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# How to make money on mobile applications

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## Problem Description

### How to Make Money on Mobile Application

The number of applications on mobile devices have had an extreme increase the last two years. Apps in *App Store* have increased from 140,000 in January 2010, to over one million in January 2014. Google's *Google Play* have witnessed an even greater increase, with 100,000 applications available in October 2010, to more than one million in July 2013. Applications have begun to take a larger part in people's life, and by introducing Firefox OS in developing countries, this is likely to continue. It is a highly profitable market, and every day new applications compete to get the consumers' attention. One example of a huge success is Snapchat. Last year, Snapchat turned down a 3 billion dollars offer from Facebook, and a 4 billion dollars offer from Google. The main research question for this thesis is to analyze the money-earning logic for mobile device applications. A case study of a self-developed application for both Android and iOS will be performed. In particular, the following issues will be analyzed:

- Background study of the economic markets for mobile device applications and their history, with emphasis on indie applications.
- Present and analyze a complete business model for the case study application, using Osterwalders business model ontology.
- Analyze different income models, using available sale statistics.
- General analysis of how the application is influenced by network effects, positive feedback and other digital economic key aspects.

## **Preface**

This master thesis concludes my master's degree in Communication Technology with emphasis in telecommunications economy at the Norwegian University of Science and Technology (NTNU), department ITEM. The thesis was carried out during the spring semester of 2014. It is a customized thesis based on an idea about obtaining an in-depth understanding of the application market through an analysis of a self developed application.

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Last I would like to thank everyone that downloaded my app, tested it and contributed to enough data for me to analyze in this thesis.

T.T.

## Sammendrag

Antall mobilapplikasjoner vokser eksponensielt med over 1,000 nye applikasjoner utgitt hver dag, og allerede 1 million tilgjengelig. Konkurransen mellom applikasjoner er hard, men applikasjonene som blir populære genererer store inntekter. Et eksempel er WhatsApp som ble kjøpt opp av Facebook i 2014 for 19 milliarder dollar. Applikasjonsmarkedet er et *vinneren tar alt* marked, som alle kan delta i ved å utvikle sin egen applikasjon. Det er ingen kostnader i form av penger for å utvikle en applikasjon, og utviklere trenger derfor bare å riskere sin egen tid. Formålet med denne masteroppgaven er å øke forståelsen av mobil applikasjonsmarkedet, og å analysere det fra et forretningsmessig perspektiv. Det er spesielt et emne masteroppgaven utdyper, og det er analysen av den egenutviklede applikasjonen i forbindelse med applikasjonsmarkedet. Tre er tre hovedteamer som blir analysert assosiert med dette emnet, og er som følger.

1. Utviklingen og markedsføringen av mobilapplikasjoner
2. En fullstendig forretningsmodell for mobilapplikasjoner
3. Graden nettverkseksternaliteter påvirker mobilapplikasjoner

1. For å kunne gjøre en grundig analyse av hovedfaktorene som påvirker applikasjoner, utviklet og analyserte jeg min egen mobilapplikasjon. Under utviklingen fikk jeg erfaringer av den enorme mengden av tid og krefter som ligger bak utviklingen av applikasjoner, og faktorene som må være tilstede for å møte brukerens behov. Da applikasjonen var ferdig, gjennomførte jeg en omfattende markedsføring gjennom reklame på Facebook. Under markedsføringen ble applikasjonen rangert som den 26. mest populære applikasjonen på den norske App Store, og som det 2. mest populære ordspillet. På grunn av applikasjonens popularitet, ble jeg intervjuet av avisen *Byavisa*, TV-kanalen *TV2*, og i boken *Mobile App Growth Hacks*. Masteroppgaven gir en analyse av effekten fra markedsføringen og de ulike intervjuene, samt effekten fra andre markedsføringskanaler benyttet. Primær funnet i forhold til dette temaet, er den store effekten markedsføring har på applikasjonens popularitet og applikasjonens evne til å tilegne seg nye brukere. Dette indikerer viktigheten for applikasjoner som strever med å bli lagt merke til.

2. Masteroppgaven presenterer en fullstendig forretningsmodell for den egenutviklede applikasjonen ved bruk av Osterwalders forretningsmodell ontologi. Forretningsmodellen undersøker hvordan applikasjoner skaper verdi for målgruppen deres, og gir en grundig analyse av den egenutviklede applikasjonens kostnadsstruktur og hvordan den genererer inntekter. Hovedfunnene i forhold til forretningsmodellen, er den store innvirkningen applikasjonens brukeraktivitet har på inntektene, og at inntektene subsidierer kostnadene i en stor grad.

3. En omfattende analyse av nettverkseksternalitetene som påvirker den egenutviklede applikasjonen er utført. Analysen viser til den store påvirkningen nettverkseksternaliteter har på applikasjonens evne til å opprettholde eksisterende brukere og tilegne seg nye. På grunn av nettverkseksternalitetene, kan det føre til en eksponensiell økning eller reduksjon i applikasjonens popularitet. Ved å avvende en modifisert epidemiologisk modell på den egenutviklede applikasjonen, er applikasjonens nettverkseksternaliteter modelert. Modellen er beregnet basert på applikasjonens brukeraktivitet og effekten fra nettverkseksternalitetene, og gir dermed matematiske ligninger som kan bli brukt av utviklere for å få mer kontroll over effektene.

Det er tre andre funn i masteroppgaven verdt å merke seg. For det første, psykologien i applikasjoner er en av de viktigste faktorene for å øke applikasjonens brukeraktivitet, og dermed inntektene. Applikasjonens psykologi øker brukernes ønske om å fortsette å bruke applikasjonen, ved å fokusere på brukernes følelser og atferd. For det andre, det er fem nøkkelindikatorer som analyserer applikasjonens styrker og svakheter for å kunne øke brukernes engasjement, og dermed øke applikasjonens inntekter ved å fokusere på de mest lønsomme brukerne. For det tredje, applikasjonens popularitet er hovedsakelig bestemt av applikasjonens omfanget av *Jungeltelegraf* konseptet. *Jungeltelegrafen* er i utgangspunktet formidling av informasjon fra person til person ved muntlig eller digital kommunikasjon. I applikasjonsmarkedet, oppstår dette når personer deler deres mening om en applikasjon til andre. Effekten fra konseptet er stor, og må være tilstede for at en applikasjon skal kunne opprettholde sin popularitet.

## Abstract

The number of mobile applications grows exponential fast with 1,000 new applications published each day, and 1 million already available. The competition among applications is fierce, but the applications that become popular generates large revenues. One example is WhatsApp, which was acquired by Facebook in 2014 for \$19 billion. The application market is a *winner-take-all* market, that everyone can participate in by developing their own application. There is no cost in terms of money to develop an application, and thus developers only need to risk their own time. The aim of this thesis is to gain an understanding of the mobile application market, and to analyze it from a business perspective. It is especially one topic this thesis elaborates, and that is the analysis of the self-developed application in relation to the application market. There are three main subjects that are analyzed associated with this topic, and are as followed.

1. The developing and marketing of mobile applications.
2. A complete business model for mobile applications
3. The impact of network externalities influencing mobile applications.

1. In order to do an in-depth analysis of the main factors influencing applications, I developed and analyzed my own mobile application. During the development I obtained experiences of the vast amount of time and effort behind the development of applications, and the factors that need to be present in order to meet the users' needs. When the application was finished, I conducted an extensive marketing through advertising on Facebook. During the marketing the application became ranked as the 26th most popular application on the Norwegian App Store, and the 2nd most popular word game. Due to the application's popularity, I was interviewed by the newspaper *Byavisa*, the TV channel *TV2*, and in the book *Mobile App Growth Hacks*. The thesis presents an analysis of the effect from the marketing and the various interviews, along with the effect from other marketing channels utilized. The primary finding in relation to this topic, is the large effect marketing has on the application's popularity and the application's ability to acquire new users. This indicates the importance of marketing for applications that struggle to be noticed.



2. The thesis presents a complete business model for the self-developed application by using Osterwalder's business model ontology. The business model examines how applications create value to their target customers, and provides an in-depth analysis of the self-developed application's cost structure and how it generates revenue. The main findings in relation to the business model, is the large impact the application's user activity has on the revenue generated, and that the revenue subsidizes the costs to a large extent.

3. An extensive analysis of the networks externalities influencing the self-developed application is performed. The analysis presents the large influence network externalities have on applications' ability to maintain existing users, and acquire new. Due to the network externalities, this may lead to an exponential increase or decrease in the application's popularity. By applying a modified epidemiological model on the self-developed application, the application's network externalities are modeled. The model is calculated based on the application's user activity and the effect from the network externalities, and thus provides mathematical equations that can be used by developers to gain more control over the effects.

There are three other findings in this thesis worth noting. First, the psychology in applications are one of the key factors to increase applications' user activity, and thus the revenue. The application's psychology increases users' desire to continue using the app, by focusing on users' emotions and behavior. Second, there are five key performance indicators that analyze the application's strengths and weaknesses in order to increase users' engagement, and thus increase the application's revenue by focusing on its most profitable customers. Third, the application's popularity are primarily determined by the application's extent of the Word of Mouth concept. Word of Mouth is basically passing of information from person to person by oral or digital communication. In the application market, this occurs when people share their opinion about an application to others. The effect from the concept is large, and has to be present in order for an application to maintain its popularity.

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# Acronyms

**App** Application

**OS** Operating System

**IAPs** In-App Purchases

**NTNU** Norwegian University of Science and Technology

**ARPD** Average Revenue Per Download

**ARPU** Average Revenue Per User

**ARPPU** Average Revenue Per Paying User

**ARPPDAU** Average Revenue Per Daily Active User

**CAC** Customer Acquisition Cost

**KPI** Key Performance Indicator

**LTV** Customer Lifetime Value

**CTR** Click-Through Rate

**CPM** Customer Per Thousand

# Chapter 1

## Introduction

This chapter presents the background and motivation behind writing this thesis, and the problem formulation based on the motivation. Later on, the main objectives in this thesis are discussed and the thesis' limitations in relation to the objectives given. At the end the structure of the report is provided.

### 1.1 Background and Motivation

The number of applications (apps) on mobile devices have had an extreme growth the last two years. Apps on Apple's *App Store* have increased from 140,000 in January 2010, to over one million in January 2014 [70]. The growth on Google's *Google Play* is even bigger, from 100,000 apps available in October 2010, to more than one million in July 2013 [71]. Apps have begun to take a larger part in people's life, and by introducing Firefox OS in developing countries, this is likely to continue.

With approximately 1,000 new apps released every day [22], the competition is fierce, and apps struggle to compete with the enormous amount of other apps available. It is a *winner-take-all* market, where popular apps become highly valuable, one example is Snapchat. Last year (2013), Snapchat turned down a \$3 billion offer from Facebook, and a \$4 billion offer from Google [72].

A large percentage of students in technological environments have begun to take part in this

new market, and already at NTNU two very successful apps have their origin; Fun Run and Wordfeud. In the beginning of 2013, NTNU established *Applab*<sup>1</sup>, in order to create an environment for developers at NTNU. This resulted in an increase of interest to develop apps among the students. There are papers written about the app market with the emphasis on its growth and future potential, but since data from available apps are limited, assumptions are usually done. In order to avoid this, I created my own app to obtain a deeper understanding of the app market. Thus, the thesis differentiate itself from other papers, because it provides an in-depth analysis of the fundamentals influencing apps through the study of a self-developed application. The thesis therefore presents an analysis of the app market from both a technological research perspective, and a developer's perspective.

To obtain enough data from the case study application in the limited time it was available on the app stores, an extensive marketing was conducted. During the marketing, the app became ranked as the 26th most popular app on the Norwegian App Store, and the 2nd most popular word game. By reaching out to the media after the app had gained popularity, I was interviewed three times. The first interview was conducted by the American company *Serenity App Solutions* in its book *Mobile App Growth Hacks*, see Appendix C. The interview's goal was to give the readers an understanding of the requirements related to developing and marketing apps. The second interview was performed by the newspaper *Byavisa* and became the headline in the business section from May 13th to May 20, see Appendix B. The interview's topic was concerned with the factors behind apps' popularity. The third interview was conducted by the tv channel *TV2* and was sent every hour on May 30th, on the news channel *TV2 Nyhetskanalen*. The interview's topics was the case study app's popularity. Through the interviews, I obtained outreach experience and a deeper understanding of media's effect on apps' popularity.

## 1.2 Problem Formulation

The main research objective in this thesis is to analyze the money-earning logic for mobile device apps. In order to encounter the objective, a background study of the economic markets for

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<sup>1</sup>Applab is a place where the students at NTNU can meet, discuss and work in team to develop apps for both iOS and Android.

mobile device apps and their history is provided. Later on, a case study of a self-developed app is performed. The thesis presents and analyze a complete business model for the case study app, using Osterwalders business model ontology. Thereafter, an analysis of the effect from the different distribution channels in relation to the case study app is performed. Later on, a general analysis on how the app is influenced by network effects, positive feedback and other digital economic key-aspects are discussed. Then, the thesis provides an overall analysis of the challenges developers encounter during the developing and marketing of apps. In the end, the conclusion and recommendation for further work are given.

### **1.2.1 Objectives**

The main objectives of this master thesis are collected and elaborated from the problem formulation. An extensive analysis of the app market, and an in-depth study of a self-developed application provides answers to the objectives. Due to the limited time the case study app had been available on the app stores, it did not generated enough sufficient data to analyze its revenue stream, and thus two of the economic key-aspects in relation to revenue are not of relevance. However, as few apps ever generate revenue, the thesis rather provides the requirements and challenges related to developing and marketing apps. The main objectives this thesis aims to answer are as followed.

1. What are the costs related to apps, and how do they generate revenue? Are there any digital economic key-aspects relative to apps?
2. To what extent are apps influenced by network externalities? Are there ways to model these effects, and thus learn how to benefit from them?
3. What are the requirements and challenges in relation to developing and marketing apps? What does it take for an app to become successful?

### **1.3 Limitations**

The thesis focuses on the app market as a business from the perspective of independent app developers and small developer teams. This limits the available funds the team has to hire design-

ers, developers, people with marketing skills or invest large amounts of money in advertising. These options are therefore not elaborated to the same extent as the options relative to developers with a limited budget.

The main focus of this thesis is the case study app *Guess This Sound*. The thesis presents a business model and a business strategy for the case study app, by using Osterwalder's business ontology and other business strategy key concepts. The business model is therefore representative for independent developers or teams consisting of few individuals, and not large enterprises. Due to the limited time the app was available on the app stores, the analysis was done based on the data available on that time. Since the app did not generate any revenue, only the cost structure is evaluated. Thus it was not possible to calculate two of the apps' key performance indicators; *lifetime value* and *ARPU*, *ARPPU* and *ARPDau*. However, in terms of network externalities, the data analyzed gives an in-depth analysis of the app's network effects and shows that a modified epidemiological model (SIR model) can be successfully applied in order to model these effects.

The thesis is limited by only one in-depth study of an app in the app category game, considering the vast amount of apps in this category and the total amount of available apps. Due to the limited time, I had to focus on developing the app, and later do an extensive marketing to obtain enough sufficient data. My main focus was therefore to analyze the developing and marketing of the app, and the large amount of factors that influence the app on different levels. These factors are studied and explained in advanced in the chapters before the elaborating of the case study app. Examples of the factors studied are network externalities, pricing strategies, economic key-aspects, marketing, Osterwalder's business model ontology and other business concepts. However, because of the limited time, they are not elaborated to a large extent, and are only explained on a general level. They are however analyzed in conjunction with the case study app which provides a sufficient analysis of these factors in relation to this particular app. In other words, the thesis presents these factors on an overall level, and thereafter analyze them in relation to the case study app which is the in-depth study in this thesis.

