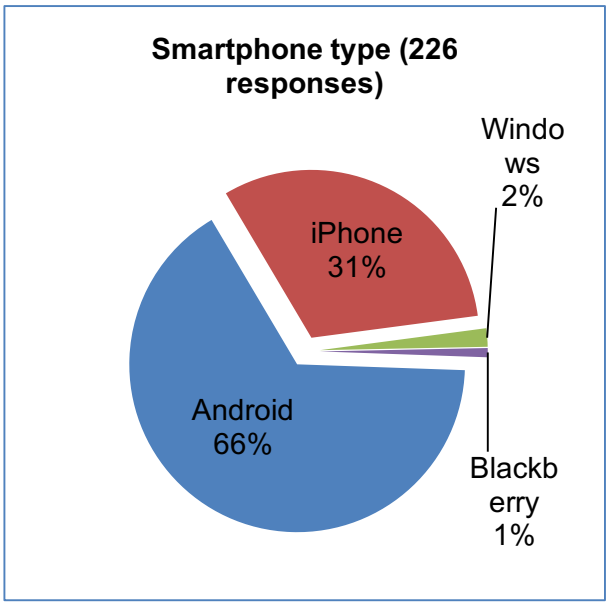


Figure 4.4: Respondents' smartphone types

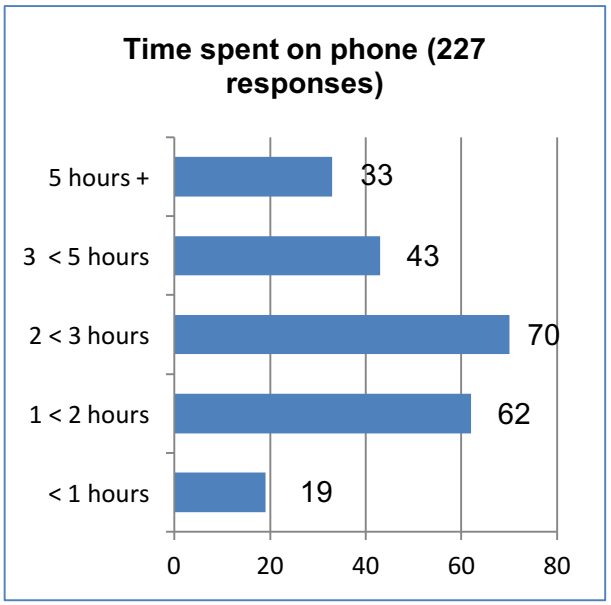


Figure 4.5: Respondents' time spent on phone

As can be seen in Fig. 4.4, most of the respondents had smartphones with an Android (66%) operating system, with iPhones (31%) coming in second. The percentage of Windows (2%) and Blackberry (1%) users is small enough to be negligible, and was thus excluded from the t-tests. The total time spent on their phone each day as shown in Fig. 4.5 is almost evenly distributed among the average of 2 < 3 hours a day, with just more than 70 respondents over or under the centre of 70 respondents.

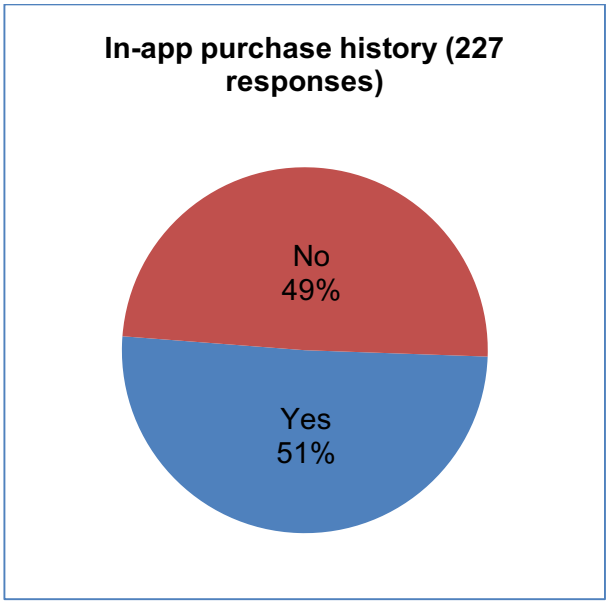


Figure 4.6: Respondents' in-app purchase history

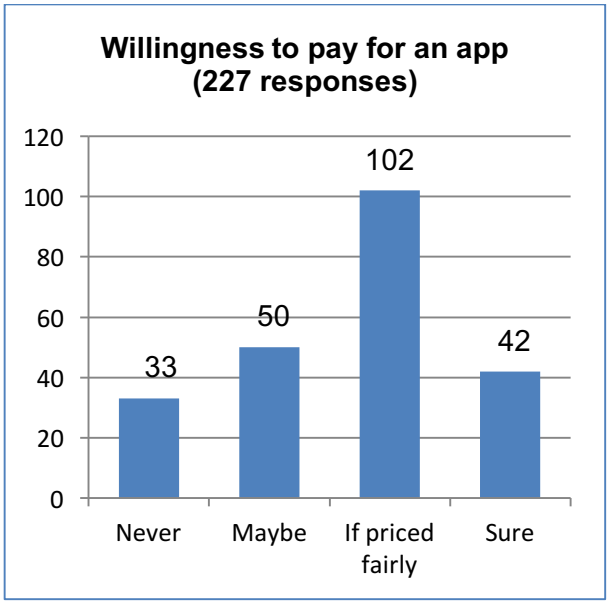


Figure 4.7: Respondents' willingness to pay for an app

Just more than half of the participants indicated that they have purchased an app or made in-app purchases as can be seen in Fig. 4.6. Regarding their willingness to spend money on

mobile applications, Fig. 4.7 indicates that 102 of the participants would do so if they felt it was priced fairly, 42 participants had no problem paying for mobile apps, 50 said maybe, and 33 participants said they would never pay for mobile applications.

4.2. Contingency table analysis

The contingency table analysis (also known as cross-tabulation) was used to compare user-profile data based on different user groups. This was done by dividing participants into groups and then determining some percentage values of groups within these groups. A demonstration of cross-tabulation between different user profiles, based on aspects, such as gender, phone type, occupation, time spent on phone, age and purchase history is presented next.

In order to interpret the results, the chi-square will only be reported where statistically significant differences were found (0.3 < medium significance, 0.5 < large significance).

In order to understand the tables, groups are colour-coded to match their values. Each heading will serve for two groups of values, namely their own values and as divider for values from the other headings. For example, Table 4.1 below can be interpreted as follows:

Within the group of participants who owned an Android phone, 57.05% identified as male and 42.95% as female. Within the participants who owned an iPhone, 67.61% identified as male and 32.39% as female. Within the group of participants who identified as male, 63.91% owned an Android phone and 36.09% owned an iPhone. Within the participants who identified as female, 73.56% owned an Android phone and 26.44% owned an iPhone. By examining these results, it can be said that Android phones were a bit more popular with female users and iPhones were more popular with male users, although not at a statistically-significant level.

Table 4.1: Smartphone-type use according to gender

Smartphone vs Gender	Android	iPhone	Total responses
Male	63.91%	36.09%	133
	57.05%	67.61%	60.45%
Female	73.56%	26.44%	87
	42.95%	32.39%	39.55%
Total responses	149	71	220

In Table 4.2 below, it can be seen that smartphone users who own an iPhone are more likely to buy mobile applications and make in-app purchases. This result was statistically significant, with a chi-square value of 0.3092.

Table 4.2: Purchase history for smartphone types

Smartphones vs Purchase	Android	iPhone	Total responses
Yes	53.91%	46.09%	115
	41.61%	74.65%	52.27%
No	82.86%	17.14%	105
	58.39%	25.35%	47.72%
Total responses	149	71	220

Table 4.3 below suggests that female smartphone users tend to use their phones more than male smartphone users.

Table 4.3: Time spent on phones by gender

Gender vs Time on phone	< 1 hours	1 < 2 hours	2 < 3 hours	3 < 5 hours	5 hours +	Total responses
Male	10.95%	32.12%	25.55%	19.71%	11.68%	137
	78.95%	70.97%	50.00%	62.79%	48.48%	60.35%
Female	4.44%	20.00%	38.89%	17.78%	18.89%	90
	21.05%	29.03%	50.00%	37.21%	51.52%	39.55%
Total responses	19	62	70	43	33	227

According to Table 4.4 below, there is no indication that a user's likeliness to perform in-app purchases will change based on the length of time he/she spends on the phone.

Table 4.4: Time spent on phone by users according to their purchase history

Purchase vs Time on phone	< 1 hours	1 < 2 hours	2 < 3 hours	3 < 5 hours	5 hours +	Total responses
Yes	8.70%	32.17%	28.70%	14.78%	15.65%	115
	52.63%	59.68%	47.14%	39.53%	54.55%	50.66%
No	8.04%	22.32%	33.04%	23.21%	13.39%	112
	47.37%	40.32%	52.86%	60.47%	45.45%	39.34%
Total responses	19	62	70	43	33	227

Table 4.5 indicates that male participants had a slightly better chance of having made purchases in mobile applications.

Table 4.5: Purchase history based on gender

Gender vs Purchase	Yes	No	Total responses
Male	53.28%	46.72%	137
	63.48%	57.14%	60.35%
Female	46.67%	53.33%	90
	36.52%	42.86%	39.55%
Total responses	115	112	227

Confirming the results of the purchase history, Table 4.6 shows that male participants are more willing to purchase apps or in-app content.

Table 4.6: Willingness to purchase based on gender

Gender vs Willingness to buy	Never	Maybe	If the price is fair	Sure	Total responses
Male	13.87%	18.98%	46.72%	20.44%	137
	57.58%	52.00%	62.75%	66.67%	60.35%
Female	15.56%	26.67%	42.22%	15.56%	90
	42.42%	48.00%	37.25%	33.33%	39.55%
Total responses	33	50	102	42	227

According to Table 4.7, participants who had already performed in-app purchases are more likely to do it again. Some of the participants who have never purchased app content are also willing to do so, with only about 30% of participants having never bought app content and saying they never will. This result was statistically significant, with a chi-square value of 0.586.

Table 4.7: Willingness to invest in mobile apps based on previous purchase history

Purchase vs Willingness to buy	Never	Maybe	If the price is fair	Sure	Total responses
Yes	0.00%	10.43%	58.26%	31.30%	115
	0.00%	24.00%	65.69%	85.71%	50.66%
No	29.46%	33.93%	31.25%	5.36%	112
	100.00%	76.00%	34.31%	14.29%	39.34%
Total responses	33	50	102	42	227

Table 4.8 shows that students indicated a preference for Android smartphones. Professionals were more or less evenly distributed, while self-employed individuals tend to favour iPhone smartphones. This result was statistically significant, with a chi-square value of 0.3162.

Table 4.8: Smartphone type based on occupation

Smartphone vs Occupation	Student	Professional	Self-employed	Public sector	Academics	Assistant	Total responses
Android	34.93%	41.78%	8.90%	5.48%	7.53%	1.37%	146
	78.46%	62.40%	45.28%	77.72%	84.62%	50.00%	64.31%
iPhone	19.72%	50.70%	21.13%	2.82%	2.82%	2.82%	71
	21.54%	37.60%	54.72%	22.18%	15.38%	50.00%	31.27%
Total responses	65	97	28	10	13	4	217

Table 4.9 shows that the younger participants favoured Android smartphones and that as the age increases, so too does the iPhone percentage. This result was statistically significant, with a chi-square value of 0.3092.

Table 4.9: Smartphone type based on age groups

Smartphone vs Age Group	18-25	26-39	40-65	66+	Total responses
Android	47.65%	22.82%	28.86%	0.67%	149
	83.88%	62.29%	53.56%	33.33%	67.72%
iPhone	18.31%	28.17%	50.70%	2.82%	71
	16.12%	36.71%	46.44%	66.67%	32.27%
Total responses	84	54	79	3	220

Table 4.10 shows no significant correlations between the smartphone types and the length of time that users spend on their phones, however, the very light users tended to favour Android smartphones.

Table 4.10: Smartphone type based on time spent on phone per day

Smartphone vs Time on phone	< 1 hours	1 < 2 hours	2 < 3 hours	3 < 5 hours	5 hours +	Total responses
Android	10.07%	26.85%	32.21%	17.45%	13.42%	149
	78.95%	65.57%	70.43%	64.44%	62.61%	67.72%
iPhone	5.63%	29.58%	28.17%	19.72%	16.90%	71
	21.05%	34.43%	29.57%	35.56%	37.39%	32.27%
Total responses	19	61	68	40	32	220

Table 4.11 indicates that students and employees from the public sector are the least likely to have performed app purchases. Academic and self-employed participants were the most likely to have purchased apps or app content.

Table 4.11: Purchase history based on occupation

Occupation vs Purchase history	Yes	No	Total responses
Student	33.85%	66.15%	65
	19.30%	39.09%	29.01%
Professional	55.88%	44.12%	100
	50.00%	40.91%	44.64%
Self-employed	68.97%	31.03%	29
	17.54%	8.18%	12.94%
Public sector	27.27%	72.73%	11
	2.63%	7.27%	4.91%
Academics	76.92%	23.08%	13
	8.77%	2.73%	5.80%
Assistant	50.00%	50.00%	4
	1.75%	1.82%	1.78%
Total responses	114	110	224

Table 4.12 suggests that younger participants tend to spend more time on their phones compared to older participants.

Table 4.12: Time spent on phone per day based on different age groups

Age vs Time on phone	< 1 hours	1 < 2 hours	2 < 3 hours	3 < 5 hours	5 hours +	Total responses
18-25	5.81%	18.60%	36.05%	25.58%	13.95%	86
	26.32%	25.81%	44.29%	51.16%	36.36%	37.88%
26-39	7.14%	25.00%	28.57%	17.86%	21.43%	56
	21.05%	22.58%	22.86%	23.26%	36.36%	24.67%
40-65	12.20%	36.59%	28.05%	12.20%	10.98%	82
	52.63%	48.39%	32.86%	23.26%	27.27%	36.12%
66+	0.00%	66.67%	0.00%	33.33%	0.00%	3
	0.00%	3.23%	0.00%	2.33%	0.00%	1.32%
Total responses	19	62	70	43	33	227

Table 4.13 indicates that the older age groups are more likely to have spent money on mobile apps and app content. This result was statistically significant, with a chi-square value of 0.3626.

Table 4.13: Purchase history based on different age groups

Age vs Purchase history	Yes	No	Total responses
18-25	27.91%	72.09%	86
	20.87%	55.36%	37.88%
26-39	58.93%	41.07%	56
	28.70%	20.54%	24.67%
40-65	68.29%	31.71%	82
	48.70%	23.21%	36.12%
66+	66.67%	33.33%	3
	1.74%	0.89%	1.32%
Total responses	115	112	227

What follows is a representation of individual attributes influencing the user acceptance of mobile applications ranked according to feedback from the participants.

4.3. User-acceptance data

According to data received from the questionnaire, the positive and negative attributes as gathered from the literature and interviews were confirmed by the survey to carry significance. To the left, Figure 4.8 is a depiction of the feedback received from participants in terms of their individual importance. To the right, Table 4.14 indicates the mean of the responses out of a maximum value of 4, with everything higher than 2.5 being of importance to the participants.

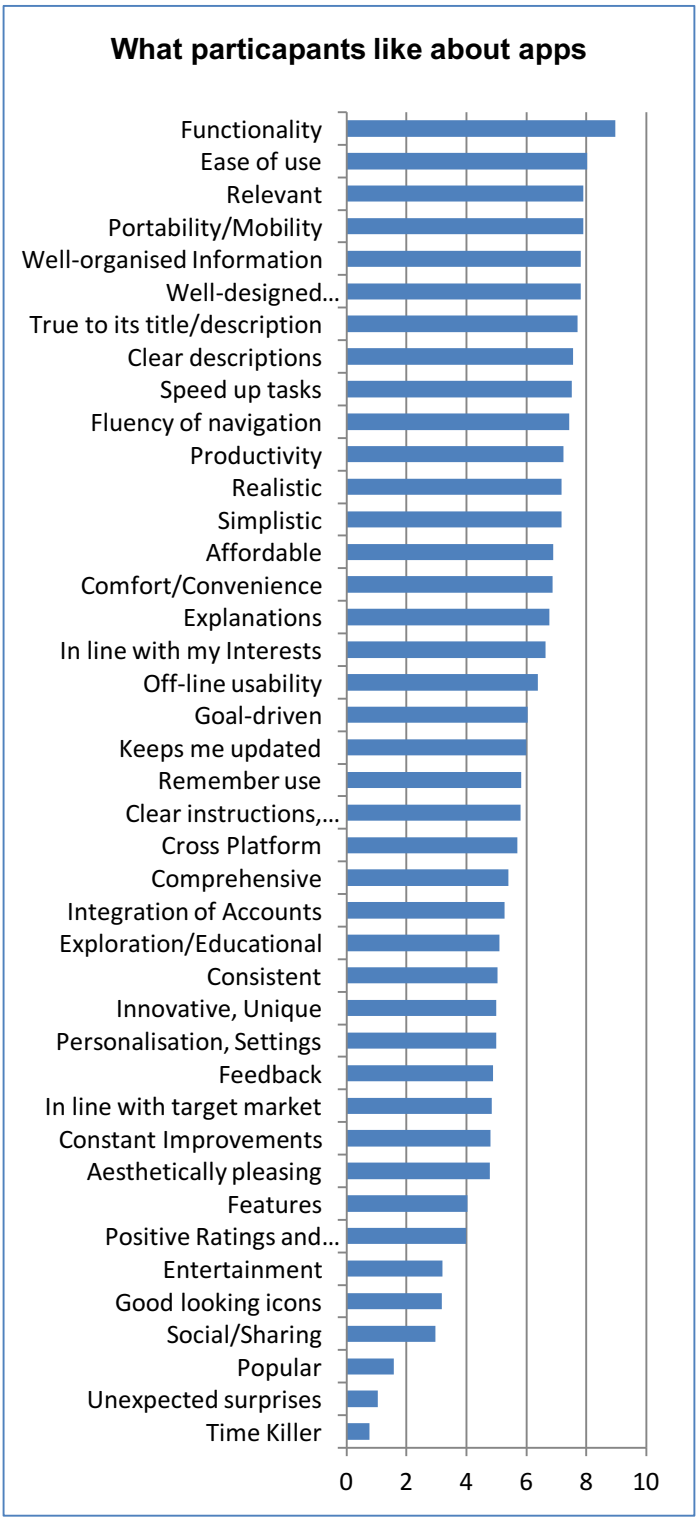


Figure 4.8: Respondents' preferences towards positive attributes

Table 4.14: Statistics for positive attributes

Attribute	Mean	Deviation
Functionality	3.7929515	0.4375552
Ease of use	3.6061947	0.5575794
Relevant	3.5814978	0.6141484
Portability/Mobility	3.579646	0.6568151
Well-organised Information	3.5644444	0.5642455
Well-designed interface/layout	3.5619469	0.5720635
True to its title/description	3.539823	0.7246197
Clear descriptions	3.5132743	0.7069816
Speed up tasks	3.5022026	0.5751064
Fluency of navigation	3.4844444	0.634554
Productivity	3.4469027	0.6458855
Realistic	3.4361233	0.7158873
Simplistic	3.4336283	0.6782475
Affordable	3.380531	0.8145192
Comfort/Convenience	3.3744493	0.7382466
Explanations	3.3539823	0.7708045
In line with my Interests	3.3259912	0.8089014
Off-line Usability	3.2743363	0.8615004
Goal-driven	3.2079646	0.8089106
Keeps me updated	3.1982379	0.8203153
Remember use	3.1637168	0.8509928
Clear instructions, Obvious tutorials	3.159292	0.8117621
Cross Platform	3.1383929	0.9247708
Comprehensive	3.079646	0.9007808
Integration of Accounts	3.0528634	0.9532563
Exploration/Educational	3.0222222	0.787426
Consistent	3.0088889	0.9954858
Personalisation, Settings	3	0.8844333
Innovative, Unique	3	0.8219219
Feedback	2.9777778	0.8836028
In line with target market	2.969163	0.8434656
Constant Improvements	2.9596413	0.8869341
Aesthetically pleasing	2.9557522	0.868095
Features	2.8054299	0.9061243
Positive Ratings and Reviews	2.7964602	0.9252919
Entertainment	2.6387665	0.9226234
Good looking icons	2.6371681	1.0246903
Social/Sharing	2.5947137	0.9792395
Popular	2.3171806	0.9527858
Unexpected surprises	2.2088889	0.9092339
Time Killer	2.1548673	1.0101257