The app had to be done before writing this thesis, and thus because of the limited time, not all desirable approaches have been feasible. The thesis therefore assumes in the less elaborated cases that others' research are sufficient. For example, the app's price was not switch back and forth from paid to free to see the effect Thomas Carter explained in 5.1.3. I neither had the money or time to see if I could avoid the app's user activity to rapidly decline, by preventing the irSIR Equation 4.7 to be satisfied.

## 1.4 Contributions

The contributions in this thesis are as followed.

- Chapter 2 presents a detailed study of the app market in general with the main focus on its evolvement, based on a composition of different studies and analysis.
- Chapter 4 provides a qualitative analysis of the app market in relation to its ecosystem and the network externalities influencing it. The analysis is carried out based on studies and research written by other individuals.
- Chapter 5 gives a detailed study of the app market from a business perspective with main focus on the different pricing strategies, economic key indicators and the marketing. The study is composed of extensive studies from numerous different sources.
- In order to analyze the key factors in the app market in-depth, I developed a self-developed app during the time I wrote this thesis.
- Chapter 7 presents an extensive study of the self-developed app's business model using Osterwalder's business model ontology framework. The ontology is thoroughly described in the thesis in chapter 6. The study further presents an analysis of the self-developed app in relation to the main factors in the app market, such as marketing, network externalities and economic key indicators. The study provides an in-depth analysis of the case study app's network effects by applying a modified epidemiological model (SIR model).
- Finally, a composition of the experiences obtained through the development and marketing of the self-developed app is provided in chapter 8.

## 1.5 Structure of the Report

The report is structured as follows.

**Chapter 2** provides the necessary background information of the app market in general, from the beginning to its current state.

**Chapter 3** explains the methods and approaches used to acquire and process relevant data for the qualitative analysis in this thesis, both in relation to the research studies and the case study app.

**Chapter 4** presents the app market from a business perspective by looking on different concepts such as the *long tail*, *value creation* and *network externalities*. The concepts are later used in the analysis of the case study app. The section *irSIR Models* uses epidemiological modeling to model and analyze the app market's network effects.

**Chapter 5** describes the different business strategies in relation to apps, such as pricing strategies and apps key performance indicators. Further, the chapter examines different marketing channels with emphasis on the Word of Mouth concept and the psychology within apps.

**Chapter 6** describes Osterwalder's business model ontology which is later used to analyze and present a complete business model for the case study app.

**Chapter 7** presents a brief description of the case study app and later a complete business model by using Osterwalder's business model ontology. Further the chapter provides an analysis of the different marketing channels and their effect. Later on, the chapter analysis the case study app's network externalities and model them by applying a modified SIR model. At the end, the chapter analyze the different key performance indicators in relation to the case study app.

**Chapter 8** discuss the challenges and requirements developers face when developing and mar-

keting apps. The chapter later describes key factors developers should be aware of, in order to increase the probability for the app to become popular. At the end, the chapter presents a collection of the most important experiences I obtained during the developing and marketing of the self developed app.

**Chapter 9** provides the conclusion and recommendation for further work.

**Appendix A** contains the calculation of the case study app's irSIR model.

**Appendix B** contains the interview with the newspaper *Byavisa*.

**Appendix C** contains the interview in the book *Mobile App Growth Hack*.



# Chapter 2

## Background

This chapter provides background information about the mobile app market in general with an overview on how this market has evolved from the beginning. In addition a description of the different app categories is provided, and later a valuation of digital products and popular apps from an economic perspective is given. At the end, the related work is presented.

Before presenting the apps' history and a description of this new market, it is necessary to provide an elaboration of what an app is. App is short for application and are basically a software that runs on top of the computer's operating system. According to Techopedia [110], apps are generally small, individual software units with limited function, that are downloaded from the app stores (digital distribution platforms for mobile apps) through the phone or the Internet. According to [42], the difference between an app and general software is that *software is the OS and all its associated programs installed in the computer in order to run the hardware. Apps on the other hand are also a piece of software, but they are designed to help the user perform various of tasks on the OS, and are usually an add-on on top of the OS.* Apps are not limited to handset devices, they are developed for a vast amount of other electronic devices such as cars, refrigerators and TVs [50]. However, the thesis's scope is limited to apps running on mobile devices.

## 2.1 History

In the beginning the most popular functions in mobile phones were calling and sending text messages. Back then, the competition among the mobile phone companies was fierce, and the secrets were closely guarded. In order to not expose the secrets of the phones, the software were developed in-house (first-party) resulting in a very limited amount of functionalities inside the software [5]. At the end of the twentieth century, the company *Nokia* became famous for including the game Snake (see Figure 2.1) in some of the company's first mobile phones. Other companies followed and added games such as Tetris, and Tic-Tac-Toe. The games were developed in-house and were part of the mobile phone operating system (OS). Therefore, they are not considered as apps. However, this was the first step towards implementing apps on mobile devices.

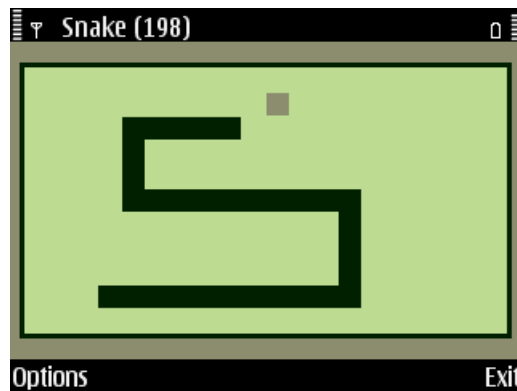


Figure 2.1: The Game Snake on a Nokia Mobile Phone [43]

Mobile phones became cheaper and more commonly used, and thus more functionalities were added to the phones. Already in 1993, IBM introduced its mobile phone *IBM Simon* which was the world's first smartphone. It included a calendar, address book, clock, calculator, notepad, email and a touchscreen with a *QWERTY* keyboard<sup>1</sup>. However, due to limited storage, processor capacity, and low battery time, the mobile phone never became a success [80]. In 1991 2G<sup>2</sup> was introduced. 2G technology allowed mobile data services, and later in 1998 the first downloadable content was sold on mobile phones; ring tones. Later in 1999 Nokia released their mobile

<sup>1</sup>QWERTY keyboards are the standard keyboard on all computers

<sup>2</sup>2G (or 2-G) is short for second-generation wireless telephone technology [81]

phone Nokia 7110, which was the first mobile phone with an WAP<sup>3</sup> browser [79].

3G<sup>4</sup> was commercially opened for businesses in Europe, by Telenor in December 2001. The technology continued to spread and in June 2007, the same month as the first iPhone was introduced, 200 million subscribers in total were connected. Although mobile phones long had the ability to access data networks such as the Internet, people did utilize it until the widespread of good quality 3G coverage [83].

In 1998, Nokia became the largest mobile phone company in the world, and held the position until 2012. Nokia still has 9 of 10 mobile phones on the top 10 list of most selling mobile phones ever, the number one is Nokia 1100 with 250 million units sold [84]. Unfortunately for Nokia, Apple had a new mobile phone concept, and in June 2007, the iPhone 1G was released. iPhone 1G made it possible and easy to do more than just call and send text messages. With the iPhone, people could listen to music, upload photos to the Internet or browse the Internet with the Safari web browser. These new functionalities, also referred to as apps, quickly became very popular. Apple saw this opportunity, and encouraged developers to program web-based apps that would behave like native apps<sup>5</sup>. However few good web apps were developed, and Apple later opened up for third-party developers to develop native apps by releasing the iOS SDK<sup>6</sup> in March 2008. This gave everyone the opportunity to develop apps for iPhone's operating system iOS, resulting in a large increase of number of apps created. The day after, Apple released App Store, a digital distribution platform containing every iOS app. This made it easy for everyone to share their apps and create a business around them.

On July 10 2008, only few month after the iOS SDK was released, Steve Jobs (the former CEO of Apple) announced that App Store contained 500 third-party apps to iPhone and iPod Touch, and of these 25% of them were free. When App Store opened the day after, 10 million apps were

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<sup>3</sup>Wireless Application Protocol (WAP) is a technical standard for accessing information over a mobile wireless network [78]

<sup>4</sup>3G, short for third Generation, is the third generation of mobile telecommunications technology [82]

<sup>5</sup>Native apps, are apps which are developed for one operating system such as iOS, Android, or Windows

<sup>6</sup>SDK is short for Software Development Kit, which allows developers to create apps for a certain operating system.

downloaded the first weekend. Only half a year later in January 2009, Apple announced that 500 million apps had been downloaded, and the billionth app was downloaded on April 23rd, 2009 [2]. On Apple's annual iPad event in 2013, Tim Cook (the CEO of Apple) announced that more than 60 billion apps had been downloaded from App Store, and that 1 million apps were available [3]. Figure 2.2 shows the increase in number of apps on App Store.

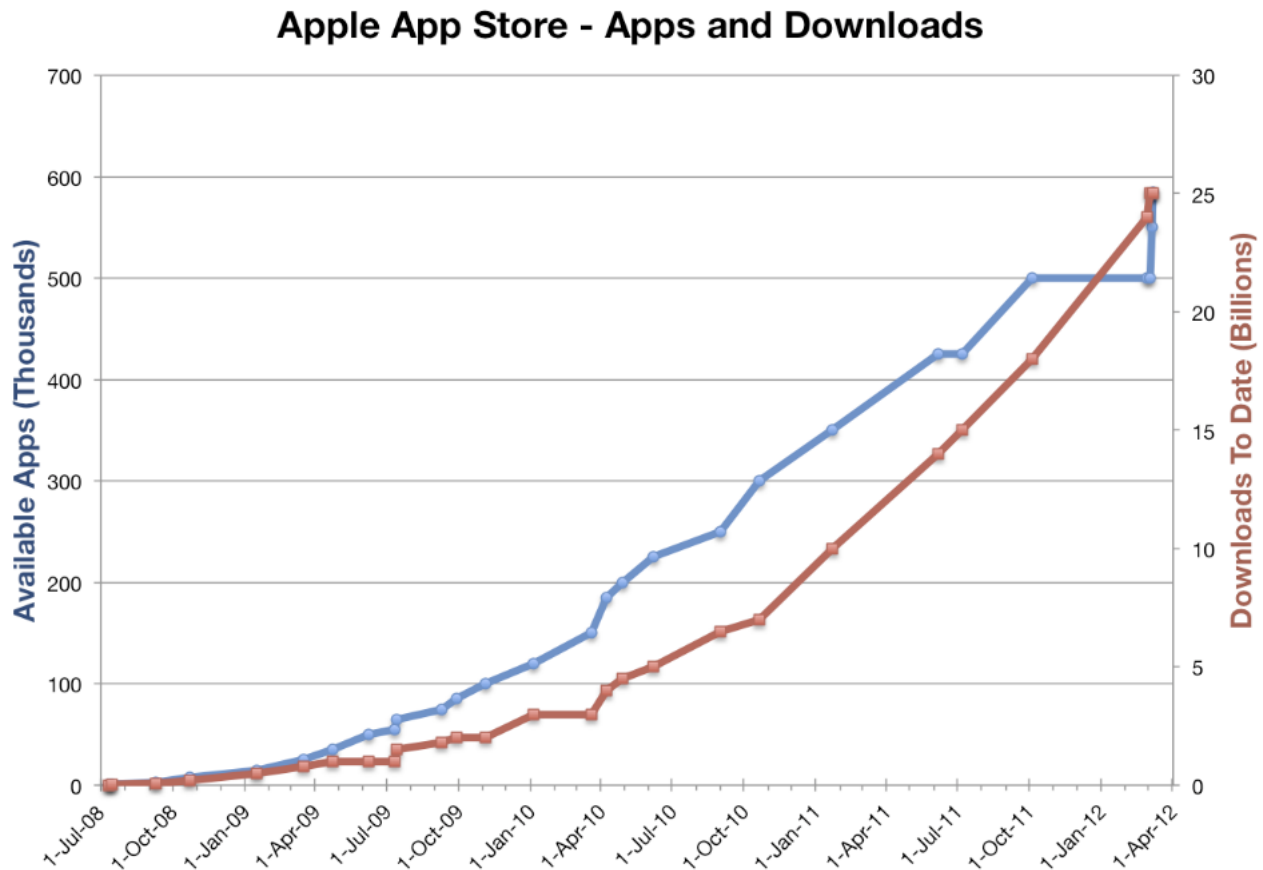


Figure 2.2: The Number Of Available and Downloaded Apps on App Store [44]

The enormous success with iPhone and iPad, made Apple in 2012 the most valuable company in history in terms of market capitalization, taking the throne from their old rival Microsoft[4]. Other companies witnessed Apple's success, and decided to join the market. In September 2008, more than a year after the first iPhone was introduced, Google's OS Android was released, and only one month later, Google Play (formerly Android Market). Google Play is exactly the same as App Store; a digital distribution platform for Android apps developed by first- and third-party.

Google entered the mobile app business later than Apple, but has enjoyed an even greater increase in amount of available and downloaded apps. This is due to the fact that Android is a free OS that every smartphone manufacture company can utilize, and thus faster distributed compared to iOS which is limited to Apple's products. Figure 2.3 shows the global OS market share in percentage, in the end of 2012.



Figure 2.3: Smartphone OS Global Market Share 2012 [40]

Figure 2.3 shows that Android had 68.4% of the global OS market share, and sold in 2012 more than 700 millions smartphones. Compared to Android, iOS had only 19.4% in 2012 [40]. With an almost equal amount of available apps on App Store and Google Play, one would think that Google generates more revenue in this market compared to Apple. However, due to complete different business models, this is not the case. In 2013 the total revenue in the app market was \$26 billion, where Android stood for \$5.2 billion and iOS \$19.24 billion [54], Figure 2.4 shows this in percentage.

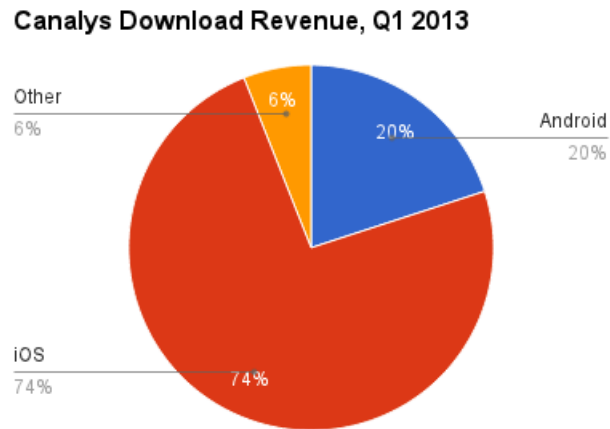


Figure 2.4: Average Revenue From Downloaded Apps [41]

This is because Android was developed to increase Google's largest revenue stream, advertising. On the other hand, Apple focus on generating money on in-app purchases (IAPs), in-ads, and priced apps. iPhones are also more expensive than most Android phones, and people with more money tend to use more than people with less. This is only an assumption, but studies [41] show that iOS users are spending a lot more on apps, even when they are downloading fewer of them overall.

Other companies that compete for the market share are Microsoft, and Mozilla with Firefox OS. Microsoft had only 3.6% of the globally smartphone market share the third quarter of 2012, but there are claims that Microsoft actually will surpass Apple's globally OS market share in approximately three years. The assumptions might be overestimated, but as the numbers show, Microsoft gain market share while its competitors lose [85]. Further, Microsoft acquired Nokia's phone business for \$7.2 billion the first quarter of 2014 [87], and tries to compete with Android by allowing smartphone manufactures to utilize Windows OS for free [86]. Firefox OS aims to attract users in developing countries that can not afford a high-end mobile device. The smartphone costs \$25, and thus several compromises in relation to the processor performance were necessary in order to create the phone. The first Firefox OS smartphone was launched in July 2013, and have already expanded into 15 markets. Firefox OS is predicted to become prevalent in this part of the market in the years to come [114]. However, Google and Apple are currently in control of this market as they are by far the largest smartphone OS distributors in the world,

and the thesis therefore focus on those two companies in relation to the app market.

In 2010 Apple secured the trademark for the iPhone-promoting phrase *there is an app for that* [51], and by looking on the exponential growth of apps in Figure 2.2 this might be true. However, as technology continue to evolve significantly fast, will apps continue to be a large part of peoples' life or will they be replaced by new technologies? For most technologies this is inevitable, however apps are not just a technology product, they are a type of software. The large mobile device manufactures will never have enough manpower or resources to develop everything the customers desire. Thus, to fulfill the customers' needs, the mobile device software must have the ability to add additional software developed by a third-party (i.e. apps).

When the 1 million app threshold on App Store breached on December 17th 2013, they came from 262,000 different publishers and a high percentage of them were indie developers<sup>7</sup>. Hence, there are a large variations of the quality of apps. Fortunately, Google and Apple remove apps they find as low quality apps and currently a total of 370,000 apps are removed [22]. An app is considered as an low quality app if the percentage of users downloading the app and later delete it is high. As of March 24th 2014, there are 1,185,734 available apps on Google Play, where the percentage of low quality apps are 21% (249,004 apps) [23]. In order to obtain a deeper understanding of the different apps available, a description of the different categories is needed.

## 2.2 App Categories

There are a vast amount of categories and subcategories in the app market, which separate apps on slight differences. To not to describe them all, this subsection provides a brief description of the most popular categories on both Google Play and App Store in 2013 [115].

### 2.2.1 Social network

The *Social Network* category represents apps used to communication and information sharing at on single place. They are usually developed based on the company's already existing service

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<sup>7</sup>Indie developers refers to apps developed by one independent developer, or a small team up to 10 persons.

on Internet. Social network apps are for example, dating apps like Badoo, or a place to share short messages such as Twitter. The most successful app in this category is however Facebook, with 945 million mobile users of its 1.23 billion users on Internet. Developers usually integrate Facebook in their apps, to let the users share the app's content on the social network [7]. This increases Facebook's value, since a large number of apps use it as a distribution channel in order to benefit from its network effects. Social networks are highly influenced by network effects, and the thesis later analyze Facebook in relation to these effects, presenting a less bright future for the large company.

### 2.2.2 Photography

The category *Photography* includes apps that have a photographic concept, such as editing or sharing of pictures and videos. Two very popular apps in this category are Instagram and Snapchat. Instagram let the users take a picture or a video with the phone, add effects to it, and later publish it on their Instagram profile. People can see others' pictures by following their profile. Instagram was published in October 2010, and in April 2012, the app had 100 million active users. Later that month Facebook acquired the app for approximately \$1 billion [8].

Instagram is a huge success, but an even larger success is Snapchat. In Snapchat, users basically take a photo or a short video with their phone and send it to friends in the app. The persons that receive the picture or video can watch it up to ten seconds depending on what the sender choose, after that it disappears forever. Even with this simple idea, people tend to love it. This is because Snapchat does not expose its users with many unnecessary functionalities, it provides an easy way for users to share small events in their daily life through pictures or videos. Snapchat was released September 2011 and had in December 9th 2013, 60 million downloads with 30 million monthly active users. With more than 400 million messages sent every day, Snapchat has an estimated value of \$800 million in relation to in-ads [9]. However, when Facebook made an offer of \$3 billion to acquire the company [10], and Google offered \$4 billion [11], Evan Spiegel (owner and creator of Snapchat) still declined to sell it. What Instagram and Snapchat have in common, without the fact that they are highly popular, is that they do not generate any revenues. The high estimated value is based on the potential revenue the apps could generate if advertising was im-



plemented. People clearly believe in this potential, and only in June 2013, Snapchat raised \$60 million from investors [12].

### 2.2.3 Communication

The category *Communication*, represents apps used to communicate through texting and calling. With emphasis on large numbers, it is particular one communication app which has become incredible successful; WhatsApp. WhatsApp's users can send text messages, images and videos to each other. It works almost the same as the message app implemented in the phone's OS, where people communicate by sending SMS and MMS. However, with WhatsApp users do this by using data traffic, leaving no telecommunication fees except the data traffic fee itself. With free Wi-Fi almost everywhere or at a very low price, the app is perfect for people who want to save money. With more than 400 million users, and 1 million new registered every day, it is no surprise that the app is highly valued. So valuable that Facebook bought it for \$19 billion in February 2014, making WhatsApp the largest app acquisition of all time.

### 2.2.4 Games

One of several app categories that have gained the consumers' attention is the category *Game*. As every other category, the game category has several subcategories (18 in total) to differentiate what kind of game it is. Every game has also different game modes, such as single player mode, multiplayer mode and survival mode. The most common game modes are single player mode and multiplayer mode. Single player mode is where the players play the game alone and try to complete different stages while playing, for example winning a car race. Multiplayer mode is where the players play with other players on the same team or against each other. This can happen in-game where the players can play simultaneously, or turned based where the players are waiting in turn.

A vast amount of games have been very popular, for example Draw Something, Flappy Bird and Angry Birds. In 2013, Rovio (the company behind Angry Birds) reported that Angry Birds had more than 1.7 billion downloads and 263 million monthly active users, which generated a to-

tal revenue of \$200 million in 2012. The game is so popular that it has its own theme park in Finland and stuffed animals and electronic devices all around the world for sale. Angry Birds is highly successful, but it is not the game to be highlighted. The game this thesis emphasis is Draw Something. This is because of the similarities it has in relation to the case study app.

Draw Something was developed in February 2012, by the company Omgpop. After five weeks, the game had been downloaded 20 million times with 15 million daily active users. Already in the end of March 2012, the company Zynga acquired Omgpop with Draw Something for more than \$200 million [6]. Draw Something is very similar to the case study app, and thus a wider description of the game is given. It is a turned based game where two users play against each other. The player with the turn, picks a word among three random words (see Figure 2.5 to the left), and draws a drawing based on that word. When the player is pleased with the drawing, he sends it to the other player. The other player receives the drawing, and tries to guess the word the other player picked by looking on the drawing (see Figure 2.5 in the middle). If the player guess the correct word, he needs to create a drawing based on a new word and send the drawing back to the other player. When players guess the correct word, both players earn coins based on the difficulty of the word. If the word is hard to guess, the player can use a “bomb” that removes letters that are not part of the word, and thus make it easier to guess the word.



Figure 2.5: Pictures of Draw Something [45]

The Figure 2.5 to the right shows the shop in the game, where players can buy bombs or new colors to use in drawings. With the opportunity to log in and play against friends on Facebook, the game benefits from Facebook's network effects. Before describing the case study app *Guess This Sound*, the thesis presents an analysis of the app market from a business perspective.

## 2.3 App Valuation

Highly valued apps have become a common phenomena. They are usually valued based on the potential revenue they can generate rather than what they are currently making. They are normally free, and thus generate revenue from advertises or purchases of virtual goods inside the app. Hence, they share similarities with other free digital services that generate revenue through advertises, such as social networks. Twitter and Facebook are examples of highly valued social networks, and by analyzing their market capitalization can give a deeper understanding on apps' valuation.

Twitter has not generated any revenue, but its stocks continues to rise, and the firm has a marked value of \$24.5 billion [13]. On the other hand, Facebook however struggles to not lose market value. Facebook was highly overvalued before it entered the Nasdaq stock exchange, and only three months after it was published on May 18th 2012, the market value shrunk as much as \$50 billion [14]. In 2011 the year before Facebook entered Nasdaq, the company made \$3.7 billion in revenue, and had a market value of \$104 billion [15]. The market value was 28.12 times bigger than their annually revenue, and in comparison to other business areas this is highly unusually. For example, Exxon Mobil had in January 2013 a market value of \$416.9 billion and a revenue of \$428.38 billion, thus the company's market value is almost equal to the revenue [16]. Another example is Telenor, which had a revenue of NOK 104 billion, and a market capitalization twice as much (NOK 223 billion) in 2013 [17]. Hence, there are uncertainty on how to estimate an accurate market value on digital services, such as social networks. WhatsApp was acquired by Facebook for \$19 billion, and Nokia's handset business was acquired by Microsoft for \$7.2 billion. Thus, WhatsApp was acquired for more than twice the amount compared to Nokia. Further, WhatsApp had only 55 employees [105] compared to the 25,000 employees in Nokia's

handset business [116]. This raises speculations in how valuable WhatsApp actually is, and how companies calculate the value of these highly popular apps.

According to Leo Polovets, Partner at Susa Ventures [104], investors analyze several factors when they value a pre-revenue company or product, such as apps. There are primarily four key factors that are analyzed to evaluate the app. The first one is the *team* behind the app, and for how long they will continue to work with the app after the app is acquired. If the team consists of individuals with little or no experience to grow the business further, the company is worth less compared to a team consisted of individuals with experience or high university degrees. The second factor is the user's *lifetime value* (LTV), which is the estimated average revenue a user generates during the app's lifetime. LTV is used to estimate the app's potential total revenue, by looking on the percentage of growth in terms of app downloads, and the app's user activity. This provides information on how fast the return of the investment could be expected. LTV is also used in relation to the third factor; *market size*. By estimating the maximal number of consumers the app is expected to acquire, an estimation of the total revenue based on the LTV can be calculated. The last factor is the *competition*. If the app has several competitors especially with similar ideas, the risk is higher for the app to become popular and thus the value of the app decline. However, the risk depends on the popularity of the competitors' apps, and the probability that a fierce competition occurs. Another factor with impact on the company's value is the market force. It does not matter what a company is worth, if investors all think it is worth \$7 million, that is what the market value will be.

Instagram and WhatsApp are highly valuable apps because of the factors described, but the main reason why Facebook acquired them was due to the potential value they could achieve in combination with Facebook. According to [105], WhatsApp continues to obtain 1 million users a day, and thus absorbs up user messaging and connection time that once could have belonged to Facebook. To avoid this, Facebook acquired the company and thus reduced the risk of losing its customers, and increased the value through collaboration with WhatsApp. This is also why Facebook bought Instagram in 2012 [106]. Thus, apps are valued based on the revenue they potential can generate, and the value they can provide other companies.

*The quality and the overall value of companies that you invest in becomes more important than your ability to calculate their economic valuations to the nearest dollar.*

Leo Polovets, Partner at Susa Ventures.

## 2.4 Related Work

There are several papers with similar studies as the topics described in this thesis. The research *Hacking App Store Pricing* [35], by Thomas Carter is especially interesting. The research analyze the different price strategies and price methods relative to apps, based on a self-developed app. By changing the app's price, back and forth from free to paid, he obtains enough information to present a preferred pricing strategy for the app. The research concludes that freemium with in-ads and IAPs is the optimal price strategy as it results in more revenue.

The next paper of interest is *Epidemiological Modeling For Online Social Network Dynamics* [38], written by John Cannarella and Joshua A. Spechler at Princeton University. The paper analyze network effects in online social networks by using a modified epidemiological modeling (SIR models). The model is adopted to analyze the impact networks effects have on the case study app, and proves to be very applicable.

*Mobile Application Ecosystem from the Application Developers' Perspective* [57], written by Myryam Roshan Kokabha at Aalto University, provides a description of the ecosystem surrounding the app market with focus on Google Play and App Store. The paper is however slightly beyond this thesis scope, and was only used as a guidance for the app market's value chain and the two-sided market effect. The paper *Mobile App Value Network* [61], written by Felix Cuadrado at Queen Mary University of London, presents the mobile app value network and an analysis comparing App Store and Google Play from a business perspective. *Business Model Analysis* [73], written by Xiangqian Kong at Helsinki School of Economics, analyze different business models. I took advantage of this paper in the thesis in order to describe Osterwalder's business ontology.

McKinsey provides a deeper understanding of the Word of Mouth effect, through its analysis A

*new way to measure word-of-mouth marketing* [68]. Nir Eyal explains through his research in psychology, *How to manufacture desire* [75], how to create desire in the users in order to create super users. Studies collected from *Capptain*, presents the apps key performance indicators used to analyze the strength and weaknesses in apps, and focus on the most profitable customers to increase the revenue. The studies can be found in [27], [29], [30] and [31]. Other sources I have exploited are *Forbes* and *Mashable*. Forbes has provided information regarding apps' revenue and how to determine their value.

# Chapter 3

## Methodology

This chapter presents the methods and approaches I used to acquire and process relevant data for the qualitative analysis in this thesis, and thus provided sufficient answers to the thesis's objectives. This chapter is divided into two parts. The first part describes the methods I used to collect information relative to the fundamentals in the app market. The fundamentals represents general background information about the app market and from a business perspective. The second part provides the methods I utilized to obtain and evaluate the data from the case study app.

### 3.1 Part 1 - The fundamentals

In order to obtain information about the app market's fundamentals, I analyzed papers and literatures based on extensive studies of these fundamentals. This provided a deeper understanding of the app market from a business perspective, and thus the revenue, cost and other digital economic key-aspects relative to apps. In order to perform an in-depth analysis of these factors, they were later analyzed in relation to the case study app. I exploited papers and articles written by developers, to obtain information about their experience and knowledge related to the app market from a developers' perspective.

To analyze network externalities in relation to apps, I searched for background information on the topic and studied apps that had benefit from these effects. I interviewed a successful app

developer, the CEO of Dirtybit, Nicolaj Broby Petersen, to understand the factors behind his success. I studied the spread effect in epidemiological modeling (SIR model), and later compared it to the network effects influencing apps to see if they had similarities. Thereafter, I modeled the network effects in the case study app by applying a modified SIR model. After I had studied the app market from a research perspective, I analyzed the obtained information with the self-developed app. Thus, I obtained information about the app market from a developer's perspective.

### 3.2 Part 2 - Case Study Application

In order to obtain a deeper understanding of the app market without being limited to the available information from apps, I developed my own app. To achieve enough data from the case study app to analyze, I conducted an extensive marketing through advertising on Facebook, reached out to the media, and utilized other marketing channels such as Twitter and Instagram. In order to analyze the impact the app stores' ranking lists have on apps' popularity, one of my main objectives during the marketing was to achieve a good rank for the app. This succeeded, and the app became ranked as the 26th most popular app on the Norwegian App Store, and the 2nd most popular app in the app category word game. This was impressive considering the short time the app had been available. I reached out to several media sources, in order for them to create a case about the app. This resulted in three interviews. The first interviewed was performed by the newspaper *Byavisa*, and became the headline in the paper's business section. The second interview was conducted by the American company, *Serenity App Solutions*, regarding their book *Mobile App Growth Hacks*. The last interview was performed by the TV channel *TV2*, and was sent every hour on their news channel *TV2 Nyhetskanalen*. I analyzed the effect from the interviews and the marketing, in order to obtain information about their impact on apps' popularity, and to determine the most cost-efficient way to market an app.

To retrieve data from the app, I used especially two sources. First, I collected data from the server company *Parse*<sup>1</sup> to analyze the app's user activity and the number of daily downloads. This was

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<sup>1</sup>Parse is a web service that provides an easy way for developers to establish communication from their apps to



later used to analyze the app's network effects and its potential revenue. Parse stores all the data sent between the server and the app, and provides an easy way for developers to analyze the app's growth in relation to downloads, activity and server performance. Parse is a free service if the app's communication does not exceed the free limits. The case study app did not exceed these limits, and thus did not generate any server cost. However, I utilized Parse's price structure in order to calculate the potential server costs in relation to the communication the app already generated.

Second, I exploited the web service *App Annie*<sup>2</sup> to analyze the effect the app's rank had on the number of daily downloads. App Annie presents orderly statistics for the app's progress in relation to its revenue, rank and downloads. These statistics were analyzed in relation to marketing, in order to determine the effect from the different distribution channels utilized. The case study app did not generate any revenue, and this is therefore not analyzed. The information from App Annie and Parse were exploited in order to analyze the case study app's network externalities. When the app's popularity increased due to the extensive marketing, I was able to analyze the network externalities related to the app's rank. Further, by applying the modified SIR model, I was able to model the app's user activity, in relation to the network effects influencing it.