When looking at Fig. 4.8, it can be seen that the highest-ranked individual attributes according to the respondents were functionality, ease of use, relevance, mobility and well-organised information. Some of the lower-ranking attributes were popularity, unexpected surprises and time killer apps. The data in Fig. 4.8 was modified to provide a better visual representation, but

to the right in Table 4.14, the original averages and standard deviation of each attribute can be found.

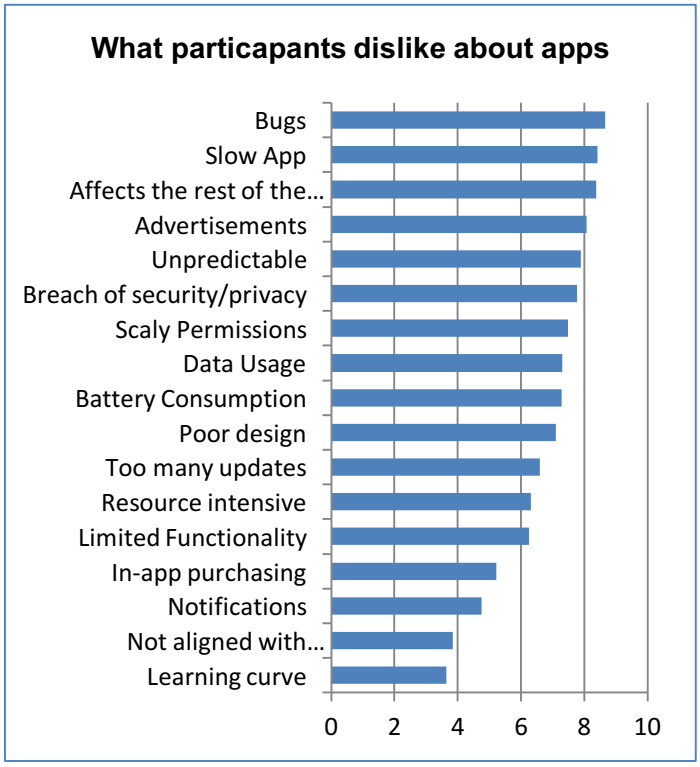


Figure 4.9: Respondents' preferences towards negative attributes

Table 4.15: Statistics for negative attributes

Attribute	Mean	Deviation
Bugs	3.7300885	0.5982768
Slow App	3.6814159	0.5775887
Affects the rest of the phone	3.6740088	0.5717411
Advertisements	3.6150442	0.6847833
Unpredictable	3.5758929	0.672022
Breach of security/privacy	3.5506608	0.7471699
Scaly Permissions	3.4955752	0.7318032
Data Usage	3.4577778	0.7787607
Battery Consumption	3.4557522	0.7889727
Poor design	3.420354	0.7747871
Too many updates	3.3171806	0.8548741
Resource intensive	3.2622222	0.7948745
Limited Functionality	3.2511013	0.8588097
In-app purchasing	3.0440529	1.0381218
Notifications	2.9513274	0.9763073
Not aligned with computer version	2.7699115	1.103601
Learning curve	2.7268722	0.9934878

As shown in Fig. 4.9 the participants were most irritated by negative attributes, such as bugs, slow performance and apps that have a negative effect on the rest of the phone. Some of the attributes that did not have such a negative effect, included not aligned with computer version and apps that had a learning curve, which did not bother participants as much. This data was also modified to provide a better visual representation, but to the right in Table 4.15 the original averages and standard deviation of each attribute are shown.

Scale:	5	4	3	2	1	1	2	3	4	5	
A colourful happy app								X			Professional looking
Innovative and creative									X		Stable and error free
Faster performance							X				Longer battery life
Lots of features								X			Simplistic design
Regular reminders								X			Quiet with no notifications
Useful and productive				X							Time killer
Free and half made							X				Paid and excellent
Goal driven						X					Multi purpose
Focus on functionality					X						Aesthetically pleasing
Regular improvements							X				Few as possible updates
Advanced but complex							X				Easy to use and basic
Social and sharing									X		Private and secure

Figure 4.10: Preferences of certain conflicting attributes

Another part of the questionnaire asked participants to choose which was more important between two conflicting attributes, and Fig. 4.10 indicates their preferences. The clear winners were stable and error free over innovative and creative and private and secure rather than a social app that shares everything. They also seemed to prefer a simplistic design rather than plenty of features, professional looking over colourful and happy, and quiet instead of notifications and reminders. The participants seemed to be conflicted on attributes, such as multipurpose vs goal-driven and aesthetics vs functionality, as their scale was close to the centre.

4.4. Descriptive statistics of different participant demographics

In this section, the means of all the attributes ranked according to different levels of importance to different participant demographics are demonstrated. The general information, which will be statistically analysed and described in sections 4.6 and 4.7 is provided. Table 4.16 shows the differences when participants are divided by gender. The positive attributes are marked green and negative attributes are shown in red.

Table 4.16: Descriptive statistics of the perceptions of male and female participants regarding the attributes that influence user acceptance

Male		Female	
Functionality	3.82	Bugs	3.80
Bugs	3.68	Functionality	3.74
Slow App	3.68	Affects the rest of the phone	3.70
Affects the rest of the phone	3.66	Slow App	3.69
Unpredictable	3.62	Ease of use	3.67
Advertisements	3.58	Advertisements	3.66
Relevant	3.58	Portability/Mobility	3.61
Well-designed interface/layout	3.57	Affordable	3.60
Ease of use	3.56	Relevant	3.59
Portability/Mobility	3.56	Breach of security/privacy	3.59
Well-organised Information	3.56	True to its title/description	3.57
Breach of security/privacy	3.53	Well-organised Information	3.57
True to its title/description	3.52	Data Usage	3.57
Fluency of navigation	3.51	Simplistic	3.56
Clear descriptions	3.50	Well-designed interface/layout	3.56
Speed up tasks	3.49	Scaly Permissions	3.55
Poor design	3.47	Clear descriptions	3.53
Battery Consumption	3.46	Speed up tasks	3.52
Scaly Permissions	3.46	Unpredictable	3.51
Productivity	3.43	Realistic	3.51
Realistic	3.39	Limited Functionality	3.49
Data Usage	3.39	Comfort/Convenience	3.48
Simplistic	3.35	Productivity	3.47
Comfort/Convenience	3.31	Fluency of navigation	3.45
Explanations	3.31	Battery Consumption	3.44
Too many updates	3.30	In line with my Interests	3.43
In line with my Interests	3.26	Explanations	3.43
Affordable	3.24	Resource intensive	3.40
Goal-driven	3.21	Off-line Usability	3.38
Off-line Usability	3.20	Too many updates	3.34

Keeps me updated	3.18	Poor design	3.34
Resource intensive	3.17	Clear instructions, Obvious tutorials	3.24
Cross Platform	3.15	Remember use	3.23
Remember use	3.12	Keeps me updated	3.22
Clear instructions, Obvious tutorials	3.10	Goal-driven	3.20
Limited Functionality	3.09	In-app purchasing	3.19
Integration of Accounts	3.08	Exploration/Educational	3.16
Consistent	3.04	Comprehensive	3.13
Comprehensive	3.04	Cross Platform	3.13
Personalisation, Settings	3.01	Feedback	3.01
Innovative, Unique	3.00	Integration of Accounts	3.01
Aesthetically pleasing	3.00	Innovative, Unique	3.00
In line with target market	2.98	Personalisation, Settings	2.98
Constant Improvements	2.97	In line with target market	2.96
Feedback	2.96	Notifications	2.96
In-app purchasing	2.95	Consistent	2.96
Notifications	2.95	Learning curve	2.94
Exploration/Educational	2.93	Constant Improvements	2.94
Positive Ratings and Reviews	2.85	Aesthetically pleasing	2.89
Features	2.79	Not aligned with computer version	2.85
Not aligned with computer version	2.72	Features	2.84
Good looking icons	2.68	Social/Sharing	2.82
Learning curve	2.58	Entertainment	2.78
Entertainment	2.55	Positive Ratings and Reviews	2.72
Social/Sharing	2.45	Good looking icons	2.57
Popular	2.28	Popular	2.38
Unexpected surprises	2.27	Time Killer	2.27
Time Killer	2.08	Unexpected surprises	2.11

When looking at the comparisons in Table 4.16, it can be said that males and females feel the same about the top prioritised attributes. The first difference is unpredictability, which is a bigger problem for the men. The second difference that jumps out is data usage, which is a bigger problem for the women. Women placed a greater importance on simplicity. Men were more bothered by poorly designed apps. When looking at the least important attributes, some of the biggest differences occur on social and sharing capabilities, which are much more important to women, and time killer apps, which are even less important to men. All the differences will not be discussed, but Table 4.16 above provides detailed information.

Table 4.17: Descriptive statistics of the perceptions of different aged participants regarding the attributes that influence user acceptance

18 – 25		26 - 39		40 - 65	
Functionality	3.76	Functionality	3.73	Functionality	3.87
Bugs	3.69	Slow App	3.68	Bugs	3.85
Slow App	3.66	Breach of security/privacy	3.66	Unpredictable	3.80
True to its title/description	3.65	Affects the rest of the phone	3.66	Affects the rest of the phone	3.78
Well organized Information	3.59	Scaly Permissions	3.64	Ease of use	3.72
Affects the rest of the phone	3.57	Relevant	3.61	Advertisements	3.72
Well-designed interface/layout	3.56	Bugs	3.61	Poor design	3.71
Clear descriptions	3.55	Unpredictable	3.57	Slow App	3.70
Ease of use	3.55	Advertisements	3.55	Portability/Mobility	3.67
Advertisements	3.55	Portability/Mobility	3.55	Relevant	3.66
Portability/Mobility	3.53	Fluency of navigation	3.53	Clear descriptions	3.61
Speed up tasks	3.52	Ease of use	3.53	Well-organised Information	3.60

Relevant	3.50	Well-designed interface/layout	3.52	Well-designed interface/layout	3.59
Breach of security/privacy	3.48	Speed up tasks	3.50	True to its title/description	3.56
Fluency of navigation	3.47	Explanations	3.50	Realistic	3.55
Data Usage	3.47	Affordable	3.47	Breach of security/privacy	3.54
Productivity	3.45	Well-organised Information	3.47	Simplistic	3.53
Affordable	3.44	Battery Consumption	3.46	Battery Consumption	3.52
Scaly Permissions	3.43	Data Usage	3.45	Productivity	3.51
Comfort/Convenience	3.40	Off-line Usability	3.40	Speed up tasks	3.50
Simplistic	3.40	True to its title/description	3.39	Limited Functionality	3.49
Battery Consumption	3.39	Simplistic	3.38	Fluency of navigation	3.48
Realistic	3.38	Clear descriptions	3.34	Scaly Permissions	3.47
Off-line Usability	3.38	Realistic	3.34	Data Usage	3.46
Unpredictable	3.35	Productivity	3.32	Comfort/Convenience	3.45
Too many updates	3.34	Too many updates	3.32	Resource intensive	3.42
Explanations	3.31	In line with my Interests	3.30	In line with my Interests	3.41
In line with my Interests	3.26	Cross Platform	3.29	Keeps me updated	3.39
Poor design	3.23	Poor design	3.27	Explanations	3.30
Goal-driven	3.17	Comfort/Convenience	3.25	Goal Driven	3.29
Resource intensive	3.15	Remember use	3.23	Affordable	3.28
Aesthetically pleasing	3.10	Limited Functionality	3.21	Too many updates	3.28
Comprehensive	3.08	Resource intensive	3.20	Clear instructions, Obvious tutorials	3.23
Clear instructions, Obvious tutorials	3.08	Exploration/Educational	3.18	Cross Platform	3.20
Keeps me updated	3.07	Goal Driven	3.16	Remember use	3.20
Remember use	3.07	Clear instructions, Obvious tutorials	3.16	Learning curve	3.17
Features	3.02	Integration of Accounts	3.14	Notifications	3.16
Limited Functionality	3.02	Innovative, Unique	3.13	In-app purchasing	3.15
Innovative, Unique	3.01	Keeps me updated	3.13	Comprehensive	3.12
Cross Platform	2.97	In-app purchasing	3.13	Consistent	3.11
Personalisation, Settings	2.94	Feedback	3.11	Not aligned with computer version	3.11
Integration of Accounts	2.94	In line with target market	3.04	In line with target market	3.07
Consistent	2.92	Personalisation, Settings	3.02	Exploration/Educational	3.07
In App purchasing	2.91	Consistent	3.02	Integration of Accounts	3.07
Constant Improvements	2.90	Constant Improvements	3.00	Personalization, Settings	3.06
Entertainment	2.87	Comprehensive	2.96	Off-line Usability	3.06
Exploration/Educational	2.87	Notifications	2.93	Feedback	3.02
Positive Ratings and Reviews	2.86	Not aligned with computer version	2.89	Constant Improvements	3.00
Feedback	2.85	Aesthetically pleasing	2.84	Innovative, Unique	2.91
Good looking icons	2.85	Positive Ratings and Reviews	2.78	Aesthetically pleasing	2.85
In line with target market	2.84	Features	2.78	Positive Ratings and Reviews	2.74
Notifications	2.78	Entertainment	2.75	Features	2.58
Social/Sharing	2.62	Good looking icons	2.67	Social/Sharing	2.57
Popular	2.45	Social/Sharing	2.59	Good looking icons	2.37
Learning curve	2.40	Learning curve	2.59	Entertainment	2.30
Time Killer	2.35	Unexpected surprises	2.45	Popular	2.13
Not aligned with computer version	2.33	Popular	2.39	Unexpected surprises	2.04
Unexpected surprises	2.19	Time Killer	2.16	Time Killer	1.94

The comparisons for the different age groups in Table 4.17 show that the senior participants favoured ease of use and were more bothered by advertisements than the younger groups. The negative attributes seemed to be more of an irritation for the two older groups. The younger group of participants had a strong preference for apps that are true to their descriptions and also emphasised the importance of a well-designed and organised interface. When looking at the least important attributes, the younger participants did not worry about a learning curve as much, and were also not really bothered if the app was not the same as on the computer or had

regular notifications. Entertainment ranked very low with the senior participants compared to the others.