I created a complete business model for the case study app by using Osterwalder's business model ontology. In order to provide information about apps from a business perspective, I analyzed the case study app in relation to this model and the data collected from the first part of this methodology. Thus, I obtained information about how economic key-aspects can increase the app's popularity and thus revenue. Through the development and marketing of the case study app, I experienced the challenges and requirements developers encounter and the enormous amount of time and effort behind apps. Together with the studies of the fundamentals in the app market in part one of the methodology, I obtained sufficient information about the app market from both a technological research perspective and a developer's perspective. This gave me a deeper understanding for what it takes for an app to be successful, and thus the thesis

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servers that store information from the app.

<sup>2</sup>App Annie is a web service that collects data about the submitted app in relation to the app's revenue, number of downloads, rank and costs.

provides a guidance for new developers to avoid pitfalls and increase the probability for their app to become popular.

# Chapter 4

## Business Concepts

This chapter presents the business concepts in relation to the app market, and is divided into three sections; *The Long Tail*, *Value Creation* and *Network Externalities*. The first section provides an overall description of apps distribution in the long tail concept in relation to their popularity. The value creation section presents three concepts; value chain, value network and value shop. The last section, network externalities, explains the different network externalities relative to apps such as network effects and positive feedback. The section later provides an analysis of network effects relative to apps and social networks by applying a modified epidemiological model (SIR model<sup>1</sup>).

Number of apps increases exponential fast. On App Store, 25,000-30,000 apps are published every month [22], and Google Play registered around 80,000 new apps only in January 2014 [23]. The competition is fierce, but research [55] shows that apps that succeed, can generate huge revenues. Only 25 of the 262,000 different app publishers account for 50% of the total revenue on App Store and Google Play. Apps' revenue depends on their popularity, and because there are only a few percentage that ever become popular, the market can be analyzed as a long tail market.

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<sup>1</sup>SIR models are used to model the epidemiology spread in large populations.

## 4.1 The Long Tail

Before App Store and Google Play were established, apps were developed by the large mobile phone manufacturing companies and not the general public. The companies did not have the resources to build every app the users wanted, which resulted in basic apps such as calendars, calculators, mail, and a few games. Today, this has changed, everyone can develop their own app using existing framework and available source code from the Internet. Several online tutorials make it easier for inexperienced developers to create apps, and Google's and Apple's official developer guides continue to improve to attract new developers. For people that do not have the time or the skills required to develop apps, other solutions are available on the Internet, such as the web service *Appsbar.com*. Apps Bar let people with no knowledge of coding, create their own app in three easy steps. The apps' quality is however very low, and it is unlikely that they ever will become popular. However, such solutions are on the rise and will most likely experience large improvements in the years to come. With the large number of different ways to develop an app, and the vast amount of different publishers, it is a huge variation of apps being developed. Figure 4.1 illustrates the distribution of apps in the app market relative to their popularity by using the long tail concept.

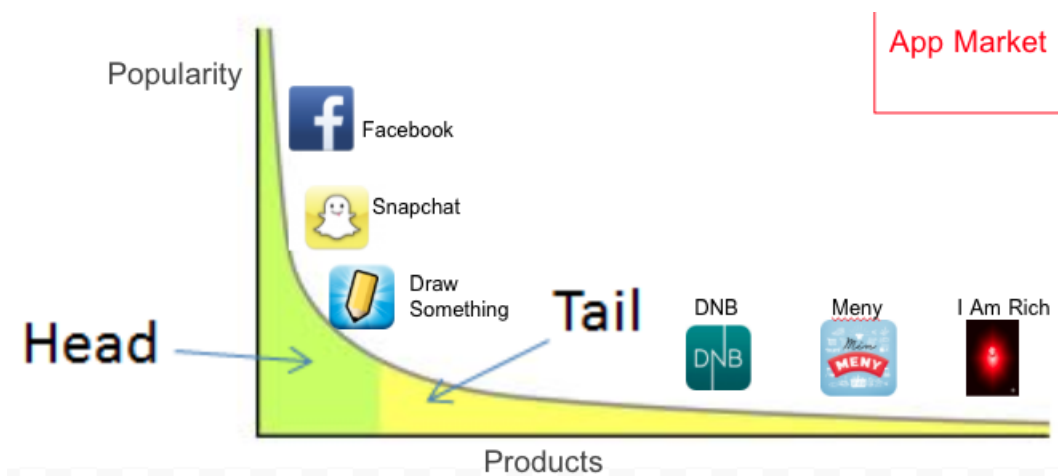


Figure 4.1: The App Market Long Tail

According to [102], approximately 10% of all apps obtain more than 500 daily downloads, and only 0.01% generates large amounts of money. The 10% represents the head of the long tail where the popular apps are located, for example *Snapchat*, *Draw Something* and *Facebook*.

Apps located in the head usually aim to fulfill most users' needs, and thus have a high percentage of the general public as their target customers. The long tail contain apps that are less popular in terms of downloads, and thus represents 90% of all apps. Long tail apps are either low quality apps, apps created for a smaller part of the population, or apps that have not experienced a large number of downloads. Figure 4.1 provides three examples of long tail apps, *DNB*, *Meny* and *I Am Rich*. *DNB* is the *The Norwegian Bank's* official app, and provides a mobile solution for the bank's already existing customers based on the bank's originally services. The app will always be in the long tail, due to the limited number of target customers. The app *Meny* is similar, since it is developed for the already existing customers to the Norwegian grocery store company *Meny*. However, the app is also developed to attract more customers since everyone can use it, and thus aims at a larger audience than the *DNB* app. Compared to the *DNB* app, *Meny* has less downloads and is therefore placed more to the right in the long tail. The objective for the apps *Meny* and *DNB* are to create loyal customers, and not to generate revenue. The last example of an app in the long tail is *I Am Rich*. In the few days it was available on App Store, it aimed at a very low percentage of the market; people with too much money. It had in total eight downloads, but since it was priced for \$999.99 and had no functionality, it is considered to be a popular app among the few target customers it tried to attract. The long tail concept illustrates that the app market is a *winner-take-all* market, where only a low percentage of apps become extremely popular.

## 4.2 Value Creation

There are three main business concepts in relation to creating value; value chain, value network and value shop. A value chain is a chain of activities that a firm performs in order to deliver a valuable product or service to the market. The goal is to deliver maximum value for the minimum possible cost. Value chain is normally used by manufacturing companies turning input of raw material into output (value) through a step by step process [58]. A value network is a set of connections between organizations and individuals that interact to benefit the entire group. Each member in the network relies on the others to foster growth and increase the value. The more people connected, the higher the value of the network [59]. A value shop is an organization

designed to solve customer or client problems rather than creating value by producing output from an input of raw materials. Compared to value chain, there is no sequential fixed set of activities or resources utilized to create value. Activities and resources are allocated specifically to cater the one problem in question. The company tailor products for specific needs and tries to accommodate them [60]. From the app market perspective, value shop is not that relevant. Hence, the thesis focus on value chain and value network.

### 4.2.1 Value Chain

The app market's value chain starts with an idea, which is developed further to an complete idea while the team is assembled. The thesis focus on indie apps<sup>2</sup>, therefore parts of the value chain is different comparing to the value chain of big established corporations with large investment funds available. Figure 4.2 contains the factors in the value chain from a developer's perspective, which fit into wider categories that almost follow Porter's value chain (i.e. *Inputs for App Development, Application Development, Application Delivery and Marketing and Sale*).

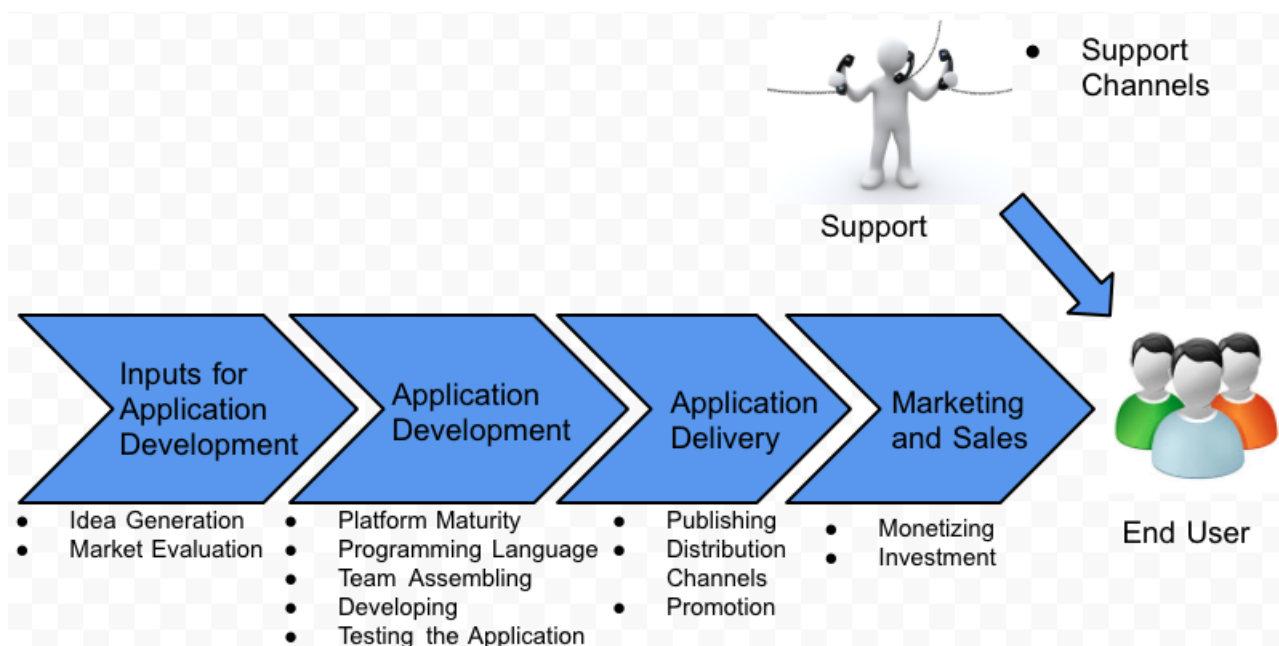


Figure 4.2: Mobile Application Value Chain

<sup>2</sup>Indie (short for independent) apps are developed by one individual or a small team

The **inputs for application development** stage is where the idea generation find place. The idea is shaped to a complete idea and the target customer is defined. It is important to keep room for changes, as the final product might change relative to changes in the concept during the development. In this stage, competition, challenges and the market get evaluated based on the target customer already defined.

The **application developer** stage describe the team consisting of developers and designers that develop the app and customize its design. The team is usually the center of the value chain, since the team members continue to have an important role even after the release of the app. Indie developers are usually the idea inventor themselves, and choose programming languages based on their current skills. If the app becomes popular the team normally hire developers with the required skills needed. If the goal is to be in the head of the long tail, developers need to choose carefully regarding the mobile platform the app should be supported on. A common strategy is to develop the app for iOS in the beginning and later consider to develop it on Android. This is because iOS apps generate more revenue compared to Android [18], and the download rate is usually higher in the beginning. Apps are normally developed native<sup>3</sup>, but the popularity of hybrid<sup>4</sup> apps is on rising. In order to develop an hybrid app, developers use the web programming language Javascript interacted with a framework that connects the Javascript code with the native code. Hybrid apps (or HTML5 apps) are usually combined with frameworks such as PhoneGap, Bootstrap and JQuery. Phonegap is the framework that combines the native programming language and the Javascript. Bootstrap and JQuery are frameworks that give developers a way to shape and design GUI<sup>5</sup> elements within the app by altering the CSS3 code. CSS3 is a programming language used to change the appearance and the design of the elements within the app. For example, if a developer want to change the color of a button, he will edit the CSS3 code. HTML5 apps can be used on every smartphone OS with just small adjustments in the code, and can also utilize the native device APIs<sup>6</sup>. If the app is developed native, it can

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<sup>3</sup>Native apps are apps developed specific to that platform. For example, iOS develop apps in Objective-C while Android develop their apps in Java.

<sup>4</sup>Hybrid apps are web apps developed in Javascript and CSS3, and can be used on every mobile OS.

<sup>5</sup>A graphical user interface (GUI) is a human-computer interface (i.e. a way for humans to interact with computers)[97]

<sup>6</sup>API (Application Programming interface) specifies a set of functions that accomplish a specific task or are allowed to interact with a specific software component [19]

only be used on the specific platform it was developed for. Hence, it is more time consuming to develop the app in two different programming languages to support both Android and iOS, compared to develop it as a HTML5 app. However, the HTML5 code is transformed into native code before it can run on a device, and thus the app suffers a reduction in both security and performance. It is also a reduction in user experience, since the app is developed to meet the requirements of all the platforms, rather than just one. Therefore, it is recommended to develop native apps rather than HTML5 apps, especially if the app is complex [20]. Another important part in the app developer layer is the testing. There are two ways to test an app; *Black Box Testing* and *White Box Testing*.

*Black Box Testing* is a method often known as behavioral testing, because the areas being tested is not known to the tester. When applying black box testing, the target customers are the ones that should test the app. This gives the developers a better understanding on how they interact with it, and how to improve the app. The different levels of black box testing are unit testing (i.e. the tester clicks on an element), integration testing (i.e. the tester do a small task combined with several unit tests), system testing (i.e. the tester tests the whole system by going through different tasks), and acceptance testing (i.e. the last test before accepting the app to be published) which focus on the business's requirements. The advantages of black box testing is that the tests are done from a user's perspective and expose discrepancies in the specifications, by letting the target customer interact with the design and functionalities within the app. The tests therefore provide an objective perspective and avoiding developer-bias. The disadvantages of using black box testing is that only a small number of inputs can be tested, and several paths is therefore left untested. The tests can only take place in a later stage, when most of the functionalities and design are implemented [89].

*White Box Testing* is a software testing method in which the items being tested is known to the tester. Developers can utilize this method by creating automated tests for every function in the code. Automated tests can be created by adding a correct or incorrect value as input in a function, and then check if the output is what to be expected. They are called automated because developers can run them continuously all together to see if any of them breach. If a test breach,



the developer knows where to look and can easily fix the error. The tests could either be a unit test (i.e. test one function at a time), an integration test (i.e. test more than one function combined, and see how they interact), and a system test (i.e. test the whole app; run the tests all together). The advantage with white box testing is that it can be commenced at an early stage, and do not need to wait for the design or all of the functionality to be implemented. With thorough testing, the tests can cover most of the paths in the code. The disadvantage with white box testing is that it requires a lot of time to write all the automated tests, or to go through the code manually [90].

The **application delivery stage** is concerned with reaching customers through available channels; *distribution channels*. The most common distribution channels to utilize when marketing apps are social networks, such as Facebook and Twitter. Because of limited resources, TV and radio-commercials are often too costly. In order to see how the target customers welcome the app, a good approach is to hand out flyers. Another factor in the application delivery stage, is where to publish the app. This depends on the platform choice done in the application developer stage. iOS apps are published on App Store, through Apple's developer site *Itunes Connect*. Itunes Connect is a web page where developers can manage, publish and test their apps. After the app is published, it needs to be reviewed by Apple which takes 5-8 days. The app is reviewed based on its content, where Apple looks for inappropriate things such as pornography. If the app passes its review, it is published on App Store. If not, the developers need to change the app according to the feedback on the review, and start the review process again. Android apps are published on Google Play, through Google's developer site *Google Play Console*. Google Play Console works the same way as Itunes Connect. After the app is published on Google Play, it takes maximum 8 hours before it is available. Hence, it is more convenient for developers to publish apps on Google Play compared to App Store, because if the published Android app has any bugs<sup>7</sup> (i.e. flaws), developers can fix them and publish a new version of the app in a short time. However, it is an advantage for the users on App Store that apps have a long review time, because developers are then more thoroughly with what they publish.

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<sup>7</sup>A software bug is an error, flaw, failure or fault in a computer program or system that causes it to produce an incorrect or unexpected results [21]

The **market and sales stage** is a continuation of the application delivery stage. In this stage developers can usually see the potential of the app, and therefore a larger investment in terms of money should be considered. If the app does not generate enough revenue in order to cover the expenses related to server costs and marketing, financial support is needed. The team should create a thorough marketing plan in combination with the costs and revenue, and then reach out to investors that are experienced with marketing of digital goods.

The two final stages in Figure 4.2, are the *end user stage* and the *support stage*. They are done in parallel together with either the market and sales stage, or the application delivery stage. The **end user stage** is as the name suggests, the users of the app.

The **support stage** is connected to the end user stage and represents the app's user support, for example error fixing and maintaining the customer relationship through support channels. This stage is usually referred to as the phase where the real work starts. Even with an extensive test phase before the app is published, there are always flaws in the app that need to be fixed. The app also needs to improve with new features and new design, which is important in order to maintain the existing users and acquire new.

### 4.2.2 Value Network

The initial mobile content business was strict, because the mobile phone operators had complete control of the value chain. However, after App Store was launched, this has been significantly changed and is now an open environment. The established relationships in the new market are more complex, and the number of actors are significantly larger. A value chain is therefore no longer suitable for analyzing the whole network, hence a value network is more convenient. Figure 4.3 shows the relation between the different actors that provide value to the ecosystem<sup>8</sup> [56].

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<sup>8</sup>Ecosystem is a community supported by a foundation of interacting organizations and individuals - the organism of the business world. The community produces goods and services of value to customers, who are themselves members of the ecosystem [56]

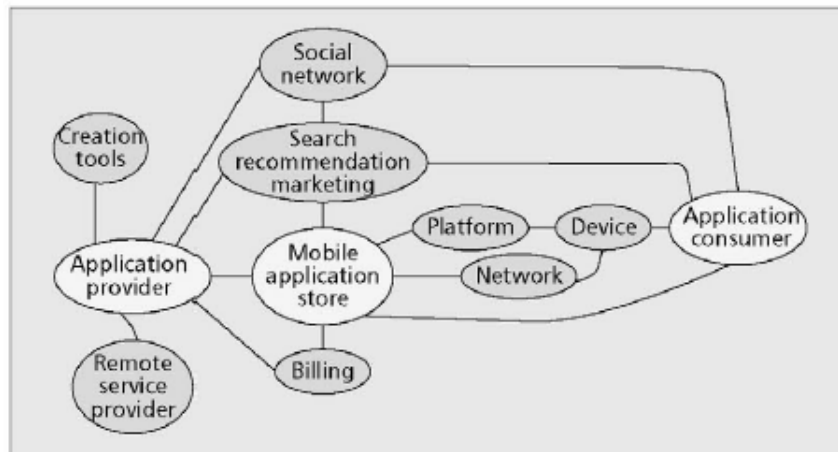


Figure 4.3: The Mobile Application Store Value Network [61]

The connections (i.e. relations) between the actors show value or information exchanged. The highlighted circles are the central pieces of the ecosystem (i.e. Application Consumers, Mobile Application Stores and Application Providers). The value of the app stores is proportional to the apps they contain and the customers they attract. Application providers are the suppliers to the ecosystem, and are the key to the success of this model as they fill the market with apps to be acquired. Multiple profiles of app providers coexists, from amateur developers to large enterprises. They develop apps to the different app stores and maximum their value through the value chain described earlier. On the other end of the value network, resides the application consumers; the end users. They access the app stores and consume the developed apps, and become the center of the ecosystem by interacting with a large number of different developers through social networks and app stores. The app stores combine the traditional roles of content aggregator and distributor, and constitute a direct link between the developers and the consumers. In principle, the app stores are an open market, where every competitor has equal chance to succeed. The app stores provide value to the developers through the integrated billing function in the middle of Figure 4.3, and value to the consumers through the apps available [61].

### 4.3 Network Externalities

The app market works as a two-sided market, with the app stores at one side and developers at the other. The difference between a two-sided market and a traditional market, is that the

value moves from left to right (from cost to revenue) in a traditional market, while in a two-sided market the value exists on both sides. In a two-sided market the cost and revenue are present on both sides, and the members on each side benefit from the members on the other side. Network effects can occur on the same side or cross-side. Network effects on the same side are present if an increase in the number of users on one side, influence the value of the network for the users on that side. With cross-side network effects, an increase in the number of users on one side, influence the value of the network for users on the other side [57]. In relation to the app market, the platform providers offer a technological platform where they try to attract a larger number of developers and consumers in order to make their app store profitable. The app market experiences both cross-side and one side network effects, for example the more developers developing iOS apps, the more users will be attracted to use iPhone to get access to all the apps, and the more iPhone users the larger the incentive to develop iOS apps will be. Apps' popularity are influenced by especially two network externalities; *Network Effects* and *Positive Feedback*.

### 4.3.1 Network Effects

*Network Effect* is the effect a user of a product has on the value of the product, i.e. the value of the product is dependent on the number of other using it. In relation to apps, users create value by downloading the app, and as the app's popularity increases, more users are motivated to download it. *Word of Mouth* is one of the network effects in the app market with biggest influence. Word of Mouth is a common concept for passing of information from person to person by oral communication. However, Word of Mouth is also present through digital channels such as social networks. In the app market, Word of Mouth occurs when people share their opinion about an app, and the more people that talk about it, the larger the impact and spread become. Word of Mouth is further described in 5.3.1

The app *Fun Run* developed by *Dirtybit*, a Norwegian company founded by 2 students at the Norwegian University of Science and Technology (NTNU), is an example of an app that made it big due to network effects. Fun Run is a game where players race to reach the finished line first, and on the way pick up different weapons to use on their competitors to slow them down.

According to Dirtybit’s own blog [77], the app’s success started when they launched their Twitter competition on November 25th 2012. The players were asked to tweet their username and #funrun to get a chance to win 10,000 in-game coins. The competition resulted in twice as many downloads that day, and users started to recruit their friends by writing #funrun on social networks such as Facebook and Instagram. The game climbed fast on App Store’s ranking list, and in December 11th 2012 it was ranked as the number one app on the American App Store. Figure 4.4 shows how rapidly Fun Run climbs in rank on both the Norwegian and American App Store. When the game was launched it had no integration with Facebook, and thus players had a hard time adding their friends’ username in the game. However, it turned out to be a good thing, because the players used other ways to broadcast their username to friends, such as tweeting “Add me [username] #funrun”. Due to the Word of Mouth effect the users created on Twitter, the game became incredibly popular in a short time. According to the interview with Nicolaj Broby Petersen, COO and Co-Founder of Dirtybit, Fun Run spread extremely fast when it got popular in USA.

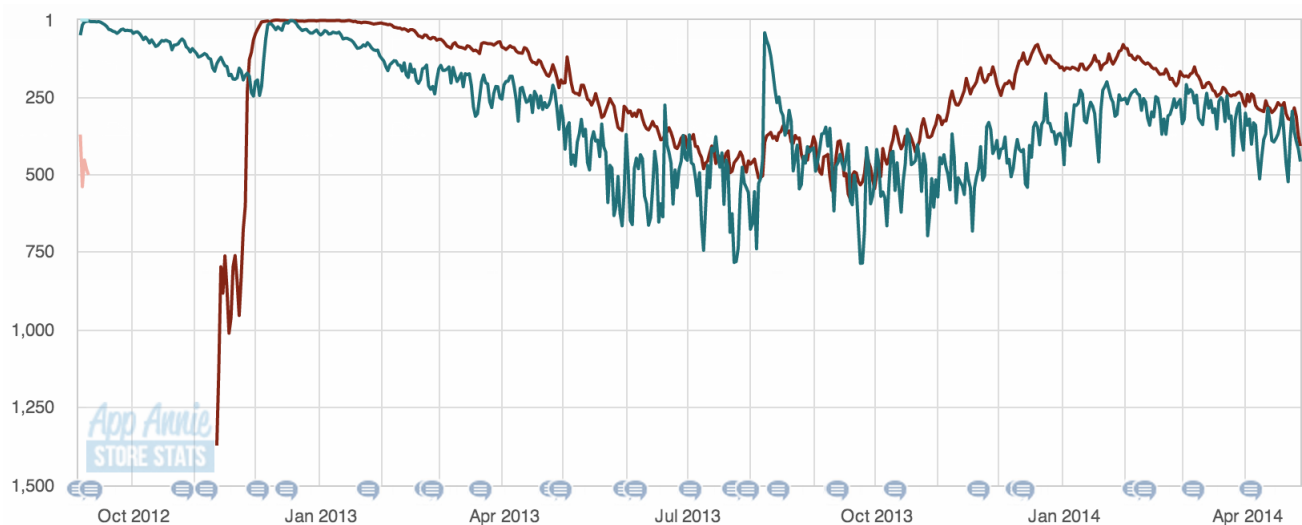


Figure 4.4: Fun Run ranking on App Store. Red = USA, Green = Norway [77]

*We went from thousands daily downloads in September to more than 100,000 each day in December. At the most we had more than 500,000 daily downloads, and 100,000 active users every second.*

Nicolaj Broby Petersen.

According to Nicolaj, no investment in marketing was conducted, because it quickly spread the day it was introduced at NTNU. Hence, the app became popular because of the Word of Mouth effect. Figure 4.4 illustrates the big influence network effects have on apps' popularity.

### 4.3.2 Positive Feedback

*Positive feedback* is a process in which the effects of a small disturbance on a system, results in an increase on the magnitude of the disturbance. For example the number of cattle running increases the overall level of panic, which again increase the number of cattle running. Positive feedback is mathematically defined as a positive loop, and the effect can lead to a rapid or even exponential growth over a period of time. An example of a positive feedback effect in the app market, is the app stores ranking lists. Google Play and App Store have the same set of rules in relation to the apps' rank; one can not pay for a better rank. An app's rank is determined based on two criteria; number of daily downloads and average rating. When a user download an app, he can rate it 1-5 stars depending on how satisfied he is with the app. The app's rating and its number of daily downloads have a large impact on its rank, which then again works as a positive feedback loop. The more daily downloads an app gets, the higher it is ranked, and a higher rank results in more daily downloads. This is because a higher rank makes the app more visible and enticing on the app stores, and thus more people download it. The more users downloading the app, the more revenue it generates, which makes it a continuous competition for the best rank. The app's rank can result in an exponential increase or decrease in number of daily downloads, and developers must therefore try to control it or maintain it. The positive feedback loop is further analyzed in relation with the case study app in 7.4.

### 4.3.3 irSIR Models

One way to analyze network effects is by using an epidemiological model (SIR models) [37]. SIR models describe the probability for a human to be infected with a disease by looking on the percentage of the population that are already infected. Likewise, the model gives the probability for a human to be recovered, based on the percentage of the population that are already recovered.

In the SIR model,  $S$  is the amount of susceptible,  $I$  the number of infectious, and  $R$  is the number of recovered. The number of susceptible falls rapidly as more of them are infected, and thus enter the infectious compartments. Each member of the population typically goes from susceptible to infectious, to recovered, which Figure 4.5 illustrates. The x-axis in Figure 4.5 represents the time and the y-axis represents the total number people in the population.

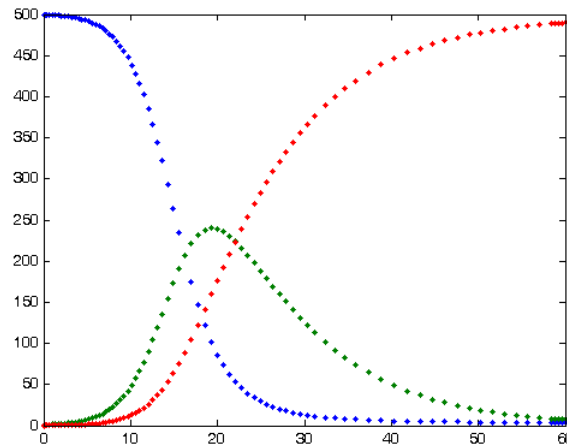


Figure 4.5: SIR Model. Blue = Susceptible, Green = Infected, Red = Recovered [47]

Figure 4.5 illustrates that when the amount of infected increases, the amount of susceptible decreases, and the amount of recovered increases. This is because when a person gets infected, he leaves the susceptible compartment and joins the infected compartment, and later leaves the infected compartment by joining the recovered compartment. When a person is recovered, the person becomes immune and can no longer be infected with the same disease again. When the amount of recovered increases, the probability that a person can be infected becomes lower because the amount of susceptible and infected becomes smaller, and thus the infected rate declines [38]. The infection rate is influenced by network effects related to the number of people infected and the number of susceptible left in the population. In other words, the higher percentage of the population infected and the lower the percentage of the population recovered, the higher the infection rate is.

SIR models can also be used to analyze network effects in social networks, by looking on the users joining and leaving the network. Joining the network is analogous to infection, and leaving

the network is analogous to recovery. The susceptible population is equal to potential users joining the network. The time interval from when the user joins the network to leaving it, is analogous to the retention rate. Retention rate is how long a user stays in a network after joining it, and is described further in 5.2.3. Users join the network because their friends have joined it, likewise they leave the network if their friends leave or if they lose interest. Mathematically the formula for the SIR model in a given timeframe is  $S + I + R = N$ , where  $N$  is the entire population. This can be transformed into three equations that give the rate of each category; susceptible, infected and recovered.

$$S' = -\frac{\beta IS}{N} \quad (4.1)$$

$$I' = \frac{\beta IS}{N} - \gamma I \quad (4.2)$$

$$R' = \gamma I \quad (4.3)$$

Equation 4.1 gives the rate at which the susceptible population becomes infected  $S'$ , which is proportionate to the infection rate  $\beta$ , the susceptible population  $S$ , and the fraction of the infected population  $\frac{I}{N}$ . In other words, the disease is transferred through interaction between the susceptible and the infected population with the infection rate  $\beta$ . Likewise, Equation 4.3 gives that the rate at which the infected population recovers  $R'$ , is proportional to  $I$  and the recovery rate  $\gamma$ . Equation 4.2 gives the infection rate  $I'$  which is equal to how fast the susceptible population  $S$  gets infected minus how fast the infected population recovers from the infection.

However, it is differences between social network effects and epidemiological spread. Users that leave the network (recover), leave it because their friends leave it or they lose interest, which gives the same spread effect as when they join the network (get infected). The equations need to be modified to match these requirements, and the infectious recovery SIR (irSIR) model is therefore created. To incorporate this spread, the recovery rate in the equations above need to be modified to be proportionate to the recovered population fraction  $\frac{R}{N}$ , similar to the infection spread which is proportionate to the infected population fraction  $\frac{I}{N}$  in Equations 4.1. This is



achieved by multiplying the  $\gamma I$  terms in Equations 4.2 and 4.3 by  $\frac{R}{N}$ , the new equations are represented as followed.

$$S' = -\beta S \frac{I}{N} \quad (4.4)$$

$$I' = \beta S \frac{I}{N} - \gamma I \frac{R}{N} \quad (4.5)$$

$$R' = \gamma I \frac{R}{N} \quad (4.6)$$

The new equations show that the amount of users leaving the network which is  $R$ , have an impact on how fast people leave. This is the same effect as when people join the network. By setting the left side of Equation 4.5 equals 0, Equation 4.7 can be created.

$$\frac{S}{R} < \frac{\gamma}{\beta} \quad (4.7)$$

If Equation 4.7 is satisfied,  $I'$  will always be less or equal to 0, meaning it will be more users leaving the network rather than joining it. Since network effects amplify each other, it is important to avoid Equation 4.7 to be satisfied. The report [38], studied the irSIR model in relation to network effects by applying it on two popular social networks; MySpace, and Facebook. To obtain the data needed to analyze and estimate the irSIR model on social networks, the author used available historical Google search queries. This method is advantageous compared to using registration or membership data from the social networks. That is because the search queries measure the level of web traffic from the given social network, thus representing the level of user activity within that network. The search query data obtained is presented in arbitrary units of weekly search query frequency which are normalized such that the maximum data point in the selected time period corresponds to a value of 100, see Figure 4.6.