Table 4.18: Descriptive statistics of the perceptions of participants with different purchase histories regarding the attributes that influence user acceptance

Yes		No	
Functionality	3.84	Functionality	3.74
Bugs	3.80	Bugs	3.66
Slow App	3.75	Affects the rest of the phone	3.63
Affects the rest of the phone	3.71	Slow App	3.61
Advertisements	3.67	Ease of use	3.60
Well-designed interface/layout	3.63	True to its title/description	3.57
Relevant	3.63	Portability/Mobility	3.57
Unpredictable	3.61	Affordable	3.56
Ease of use	3.61	Well-organised Information	3.56
Portability/Mobility	3.59	Advertisements	3.56
Battery Consumption	3.59	Breach of security/privacy	3.54
Fluency of navigation	3.57	Scaly Permissions	3.54
Well-organised Information	3.57	Unpredictable	3.54
Breach of security/privacy	3.56	Relevant	3.54
Poor design	3.55	Clear descriptions	3.51
Clear descriptions	3.51	Speed up tasks	3.51
True to its title/description	3.51	Well-designed interface/layout	3.49
Productivity	3.50	Data Usage	3.49
Speed up tasks	3.50	Realistic	3.47
In line with my Interests	3.45	Simplistic	3.47
Scaly Permissions	3.45	Productivity	3.39
Data Usage	3.42	Fluency of navigation	3.39
Realistic	3.40	Off-line Usability	3.39
Simplistic	3.39	Comfort/Convenience	3.38
Explanations	3.39	Too many updates	3.37
Comfort/Convenience	3.37	Battery Consumption	3.32
Limited Functionality	3.31	Explanations	3.32
Too many updates	3.27	Poor design	3.29
Resource intensive	3.26	Resource intensive	3.26
Keeps me updated	3.26	Goal Driven	3.20
Remember use	3.24	In line with my Interests	3.20
Goal Driven	3.22	Limited Functionality	3.19
Affordable	3.20	Clear instructions, Obvious tutorials	3.16
Cross Platform	3.17	Keeps me updated	3.13
Off-line Usability	3.17	In-app purchasing	3.12
Clear instructions, Obvious tutorials	3.16	Cross Platform	3.11
Consistent	3.11	Remember use	3.08
Exploration/Educational	3.10	Comprehensive	3.08
Personalisation, Settings	3.10	Integration of Accounts	3.00
Integration of Accounts	3.10	Innovative, Unique	2.95
Aesthetically pleasing	3.10	Notifications	2.95
In line with target market	3.10	Exploration/Educational	2.94
Comprehensive	3.08	Feedback	2.93
Innovative, Unique	3.05	Consistent	2.90
Constant Improvements	3.04	Personalisation, Settings	2.89
Feedback	3.03	Constant Improvements	2.87
Not aligned with computer version	3.03	In line with target market	2.84
In App purchasing	2.97	Aesthetically pleasing	2.80
Notifications	2.96	Features	2.75
Positive Ratings and Reviews	2.93	Positive Ratings and Reviews	2.66
Features	2.86	Learning curve	2.66
Learning curve	2.79	Entertainment	2.65
Good looking icons	2.74	Social/Sharing	2.60
Entertainment	2.63	Good looking icons	2.53
Social/Sharing	2.59	Not aligned with computer version	2.50
Popular	2.36	Popular	2.28
Unexpected surprises	2.29	Time Killer	2.19
Time Killer	2.12	Unexpected surprises	2.13

The comparisons between participants who did and did not purchase apps and app content in Table 4.18 show advertisements as a bigger problem for the group that had made purchases. The group that had a purchase history also placed more importance on relevance and the design of apps. The group with no purchase history ranked affordability much higher. The negative attributes seemed to be more of a problem for participants who have performed purchases. When looking at the least important attributes, it can be seen that in-app purchasing was not a problem for participants who had already made purchases. The group who did not perform purchases ranked aesthetically pleasing as less important, but off-line usability was much more important to them.

Table 4.19: Descriptive statistics of the perceptions of participants who spend different lengths of time on their phones, regarding the attributes that influence user acceptance

0 < 2 hours		2 < 3 hours		3+ hours	
Functionality	3.84	Bugs	3.77	Functionality	3.82
Bugs	3.75	Functionality	3.71	Bugs	3.67
Affects the rest of the phone	3.72	Slow App	3.70	Slow App	3.67
Slow App	3.68	Advertisements	3.69	Affects the rest of the phone	3.63
Ease of use	3.67	Relevant	3.67	Ease of use	3.62
Well-designed interface/layout	3.67	Affects the rest of the phone	3.67	Speed up tasks	3.61
Breach of security/privacy	3.63	Breach of security/privacy	3.64	Well-organised Information	3.61
Unpredictable	3.62	Scaly Permissions	3.61	Portability/Mobility	3.59
Clear descriptions	3.60	Portability/Mobility	3.57	Advertisements	3.58
Relevant	3.59	Unpredictable	3.56	Productivity	3.56
Well-organised Information	3.59	Ease of use	3.52	Well-designed interface/layout	3.56
Advertisements	3.59	True to its title/description	3.51	Unpredictable	3.55
Portability/Mobility	3.58	Clear descriptions	3.50	True to its title/description	3.53
Fluency of navigation	3.58	Well-organised Information	3.49	Relevant	3.49
True to its title/description	3.57	Battery Consumption	3.49	Realistic	3.49
Scaly Permissions	3.56	Data Usage	3.48	Affordable	3.49
Simplistic	3.54	Well-designed interface/layout	3.44	Fluency of navigation	3.47
Speed up tasks	3.51	Poor design	3.44	Battery Consumption	3.45
Realistic	3.51	Affordable	3.43	Data Usage	3.45
Poor design	3.51	Fluency of navigation	3.40	Clear descriptions	3.43
Data Usage	3.45	Speed up tasks	3.39	Comfort/Convenience	3.41
Battery Consumption	3.44	In line with my Interests	3.39	Simplistic	3.41
Productivity	3.42	Comfort/Convenience	3.37	Breach of security/privacy	3.38
Too many updates	3.41	Too many updates	3.37	Explanations	3.37
Explanations	3.37	Productivity	3.36	Offline Usability	3.36
Comfort/Convenience	3.35	Simplistic	3.34	Scaly Permissions	3.32
In line with my Interests	3.33	Explanations	3.31	Keeps me updated	3.32
Clear instructions, Obvious tutorials	3.32	Goal-driven	3.30	Poor design	3.31
Resource intensive	3.29	Realistic	3.30	Resource intensive	3.28
Limited Functionality	3.27	Limited Functionality	3.29	In line with my Interests	3.26
Cross Platform	3.26	Keeps me updated	3.27	Remember use	3.22
Affordable	3.24	Off-line Usability	3.24	Limited Functionality	3.20
Off-line Usability	3.22	Resource intensive	3.21	Goal-driven	3.19
Remember use	3.21	Comprehensive	3.10	Too many updates	3.17
Goal-driven	3.15	Exploration/Educational	3.10	Constant Improvements	3.16
Consistent	3.11	Clear instructions, Obvious tutorials	3.09	Comprehensive	3.15
Keeps me updated	3.02	Cross Platform	3.06	Integration of Accounts	3.11
Integration of Accounts	3.02	Remember use	3.04	In-app purchasing	3.11
In-app purchasing	3.02	Integration of Accounts	3.03	Cross Platform	3.08
Exploration/Educational	3.01	Innovative, Unique	3.01	Personalisation, Settings	3.07
Comprehensive	3.00	Consistent	3.00	Feedback	3.07
Personalisation, Settings	3.00	Aesthetically pleasing	3.00	Clear instructions, Obvious tutorials	3.05
Notifications	2.96	In-app purchasing	3.00	In line with target market	3.04

Innovative, Unique	2.95	Feedback	2.96	Innovative, Unique	3.04
In line with target market	2.94	In line with target market	2.93	Notifications	3.04
Feedback	2.91	Personalisation, Settings	2.93	Aesthetically pleasing	2.99
Aesthetically pleasing	2.89	Features	2.91	Exploration/Educational	2.96
Learning curve	2.84	Constant Improvements	2.90	Features	2.96
Constant Improvements	2.83	Positive Ratings and Reviews	2.89	Consistent	2.91
Positive Ratings and Reviews	2.77	Not aligned with computer version	2.86	Social/Sharing	2.89
Not aligned with computer version	2.67	Notifications	2.84	Entertainment	2.86
Features	2.58	Entertainment	2.83	Not aligned with computer version	2.80
Good looking icons	2.49	Good looking icons	2.76	Positive Ratings and Reviews	2.75
Social/Sharing	2.30	Learning curve	2.70	Good looking icons	2.68
Entertainment	2.27	Social/Sharing	2.61	Learning curve	2.63
Unexpected surprises	2.19	Popular	2.46	Time Killer	2.48
Popular	2.14	Time Killer	2.27	Popular	2.38
Time Killer	1.75	Unexpected surprises	2.06	Unexpected surprises	2.37

The comparisons in Table 4.19 of participants who were regular and less-regular smartphone users showed that the middle group (2<3 hours) was slightly more bothered by advertisements, and relevance was slightly more important to them. The regular users (3+ hours) had a much more prominent preference for apps that speed up tasks for them, as well as apps that focused on productivity. Less frequent users (0<2 hours) favoured clear descriptions within apps. When looking at the least important attributes, it can be seen that a learning curve was a bigger problem for the less-frequent user than the users who used their smartphones frequently. Features were much less important to the less-frequent users.

Table 4.20: Descriptive statistics of the perceptions of participants from different occupations regarding the attributes that influence user acceptance

University		Industry	
Functionality	3.77	Functionality	3.80
Bugs	3.71	Bugs	3.74
Advertisements	3.63	Affects the rest of the phone	3.72
Slow App	3.62	Slow App	3.72
Well-organised Information	3.59	Unpredictable	3.70
Affects the rest of the phone	3.59	Ease of use	3.64
True to its title/description	3.57	Advertisements	3.62
Ease of use	3.54	Relevant	3.61
Data Usage	3.54	Portability/Mobility	3.60
Portability/Mobility	3.53	Well-designed interface/layout	3.59
Relevant	3.52	Breach of security/privacy	3.57
Well-designed interface/layout	3.51	Well-organised Information	3.55
Breach of security/privacy	3.51	Poor design	3.55
Affordable	3.50	Clear descriptions	3.52
Clear descriptions	3.48	Speed up tasks	3.52
Fluency of navigation	3.46	True to its title/description	3.51
Speed up tasks	3.45	Scaly Permissions	3.51
Scaly Permissions	3.45	Fluency of navigation	3.49
Battery Consumption	3.40	Productivity	3.48
Realistic	3.39	Battery Consumption	3.48
Too many updates	3.39	Realistic	3.46
Off-line Usability	3.38	Simplistic	3.45
Comfort/Convenience	3.38	Data Usage	3.40
Simplistic	3.38	Limited Functionality	3.39
Productivity	3.37	Comfort/Convenience	3.36
Unpredictable	3.35	Explanations	3.35
Explanations	3.34	In line with my Interests	3.32

In line with my Interests	3.33	Resource intensive	3.30
Goal-driven	3.26	Affordable	3.30
Poor design	3.21	Too many updates	3.28
Resource intensive	3.16	Cross Platform	3.24
Keeps me updated	3.12	Keeps me updated	3.23
Remember use	3.05	Remember use	3.21
Clear instructions, Obvious tutorials	3.05	Clear instructions, Obvious tutorials	3.21
Limited Functionality	3.05	Off-line Usability	3.20
Innovative, Unique	3.01	Goal-driven	3.16
Personalisation, Settings	3.00	Comprehensive	3.11
Comprehensive	2.99	Integration of Accounts	3.11
Consistent	2.96	In-app purchasing	3.11
In-app purchasing	2.95	Exploration/Educational	3.07
Integration of Accounts	2.93	Feedback	3.06
Cross Platform	2.93	Notifications	3.05
Aesthetically pleasing	2.93	Consistent	3.03
Exploration/Educational	2.93	In line with target market	3.01
Features	2.91	Personalisation, Settings	2.99
Positive Ratings and Reviews	2.91	Constant Improvements	2.99
In line with target market	2.88	Innovative, Unique	2.98
Constant Improvements	2.87	Aesthetically pleasing	2.96
Entertainment	2.87	Not aligned with computer version	2.96
Feedback	2.86	Learning curve	2.90
Notifications	2.78	Features	2.73
Good-looking icons	2.77	Positive Ratings and Reviews	2.71
Social/Sharing	2.61	Social/Sharing	2.57
Popular	2.52	Good-looking icons	2.56
Not aligned with computer version	2.46	Entertainment	2.48
Learning curve	2.45	Unexpected surprises	2.19
Time Killer	2.27	Popular	2.18
Unexpected surprises	2.22	Time Killer	2.05

The comparisons between participants from the industry and participants from the university in Table 4.20 showed that the industry is much more bothered by unpredictable apps. They also placed more importance on cross-platform compatibility. Data usage was ranked much lower within the industry than within the university, with students having a serious problem with it. Affordability and off-line usability is shown as more important to participants from the university. When looking at the least important attributes, it can be seen that a learning curve was not a problem for participants from the university. Popularity and positive ratings were much less important to participants from the industry.

Table 4.21: Descriptive statistics of the perceptions of participants with Android and iPhone smartphones regarding the attributes that influence user acceptance

Android		iPhone	
Functionality	3.79	Functionality	3.80
Bugs	3.75	Advertisements	3.73
Slow App	3.68	Bugs	3.70
Affects the rest of the phone	3.67	Ease of use	3.66
Relevant	3.60	Slow App	3.66
True to its title/description	3.59	Affects the rest of the phone	3.66
Portability/Mobility	3.58	Well-designed interface/layout	3.63
Ease of use	3.58	Well-organised Information	3.61
Unpredictable	3.58	Poor design	3.61
Advertisements	3.56	Battery Consumption	3.59
Well-organised Information	3.55	Unpredictable	3.59
Breach of security/privacy	3.54	Portability/Mobility	3.57
Well-designed interface/layout	3.54	Relevant	3.54

Scaly Permissions	3.53	Simplistic	3.54
Clear descriptions	3.53	Fluency of navigation	3.52
Data Usage	3.50	Breach of security/privacy	3.52
Speed up tasks	3.50	Speed up tasks	3.51
Realistic	3.48	Productivity	3.49
Fluency of navigation	3.47	Clear descriptions	3.49
Affordable	3.44	Comfort/Convenience	3.44
Productivity	3.42	Data Usage	3.43
Explanations	3.40	In line with my Interests	3.42
Simplistic	3.39	True to its title/description	3.41
Battery Consumption	3.39	Scaly Permissions	3.40
Comfort/Convenience	3.36	Keeps me updated	3.35
Too many updates	3.34	Realistic	3.35
Poor design	3.33	Limited Functionality	3.30
Off-line Usability	3.32	Cross Platform	3.28
In line with my Interests	3.28	Too many updates	3.27
Resource intensive	3.27	Explanations	3.25
Goal-driven	3.22	Consistent	3.25
Limited Functionality	3.21	Resource intensive	3.24
Remember use	3.19	Affordable	3.21
Clear instructions, Obvious tutorials	3.15	Integration of Accounts	3.17
Keeps me updated	3.12	Clear instructions, Obvious tutorials	3.17
Cross Platform	3.08	Comprehensive	3.15
Innovative, Unique	3.06	Goal-driven	3.14
In-app purchasing	3.05	Off-line Usability	3.13
Comprehensive	3.03	Remember use	3.13
Exploration/Educational	3.01	In line with target market	3.10
Integration of Accounts	3.01	Not aligned with computer version	3.10
Feedback	2.99	Constant Improvements	3.09
Personalisation, Settings	2.97	Exploration/Educational	3.06
Aesthetically pleasing	2.95	Personalisation, Settings	3.06
Notifications	2.93	Learning curve	3.03
Consistent	2.91	Aesthetically pleasing	3.01
In line with target market	2.91	Feedback	3.00
Constant Improvements	2.90	Notifications	3.00
Positive Ratings and Reviews	2.80	In-app purchasing	3.00
Features	2.78	Innovative, Unique	2.87
Entertainment	2.73	Features	2.87
Not aligned with computer version	2.64	Positive Ratings and Reviews	2.82
Learning curve	2.59	Good-looking icons	2.76
Social/Sharing	2.57	Social/Sharing	2.59
Good-looking icons	2.57	Entertainment	2.49
Popular	2.30	Popular	2.39
Unexpected surprises	2.24	Unexpected surprises	2.23
Time Killer	2.22	Time Killer	2.01

When looking at the comparison between users of Android and iPhone smartphones in Table 4.21, it can be said that iPhone users are much more bothered by advertisements and poorly-designed apps. They placed more importance on a well-designed interface or layouts. Android users placed great importance on apps having to be true to their title or descriptions and affordability. When looking at the least important attributes, Android users placed more importance on entertainment, and did not have such a big problem with a learning curve. iPhone users did not place as much importance on innovative and unique apps.

The following section demonstrates the factor analysis that was performed to group similar types of attribute into more manageable groups.

4.5. Factor analysis: Reliability and validity

An exploratory factor analysis was performed on all the attributes influencing the user acceptance to reduce the large number of different attributes to constructs. There was a total of 58 attributes, reduced to 11 factors. The exploratory factor analysis is a data-reduction method, which could explain a variation of 67.82%. To determine whether a factor analysis may be appropriate, Kaiser's measure of sample adequacy (MSA), which gives an indication of the intercorrelations among variables, should be computed (Tabachnick & Fidell, 2001). The overall MSA was 0.76, which can be considered as appropriate when above 0.6, according to Hair *et al.* (1998). The results of the factor analysis are shown in Table 4.22 below.

Table 4.22: Factor analysis results and Cronbach alpha values

	Factor analysis	Factor loading scores	Group Name	Cronbach Alphas
q48	Good-looking icons	0.84983		
q47	Aesthetically pleasing	0.73148		
q49	Features	0.60833	**Appearance**	0.74
q22	Constant improvements	0.30674		
q44	Well-organised information	0.7713		
q45	Well-designed interface/layout	0.6682		
q43	Simplistic	0.66427	**Ease of use**	0.73
q42	Ease of use	0.62061		
q28	Realistic	0.42902		
q46	Consistent	0.33078		
q24	Time killer	0.79905		
q23	Entertainment	0.78782	**Fun**	0.69
q25	Social/Sharing	0.49742		
q50	Unexpected surprises	0.39639		
q59	Slow app	0.78605		
q60	Bugs	0.6705	**Problem causing**	0.77
q64	Affects the rest of the phone	0.45427		
q58	Poor design	0.35785		
q65	Unpredictable	0.31313		
q61	Battery consumption	0.72311		
q62	Data usage	0.69611	**Resource usage**	0.7
q63	Resource intensive	0.6885		
q37	Cross platform	0.77301		

q36	Integration of accounts	0.73687	**Platform Consistency**	0.63
q66	Not aligned with computer version	0.3818		
q19	True to its title/description	0.80498	**Clarity**	0.76
q20	Clear descriptions	0.7897		
q68	In-app purchasing	0.7473		
q67	Limited functionality	0.71038	**Costs**	0.63
q35	Affordable	0.4765		
q55	Scaly permissions	0.81758		
q54	Breach of security/privacy	0.78107	**Security**	0.73
q30	Exploration/Educational	0.68404		
q11	Keeps me updated	0.51887	**User-centred**	0.62
q31	Personalisation, Settings	0.49264		
q32	Innovative, Unique	0.32127		
q38	Remember use	0.64975		
q39	Fluency of navigation	0.60851		
q21	Functionality	0.46356	**User-friendly**	0.66
q17	Relevant	0.35087		
q40	Clear instructions, Obvious tutorials	0.30094		

A reliability analysis was performed on the identified factors. The attributes with a Cronbach alpha value higher than 0.6 were considered to match, and were subsequently grouped together. The new attribute groups that were used for further tests and analysis are thus as shown in Table 4.23:

Table 4.23: New attribute groups

Constructs	Means	Std. deviation
Problem causing	3.6168135	0.4656462
Clarity	3.5264317	0.6443815
Security	3.5198238	0.660721
User-friendly	3.4376652	0.4487961
Ease of use	3.4349486	0.4538726
Resource usage	3.3950073	0.6225163
Costs	3.2232012	0.6906527
User-centred	3.0550661	0.5616186
Platform consistency	2.9904552	0.7578056
Appearance	2.845815	0.6978974

Fun	2.400514	0.6933158

The remaining attributes that did not find strong enough correlations to be grouped are shown below in Table 4.24. They will be use separately along with the groups in future calculations.

Table 4.24: Attributes with low grouping values

Attributes with grouping values under 0.6	
q13	Productivity
q14	Speed up tasks
q33	Off-line usability
q12	Comprehensive
q10	Comfort/Convenience
q15	Portability/Mobility
q57	Learning curve
q27	Popular
q26	Positive ratings and reviews
q53	Too many updates
q52	Notifications
q56	Advertisements
q18	In line with target market
q16	Goal-driven
q29	In line with my interests
q41	Feedback
q34	Explanations

In the following section, tables comparing attribute differences statistically using effect sizes are provided.

4.6. Effect sizes on user groups

The previous descriptive statistics (4.4) on the means provided some indication about different user preferences at a glance. In this section, a statistical approach to indicate the differences in a scientifically meaningful way will be followed. To examine the different effect sizes, the p-value and d-values will be considered. A p-value smaller than 0.05, in the case of this study is considered as sufficient evidence that the result is statistically significant.

Cohen (1988:20-25) gives the following guidelines for the interpretation of the effect size in the current case: small effect: (*) d=0.2, medium effect: (**) d=0.5 and large effect: (***) d=0.8.

When examining the demographical data from the participants involved with the questionnaire, the response data can be divided into groups based on the following types:

- Gender (Male, Female)
- Daily time spent on phone (Seldom users, Average users, Regular users)
- Smartphone type (Android, iPhone)
- Occupation (Industry, University)
- Age group (18-25, 26-39, 40-65)
- In-app purchase history (Yes, No)

Gender (Male, Female)

Starting out with observed differences between males and females in Table 4.25, no significant differences could be found. For interest's sake, there were two differences (underlined), which had a small to medium effect size. Women placed greater importance on low costs than men, and the men were not bothered as much by applications that have a steeper learning curve.

Table 4.25: Descriptive statistics and effect sizes on the subtests of positive and negative attributes for differences in gender

Construct	Gender	n	Mean	Std. Dev	Pr > |t|	d-value
Appearance	Male	137	2.86	0.69	0.7423	-0.04
	Female	90	2.83	0.71		
Ease of use	Male	137	3.41	0.45	0.3363	0.13
	Female	90	3.47	0.45		
Fun	Male	137	2.34	0.71	0.0747	0.23
	Female	90	2.5	0.65		
Problem causing	Male	137	3.62	0.45	0.8386	-0.03
	Female	90	3.61	0.49		
Resource usage	Male	137	3.34	0.6	0.1111	0.21
	Female	90	3.48	0.65		
Platform consistency	Male	137	2.98	0.75	0.8556	0.02
	Female	90	3	0.77		
Clarity	Male	137	3.51	0.71	0.6375	0.06
	Female	90	3.55	0.54		
Costs	Male	137	3.09	0.74	0.0002	0.44*
	Female	90	3.42	0.56		
Security	Male	137	3.49	0.7	0.4332	0.1
	Female	90	3.56	0.6		
User-centred	Male	137	3.03	0.54	0.4633	0.09
	Female	90	3.09	0.6		
User-friendly	Male	137	3.43	0.45	0.6714	0.06
	Female	90	3.45	0.45		
Comfort/ Convenience	Male	137	3.31	0.72	0.0904	0.23
	Female	90	3.48	0.75		
Portability/ Mobility	Male	137	3.56	0.66	0.5573	0.08
	Female	90	3.61	0.65		
Productivity	Male	137	3.43	0.64	0.7106	0.05
	Female	90	3.47	0.66		
Speed up tasks	Male	137	3.49	0.57	0.6734	0.06
	Female	90	3.52	0.58		
Comprehensive	Male	137	3.04	0.93	0.4512	0.1
	Female	90	3.13	0.86		
Off-line usability	Male	137	3.2	0.85	0.1326	0.2

	Female	90	3.38	0.87		
Positive Ratings and Reviews	Male Female	137 90	2.85 2.72	0.87 1.01	0.3284	-0.13
Popular	Male Female	137 90	2.28 2.38	0.95 0.97	0.4409	0.1
Notifications	Male Female	137 90	2.95 2.96	0.99 0.96	0.9576	0.01
Too many updates	Male Female	137 90	3.3 3.34	0.84 0.88	0.7002	0.05
In line with target market	Male Female	137 90	2.98 2.96	0.81 0.9	0.8477	-0.03
Goal-driven	Male Female	137 90	3.21 3.2	0.81 0.81	0.9321	-0.01
In line with my Interests	Male Female	137 90	3.26 3.43	0.82 0.78	0.1016	0.22
Explanations	Male Female	137 90	3.31 3.43	0.79 0.74	0.2452	0.15
Feedback	Male Female	137 90	2.96 3.01	0.83 0.96	0.6566	0.06
Learning curve	Male Female	137 90	2.58 2.94	1 0.95	0.0068	0.36*
Advertisements	Male Female	137 90	3.58 3.66	0.69 0.67	0.3954	0.11

Daily time spent on phone (0 < 2 hours, 2 < 3 hours, 3+ hours)

Some significant differences could be found between seldom (0 < 2 hours), average (2-3 hours) and regular (3+ hours) phone users in Table 4.26. The first attribute is Fun, which was more important as groups spent more time on their phones. Security threats was a bigger problem for participants who spent less time on their phones.

Table 4.26: Descriptive statistics and effect sizes on the subtests of positive and negative attributes for differences between users' time spent on phone each day

Construct	Time Group	n	Mean	Std. Dev	Pr > |t|	d-value		
						0 < 2 hours	2 < 3 hours	3+ hours
Appearance	0 < 2 hours	81	2.7	0.7			0.28	0.35
	2 < 3 hours	70	2.91	0.74	0.0616	0.28		0.05
	3+ hours	76	2.94	0.64		0.35	0.05	
Ease of use	0 < 2 hours	81	3.51	0.44			-0.34	-0.18
	2 < 3 hours	70	3.35	0.48	0.0908	-0.34		0.17
	3+ hours	76	3.43	0.43		-0.18	0.17	
Fun	0 < 2 hours	81	2.13	0.64			0.48*	0.77**
	2 < 3 hours	70	2.44	0.65	<.0001	0.48*		0.31*
	3+ hours	76	2.65	0.69		0.77**	0.31*	
Problem causing	0 < 2 hours	81	3.65	0.46			-0.05	-0.19
	2 < 3 hours	70	3.63	0.49	0.4901	-0.05		-0.13
	3+ hours	76	3.57	0.45		-0.19	-0.13	
Resource usage	0 < 2 hours	81	3.4	0.65			-0.01	-0.01
	2 < 3 hours	70	3.4	0.69	0.9961	-0.01		-0.01
	3+ hours	76	3.39	0.52		-0.01	-0.01	
Platform Consistency	0 < 2 hours	81	2.99	0.77			-0.01	0.02
	2 < 3 hours	70	2.98	0.75	0.9851	-0.01		0.03
	3+ hours	76	3	0.77		0.02	0.03	
Clarity	0 < 2 hours	81	3.59	0.56			-0.12	-0.15
	2 < 3 hours	70	3.51	0.69	0.5634	-0.12		-0.04

	3+ hours	76	3.48	0.69		-0.15	-0.04	
Costs	0 < 2 hours	81	3.17	0.75			0.09	0.12
	2 < 3 hours	70	3.24	0.62	0.7003	0.09		0.04
	3+ hours	76	3.26	0.69		0.12	0.04	
Security	0 < 2 hours	81	3.59	0.69			0.05	-0.37*
	2 < 3 hours	70	3.63	0.6	0.0145	0.05		-0.43*
	3+ hours	76	3.34	0.66		-0.37*	-0.43*	
User-centred	0 < 2 hours	81	3	0.56			0.14	0.16
	2 < 3 hours	70	3.08	0.52	0.5159	0.14		0.03
	3+ hours	76	3.09	0.61		0.16	0.03	
User-friendly	0 < 2 hours	81	3.51	0.47			-0.27	-0.21
	2 < 3 hours	70	3.38	0.46	0.1781	-0.27		0.06
	3+ hours	76	3.41	0.41		-0.21	0.06	
Comfort/ Convenience	0 < 2 hours	81	3.35	0.79			0.03	0.08
	2 < 3 hours	70	3.37	0.71	0.8703	0.03		0.05
	3+ hours	76	3.41	0.72		0.08	0.05	
Portability/ Mobility	0 < 2 hours	81	3.58	0.63			-0.02	0.02
	2 < 3 hours	70	3.57	0.63	0.9704	-0.02		0.04
	3+ hours	76	3.59	0.72		0.02	0.04	
Productivity	0 < 2 hours	81	3.42	0.69			-0.09	0.2
	2 < 3 hours	70	3.36	0.61	0.1501	-0.09		0.33
	3+ hours	76	3.56	0.62		0.2	0.33	
Speed up tasks	0 < 2 hours	81	3.51	0.59			-0.2	0.17
	2 < 3 hours	70	3.39	0.6	0.0695	-0.2		0.37
	3+ hours	76	3.61	0.52		0.17	0.37	
Comprehensive	0 < 2 hours	81	3	0.89			0.11	0.16
	2 < 3 hours	70	3.1	0.89	0.5836	0.11		0.05
	3+ hours	76	3.15	0.93		0.16	0.05	
Off-line usability	0 < 2 hours	81	3.22	0.91			0.02	0.15
	2 < 3 hours	70	3.24	0.91	0.57	0.02		0.13
	3+ hours	76	3.36	0.76		0.15	0.13	
Positive Ratings and Reviews	0 < 2 hours	81	2.77	0.87			0.13	-0.02
	2 < 3 hours	70	2.89	0.91	0.6209	0.13		-0.14
	3+ hours	76	2.75	1.00		-0.02	-0.14	
Popular	0 < 2 hours	81	2.14	0.89			0.33	0.25
	2 < 3 hours	70	2.46	0.99	0.0906	0.33		-0.08
	3+ hours	76	2.38	0.97		0.25	-0.08	
Notifications	0 < 2 hours	81	2.96	1.07			-0.11	0.07
	2 < 3 hours	70	2.84	0.96	0.4699	-0.11		0.21
	3+ hours	76	3.04	0.89		0.07	0.21	
Too many updates	0 < 2 hours	81	3.41	0.85			-0.04	-0.27
	2 < 3 hours	70	3.37	0.84	0.1827	-0.04		-0.23
	3+ hours	76	3.17	0.87		-0.27	-0.23	
In line with target market	0 < 2 hours	81	2.94	0.86			-0.01	0.12
	2 < 3 hours	70	2.93	0.86	0.6726	-0.01		0.13
	3+ hours	76	3.04	0.82		0.12	0.13	
Goal-driven	0 < 2 hours	81	3.15	0.84			0.18	0.05
	2 < 3 hours	70	3.3	0.75	0.4983	0.18		-0.14
	3+ hours	76	3.19	0.83		0.05	-0.14	
In line with my Interests	0 < 2 hours	81	3.33	0.83			0.06	-0.09
	2 < 3 hours	70	3.39	0.79	0.6567	0.06		-0.15
	3+ hours	76	3.26	0.83		-0.09	-0.15	
Explanations	0 < 2 hours	81	3.37	0.73			-0.06	0
	2 < 3 hours	70	3.31	0.89	0.8749	-0.06		0.07
	3+ hours	76	3.37	0.69		0	0.07	
Feedback	0 < 2 hours	81	2.91	0.88			0.05	0.18
	2 < 3 hours	70	2.96	0.94	0.5405	0.05		0.12
	3+ hours	76	3.07	0.84		0.18	0.12	
Learning curve	0 < 2 hours	81	2.84	1.02			-0.14	-0.2

	2 < 3 hours	70	2.7	1.01	0.4101	-0.14		-0.07
	3+ hours	76	2.63	0.95		-0.2	-0.07	
Advertisements	0 < 2 hours	81	3.59	0.76			0.13	-0.01
	2 < 3 hours	70	3.69	0.63	0.583	0.13		-0.16
	3+ hours	76	3.58	0.66		-0.01	-0.16	

Age Groups (18-25, 26-39, 40-65)

There were some significant differences found between young users (18-25), adult users (26-39) and older users (40-65) as shown in Table 4.27. Again, the first attribute is Fun, which was more important to younger and adult users than older users. Apps causing problems with phones were a bigger problem for older users. Platform consistency was less important to younger users. A learning curve was a bigger problem as the users age increased.

Table 4.27: Descriptive statistics and effect sizes on the subtests of positive and negative attributes for differences between users' age groups

Construct	Age Group	n	Mean	Std. Dev	Pr > |t|	d-value 18-25	d-value 26-39	d-value 40-65
Appearance	18-25	86	2.97	0.59			-0.2	-0.32
	26-39	56	2.83	0.68	0.0603	-0.2		-0.15
	40-65	82	2.71	0.79		-0.32	-0.15	
Ease of use	18-25	86	3.4	0.42			-0.05	0.25
	26-39	56	3.38	0.49	0.1351	-0.05		0.29
	40-65	82	3.52	0.46		0.25	0.29	
Fun	18-25	86	2.51	0.67			-0.02	-0.42*
	26-39	56	2.5	0.68	0.01	-0.02		-0.41*
	40-65	82	2.21	0.69		-0.42*	-0.41*	
Problem causing	18-25	86	3.5	0.48			0.11	0.55**
	26-39	56	3.56	0.54	0.0005	0.11		0.39*
	40-65	82	3.77	0.35		0.55**	0.39*	
Resource usage	18-25	86	3.34	0.52			0.06	0.19
	26-39	56	3.38	0.67	0.3646	0.06		0.14
	40-65	82	3.47	0.69		0.19	0.14	
Platform Consistency	18-25	86	2.75	0.71			0.5	0.49*
	26-39	56	3.11	0.72	0.0014	0.5		0.02
	40-65	82	3.13	0.77		0.49*	0.02	
Clarity	18-25	86	3.6	0.51			-0.3	-0.02
	26-39	56	3.37	0.78	0.0711	-0.3		0.28
	40-65	82	3.59	0.64		-0.02	0.28	
Costs	18-25	86	3.12	0.67			0.19	0.27
	26-39	56	3.26	0.74	0.2141	0.19		0.06
	40-65	82	3.3	0.68		0.27	0.06	
Security	18-25	86	3.45	0.59			0.34	0.05
	26-39	56	3.65	0.56	0.2019	0.34		-0.2
	40-65	82	3.49	0.79		0.05	-0.2	
User-centred	18-25	86	2.97	0.47			0.21	0.23
	26-39	56	3.11	0.64	0.2113	0.21		0
	40-65	82	3.11	0.59		0.23	0	
User-friendly	18-25	86	3.37	0.44			0.17	0.25
	26-39	56	3.45	0.46	0.2397	0.17		0.08
	40-65	82	3.49	0.46		0.25	0.08	
Comfort/ Convenience	18-25	86	3.4	0.76			-0.18	0.07
	26-39	56	3.25	0.81	0.286	-0.18		0.25

	40-65	82	3.45	0.67		0.07	0.25	
Portability/ Mobility	18-25	86	3.53	0.7			0.01	0.19
	26-39	56	3.55	0.74	0.3536	0.01		0.17
	40-65	82	3.67	0.55		0.19	0.17	
Productivity	18-25	86	3.45	0.61			-0.18	0.09
	26-39	56	3.32	0.74	0.2519	-0.18		0.25
	40-65	82	3.51	0.61		0.09	0.25	
Speed up tasks	18-25	86	3.52	0.55			-0.04	-0.04
	26-39	56	3.5	0.63	0.9581	-0.04		0
	40-65	82	3.5	0.57		-0.04	0	
Comprehensive	18-25	86	3.08	0.82			-0.12	0.04
	26-39	56	2.96	1.01	0.591	-0.12		0.16
	40-65	82	3.12	0.91		0.04	0.16	
Off-line usability	18-25	86	3.38	0.81			0.02	-0.34
	26-39	56	3.4	0.76	0.0225	0.02		-0.36
	40-65	82	3.06	0.95		-0.34	-0.36	
Positive Ratings and Reviews	18-25	86	2.86	0.83			-0.07	-0.12
	26-39	56	2.78	1.07	0.7127	-0.07		-0.04
	40-65	82	2.74	0.94		-0.12	-0.04	
Popular	18-25	86	2.45	0.92			-0.06	-0.35
	26-39	56	2.39	1.06	0.0766	-0.06		-0.24
	40-65	82	2.13	0.9		-0.35	-0.24	
Notifications	18-25	86	2.78	0.96			0.16	0.37
	26-39	56	2.93	0.91	0.5533	0.16		0.23
	40-65	82	3.16	1.02		0.37	0.23	
Too many updates	18-25	86	3.34	0.79			-0.02	-0.06
	26-39	56	3.32	0.83	0.9094	-0.02		-0.04
	40-65	82	3.28	0.95		-0.06	-0.04	
In line with target market	18-25	86	2.84	0.84			0.24	0.27
	26-39	56	3.04	0.79	0.16	0.24		0.04
	40-65	82	3.07	0.89		0.27	0.04	
Goal-driven	18-25	86	3.17	0.77			-0.01	0.14
	26-39	56	3.16	0.83	0.5533	-0.01		0.15
	40-65	82	3.29	0.84		0.14	0.15	
In line with my Interests	18-25	86	3.26	0.77			0.05	0.2
	26-39	56	3.3	0.89	0.4329	0.05		0.12
	40-65	82	3.41	0.78		0.2	0.12	
Explanations	18-25	86	3.31	0.76			0.25	-0.02
	26-39	56	3.5	0.71	0.2639	0.25		-0.25
	40-65	82	3.3	0.83		-0.02	-0.25	
Feedback	18-25	86	2.85	0.93			0.28	0.19
	26-39	56	3.11	0.81	0.1957	0.28		-0.1
	40-65	82	3.02	0.88		0.19	-0.1	
Learning curve	18-25	86	2.4	0.95			0.2	0.82**
	26-39	56	2.59	0.99	<0.0001	0.2		0.59**
	40-65	82	3.17	0.89		0.82**	0.59**	
Advertisements	18-25	86	3.55	0.7			0.01	0.24
	26-39	56	3.55	0.78	0.2201	0.01		0.21
	40-65	82	3.72	0.6		0.24	0.21	

In-app purchase history (Yes, No)

There were many differences between users who had a purchase history and users who did not have a purchase history, as shown in Table 4.28. The first attribute is Appearance, which was more important to users who had a purchase history. Apps causing problems was also a bigger problem for these users. Platform consistency was also more important to the users who had a

purchase history, and they also preferred apps that are more user-centred and have more positive ratings and reviews. Users that did not have a purchase history did not place as much importance on apps being in line with their interests and a target market.