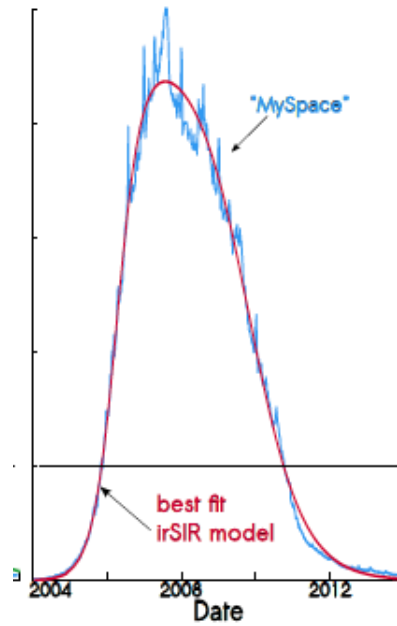


Figure 4.6: irSIR model for MySpace [38]

The red line in Figure 4.6 is how the irSIR model ordinary looks like when calculating the infection and recovery rate by using the Equation 4.5. The blue line shows the user activity collected from MySpace. MySpace is a good example to apply the irSIR model on, because it was one of the largest social networks in history, and all the data from its full life cycle (from rise to fall) is available. The blue line in Figure 4.6 fits in most cases very good with the irSIR model, showing that it is similarities between epidemiological irSIR modeling and the networks effects in social networks. In other words, the irSIR model can be successfully applied to analyze the network effects in social networks. Another example analyzed by applying the irSIR model is Facebook. According to the analysis in [38], Facebook's popularity will decline and later disappear in 2020 at the latest, see Figure 4.7 to the left.

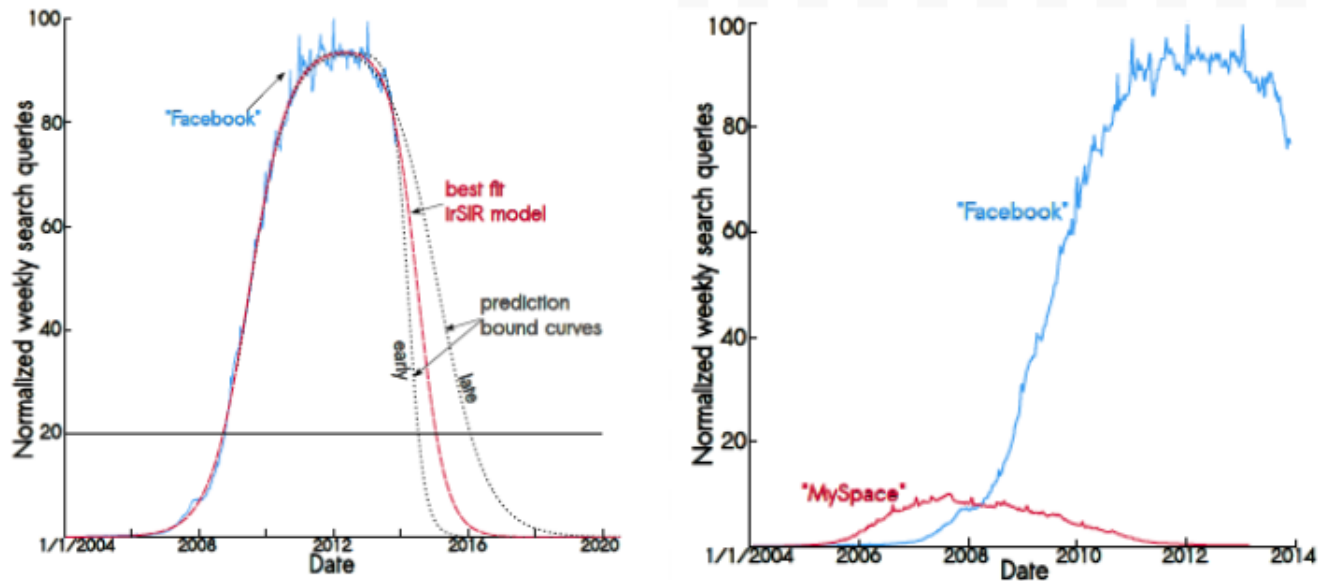


Figure 4.7: irSIR model for Myspace and Facebook respectively [38]

Figure 4.7 to the left only predicts what will happen with Facebook by applying the irSIR model. However, by looking on the two figures in Figure 4.7, the pattern is surprisingly similar to MySpace's pattern in Figure 4.6. That Facebook no longer will be used in 2020 is difficult to comprehend, but as news about Facebook struggles to not lose customers flourishes on the Internet, it is worth taken into consideration. Still, Facebook has a significant larger user base compared to what MySpace had, thus it will take long time before it is possible to see if Facebook experiences the same fate as MySpace [38]. Network effects have a large impact on apps and social networks, and to get a better understanding of the effects, Figure 4.8 is provided.

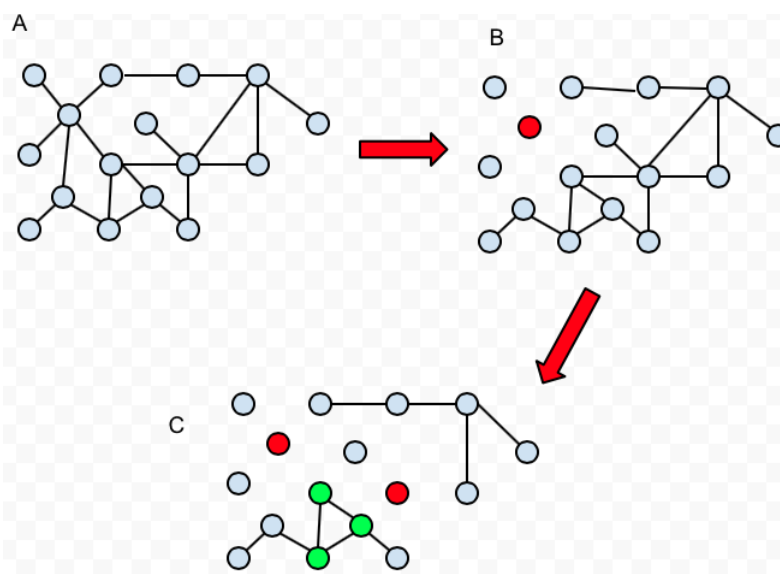


Figure 4.8: The Network Effect Concept

Figure 4.8 illustrates how network effect causes social networks to rapidly decline in amount of users. The nodes illustrate the users, and the connection between them represents the value they provide each other. When one user leaves the network, the connections to that user disappears, as Figure 4.8 B illustrates. The effect becomes bigger as more users leave, which is illustrated in Figure 4.8 C, especially if the users are super users (have a large number of connections). Another factor illustrated in Figure 4.8, is that the value the social network provides, decreases for users that lose connections. If the social network only provides value to users with more than one connection, the green nodes are the only users left in the network, see Figure 4.8 C. This is important because the fewer connections a user has, the less value the social network provides that user, and thus the incentive to leave the network becomes bigger. This creates a positive feedback loop which can differentiate between the rise and fall of the network.

The paper [38] analyze social networks by applying the irSIR model, but the irSIR model is also applicable to the app market especially for apps that are sensitive to network effects. One example is Draw Something, which is very similar to the case study application Guess This Sound. When a player stops using the app, all the player's games can no longer be played, as it requires two players to play a game. This is analogous to losing a connection in 4.8. Therefore when a player leaves, the value the app provides users connected to that player decreases. When the

value decreases, the incentive for continue using the app becomes smaller, which results in even more users leaving. Figure 4.8 is later used to illustrate the network effects for the case study app in 7.4.3. Figure 4.9 shows the daily active users in Draw Something which is equivalent of the activity within the app.

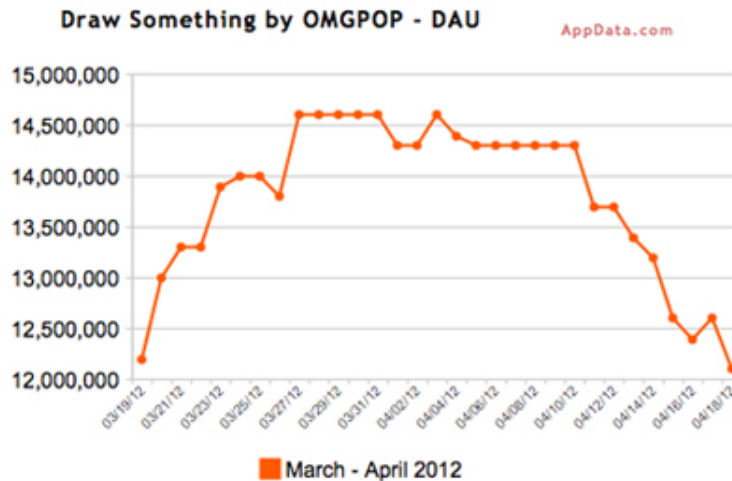


Figure 4.9: Number of Daily Active Users in Draw Something [49]

Figure 4.9 has not the same gradient as the irSIR model, but an app could never achieve the same network effects as a social network due to the fact that social network are build on network effects. Nevertheless, the pattern has similarities with the irSIR model, indicating that the irSIR model can be applied to some extent on apps influenced by network effects. According to Forbes [74], Draw Something had 10 million daily active users in May 2012 after losing 5 million users in only one month. The number of daily active users is probably lower today, but since Draw Something still is a popular game, it has not experienced the same fate as MySpace. Research [94], shows that only 5% use an app more than 30 days. Hence, popular apps increase in amount of active users until it peaks, and then drop rapidly when the number of people leaving the app becomes bigger than the number of active users within it. The irSIR model analysis of the case study app (provided in 7.4.3) strengthen this theory, since the model has the same pattern as the pattern shown in Figure 4.6. It is especially one factor that differentiate epidemiological modeling from the modeling of network effects; freedom of action. Individuals do not decide to be infected, but they decide whether they download an app or not. However, when they

download an app, it increases the probability for other users to download it. Thus, the download rate is proportional with the network effects related to number of downloads the app achieves.

# Chapter 5

## Business Strategy

The company's business strategy and business model shape the company's business and have a large impact on the determination of the company's future. These two concepts are however not the same, and to differentiate them a description is given. The business strategy describes how the company engages competitors, identify and segment customers, and respond to the market environment. Business models describe how a company is structured and its methods for maximizing revenues and profits. The business model is independent of competitors and the current state of the market, which is where the strategy comes in. Two companies employing the exact same business model may experience a completely different future, based on their different business strategies [98]. MySpace and Facebook are examples of two companies with equal business model (i.e. focus on building a large network of users), but due to different business strategy only Facebook is still active. By looking on Figure 4.7 one can argue that MySpace's downfall was caused by Facebook's increased popularity, and thus that MySpace's users chose to leave the network in favor of Facebook. According to [98], Facebook is still active because it had an open business strategy which allowed for new growth, while MySpace focused on a niche audience limited to the users' interests of music. Facebook's business strategy evolved and facilitated for a larger audience while MySpace did not, which resulted in complete different outcomes for the two companies. MySpace decrease in user activity, initialized the network effects that resulted in that MySpace no longer exists. Facebook has witnessed the same effect from popular apps obtaining its user activity, and as discussed in 2.3, this is one of the main reasons why Facebook acquired WhatsApp and Instagram.

This chapter describes apps' different pricing strategies, and provide an optimal strategy based on an extensive case study. The chapter further provides five key performance indicators for apps, and at the end a description on how to market an app with emphasis on key concepts like Word of Mouth and the psychological inside apps. The next chapter presents the business model concept in relation to the topics described in this chapter.

## 5.1 Pricing Strategy

With over one million available apps, the competition is fierce and apps struggle to get noticed among the vast amount of other apps. The app's pricing strategy is therefore crucial for lowering the barriers for users to choose the app instead of the competitors', which is why most apps are free. Revenues are usually no longer generated by an installation fee, they are rather generated by the users' interaction with the app such as in-app purchases (IAPs) and in-ads.

In the end of 2013, 62% of apps were free. Apps with a price of \$0.99 had the second highest percentage, and represented 19% of all apps. Nevertheless, there are apps that chooses to use a whole different price strategy. In 2013 there were approximately 50 apps to a price of \$999.99, and one of them was *I Am Rich* [22]. The only functionality the app *I Am Rich* had, was that when it was opened on the phone, the phone's screen changed to a glowing red gem and displayed the text "I Am Rich, I deserve it, I am good, healthy successful". App Store removed the app few days after it was released, but in the meantime eight people bought it. This shows that even an app that does nothing and cost a fortune, can make money by hitting the right market and using the right price strategy.

### 5.1.1 Freemium

Freemium is a new price strategy, which has become very popular for digital services and goods. The word freemium is made up from the words free and premium, and is basically to give a core product away for free and sell the premium product for a flat fee. The usage of computers are becoming increasingly pervasive, and the cost is declining. Moore's law describes the exponen-



tially decreasing in computing costs and observes that the amount of computer power one can buy today for a certain cost, doubles every 18 months. The effect is that the computer production is very inexpensive, and digital products can be duplicate at almost no cost. Therefore, only a small percentage of the consumers need to buy the product, to make the freemium strategy profitable.

The freemium strategy was not possible when the goods were non-digitally and costed money to produce. For example, it did not make sense to distribute 100 free CDs in order to sell 2 concert tickets, because the cost of producing and distributing the CDs would be too high compared to the revenue from the concert. However, today when computers can create mp3 files and distribute them for almost nothing, it becomes profitable. In other words, freemium is a suitable pricing strategy for companies that can deliver their services digitally, and not for companies that depend on non-digital services [63].

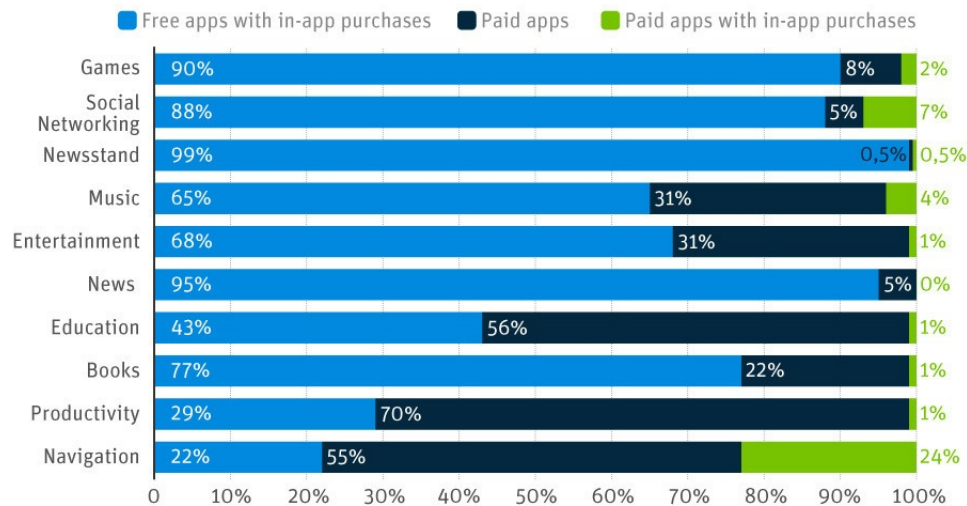
In relation to the app market, research [24] shows that it is relatively hard to make money from Android apps relying on a one-off installation fee. Only 20% of the free apps and 80% of the paid apps are never downloaded on anyone's device. 52% of all free Android apps are downloaded less than 1000 times, and only 5.6% are downloaded between 50,000 and 500,000 times. For paid Android apps, the numbers are even worse. Only 0.1% of paid apps have ever seen 50,000 downloads, and 5% are downloaded between 1,000 and 50,000 times. This makes the strategy for Android apps clear, freemium is the optimal choice. It is a huge difference between apps on App Store and Google Play. According to research [111], on App Store, the popular free apps are downloaded 15 times more than popular paid apps. On Google play, popular free apps are downloaded 82 times more. This strengthen the statement that iOS users spend more money on apps compared to Android users.