Table 4.28: Descriptive statistics and effect sizes on the subtests of positive and negative attributes for differences between users' purchase history

Construct	Purchased	n	Mean	Std. Dev	Pr > |t|	d-value
Appearance	Y	115	2.94	0.69	0.0311	-0.29*
	N	112	2.74	0.69		
Ease of use	Y	115	3.45	0.44	0.5701	0.07
	N	112	3.42	0.47		
Fun	Y	115	2.41	0.71	0.8326	-0.03
	N	112	2.39	0.68		
Problem causing	Y	115	3.69	0.42	0.0243	-0.28*
	N	112	3.55	0.5		
Resource usage	Y	115	3.43	0.61	0.367	-0.12
	N	112	3.36	0.63		
Platform Consistency	Y	115	3.1	0.76	0.0214	-0.31*
	N	112	2.87	0.74		
Clarity	Y	115	3.51	0.64	0.6753	0.06
	N	112	3.54	0.65		
Costs	Y	115	3.16	0.7	0.159	0.19
	N	112	3.29	0.68		
Security	Y	115	3.5	0.72	0.5776	0.07
	N	112	3.54	0.6		
User-centred	Y	115	3.13	0.54	0.0383	-0.27*
	N	112	2.98	0.57		
User-friendly	Y	115	3.49	0.43	0.0826	-0.22
	N	112	3.39	0.46		
Comfort/ Convenience	Y	115	3.37	0.69	0.9912	0
	N	112	3.38	0.78		
Portability/ Mobility	Y	115	3.59	0.63	0.7866	-0.03
	N	112	3.57	0.68		
Productivity	Y	115	3.5	0.58	0.2132	-0.15
	N	112	3.39	0.7		
Speed up tasks	Y	115	3.5	0.57	0.8624	0.02
	N	112	3.51	0.59		
Comprehensive	Y	115	3.08	0.91	0.9906	0
	N	112	3.08	0.89		
Off-line usability	Y	115	3.17	0.87	0.0524	0.21
	N	112	3.39	0.84		
Positive Ratings and Reviews	Y	115	2.93	0.85	0.0285	-0.27*
	N	112	2.66	0.98		
Popular	Y	115	2.36	0.97	0.5296	-0.08
	N	112	2.28	0.94		
Notifications	Y	115	2.96	0.93	0.9406	-0.01
	N	112	2.95	1.03		
Too many updates	Y	115	3.27	0.87	0.3963	0.11
	N	112	3.37	0.84		
In line with target market	Y	115	3.1	0.76	0.0217	-0.28*
	N	112	2.84	0.91		
Goal-driven	Y	115	3.22	0.81	0.8589	-0.02
	N	112	3.2	0.81		
In line with my Interests	Y	115	3.45	0.73	0.0169	-0.29*
	N	112	3.2	0.87		
Explanations	Y	115	3.39	0.76	0.46	-0.1

	N	112	3.32	0.79		
Feedback	Y	115	3.03	0.81	0.4068	-0.1
	N	112	2.93	0.96		
Learning curve	Y	115	2.79	0.97	0.3232	-0.13
	N	112	2.66	1.02		
Advertisements	Y	115	3.67	0.65	0.2538	-0.14
	N	112	3.56	0.72		

Occupation (Industry, University)

The differences between participants from the industry and university, shown in Table 4.29, are as follows: The first attribute is problem causing, which was a bigger problem for participants from the industry. Platform consistency was also more important to this group. Popular apps were more important for participants from the university. Too many notifications and apps with a learning curve were bigger issues for participants from the industry.

Table 4.29: Descriptive statistics and effect sizes on the subtests of positive and negative attributes for differences between users' occupations

Construct	Occupation	n	Mean	Std. Dev	Pr > |t|	d-value
Appearance	University	82	2.87	0.59	0.6175	-0.06
	Industry	142	2.82	0.75		
Ease of use	University	82	3.4	0.43	0.3975	0.11
	Industry	142	3.45	0.47		
Fun	University	82	2.5	0.64	0.0615	-0.25
	Industry	142	2.32	0.7		
Problem causing	University	82	3.49	0.5	0.0027	0.39*
	Industry	142	3.69	0.44		
Resource usage	University	82	3.37	0.51	0.7371	0.04
	Industry	142	3.4	0.68		
Platform Consistency	University	82	2.77	0.71	0.0013	0.44*
	Industry	142	3.11	0.76		
Clarity	University	82	3.52	0.6	0.9749	0
	Industry	142	3.52	0.68		
Costs	University	82	3.17	0.62	0.3139	0.13
	Industry	142	3.26	0.72		
Security	University	82	3.48	0.59	0.5622	0.08
	Industry	142	3.54	0.71		
User-centred	University	82	3.01	0.45	0.4776	0.09
	Industry	142	3.07	0.61		
User-friendly	University	82	3.37	0.42	0.121	0.21
	Professional	142	3.47	0.46		
Comfort/Convenience	University	82	3.38	0.76	0.8544	-0.02
	Professional	142	3.36	0.73		
Portability/Mobility	University	82	3.53	0.67	0.462	0.1
	Professional	142	3.6	0.65		
Productivity	University	82	3.37	0.62	0.1958	0.18
	Professional	142	3.48	0.66		
Speed up tasks	University	82	3.45	0.55	0.3828	0.12
	Professional	142	3.52	0.59		
Comprehensive	University	82	2.99	0.81	0.3198	0.13
	Professional	142	3.11	0.95		
Off-line usability	University	82	3.38	0.83	0.1229	-0.42
	Professional	142	3.2	0.88		
Positive Ratings and	University	82	2.91	0.82	0.1162	-0.21

Reviews	Professional	142	2.71	0.97		
Popular	University	82	2.52	0.86	0.0079	-0.36*
	Professional	142	2.18	0.98		
Notifications	University	82	2.78	0.97	0.0473	0.28*
	Professional	142	3.05	0.97		
Too many updates	University	82	3.39	0.77	0.3609	-0.12
	Professional	142	3.28	0.9		
In line with target market	University	82	2.88	0.76	0.2711	0.15
	Professional	142	3.01	0.89		
Goal-driven	University	82	3.26	0.72	0.4092	-0.11
	Professional	142	3.16	0.86		
In line with my Interests	University	82	3.33	0.75	0.9128	-0.01
	Professional	142	3.32	0.85		
Explanations	University	82	3.34	0.76	0.9551	0.01
	Professional	142	3.35	0.78		
Feedback	University	82	2.86	0.89	0.1144	0.22
	Professional	142	3.06	0.86		
Learning curve	University	82	2.45	0.96	0.001	0.46*
	Professional	142	2.9	0.98		
Advertisements	University	82	3.63	0.6	0.8535	-0.02
	Professional	142	3.62	0.7		

Smartphone type (Android, iPhone)

There were two significant differences to be found between iPhone users and Android users, as seen in Table 4.30. Platform consistency was less important to Android users, while iPhone users had a bigger problem with apps that have a learning curve.

Table 4.30: Descriptive statistics and effect sizes on the subtests of positive and negative attributes for differences between users' smartphone type

Construct	Phone Type	n	Mean	Std. Dev	Pr > |t|	d-value
Appearance	Android	149	2.8	0.69	0.1684	0.2
	iPhone	70	2.94	0.69		
Ease of use	Android	149	3.41	0.43	0.1222	0.21
	iPhone	70	3.51	0.46		
Fun	Android	149	2.44	0.71	0.3091	-0.15
	iPhone	70	2.34	0.68		
Problem causing	Android	149	3.6	0.46	0.5371	0.09
	iPhone	70	3.64	0.47		
Resource usage	Android	149	3.39	0.64	0.7113	0.05
	iPhone	70	3.42	0.59		
Platform Consistency	Android	149	2.91	0.74	0.013	0.35*
	iPhone	70	3.18	0.77		
Clarity	Android	149	3.56	0.57	0.3029	-0.14
	iPhone	70	3.45	0.77		
Costs	Android	149	3.23	0.71	0.5191	-0.09
	iPhone	70	3.17	0.67		
Security	Android	149	3.54	0.67	0.3736	-0.13
	iPhone	70	3.45	0.67		
User-centred	Android	149	3.04	0.55	0.5945	0.08
	iPhone	70	3.08	0.55		
User-friendly	Android	149	3.44	0.43	0.8807	-0.02
	iPhone	70	3.43	0.49		
Comfort/ Convenience	Android	149	3.36	0.74	0.4533	0.11
	iPhone	70	3.44	0.75		

Portability/ Mobility	Android iPhone	149 70	3.58 3.57	0.67 0.65	0.9518	-0.01
Productivity	Android iPhone	149 70	3.42 3.49	0.67 0.61	0.4153	0.11
Speed up tasks	Android iPhone	149 70	3.5 3.51	0.57 0.61	0.9035	0.02
Comprehensive	Android iPhone	149 70	3.03 3.15	0.88 0.95	0.3418	0.13
Off-line usability	Android iPhone	149 70	3.32 3.13	0.87 0.84	0.1113	-0.23
Positive Ratings and Reviews	Android iPhone	149 70	2.8 2.82	0.92 0.93	0.9238	0.01
Popular	Android iPhone	149 70	2.3 2.39	0.96 0.92	0.4924	0.1
Notifications	Android iPhone	149 70	2.93 3	1 0.91	0.5854	0.07
Too many updates	Android iPhone	149 70	3.34 3.27	0.83 0.89	0.5542	0.08
In line with target market	Android iPhone	149 70	2.91 3.1	0.85 0.8	0.1028	0.23
Goal-driven	Android iPhone	149 70	3.22 3.14	0.76 0.91	0.5486	-0.08
In line with my Interests	Android iPhone	149 70	3.28 3.42	0.8 0.8	0.2046	0.18
Explanations	Android iPhone	149 70	3.4 3.25	0.77 0.77	0.2013	-0.19
Feedback	Android iPhone	149 70	2.99 3	0.86 0.88	0.9142	0.02
Learning curve	Android iPhone	149 70	2.59 3.03	0.99 0.94	0.0018	0.44*
Advertisements	Android iPhone	149 70	3.56 3.73	0.7 0.64	0.0854	0.24

In the following section, correlations between different attributes will be demonstrated.

4.7. Pearson correlations

The Pearson correlations indicate that one attribute can have an influence on another. Attributes influencing each other with a p-value lower that 0.05 are listed in Table 4.31, and their effect strengths are demonstrated by using an *. Attributes, such as ease of use, user-friendly and user-centred seem to be affected by many other attributes. Fun, clarity and comprehensive also have an influence on many other attributes. The attributes with the largest effects seem to be Appearance and Fun, and Ease of use and User-friendly.

Table 4.31: Pearson correlation coefficients between the subtests of attributes influencing the user acceptance of mobile applications

Appearance	Ease of use*	Fun**	User-centred*	User-friendly*	Popular*	
Ease of use	Appearance*	Clarity*	User-centred*	User-friendly**	Portability/ Mobility*	Speed up tasks*
Fun	Appearance**	User-centred*	Off-line Usability	Popular*	In line with Interests	
Problem causing	Resource usage*					

Resource usage	Problem causing*					
Platform Consistency	Goal-driven*					
Clarity	Security	User-friendly*	Speed up tasks	In line with target market	Explanations *	Feedback
Costs	Fun	User-friendly*	Comprehensive	Off-line Usability		
Security	Clarity	Notifications	Explanations			
User-centred	Appearance*	Ease of use*	Fun*	User-friendly*	Portability/ Mobility*	Speed up tasks
	Positive Ratings*	Popular	Goal-driven*	In line with Interests*	Feedback*	
User-friendly	Appearance*	Ease of use**	Fun	Platform Consistency*	Clarity*	Costs*
	User-centred*	Comfort/Convenience	Portability/Mobility*	Productivity	Speed up tasks*	Comprehensive*
	Off-line Usability	Positive Ratings	Popular	Goal-driven*	In line with Interests*	Explanations *
	Feedback*					
Comfort/ Convenience	Ease of use	User-friendly	Portability/Mobility*	Productivity	Speed up tasks	Goal-driven
Portability/ Mobility	Ease of use*	User-centred*	User-friendly*	Comfort/Convenience*	Speed up tasks*	Goal-driven*
Productivity	Comfort/Convenience	Portability/ Mobility	Speed up tasks*	Comprehensive	Goal-driven	
Speed up tasks	Ease of use*	Clarity	User-centred	User-friendly*	Comfort/Convenience	Portability/ Mobility*
	Productivity*	Comprehensive	Goal-driven			
Comprehensive	Platform Consistency	Clarity	Costs	Productivity	Speed up tasks	In line with target market
	Goal-driven	In line with my Interests				
Off-line Usability	Ease of use	Fun	Costs	Speed up tasks	Comprehensive	Advertisements
Positive Ratings and Reviews	Appearance	Problem causing	Resource usage	User-centred*	User-friendly	Speed up tasks
	Comprehensive	Popular*				
Popular	Appearance*	Fun*	User Centred	User-friendly	Positive Ratings*	In line with Interests
	Goal-driven					
Notifications	Security	Too many updates*				
Too many updates	Security	Notifications*				
In line with target market	Appearance	Ease of use	Fun	Clarity	User-centred*	User-friendly
	Comprehensive	Goal-driven				
Goal-driven	Ease of use	Platform Consistency*	Clarity	User-centred*	User-friendly*	Comfort/Convenience
	Portability/ Mobility*	Productivity	Speed up tasks	Comprehensive	In line with target market	
In line with my Interests	Appearance	Ease of use	Fun	User-centred*	User-friendly*	Comprehensive
	In line with target market					
Explanations	Ease of use	Clarity*	Security	User-centred	User-friendly*	Comprehensive
	Feedback					
Feedback	Ease of use*	Fun	Clarity	User-centred*	User-friendly*	Comprehensive
	Explanations					
Learning curve						
Advertisements	Problem causing	Resource usage	Costs			

* Medium effect in practice

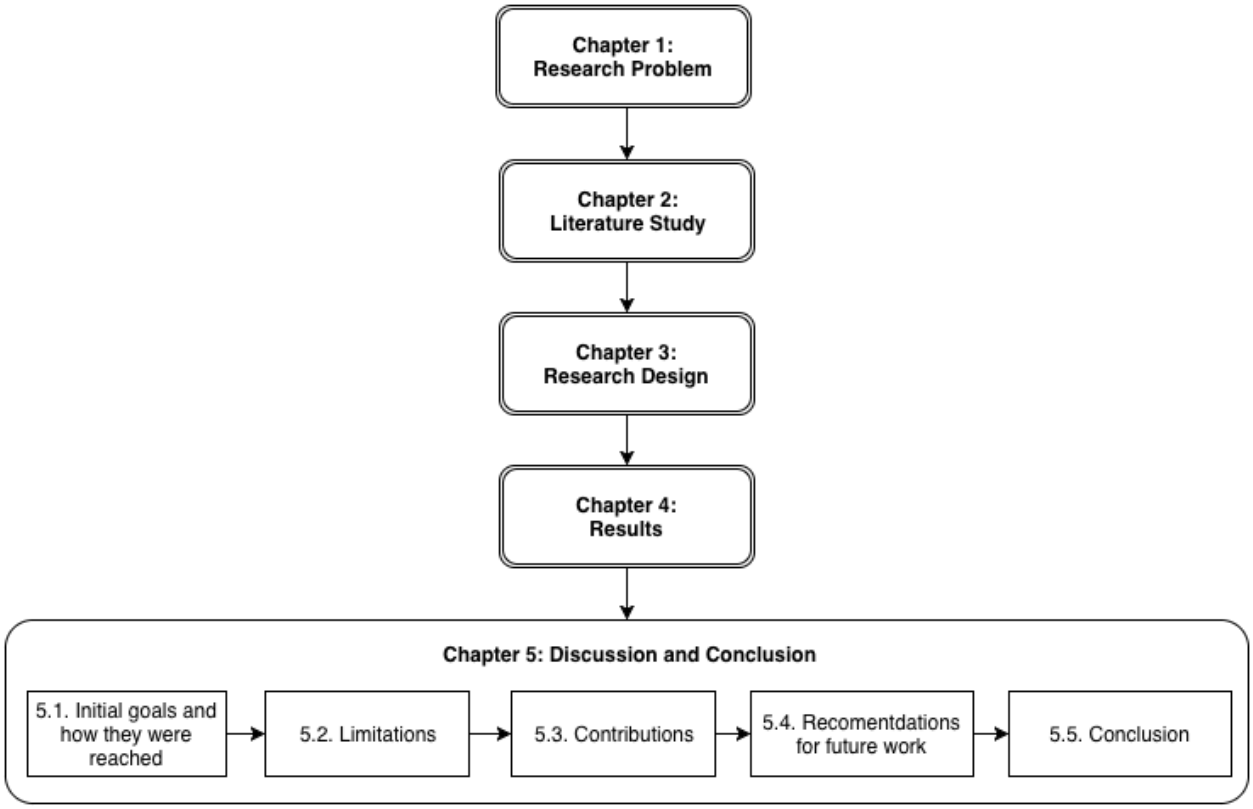
**Large effect in practice and also practically significant

4.8. Summary

In this chapter, the detailed findings of the study were presented and evaluated. The evaluation was based on the results gained from the questionnaire. The answers to the questionnaires were statistically analysed, and the findings were demonstrated using graphs and tables to assist with readability. In conclusion, the attributes were listed and prioritised as planned, along with other detailed findings surrounding the study.

In the following chapter, a discussion of the findings of this study is presented.

CHAPTER 5 DISCUSSION AND CONCLUSION



In this chapter, the findings of the study with regard to the initial research goals and objectives will be discussed. Some of the study's limitations and contributions will also be listed. Finally, recommendations for future work will be made and a conclusion is presented.

5.1. Initial goals and how they were met

5.1.1. Research question

What attributes influence the user acceptance of mobile applications?

The study attempted to investigate attributes that contribute to the user acceptance of mobile applications. These attributes were prioritised in terms of importance to the users of mobile applications. Creating applications conforming to the identified attributes should be considered by developers who wish to differentiate themselves from the ever-increasing competition in the mobile application industry. Mobile applications with a high user acceptance could yield a great financial advantage to their developers.

5.1.2. Research aims and objectives

The aim of this study was to identify a complete list of attributes that might contribute to the user acceptance of mobile applications. These attributes will then be investigated and prioritised according to their importance as indicated by users of mobile applications. In order to reach the aims, the following objectives had to be met:

1. Examine the literature to find attributes that could contribute to the user acceptance of mobile applications.
2. Determine attributes that would contribute to the user acceptance of mobile applications according to mobile users.
3. Perform a survey to investigate identified attributes in 1 and 2.
4. Perform a statistical analysis to rank the determined attributes in terms of importance to users of mobile applications.
5. Further statistical investigation to identify the difference between various user groups.

A discussion of how each of these objectives was met follows.

Examine the literature to find attributes that could contribute to the user acceptance of mobile applications.

The attributes that influenced user acceptance found in the studies that were reviewed were somewhat incomplete. Many studies mentioned some attributes, but not a satisfactory or comprehensive number. The attributes gathered from the literature were summarised in a conceptual model, as shown in Fig. 5.1.

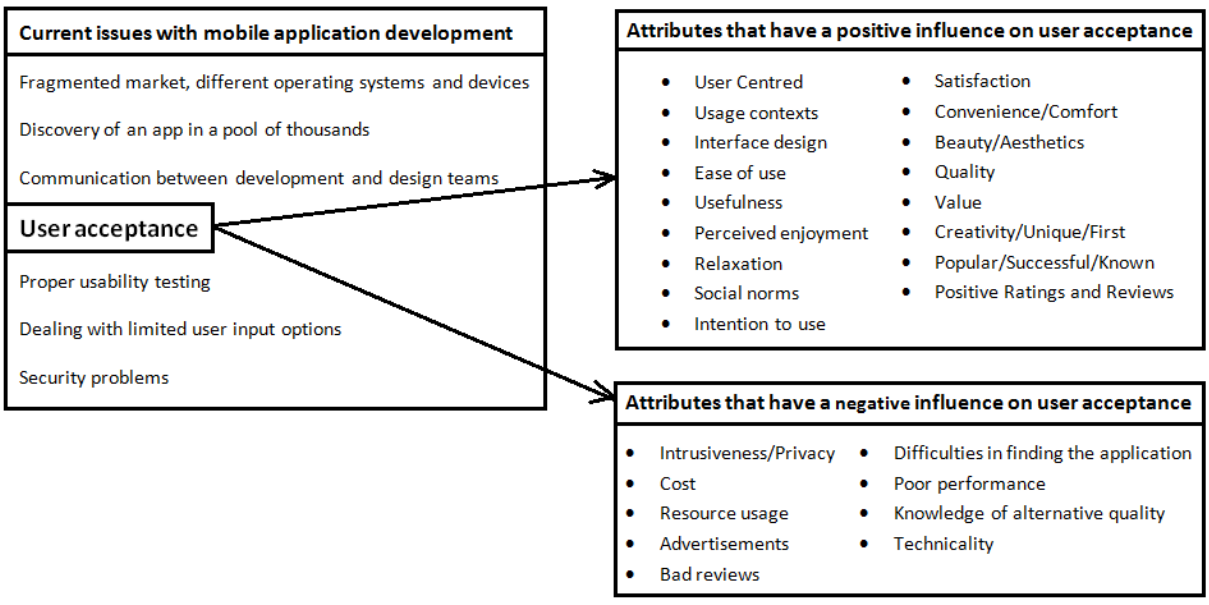


Figure 5.1: Conceptual model summarising findings from literature

Determine attributes that would contribute to the user acceptance of mobile applications according to mobile users.

A selection of 20 mobile users falling within varying demographics was interviewed. They were asked specific questions regarding what they thought caused them to accept or reject the mobile applications they downloaded. From these interviews, many of the attributes identified in the literature were confirmed. Some additional valuable attributes were also gained. These included:

- Positive: Keeps me updated, clear descriptions, realistic, off-line usability, explanations, remember use, feedback, good-looking icons.
- Negative: Too many updates, scaly permissions, affects the rest of the phone, unpredictable, not aligned with computer version.

Perform a survey to investigate identified attributes in objectives 1 and 2.

To perform the survey, a questionnaire was created. The questionnaire's questions centred on the attributes gathered from the literature and interviews. A link to the form was sent out via email. The email went out to a list of addresses from professionals in the industry, as well as a selected group of honours students at the North-West University. A total of 3 500 emails were sent, and 227 responses received, yielding a response rate of 6.5%. The survey was performed during September 2016. The group of participants consisted of users of different varieties of smartphone, including people from different age groups, genders and occupations.

Perform a statistical analysis to rank the determined attributes in terms of importance to users of mobile applications.

The statistical analysis was carried out on the data gathered from the survey. The means of the ratings were used to calculate the rankings for each attribute. The attributes were then presented in a graph in descending order according to the rating they received. Two graphs were created, for positive and negative attributes respectively.

The positive attributes that ranked the highest in the graphs include: functionality, ease of use, relevance, mobility, well-organised information and apps being true to their title. Some of the lower-ranking attributes were popularity, unexpected surprises and time killer apps.

The negative attributes that ranked the highest in the graphs include: bugs, slow performance

and apps that have a negative effect on the rest of the phone. The lower-ranking attributes included: not aligned with computer version, and also apps that had a steep learning curve.

When choosing between two conflicting attributes, smartphone users had the following preferences: stable and error free over innovative and creative, and private and secure rather than a social app that shares everything. They also seemed to prefer a simplistic design rather than plenty of features, professional looking over colourful and happy, and quiet instead of notifications and reminders. The participants seemed to be conflicted on attributes, such as multipurpose vs goal driven and aesthetics vs functionality, as their scales were close to the centre.

Further statistical investigation to identify the difference between various user groups

Additional statistical analysis was carried out, including procedures, such as a contingency table analysis, t-tests and Pearson correlations.

The statistically significant results from the contingency table analysis revealed the following interesting findings:

- Smartphone users who own an iPhone are more likely to have made purchases of or within mobile applications.
- Smartphone users who had already performed in-app purchases are more likely to do it again. In addition, some of the participants who have never purchased app content are not opposed to doing so.
- Students had a preference towards Android smartphones, while self-employed individuals tended to favour iPhone smartphones.
- Younger smartphone users favoured Android smartphones and, as the age increases, so does the iPhone percentage
- Older smartphone users are more likely to have spent money on mobile apps and app content.

Differences of opinion within some user groups showed that:

- Women placed greater importance on low costs than men, while the men were not bothered as much by applications that have a steeper learning curve.
- Fun was more important as groups spent more time on their phones. Security threats were a bigger problem for participants who spent less time on their phones.

- Fun was more important to younger and adult users than older users. Apps causing problems with phones were a bigger problem for older users. Platform consistency was less important to younger users. A learning curve was a bigger problem as the users' age increased.
- Appearance was more important to users who had a purchase history, and apps causing problems was also a bigger problem for these users. Platform consistency was also more important to the users who had a purchase history, and they also preferred apps that are more user-centred and have more positive ratings and reviews. Users that did not have a purchase history did not put as much importance on apps being in line with their interests and a target market.
- Apps causing problems was a bigger problem for participants from the industry. Platform consistency was also more important to this group. Popular apps were more important for participants from the university. Too many notifications and apps with a learning curve were bigger issues for participants from the industry.
- Platform consistency was less important to Android users. iPhone users had a bigger problem with apps that have a learning curve.

5.2. Limitations

One of the limitations of this study was the Likert scale used in the questionnaire, as it only ranged only from 1 to 4. When considering this after everything had been completed, it would have been better if the participants had more options on which to provide their opinion. A bigger scale would maybe have yielded a better visual difference between attributes when ranked, and would also perhaps have provided more differences of opinion between the user groups who made up the participants.

It would also have been beneficial to conduct more interviews during that stage of the study. The interviews yielded some practical insights as to why some of the attributes are positive or negative, and also added interesting attributes not found in the literature. More interviews could have added more new information to the field.

This study was performed in South Africa, and participants mostly consisted of students from the university and professionals from the industry. This means that these findings might not be suitable to generalise for all smartphone users, a possible limitation.

5.3. Contributions

The biggest contribution of this study is the almost complete list of attributes influencing the user acceptance of mobile applications. Other studies examining user acceptance do not cover this much ground. For example, Kangas and Kinnunen (2005:59) identified seven attributes relating

to the goal driven attribute of user acceptance, or Hermansson (2013:11), whose study was focussed only on attributes relating to the usefulness of mobile applications.

Another unique contribution of this study is the ranked order, which indicates the more and less important attributes; thereby allowing developers to see what attributes should be prioritised.

From the additional statistics, some key differences within the preferences are provided to developers when developing targeted apps for different smartphone user groups.

5.4. Future work

Many opportunities for future work resulting from this study were identified:

Determine and investigate practical solutions to influence the attributes identified in this study, for instance when taking the attribute “ease of use”, an entire new study could be performed on improving the ease of use of mobile applications. Determining important attributes only solves the problem halfway. A study that could gather information on how to get mobile applications to conform to each of these attributes individually would be ideal.

Determine how the first purchase influences further purchases. In the results of the cross-tabulation, it could be seen that users who had a purchase history are much more likely to purchase mobile apps or do in-app purchases again. In one of the interviews, a mobile user also mentioned the hurdle of making the first purchase. An interesting future study could be done to determine ways in which to get mobile users to overcome the initial step of doing their first purchase.

5.5. Conclusion

In conclusion, this study has shown that user acceptance of mobile applications is an important challenge for mobile development that often does not receive the attention it deserves and requires. There are many attributes that could be found that have an influence on the user acceptance of mobile applications, some more important than others.

The most important outcome of these attributes could be that functionality and ease of use are extremely important to mobile users, and bugs in apps are a big turn off. If developers of mobile applications wish to increase their chances of success, it might be worthwhile to direct some attention to the most important attributes identified in this study.

BIBLIOGRAPHY

Anastasi, A. & Urbina, S. 1997. Psychological testing, 7th ed. New York: Prentice Hall, Inc.

Android Studio. 2016 a. Command Line Tools.https://developer.android.com/studio/command-line/index.html Date of access: 5 November 2016

Android Studio. 2016 b. Create and Manage Virtual Devices.https://developer.android.com/studio/run/managing-avds.html Date of access: 5 November 2016

Android Studio. 2016 c. Download Android Studio.https://developer.android.com/studio/index.html Date of access: 5 November 2016

Android Studio. 2016 d. Logcat Command-line Tool.https://developer.android.com/studio/command-line/logcat.html Date of access: 5 November 2016

Anon. 2012. Mobile user types.http://www.gujmedia.de/fileadmin/redaktion/Media_Research/Deutsch/Mobile_Studien/G_J_EMS_2013_Mobile360_EXCERPT.pdf Date of access: 27 June 2016

App-Promo. 2012. The Necessity of Mobile App Marketing What It Really Takes to Succeed with a Mobile App. http://app-promo.com/wp-content/uploads/2012/04/AppPromo-TheNecessityofMobileAppMarketing.pdf Date of access: 20 July 2016

Arhippainen, L. & Tähti, M. 2003. Empirical Evaluation of User Experience in Two Adaptive Mobile Application Prototypes. MUM 2003. Proceedings of the 2nd International Conference on Mobile and Ubiquitous Multimedia, p. 27-34.

Bergvall-Kåreborn, B. & Howcroft, D. 2013. 'The future's bright, the future's mobile': a study of Apple and Google mobile application developers. *Work, employment and society*, 0(0):1-18.

Betiol, A.H. & Cybis, W. 2005. Usability Testing of Mobile Devices: A Comparison of Three Approaches. Proceedings of: Human-Computer Interaction - INTERACT 2005, IFIP TC13 International Conference, Rome, Italy, September 12-16, 2005, p. 470-481.

Bull, G. 2010. The Always-Connected Generation. International Society for Technology in Education. *Learning & Leading with Technology*, 38(3):28-29.

Burton-Jones, A., & Hubona, G.S. 2006. The mediation of external variables in the technology acceptance model. *Information & Management*, 43:706-717.

Chen, H.T. 2006. A theory-driven evaluation perspective on mixed-methods research. *Research in schools*, 13(1):75-83.

Cheshire, T. 2015. From Clash of Clans to Hay Day: the secrets of Supercell's success. http://www.wired.co.uk/article/supercell-clash-of-clans-hay-day Date of access: 28 October 2016

Chou, C., Chiu, C., Ho, C. & Lee, J. 2013. Understanding Mobile Apps Continuance Usage Behavior and Habit: An Expectance-Confirmation Theory. PACIS 2013 Proceedings. Paper 132.

Cohen, J. 1988. Statistical power analysis for the behavioural sciences. Hillside, NJ: Lawrence Earlbaum Associates.

Colman, A.M. 2014. A Dictionary of Psychology (3 ed.) Publisher: Oxford University Press.

Cooper, D.R. & Schindler, P.S. 2011. Business research Methods. McGraw-Hill Higher Education. Berkshire

Creswell, J.W. 2013. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications. California

Creswell, J.W., Fetters, M.D. & Ivankova, N.V. 2004. Designing a mixed methods study in primary care. *Annals of family medicine*, 2(1):7-12.

Cuadrado, F. & Dueñas, J.C. 2012. Mobile Application Stores: Success Factors, Existing Approaches and Future Developments. *IEEE Communications Magazine*, 50(11):160-167.

Cyr, D., Head, M & Ivanov, A. 2006. Design aesthetics leading to m-loyalty in mobile commerce. *Information & Management*, 43(8):950-963.

Davis, F.D. 1993. User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, 38(3):475-487.

Dillon, A. & Morris, M.G. 1996. User acceptance of new information technology: theories and models. *Annual Review of Information Science and Technology*, 14(4):3-32.

Fink, A. 2003. The survey kit: the survey handbook. Thousand Oaks, CA: SAGE.

Fu, B., Lin, J., Li, L., Faloutsos, C., Hong, J & Sadeh, N. 2013. Why People Hate Your App - Making Sense of User Feedback in a Mobile App Store. Proceedings of the 19th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining. p. 1276-1284.

Gasimov, A., Hoo Tan, C., Wei Phang, C. & Sutanto, J. 2010. Visiting Mobile Application Development: What, How and Where. 2010 Ninth International Conference on Mobile Business. p. 74-81.

Godoe, P. & Johansen, T.S. 2012. Understanding adoption of new technologies. *Journal of European Psychology Students*, 3(1):38-52.

Google Play. 2016. Top Charts. https://play.google.com/store/apps/top?hl=en Date of access: 19 June 2016

Girardello, A. & Michahelles, F. 2010. AppAware: which mobile applications are hot?. Proceeding MobileHCI '10 Proceedings of the 12th International Conference on Human Computer Interaction with Mobile Devices and Services. p. 431-434.

Greene, J.C., Caracelli, V.J. & Graham, W.F. 1989. Toward a conceptual framework for mixed-methods evaluation designs. *Educational evaluation and policy analysis*, 11(3):255–274.

GSMA Intelligence. 2014. The Mobile Economy 2014.http://www.gsmamobileeconomy.com/GSMA_ME_Report_2014_R2_WEB.pdf Date of access: 9 June 2015

Hair, J.R., Anderson, R.E., Tatham, R.L. & Black, W.C. 1998. Multivariate data analysis. New Jersey: Prentice-Hall, Inc.

Hammershøj, A., Sapuppo, A. & Tadayoni, R. 2010. Challenges for Mobile Application Development. Intelligence in Next Generation Networks (ICIN), 2010 14th International Conference on 11-14 Oct. 2010. p. 1-8.

Hermansson, C. 2013. The difficulties in developing useful mobile applications - Guidelines for app developers in cross media platforms. Department of Informatics, Cross Media Interaction Design, (Thesis – Masters 2nd-year level).