Freemium is by far the most popular pricing strategy among apps. This is because the download rate increases, and thus the total revenue becomes bigger since the revenue from in-ads and IAPs increases. Figure 5.1 shows that freemium with IAPs is the most common strategy to utilize. Categories like music, entertainment, education, productivity and navigation normally have an

installation fee. This is because the apps are usually more complex, or need to pay money to a third-party that provide them with the data needed. For example, Spotify (a music service) pays the artist 0.6 cents per song played, which accounts for 70% of the total gross revenue [32].

### Freemium is the No.1 Pricing Strategy in Most App Categories

% of revenue generated in Apple's App Store from January through November 2013, by app category and pricing model



statista  
The Statistics Portal

Mashable

Source: Distimo

Figure 5.1: Different Pricing Strategies in the App Market [32]

### Premium

Premium is used in combination with freemium. The apps have a free version, but users can pay extra for a better version; the premium version. The premium version can for example contain more functionality, nicer design or be free from advertises. The main objective when utilizing the freemium pricing strategy, is to get users to love the app, which increases the probability for them to purchase the premium version. Spotify is free to desktop and mobile phones, but only the premium users can play music without network connection and advertises stopping the music. These features attract users, and is the main reason why 25% (6 million) of Spotify's users are premium users, paying \$20 every month.

### **In-Ads**

The most common ways to display ads in apps, are as a fullscreen pop up picture between sessions or as a banner at the bottom. The fullscreen pop up picture is typically displayed a few seconds, while the banner usually is displayed all the time in specific views. There are two ways to generate revenue from in-ads; *Click-Through Rate* (CTR) and *Cost Per Thousand* (CPM). CTR is the revenue generated when a user clicks on an ad and thus open the page where a product is advertised. CPM refers to the passive impressions an ad receives, regardless of whether users click on it. According to *Hochman Consultants* [108], each ad impression generates on average \$0.0047. The average CTR is 0.5%, where each click generates \$0.92. A rough calculation of the average total revenue generated by a 1,000 impressions is \$9.3. In other words, an app needs high user activity to generate sufficient revenue.

### **In-App Purchases**

IAPs is a common pricing method especially for apps in the category games. In U.S. the revenue from IAPs in apps in the category game increased from 1% in 2008, to 34% in 2010. Further, according to *Distimo*, 98% of Google Play revenues and 92% of App Store revenues in November 2013 came from free apps that offered in-app items for purchase [107]. In 2012, 71% of all IAP transactions were below \$10, and generated 31% of the total revenue from IAPs. 18% of the total revenue was generated by transactions from \$10 to \$20, and 51% was generated by transactions greater than \$20. However, most users do not pay for virtual goods, in 2012 it was only 3% that spent money in freemium games [33]. Nevertheless, as Figure 5.2 shows, IAP has become the largest revenue source, representing 76% of the total revenue on App Store in the U.S. market.

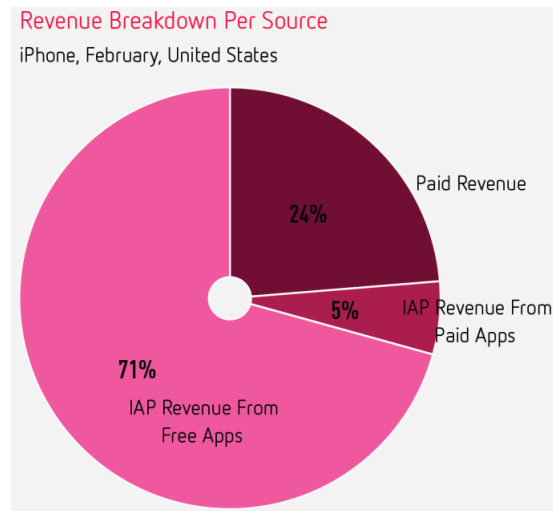


Figure 5.2: Revenue from the Different Sources [34]

With an Average Revenue Per Download (ARPD) of \$0.99 from IAPs in both U.S. and Europe and \$3 in Japan, IAP is definitely a monetization method every developer should consider regardless of whether the app is free or not [34].

*IAPs is by far the largest revenue stream in Fun Run, in-ads are more of a side thing we have.*

Nicolaj Broby Petersen, CEO Dirtybit

### 5.1.2 Paid

Users need to pay a flat fee in order to download a paid app. Paid apps are normally in the categories navigation, productivity and education. In other words, more complex apps with less competition. Paid apps are different from premium apps, because they do not have a free version users can try before deciding if they want to pay money for the app. Paid apps can also have premium versions, where the users need to pay more to get the extra features, this is however very unusually. IAPs is a more common monetization method in paid apps, but as Figure 5.2 shows, it only represents 5% of the total revenue on App Store. This is because paid apps have far less users compared to free apps.

### 5.1.3 What To Choose

The app market is currently in favor of free apps, but developers should still consider which pricing strategy to use. It is harder to increase the price, rather than lower it. To get a deeper understanding of the price strategies and their effect on downloads, Thomas Carter developed the iOS app *Alpha Combat* and changed the price back and forth to see the effect [35]. *Alpha Combat* is in the category *Game*, and the game is about shooting down planes to defend a military base. Figure 5.3 shows the number of daily downloads the game had after it was released.

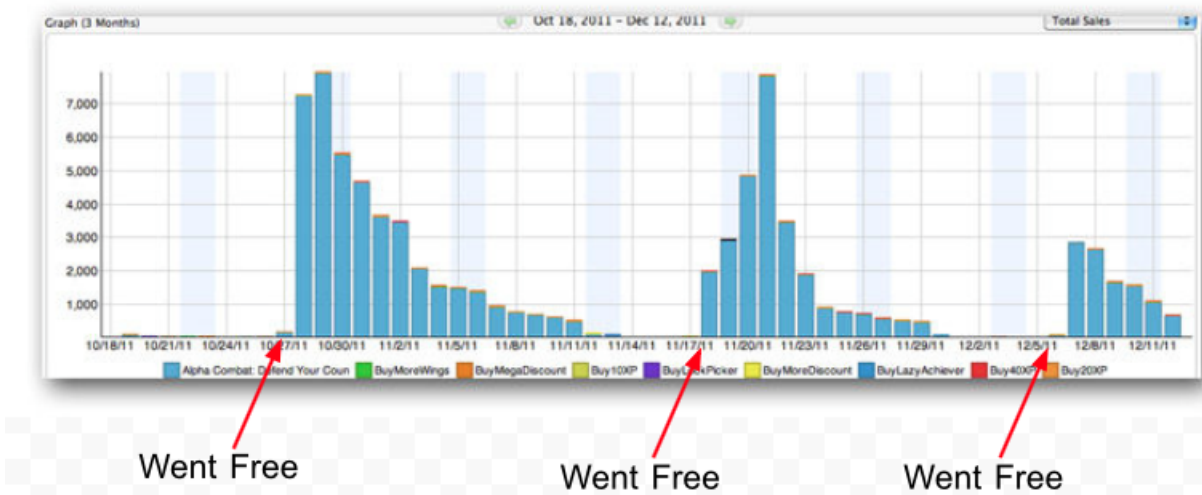


Figure 5.3: Increase In Downloads When Switching From Paid To Free [35]

The first time the app went free, it was picked up by several websites that make a living of aggregating all the apps that became free or dropped in price that day [35]. Figure 5.3 shows that the number of daily downloads increased from around 100 to more than 7,000 the day after the app became free, and approximately 8,000 downloads the day after that. The download rate then declined, and the app was switched back to paid once again. The second time the app went free, it became ranked as one of the top 10 most popular game apps on App Store in Japan, resulting in a large increase of downloads once again. The counter-argument for choosing the free price strategy is that it is a loss in revenue, because users no longer need to pay a flat fee to download the app. However, when the app is free more users download it, and the total revenue becomes bigger because the revenue from IAPs and in-ads increase, which is illustrated in Figure 5.4.

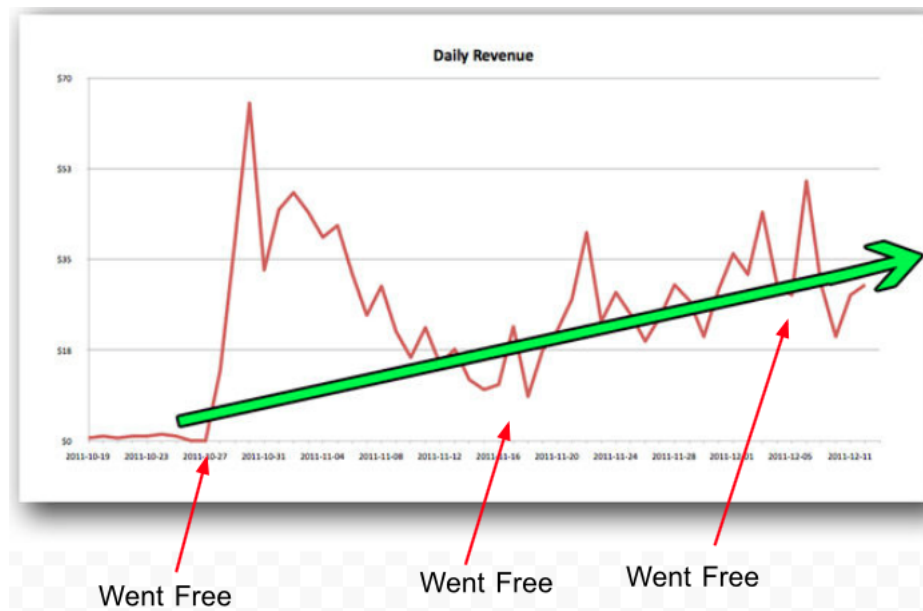


Figure 5.4: Revenue Increase When Switching From Paid to Free [35]

Figure 5.4 shows the change in revenue when the price is switched back and forth from paid to free. The revenue had an exponential growth the first time the app became free, and continued to grow after the second time it became free. The revenue increased because the app received more downloads and thus more IAPs and in-ads impressions. However, not all app categories are suited for this method. Thomas Carter tried the same method on another app in the app category *Lifestyle*, but it did not work. He concludes, that it is because the game category has more average downloads per app, than the lifestyle category. Therefore, more users are looking for free apps in the category game compared to the category lifestyle. Alpha Combat had more than 80,000 downloads in only the first two months after the app was released in the end of 2012. However, statistics from App Annie [113] shows that the app's popularity has decreased significantly, since it is no longer ranked on the overall ranking list. [35].

Figure 5.4 shows that the total revenue increased when the app was free, which is something the majority of app developers experience and therefore choose the free pricing strategy. According to an analysis from Gartner [62], the percentage of free apps will only increase and in 2015 account for 92% of the total apps available. However, with fewer paid apps, it takes less downloads for an paid app to achieve a good rank compared to a free app. According to *Distimo's* research

[36], it requires 4,000 daily downloads for paid apps to be ranked in App Store's top 10 list, versus 70,000 for free apps. To be ranked in the top 50 list, it only requires 950 daily downloads for paid apps, versus 23,000 for free apps. This could be a motivation for developers to choose the paid price strategy, because apps can achieve a good rank with less downloads, and thus benefit from the ranking list's network effects. However, developers experience that it is relatively hard to get a large number of downloads with an installation fee [36], which makes the free pricing strategy the one in favor.

## 5.2 Apps Key Performance Indicators (KPI)

A large number of downloads does not necessarily imply that an app is popular or successful. Obviously downloads are one of the key metrics for developers, but downloads means nothing if the other factors are not present. There are several key factors that are important when it comes to the app's success; *Customer Acquisition Cost (CAC)*, *Usage*, *Retention Rate*, *Average Revenue Per User (ARPU)*, *Average Revenue Per Paying User (ARPPU)*, *Average Revenue Per Daily Active User (ARPDau)*, and *Lifetime Value* [26].

*Downloads only enable an app to succeed, they do not indicate actual success.*

Brant DeBow, EVP of technology at BiTE Interactive [26]

### 5.2.1 KPI #1 - Customer Acquisition Cost

The first app Key Performance Indicator (KPI) is *Customer Acquisition Cost (CAC)*. CAC is the total cost of acquiring a new user to the app, and with high positive network effects this cost can be as low as 0. To calculate the CAC, the business needs to tally all the advertising and marketing expenses for a given time period, and divide it on the number of customers acquired in that period.

$$CAC = \frac{\text{Total Costs of Advertising \& Marketing}}{\text{\# of Customers Acquired}} \quad (5.1)$$

CAC is a good indicator for the marketing team to estimate which marketing strategy that has the lowest CAC, and thus the most cost-efficient approach to acquiring new customers [29].

### 5.2.2 KPI #2 - Usage

To be successful with an app, it is crucial to identify the app's *Usage*, the target customers and the market surrounding them. Important factors in this KPI are, *who* (i.e. the users of the app), *where* (i.e. where the app is used), and *when* (i.e. when the app is used). With a better understanding of the app's usage, it is possible to differentiate between the app's weaknesses and strengths and locate the most profitable users. Hence, developers can allocate resources to the most efficient distribution channels in relation to these users, and thus increase the app's user activity and thereafter the revenue.

### 5.2.3 KPI #3 - Retention Rate

*Retention Rate* is the percentage of users using the app after downloading it, the more frequently they use it, the higher the value. Snapchat and WhatsApp are highly valued because of their large number of active users, and thus the high retention rate. An app can have infinite number of downloads, and still be worth nothing due to extremely low retention rate. Figure 5.5 shows the average retention rate for each app category. The categories with the highest average retention rate are messaging (i.e. WhatsApp), games (i.e. Draw Something), social (i.e. Facebook and Twitter), and photo/video (i.e. Snapchat).



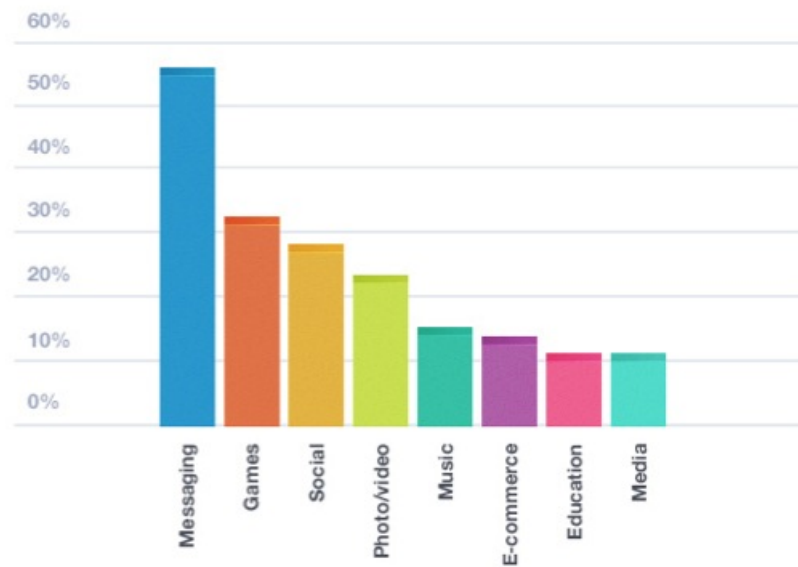


Figure 5.5: Retention Rate in the Different App Categories [52]

Retention is one of the biggest challenges of apps today, as 65% of users stop using the app three months after the installation [26]. It is far more expensive to acquire new customers rather to retain existing ones (studies shows six to seven times more expensive [28]), and thus retention rate has a large impact on the app's success. To understand how retention rate is calculated, an example is provided. If an app has 100 customers on the beginning of the week, and in the end of the week only 10 of the original 100 customers use the app, the retention rate is 10%.