Hermansson, C.T., Söderstrom, M. and Johansson, D. 2014. Developing Useful Mobile Applications in Cross-Media Platforms. In IMIS July. p. 128-132.

Hewson, C. 2006. Mixed-methods research. (*In* Jupp, V. (ed.) The SAGE Dictionary of Social Research Methods. London: Sage. p. 179-180).

Holzer, A & Ondrus, J. 2009. Trends in Mobile Application Development. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering. *Springer*, 12:55-64.

Hsieh, H. & Shannon, S.E. 2005. Three Approaches to Qualitative Content Analysis. *Qualitative Health Research*, SAGE, 15(9):1277-1288.

Ickin, S., Wac, K. & Fiedler, M. 2012. Factors Influencing Quality of Experience of Commonly Used Mobile Applications. *Communications Magazine*, IEEE, 50(4):48-56.

IDC Research. 2016. Smartphone OS Market Share, 2015 Q2.http://www.idc.com/prodserv/smartphone-os-market-share.jsp Date of Access: 2 September 2016

InsightsNow. 2012. 7 Shades of Mobile: The Hidden Motivations of Mobile Users.https://advertising.aol.com/sites/advertising.aol.com/files/insights/research-reports/downloads/aol-bbdo-7-shades-mobile-abstract-final.pdf Date of Access: 2 September 2016

IntelliJ. 2016. Making development an enjoyable experience. http://www.jetbrains.com/idea/features/ Date of access: 5 November 2016

Isomursu, M., Tahti, M., Vainamo, S. & Kuutti, K. 2007. Experimental evaluation of five methods for collecting emotions in field settings with mobile applications. *International Journal of Human-Computer Studies*, 65(4):404-418.

Johnson, R.B. & Onwuegbuzie, A.J. 2004. Mixed methods research: a research paradigm whose time has come. *Educational Researcher*, 33(7):14-26.

Joorabchi, M.E., Mesbah, A & Kruchten, P. 2013. Real Challenges in Mobile App Development. Empirical Software Engineering and Measurement, 2013 ACM / IEEE International Symposium on 10-11 Oct. p. 15-24.

Kaasinen, E. 2005. User acceptance of mobile services ñ value, ease of use, trust and ease of adoption Espoo 2005. VTT Publications 566.

Kaasinen, E. 2008. User Acceptance of Mobile Services. (*In* Lumsden, J. (ed.) Handbook of Research on User Interface Design and Evaluation for Mobile Technology. *IGI Global*, 1:102-121).

Kajanan, S., Pervin, N., Ramasubbu, N. & Dutta, K. 2012. Take-off and sustained success of apps in hypercompetitive mobile platform ecosystems: An empirical analysis. Thirty Third International Conference on Information Systems, Orlando 2012. p. 1850-1867.

Kangas, E & Kinnunen, T. 2005. Applying User-centered Design to Mobile Application Development. *Communications of the ACM*, 48(7):55-59.

Kelly, D., Harper, D. J. & Landau, B. 2008. Questionnaire mode effects in interactive information retrieval experiments. *Information processing and management*, 44:122-141.

Kim, S. 2003. Research paradigms in organizational learning and performance: competing modes of inquiry. *Information technology, learning, and performance journal*, 21(1):9-18.

Kim, Y., Kim, D.J. & Wachter, K. 2013. A study of mobile user engagement (MoEN): Engagement motivations, perceived value, satisfaction, and continued engagement intention. *Decision Support Systems*, 56:361-370.

Krosnick, J.A. 1999. SURVEY RESEARCH. *Annual Review of Psychology*, 50:537-567.

Lee, D., Chung, J.Y. & Kim, H. 2013. Text me when it becomes dangerous: Exploring the determinants of college students' adoption of mobile-based text alerts short message service. *Computers in Human Behavior*, 29:563-569.

Lee, Y., Park, J., Chung, N. & Blakeney, A. 2012. A unified perspective on the factors influencing usage intention toward mobile financial services. *Journal of Business Research*, 65:1590-1599.

Lindkvist, K. 1981. Approaches to textual analysis. *In* Rosengren, K.E. (Ed.), Advances in content analysis, Beverly Hills, CA: Sage, p.23-41.

Louis, T. 2013. How Much Do Average Apps Make?.http://www.forbes.com/sites/tristanlouis/2013/08/10/how-much-do-average-apps-make/ Date of Access: 17 Feb. 2015

Maguire, M. 2001. Methods to support human-centred design. *Human-Computer Studies*, 55:587-634.

Mei, S., Hu, X. & Zeng, Z. 2013. Factors affecting a Mobile Application's Acceptance: An empirical study of user acceptance of WeChat in China. IHH: Informatics,

Michael, R.S. 2016. Cross-tabulation & Chi Square. http://www.indiana.edu/~educy520/sec5982/week_12/chi_sq_summary011020.pdf Date of Access: 17 October 2016

Myers, M.D. & Avison, D.E. 2002. Qualitative research in Information Systems, London: Sage Publications.

Myers, M. D. 1997. Qualitative Research in Information Systems, *MIS Quarterly*, 21(2):241-242.

Nielsen, J. 1994. Usability Engineering. San Diego, CA: Academic Press.

Oates, B.J. 2006. Researching information systems and computing. London: Sage Publications.

Oinas-Kukkonen, H. & Kurkela, V. 2003. Developing Successful Mobile Applications. From Proceeding (394) Computer Science and Technology - 2003, Cancun, Mexico

Onwuegbuzie, A.J. & Leech, N.L. 2005. On Becoming a Pragmatic Researcher: The Importance of Combining Quantitative and Qualitative Research Methodologies. *Int. J. Social Research Methodology*, 8(5):375–387.

Orlikowski, W.J. & Baroudi, J.J. 1991. Studying Information Technology in Organizations: Research Approaches and Assumptions. *Information Systems Research*, 2(1):1-28.

Park, E., Baek, S., Ohm, J. & Chang, H.J. 2014. Determinants of player acceptance of mobile social network games: An application of extended technology acceptance model. *Telematics and Informatics*, 31:3-15.

Park, H.J. & Kim, S.H. 2013. A Bayesian network approach to examining key success factors of mobile games. *Journal of Business Research*, 66(9):1353-1359.

Park, J. & Han, S.H. 2013. Defining user value: A case study of a smartphone. *International Journal of Industrial Ergonomics*, 43:274-282.

Rogers, EM. 1995. Diffusion of innovations theory. 4th Ed. New York, NY: Simon & Schuster Inc.

SAS Institute Inc. 2016. The SAS System for Windows Release 9.4 TS Level 1M3 Cary, NC, USA: SAS Institute Inc.

Scharl, A., Dickinger, A. & Murphy, J. 2005. Diffusion and success factors of mobile marketing. *Electronic Commerce Research and Applications*, 4:159-173.

Schwalbe, K. 2012. Information Technology Project Management. 7th Ed. Boston, MA: Cengage Learning.

Shaw, S. & Fairhurst, D. 2008. Engaging a new generation of graduates. *Education + Training*, 50(5)366-378.

Statista. 2016. Number of apps available in leading app stores as of June 2016.https://www.statista.com/statistics/276623/number-of-apps-available-in-leading-app-stores/ Date of access: 5 September 2016

Statstutor. 2016. Pearson's correlation.http://www.statstutor.ac.uk/resources/uploaded/pearsons.pdf Date of Access: 7 November 2016

Tabachnick, B.G. & Fidell, L.S. 2001. Using Multivariate Statistics, 4th Ed. Boston: Allyn & Bacon.

Teng, C & Helps, R. 2010. Mobile Application Development: Essential New Directions for IT. Information Technology: New Generations (ITNG), Seventh International Conference on 12-14 April 2010. p. 471-475.

Tribe, J. 2001. Research Paradigms and the Tourism Curriculum. *Journal of Travel Research*, 39:442-448.

Unhelkar, B. & Murugesan, S. 2010. The Enterprise Mobile Applications Development Framework. *IT Professional*, 12(3):33-39.

Verkasalo, H., López-Nicolás, C., Molina-Castillo, F.J. & Bouwman, H. 2010. Analysis of users and non-users of smartphone applications. *Telematics and Informatics*, 27:242-255.

Viswanathan, P. 2016. All about Making Money with Mobile App Development. http://mobiledevices.about.com/od/marketingapps/a/All-About-Making-Money-With-Mobile-App-Development.htm Date of Access: 2015/04/14

Wasserman, A.I. 2010. Software Engineering Issues for Mobile Application Development. FoSER '10 Proceedings of the FSE/SDP Workshop on Future of Software Engineering Research. p. 397-400.

Xu, C., Peak, D. & Prybutok, V. 2015. A customer value, satisfaction, and loyalty perspective of mobile application recommendations. *Decision Support Systems*, 79:171-183.

Yoon, C., Kim, D., Jung, W., Kang, C & Cha, H. 2012. AppScope: Application Energy Metering Framework for Android Smartphone Using Kernel Activity Monitoring. Presented as part of the 2012 USENIX Annual Technical Conference (USENIX ATC 12) on June 13-15. p. 387-400.

ANNEXURES – PROOFREADING CERTIFICATE

This serves to confirm that I, Isabella Johanna Swart, registered with and accredited as professional translator by the South African Translators' Institute, registration number 1001128, language edited the following dissertation (excluding all Annexures).

Investigating attributes that have an influence on the user acceptance of mobile applications

by

Christian Fourie
22833129

Dr Isabel J Swart

Date: 8 April 2017

23 Poinsettia Close
Van der Stel Park
Dormehlsdrift
GEORGE
6529
Tel: (044) 873 0111
Cell: 082 718 4210
e-mail: isaswart@telkomsa.net

APPENDIX A - QUESTIONNAIRE

What do you like about mobile applications?

Project title: Investigating the user acceptance of mobile applications.

I am currently enrolled for my Master's degree in Computer Science at the Potchefstroom campus of the North-West University. This questionnaire was created to help us determine what everyday smartphone users wants to see in the apps that they are using. You will probably like all the good attributes and dislike the bad, but we would like to know how much? I will greatly appreciate it if you could provide us with your inputs on the subject by completing the questionnaire.

This should take about 10 to 15 minutes to complete depending on your thoroughness. (It took me 10 minutes 48 seconds)

Contact Details:
Christian Fourie (MSc Student)
Email: christianfourie60@gmail.com

*Required

General principles

1. Your participation in this research project is completely voluntary, and no pressure may be placed on you to take part.

2. It is possible that you may not gain any benefit personally from your participation in the research project, although the knowledge that you provide may benefit other persons or communities.

3. You are free to withdraw from the research project at any time, without giving reasons for your decision. You will in no way be harmed in doing so. You may also request that your information provided, no longer be used in the research project. However, you are kindly requested not to withdraw from the project without careful consideration, since it may have a negative effect on the reliability of the project.

4. By agreeing to take part in the research project, you are also giving consent for the data that will be generated to be used by the researchers for scientific purposes as they see fit, with the agreement that it will be confidential and that your name will not be linked to any of the data without your consent.

1. *

By completing the accompanying questionnaire, you agree that you have read the information in connection with the research project and that you understand it. You also declare that you are taking part in the project voluntarily.
Tick all that apply.

- [ ] I Agree let's do this!

Lets start with some info about you as smartphone user:

2. **What is your age group?**
Mark only one oval.

- 18 - 25
- 26 - 39
- 40 - 65
- 66 +

3. **Your Gender?**
Mark only one oval.

- Male
- Female

4. **Current occupation**
Mark only one oval.

- Student
- Professional
- Self Employed
- Public sector
- Academics
- Assistant
- Unemployed

5. **Smartphone type**
Mark only one oval.

- Android
- iPhone
- Windows Mobile
- Blackberry

6. **How much time do you spend on your phone each day?**
Mark only one oval.

- <1 hours
- 1 - <2 hours
- 2 - <3 hours
- 3 - <5 hours
- 5 hours +

7. **Please name a few of your favourite apps?**

.....

.....

.....

.....

8. **Have you ever paid for an app or in-app purchases?**
Mark only one oval.

- ◯ Yes
- ◯ No

9. **Would you pay for an app?**
1: Never! 2: Maaaybe 3: If the app is good and the price is reasonable 4: Sure why not...
Mark only one oval.

	1	2	3	4	
Never	◯	◯	◯	◯	Sure

Attributes that may cause you to like apps:

We would like to know how important you think the following attributes is for smartphone applications...

The scale is as follow:

- 1 - This is not important
- 2 - Somewhat important
- 3 - Important, should preferably be present
- 4 - Very important, should definitely be a part of mobile applications

PLEASE NOTE!!!!!
You do not have to read the description under each question, it is simply provided to help you understand the term in case it is unclear. If you are really unsure of a question, simply leave it out.

10. **Comfort/Convenience**
"improves my quality of life","I don't have to interact with people","it makes your daily tasks easier","makes some aspects I have to deal with in life more comfortable","it makes everyday things more convenient"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

11. **Keeps me updated**

"keeps me on my toes with reminders","access to information","keeps me updated with whats happening in the world"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

12. **Comprehensive**

"All similar functions should fall under the same app","I do not want a lot of small apps for every little thing","It should have all the functions you want"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

13. **Productivity**

"it provides me with a service","it helps me with my clients/job","it replaces older harder ways of doing things"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

14. **Speed up tasks**

"It helps me to be more efficient","don't need to waste time doing stuff in the slower conventional ways","it helps me access things and people quickly"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

15. **Portability/Mobility**

"It keeps things you need with you","I have immediate access","the app should be able to provide information to users who are on the move and requires quick access."

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

16. **Goal Driven**

"it has a clear goal for me","it does not try to be too much things","it must do something specific and be good at it","it gets to the point"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

17. **Relevant**

"the app and it's information should be relevant to what I need"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

18. **In line with target market**

"should be clear on who they cater for","apps designed for certain groups of users should be more oriented towards them","What is the age, gender, culture, country of the majority of your users? Adapt the application to suit their unique needs. Applications should use terminology known to users and be organized relevant to their user's thoughts."

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

19. **True to its title/description**

"It should do what I expect of it","it does not pretend to be something that it is not"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

20. **Clear descriptions**

"the app should be clear on what it is about","the things that I look for should be clearly defined"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

21. **Functionality**

"it gets the job done","it should just work","the functionality is very important","It works good","The app should perform flawless and seamless."

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

22. **Constant Improvements**

"cool features gets added with updates","the creators are always making it better"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

23. **Entertainment**

"using the app makes me happy","it keeps me entertained","fun and exciting to use"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

24. **Time Killer**

"fun to waste time with","keeps you busy when needed"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

25. **Social/Sharing**

"allows me to interact or compare myself with friends","keeps me connected to people","I can communicate with friends", "you can see what your friends are doing","I can view my friends' photos","helps to enhance pictures for sharing","how easy it can share things to Facebook"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

26. **Positive Ratings and Reviews**

"I am more likely to listen to the opinions of other people than that of the creators of the app.","I always download the app with the best ratings"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

27. **Popular**

"everyone has it","the app is Successful/Known","it is fun to use because a lot of other people have it"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

28. **Realistic**

"The app and it's information is accurate and reliable","credible"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

29. **In line with my Interests**

"the app provides something of interest to me","Example: I get to visit other countries without being there"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

30. **Exploration/Educational**

"it help you find things that you might like","lets you discover new ways of doing things","I get to learn things"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

31. **Personalization, Settings**

"I want some settings to change things to the way I prefer it"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

32. **Innovative, Unique**

"It must contribute something unique","Creative approaches will act in favor of the app, also if the app is a first of its kind"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

27. **Popular**

"everyone has it","the app is Successful/Known","it is fun to use because a lot of other people have it"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

28. **Realistic**

"The app and it's information is accurate and reliable","credible"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

29. **In line with my Interests**

"the app provides something of interest to me","Example: I get to visit other countries without being there"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

30. **Exploration/Educational**

"it help you find things that you might like","lets you discover new ways of doing things","I get to learn things"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

31. **Personalization, Settings**

"I want some settings to change things to the way I prefer it"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

32. **Innovative, Unique**

"It must contribute something unique","Creative approaches will act in favor of the app, also if the app is a first of its kind"

Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

33. **Offline Usability**

"should also work when I use it offline","if you can play a game in airplane mode","it should not want to go online all the time","it must be able to operate fully offline"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

34. **Explanations**

"it should tell me why it wants certain permissions to use my stuff"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

35. **Affordable**

"it is affordable","low costs","if it is free","it is cheap","It is inexpensive"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

36. **Integration of Accounts**

"How easy apps can just join in with your existing accounts","how easy it can connect with other apps"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

37. **Cross Platform**

"I will use an app that has a PC client","the app should work on my tablet and phone","should be available on iPhone and Android"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

38. **Remember use**

"apps should continue where you left","if you use an app and you can save its state and continue later on","it remembers your previous actions"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

39. **Fluency of navigation**

"The most important features should stand out and be the easiest to reach.","I just want to start straight up","I just want to click and scroll a few times to get where I want to be","Quick navigation"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

40. **Clear instructions, Obvious tutorials**

"clear indication on what to do","simple instructions","I like these quick three step tutorials","fast steps to help you get it"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

41. **Feedback**

"it lets me know when someone received a message or if its tasks has been completed"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

42. **Ease of use**

"Easy to figure out and accomplish the desired tasks.","it is important for an app to be user friendly","it should be wort the effort it takes to operate","something that open quickly","I can just push one button and have my music","you know what to do","they should not have to explain it to you"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

43. **Simplistic**

"keep it simple and straight","Simple Interface","not a lot of fancy nonsense","Focus on what needs to be present in the application and exclude irrelevant information."
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

44. **Well organized Information**

"well categorized","I want to see what is going on immediately","the information is organized","you know how to get to things"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

45. **Well designed inteface/layout**

"it should have a neat layout, I want to see where what is","it should be very obvious","I do not like small buttons that you cannot press easily when on the move or if you have big fingers","the flow of the app is good"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

46. **Consistent**

"Apps should be standardized","An Android app should feel like android and iPhone should feel like iPhone",
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

47. **Aesthetically pleasing**

"The app is well designed and pleasing to look at.","Lots of detail","Use of animations and pictures","It has a good feel"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

48. **Good looking icons**

"I usually download the apps with the best looking icons"
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

49. **Features**

"Lots of different features provided along with the core functionality of the application."
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

50. **Unexpected surprises**

"The app contains a lot of fancy or things the user did not expect."
Mark only one oval.

	1	2	3	4	
Not important	◯	◯	◯	◯	Very important

51. **Is there any positive features that we did not include in this list?**

.....

.....

.....

Attributes that may cause you to dislike apps:

How much does the following attributes of smartphone apps bother you?

The scale is as follow:

- 1 - Doesn't bother me
- 2 - Bothers me a little
- 3 -This is a problem for me.
- 4 - I don't like this at all!

52. **Notifications**

"how much it bothers you with stuff","should not show notifications all the time","apps interfere when I'm working"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

53. **Too many updates**

"it wants to update all the time"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

54. **Breach of security/privacy**

"they know who you are","nothing is private anymore","it can be dangerous if you're not careful","it interferes with my privacy","it has sensitive information like my banking details","I am unsure what of my data is used and stored and who has access to it"

Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

55. **Scaly Permissions**

"I do not like that an application wants my location or contacts","it wants access to things on my phone"

Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

56. **Advertisements**

"bothers you with advertisements","too much advertisements","no paid version without advertisements available","pop up ads"

Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

57. **Learning curve**

"I do not want to spend a lot of time to figure it out","it takes energy to learn","you don't want to have a hard time, you just want to start","sometimes an app is difficult","I do not buy apps because of the initial effort to get started the first time"

Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

58. **Poor design**

"some apps is just a waste of your time","splash screens waste my time","It must not be just half an app","it feels like it is still being developed","it feels cheap"

Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

59. **Slow App**

"it takes too long to load","if it is slow and laggy"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

60. **Bugs**

"If an app crashed a few times I will not use it again","if it gets stuck","the app randomly freezes","the app force close"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

61. **Battery Consumption**

"shortens the battery life","if an app is too battery intensive"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

62. **Data Usage**

"if it uses a lot of data","if it uses too much data"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

63. **Resource intensive**

"if an app uses too much of my available space on the phone","apps that use too much ram"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

64. **Affects the rest of the phone**

"influences the phones capabilities","makes my phone laggy"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

65. **Unpredictable**

"It should not randomly do stuff that you did not expect"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

66. **Not aligned with computer version**

"it is not similar to the computer version","it does not all the functionality of the computer version."
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

67. **Limited Functionality**

"if you only get a demo for something bigger and have to purchase the rest"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

68. **In App purchasing**

"in-app purchasing gives some users an unfair advantage","it advertises to be awesome but when you download it all the good stuff has to be purchased"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

69. **Paying Upfront**

"I have to purchase the app in order to download and use it"
Mark only one oval.

	1	2	3	4	
Doesn't bother me	◯	◯	◯	◯	I don't like this

70. **Is there any negative features you know of that we did not include on this list?**

.....

.....

Would you rather?

Since the world is not perfect and we can't always get everything we want, lets finish with a game called would you rather? It goes like this…Which one of the two attributes in the following list would you rather have?

71. **A colorful happy app or more professional looking**
Mark only one oval.

	1	2	3	4	
Colorful	◯	◯	◯	◯	Professional

72. **Innovative and creative or Stable and error free**
Mark only one oval.

	1	2	3	4	
Innovative	◯	◯	◯	◯	Stable

73. **Faster performance or Longer battery life**
Mark only one oval.

	1	2	3	4	
Performance	◯	◯	◯	◯	Battery life

74. **Lots of features or Simplistic design**
Mark only one oval.

	1	2	3	4	
Features	◯	◯	◯	◯	Simplistic

75. **Regular reminders or Quiet with no notifications**
Mark only one oval.

	1	2	3	4	
Reminders	◯	◯	◯	◯	Quiet

76. **Useful and productive app or Time killer**
Mark only one oval.

	1	2	3	4	
Productive	◯	◯	◯	◯	Time killer

77. **Free and half made or Paid and excelent**
Mark only one oval.

	1	2	3	4	
Free	◯	◯	◯	◯	Paid

78. **Goal driven or Multi purpose**
Mark only one oval.

	1	2	3	4	
Goal driven	◯	◯	◯	◯	Multi purpose

79. **Focus on functionality or Aesthetically pleasing**
Mark only one oval.

	1	2	3	4	
Functionality	◯	◯	◯	◯	Aesthetics

80. **Regular improvements or few as possible updates**
Mark only one oval.

	1	2	3	4	
Improvements	◯	◯	◯	◯	No updates

81. **Advanced but complex or Easy to use and basic**
Mark only one oval.

	1	2	3	4	
Advanced	◯	◯	◯	◯	Basic

82. **Social and sharing or Private and secure**
Mark only one oval.

	1	2	3	4	
Social	◯	◯	◯	◯	Secure

Thank you!

Woohooo finally it's over....Thank you very much for your contribution!

APPENDIX B - CONTENT ANALYSIS

	Interview 1	Interview 2	Interview 3	Interview 4	Interview 5	Interview 6	Interview 7	Interview 8
Age	23	55	21	24	28	26	25	23
Ocupation	Student, Masters in Economy	Industry, Real Estate Agent	Student, B.A. Communication	It Specialist NWU	Lecturer in Computer sciences	Gold Smith	Student, Masters in IT	Student, Honours risk management
Smartphone	Android	Android	Android	Android	Android	Android	Android	Android
User Type	Selective user	Experienced user	Routine user	Routine user	Enthusiastic user	Selective user	Experienced user	Routine user
Time on Phone	1 hour	2 hours	2-3 hours	5 hours	3-4 hours	2 hours	2-3 hours	2 hours
Apps	Shazam, WhatsApp, Guitar Tuner, Twitter, Instagram	WhatsApp, Weather, News, Navigation	Dual Lingo, WhatsApp, Memorize, Real Piano	WhatsApp, Facebook, Bible	WhatsApp, 9gag, ES file explorer, Sidescroller games	WhatsApp, Google Chrome, Utilities	WhatsApp, Dropbox, Random games, online banking	News24, Angry Birds, WhatsApp, SuperSport
Negative attributes								
Notifications							"It should not bother me with	
Too many updates							"It must not moan with updates"	
Breach of security/privacy						"Everything is open nothing is private, they have to much access to my account"		
Scaly Permissions				"It wants too much access to everything"	"If it wants access to strange things on your phone"			
Advertisements	"No advertisements"		"Advertisements"		"Advertisements in free apps"	"The stupid advertisements"	"If must not bother me with ads all the time"	"Advertisements"
Learning curve		"I do not want to spend time to						"I do not want to have a hrd time
Poor design			"Feels half made"		"If the app crashes every now and then"		"It must not crash all the time"	
Slow App			"a slow app"					
Bugs					"If it has strange bugs"			
Battery Consumption		"It should not drain my battery"						
Data Usage	"Should not use much data"	"It should not use a lot of my data"						"It sould not use a lot of data"
Resource intensive			"uses too much processsing					
Affects the rest of the phone		"It should not affect my phone						
Unpredictable								
Not aligned with computer version								
Limited Functionality	"Don't just want a demo"		"It should not be some kind of					
In App purchasing	"I hate in-app purchases"		"I do not want to have to buy something later					"It should not have too much in-app purchasing"
Purchases								
Purchase History	No	No	No	No	Yes	No	No	No
Willing to purchase	"Only if it is something I really need"	"If it was wort it to me"	"I do not want to pay before you play"	"Depends on the price and how often I would have to pay"	"I will buy cheap apps but prefer free"	"I will spend monet on something I use a lot such as WhatsApp"	"I will only buy the bare essentials if neccesary"	"I would buy something I use a lot like WhatsApp and SuperSport"

	Interview 9	Interview 10	Interview 11	Interview 12	Interview 13	Interview 14	Interview 15	Interview 16
Age	25	25	17	25	21	51	39	77
Ocupation	Student, Masters Pharmacy	Electronic Ingenieur	School	Junior Lecturer NWU	Student, Dietician	Real Estate Agent	Lecturer Computer sciences NWU	Retired
Smartphone	Android	Android	Android	Android	Android	Android	iPhone	Android
User Type	Routine user	Selective user	Routine user	Enthusiastic user	Routine user	Experienced user	Enthusiastic user	Selective user
Time on Phone	3 hours	1 hour	4-5 hours	1-2 hours	2-3 hours	3 hours	1-3 hours	3-5 hours
Apps	Instagram, WhatsApp, Pinterest	WhatsApp, Internet, Utilities	WhatsApp, Facebook, Photo editing, SterKinekor	WhatsApp,My Remotes, Utiliies	Facebook, WhatsApp, Utilities,	WhatsApp, Facebook, Property24, Pinterest, TrackID	WhatsApp, Flipboard, OneNote, Splashtop,	Facebook, WhatsApp, Youtube, Music players
Negative attributes								
Notifications		"Too much notifications"						
Too many updates		"It must not update all the						
Breach of security/privacy			"It can be dangerous if you are not careful"					
Scaly Permissions								
Advertisements	"Advertisements"		"Advertisements you click unintentionaly"	"Advertisements"	"Too much advertisements"		"If there is no way to get rid of advertisements"	
Learning curve								
Poor design			"If it crashes"		"If it crashes"		"No timeouts where there should be"	
Slow App			"If its slow"	"Loads to long"	"If it is slow"		"If it lags"	
Bugs								
Battery Consumption			"If it lets your battery drain to		"Uses a lot of battery"			
Data Usage	"It should not use to much data"				"Heavy data usage"			
Resource intensive	"It must not use a lot of space on my							
Affects the rest of the phone	"If it freezes my phone"							
Unpredictable								
Not aligned with computer version						"Sometimes apps are different than on the computer"	"If it does not have all the functionality of the computer"	
Limited Functionality						"If it misses some features"		
In App purchasing								
Purchases								
Purchase History	No	No	No	Yes	No	No	Yes	No
Willing to purchase	"Maybe"	"If I did it once I will do it again easier"	"Maybe if it was affordable"	"If there is no free alternative available"	"If I know it's a good app before having to buy it"	"If they are not to expensive"	"I will remove adds or buy apps that perform exclsive tasks"	"If priced fairly and once off"

	Interview 17	Interview 18	Interview 19	Interview 20
Age	23	36	15	23
Ocupation	Manager at Delhi	Subject expert NWU	School	Student, Masters computer ingenieuring
Smartphone	Android	Android	Android	Android
User Type	Experienced user	Enthusiastic user	Routine user	Experienced user
Time on Phone	6 hours	4 hours +	6 hours	1 hour
Apps	WhatsApp, Youtube, Google Chrome, Guitar tuner	9gag, Online shopping, Google apps, Dropbox, Volumeo, Deezer	WhatsApp, Facebook, Instagram	WhatsApp, Email, Google Chrome
Negative attributes				
Notifications	"Apps that interfere while I am			
Too many updates				
Breach of security/privacy	"If they interfere with my privacy and gets secure information"			
Scaly Permissions	"I do not like that apps want my location or contact info"			"I do not like shady permissions"
Advertisements		"Advertisements popping while I am busy"		"No pop up ads"
Learning curve		"I do not want to spend a lot of time		
Poor design		"If something crashes"		
Slow App				"Apps should be fast"
Bugs				
Battery Consumption		"It must not drain my battery"	"How much battery it uses"	
Data Usage			"If it uses to much data"	
Resource intensive		"It must not use to much RAM"	"How much space it takes on my	
Affects the rest of the phone				
Unpredictable				"It should not do things you did not expect"
Not aligned with computer version				
Limited Functionality				
In App purchasing				
Purchases				
Purchase History	No	Yes	No	Yes
Willing to purchase	"I will neve buy only use freeware"	"I will buy apps that is not priced ridiculously"	"I might buy WhatsApp if it was very cheap"	"If the trial version is good I might buy it"

	Interview 1	Interview 2	Interview 3	Interview 4	Interview 5	Interview 6	Interview 7	Interview 8
Positive Aspects								
Comfort/Convenience		"Comfort"		"Convenience"		"Convenient to use"	"It makes my life easier"	
Keeps me updated				"Keeps me connected to information"				
Comprehensive			"It should have everything that I expect of it"		"Does not always do what it should"			
Productivity		"It must fulfil my user needs"						
Speed up tasks								
Portability/Mobility								
Goal Driven	"Should have a clear goal"				"It should have a specific goal and be good at it"			
Relevant		"It should be of relevance to me"						
In line with target market			"Should be clear on what market this app is for"					
True to its title/ description			"It should be relevant to its title"					
Clear descriptions			"It should immediately tell you what it does"					
Functionality				"It must be stable"	"Functionality"			
Constant Improvements						"It gets improved all the time"		
Entertainment							"Fun"	
Time Killer							"Can waste time with it"	
Social/Sharing				"It keeps me connected to people"				
Positive Ratings and Reviews								
Popular							"If everyone have it"	
Realistic			"Accurate to real life"					
In line with my Interests			"It should be interesting"					
Exploration/ Educational								
Personalization, Settings								
Innovative, Unique								
Offline Usability				"It should work when you use it offline"		"I do not like that everything is synched"		"It should be usable in airplane mode"
Affordable		"Affordability"			"If they are free"	"If it is low cost"	"Free"	
Integration of Accounts					"Integration of accounts"			
Cross Platform					"If an app is cross platform"			
Remember use					"It should net reset everytime I return"			
Fluency of navigation								"Features is easy to reach"
Clear instructions,								"You know exactly what to do"
Feedback								
Ease of use	"Fast to use"	"It should be easy to use"	"It should work easily"	"Do not want a hard time finding features"		"Easy to use"	"How much effort it takes to use"	"Something that is user friendly"
Simplistic	"Simplistic"	"It should not be difficult to use"					"It should not be too complex"	"Simplistic"
Well organized Information/layout			"It should have a good layout"					"Everything is well organised and categorised"
Well designed interface				"Interface must be user friendly"	"Interface is important"		"Friendly user interface"	
Consistent				"It must be consistent"				

	Interview 9	Interview 10	Interview 11	Interview 12	Interview 13	Interview 14	Interview 15	Interview 16
Positive Aspects								
Comfort/Convenience			"It helps to make my life easier"	"It just make everyday things	"If it makes my daily tasks easier"	"It makes your life easier"		"If it is convenient to use"
Keeps me updated				"It reminds me of things"	"It can help me plan things and make notes"	"Easy access to information"		"It helps me stay in contact with everything"
Comprehensive								
Productivity				"Productive apps"		"Communicate with my clients"		
Speed up tasks			"You can do things faster on you phone"					
Portability/Mobility						"It is with you all the time"		"I have immediate access to my things"
Goal Driven		"It should do one thing and do it good"		"They get to the point"				
Relevant								
In line with target market								
True to its title/ description				"They don't pretend to be something else"			"If the app is not as expected"	
Clear descriptions				"I want to know exactly what its going to do"		"Everything should be clearly defined"		
Functionality		"It should just work"					"Functionality is very important"	
Constant Improvements								
Entertainment				"It keeps me entertained"	"I use it for relaxation"			
Time Killer								
Social/Sharing	"Sending messages to my friends"		"You can share photos with friends"		"It's fun to see what goes on in other peoples			
Positive Ratings and Reviews								
Popular					"I use the popular apps","Its easy to			
Realistic								
In line with my Interests								"I can discover things I like"
Exploration/ Educational				"You can find new ways to do things"				"I can lear new things"
Personalization, Settings								
Innovative, Unique								
Offline Usability		"It should not want internet all the time"					"It must be able to function without the internet"	
Affordable	"If it costs to much"	"If it is cheap"	"You can do things for free"		"If it is free"			"If it is cheap"
Integration of Accounts								
Cross Platform								
Remember use							"I can come back to it later on and	
Fluency of navigation				"I don't want splash screens"		"Sometimes I cannot get where I	"The flow of information	
Clear instructions,						"Easy instructions"		
Feedback						"It shows when a message was		
Ease of use			"It is easy to use and understand"	"They should not even have to explain it"	"If an app is easy to use"	"An app should not be difficult, easy to	"User friendly"	"If it is easy to use"
Simplistic		"Keep it simple and straight"	"No complicated buttons"	"I just want to start straight up"		"It is simplistic"		"I do not like complex apps"
Well organized Information/layout							"Neat layout, I want to see where is what"	
Well designed interface							"How it looks, the interface should	
Consistent								

	Interview 17	Interview 18	Interview 19	Interview 20
Positive Aspects				
Comfort/Convenience				
Keeps me updated			"I can see what everyone is doing"	
Comprehensive		"I want an app to perform everything in its scope"		
Productivity				
Speed up tasks				
Portability/Mobility				
Goal Driven				
Relevant				
In line with target market				
True to its title/ description				"It should work as you expected"
Clear descriptions				
Functionality				"It must work well"
Constant Improvements	"If they regularly add better			
Entertainment				
Time Killer				
Social/Sharing	"I can share photos with friends"	"How easy you can share content"	"It keeps me in contact with friends"	
Positive Ratings and Reviews				
Popular				
Realistic				
In line with my Interests				
Exploration/ Educational	"I can use it to learn things"			
Personalization, Settings				"If apps have settings which I can personalise
Innovative, Unique				"It should contribute something unique"
Offline Usability				"It should offer Offline support"
Affordable			"Cheap"	
Integration of Accounts		"How easy it can connect with		
Cross Platform				"I prefer apps with a PC client"
Remember use	"It remembers your preferences"			
Fluency of navigation		"I do not want to move around to		"They have a good feel"
Clear instructions,		"Quick 3 step tutorials to cover		
Feedback				
Ease of use	"User friendlyness"	"Buttons must not be to small"		"Easy to use"
Simplistic		"Simplicity"	"Simple"	
Well organized Information/layout		"The screen must not be to cluttered"		
Well designed interface		"Simplistic interface"		
Consistent		"Things that are standardised"		"It should be native"