Back in July 2011, in the beginning of the mobile app era, Fred Wilson of Union Square Ventures made the “30/10/10” retention rule for mobile apps, which is even today fairly accurately. According to the rule, 30% of all users will use the app each month. 10% of the monthly users will use the app each day, and 10% of the daily users will use the app concurrently. The rule can be used as a good basis in the beginning, but developers should notice that these numbers can vary a lot depending on the mobile platform the app is running on and the app's category. Methods to increase the retention rate, are for example to use in-app currency, push notifications <sup>1</sup>

<sup>1</sup>Push Notifications are short messages sent to the user's phone through the app (via a badge, alert or pop up message) even when the app is not in use

and tutorials to make it easier for the users to understand the app. However, the retention rate remains low if common factors like design, user experience, usability and performance are not present [30].

#### 5.2.4 KPI #4 - ARPU, ARPPU, and ARPDAU

*ARPU*, *ARPPU*, and *ARPDAU* are important business metrics analyzed in order to grow the total revenue, normally by scaling up profitable services and products the customers like. **ARPU** (Average Revenue Per User) is estimated by dividing the total revenue by the number of users in the app, which is used to understand the baseline value of an active user in a period of time. **ARPPU** (Average Revenue Per Paying User) is especially useful in the freemium model, where the free version and the revenue is driven by premium purchases and IAPs. ARPPU is normally in the range of \$5 to \$20.

A high percentage of users download apps and forget about them, the **ARPDAU** (Average Revenue Per Daily Active User) is one of the key indicators that provides a understanding on how successful an app really is. ARPDAU gives developers a sense on how their app is performing on a daily basis. An ARPDAU of \$0.05 is a good benchmark, but as the daily active users (DAU) increase, the ARPDAU normally decreases. However, over the long run, apps with good monetization can achieve an ARPDAU in between of \$0.15 and \$0.25 [31].

#### 5.2.5 KPI #5 - Lifetime Value

The last app KPI is *Lifetime Value* (LTV). Customer Lifetime Value is the average revenue a user generates over the entire time using the app. LTV makes it easier to locate the customers that are the most profitable, and thus focus the marketing on them rather than trying to reach everyone [27]. LTV is directly related to the ARPU, and the average total time customers tend to use the app, which is 1 divided by the churn rate. The churn rate is the opposite of the retention rate, it represent the rate of users leaving the app. More specifically the formula for customer lifetime value is given in Equation 5.2.

$$LTV = ARPU * \frac{1}{\text{Churn Rate}} \quad (5.2)$$

LTV should be estimated based on the areas important for the specific app. For example, a music app is interested in the amount of time each user listening to music, especially if they have ads in between of the songs. While a game app rather pay attention to the number of ad impressions per player or the ads' click rate. By comparing the different users and how they interact with the app, one can analyze the different trends for the most valuable users and customize the app to meet their requirements. LTV is therefore one of the most important metrics to allocate the marketing funds, and to improve the app to meet the most profitable customers' needs.

### 5.3 Marketing

By analyzing the app's KPIs, developers have narrowed the marketing scope to the most profitable customers, this section describes how to reach them. The approach can be very different depending the target customer's attributes, such as age, interests and gender. The most common way to market an app is through social networks. Without spending money, developers can easily spread information about the app to all their acquaintances and they might spread it further. The most popular social networks for this purpose are Facebook, Twitter and Instagram. However, in order to create a hype around the app, developers need a large network of friends or followers, if not it can be difficult to get enough publicity around the app due to the limited audience. Fortunately, Facebook has several different ways to market apps for a very low price. Developers can create a like page<sup>2</sup> on Facebook, where they can add pictures, videos and information about the app. When people like the page, they receive information posted in the page. In this way, developers can inform their users with information about the app, such as new updates. By connecting the Facebook page to Twitter and Instagram, it creates an easy way for users to follow the app on these channels as well. Thus, by increasing the amount of likes on the Facebook page, it also increase the probability of increasing the number of users on Twitter and Instagram.

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<sup>2</sup>A like page on Facebook is similar to a homepage. People can like the page and will then receive information on Facebook posted on the like page

Facebook has an enormous user base, and with its large number of advertisements, opportunities it is a great place to start the marketing. Every ad can be customized to reach the target customers by changing the ad's settings, such as age, language, gender and location. When the ad is customized, Facebook estimates the potential reach based on the customization, see Figure 5.6.

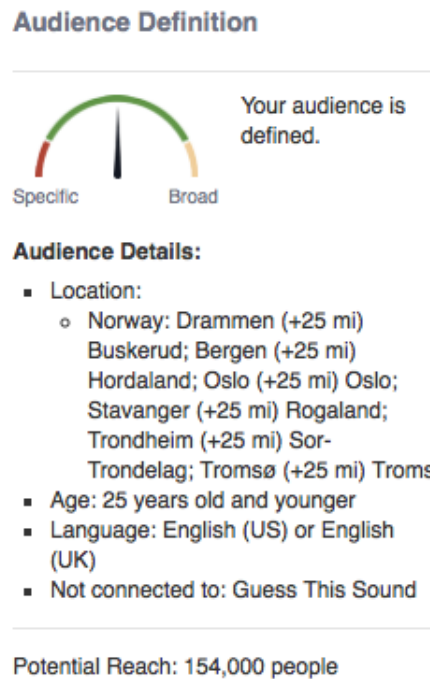


Figure 5.6: The Potential Reach On Facebook Ads [53]

Figure 5.6 shows the customized Facebook ad I used when marketing the case study app to my target customers. The ad was visible in the largest cities in Norway, for users in the age of 25 and younger, and that understand English. Facebook calculated the potential reach for the ad to be 154,000 people, which is a good balance between a specific and broad audience according to Figure 5.6. When all the pictures and information about the app are added in the ad, developers need to set the ad's budget and for how long the ad campaign shall last. The shorter it last and the larger the budget, the faster and larger the average result becomes.

There are several different ways to advertise in order to obtain people's attention, especially if

the budget is large. Popular TV programs, blogs and radio stations can have a large impact on the number of downloads, and are often exploited by large enterprises. However, indie apps usually struggle with a strict budget, and need to look on other opportunities to attract people's attention. Regardless the marketing budget, the best way to advertise an app is by making the users do it for you; Word of Mouth. To get people to talk about the app, they either need to think it is interesting or it needs to capture their attention. Ways to capture users' attention is by handing out flyers, hang up posters and do stunts where the target customers are located. For example, if the target customers are teenagers from the age of 13 to 18 years, a good approach could be to visit schools during recess. This approach takes time, but it is cheap and provides insight in how the target customers welcome the app.

### 5.3.1 Word of Mouth

*Word of Mouth* is originally a term for passing information from person to person by oral communication [65]. However, in present time people tend to spread information more digitally, especially through social networks. According to *ComScore* [64], more than half of the time spent on social networks is done via mobile devices. In 2012, Facebook reached 3 out of every 4 smartphone users, and 60% of Twitter's users accessed the site through mobile. Therefore, marketing apps through these channels does not only reach a large number of smartphone users, it is also easier for the users to download the app while they already are using the phone. The main reason why Word of Mouth is considered as one of the most efficient ways of marketing, is because users are more apt to make a purchase or download an app based on the recommendation of someone they know. The impact of Word of Mouth depends on which channels the word was spread, and from whom. According to Nielsen research [66], 92% of people trust recommendations from friends and family more than all other forms of marketing. Market Force research [67] argue that, 81% of U.S. online consumers' purchase decisions are influenced by their friends' social media posts. Analysis from Harris Interactive [69] shows that an average of 71% say that family and friends influence their purchase decisions and 45% say that friends or people they follow on social networks may influence them.

An analysis from McKinsey [68] shows that 8 to 10 percent of consumers are *influentials*, whose

common factor is trust and competence. Influentials typically generate three times more Word of Mouth messages than non-influentials, and each message has four times more impact on a recipient's decision. About 1 percent of influentials are digital influentials, such as bloggers. The analysis later argue that recommendations within a tight, trusted network have less reach, but greater impact than those circulated through dispersed communities. This is because there is usually a high correlation between options from people the users trust and the network members they most value. According to the analysis, it is up to 50 times more likely that a customer trigger a purchase when the product is recommended by a trusted person. Further, Word of Mouth is the primary factor behind 20 to 50 percent of all purchasing decisions. This illustrates the impact of Word of Mouth, and the importance of obtaining it to a large extent. According to [68], Word of Mouth can be obtained in two ways; experiential or consequential. Consequential is when marketing activities trigger Word of Mouth, which occurs when consumers directly are exposed to traditional marketing campaigns and pass on the information to others. This effect is usually stronger than the effect from the advertises. Experiential is the most common and powerful form of Word of Mouth, and typically accounts for 50 to 80 percent of Word of Mouth activities. It occurs when users try the product and pass on information to others based on their experience. Users that share their positive experiences in relation to apps are usually super users<sup>3</sup>. Super users in apps are of great importance as they are the largest contributors in terms of revenue and marketing. However, since apps usually have a small percentage of super users, the real challenge is how to obtain them.

### 5.3.2 Psychology

Nir Eyal, the founder of two startups and advisor to several Bay Area companies, claims to know how to create super users [75]. According to Nir, a company that forms strong user habits, creates *internal triggers* in users. Internal triggers makes the user use or talk about the app without any external promoting. To create internal triggers, the app needs to attach its services to the users' daily routines or emotions. For example, an app that collects all food products from every grocery store and compare them to see which grocery stores that are the cheapest, can quickly become a habit for users when they are grocery shopping. An app that became popular due

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<sup>3</sup>An app's super users, are the users with highest activity and thus use the app more then an average user.

to the users' motions (i.e. addiction) is Angry Birds. According to a survey about Angry Birds [76], 24% of the users feel irritation, 39% mastery, and approximately 50% feel joy and relaxation when using the app, see Figure 5.7.

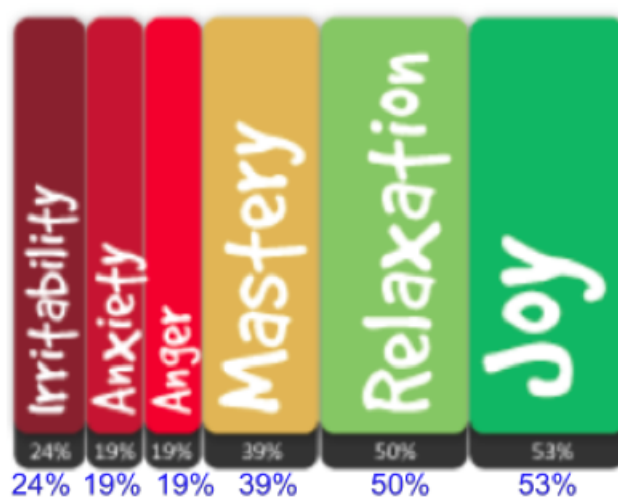


Figure 5.7: The Addiction In Angry Birds [76]

Rovio, the company behind Angry Birds focused on the players emotions when they developed the game. The game can be difficult and the players feel irritation when they fail to complete a level, and thus feel mastery and joy when they finally manage to complete it. In this way, the players continue to play the game because they desire to accomplish new levels. Another addictive app is *Flappy Bird*. Flappy Bird is a simple game where the goal is to fly a bird between obstacles, by tapping the finger on the screen to make the bird fly. The game looks very easy, but it is not as the bird is very difficult to fly. This makes the players in the game frustrated because they struggle to accomplish something they thought they would master. Due to its addictiveness it reached the top lists on both Google Play and App Store, and generated \$50,000 daily only on in-ads. However on February 11th 2014, Dong Nguyen the creator of Flappy Bird, removed the app on both App Store and Google Play because it became too addictive, as a large number of players were playing for hours at the time. One of the app's reviews, collected from App Store is as followed [99].

*I would, in a heartbeat, sell my soul to Satan just to have never downloaded this app.*

A player of Flappy Bird, App Store.

According to Nir, companies manufacture desire by guiding users through a series of experiences designed to create habits, and thus addiction. These experiences are called *Desire Engines*, and the more users iterate through them, the more likely they are to self trigger the experiences. Figure 5.8 illustrates Nir's desire engine.

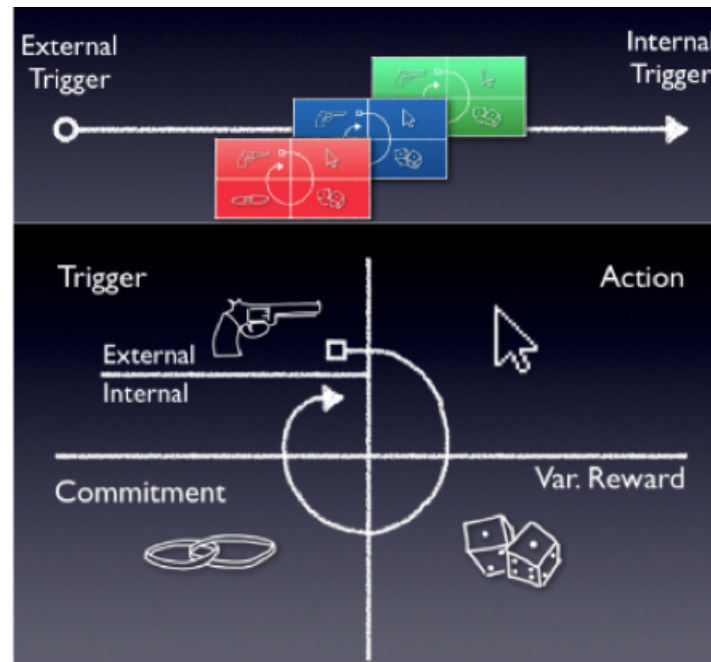


Figure 5.8: Nir Eyal's Desire Engines [75]

The Desire Engine is initialized either by an *external-* or *internal* trigger. At the beginning, the company utilize external triggers such as advertising, to start the Desire Engine. When users continuously cycle through successive desire engines, they begin to form internal triggers through their existing behavior and emotions. When the users are internally triggered by their own behavior or emotions, the internal triggers become part of their routine behavior.

**Action** is the second phase in the cycle and exploits two parts of the human behavior; motivation and ability. To increase the probability of a user taking the intended action, the designers makes the action as easy as possible. This boost the user's motivation, ensuring that the user act as the designer intends through a user friendly design.

Nir continues, "*What separates the desire engine from a plain vanilla feedback loop is the engine's*



*ability to create wanting in the users, the predictable feedback loops do not create desire*". Hence, by adding variability in the loop, creates a desire to continue the loop to see what the new result might be. **Variable reward** is the third phase in the cycle, and describes how to add variable rewards to create a frenzied hunting state in the user. This hunting state suppresses the areas of the brain associated with judgment and reason while activating the parts associated with wanting and desire. Research shows that levels of dopamine surge, when the brain is expecting a reward, hence variable rewards is one of the most powerful tools to hook the users. An classic example is slot machines and lotteries, but variable rewards can also be present in technologies. For example, an app's users can receive rewards if they complete different stages while playing, and thus continue to play in order to see the next reward.

The last phase in the desire engine cycle is the **commitment**, where the user is asked to do a bit of work. The phase has two goals. First, to increase the probability that the user will make another pass through the desire engine when presented with the next trigger. Second, make the user give a combination of time, data, effort or money before trigger a new cycle. The commitment phase is not about generating revenue, it is rather about actions that improve the app for the next cycle, for example invite friends to the app. The actions improve the app for the user, and thus make the trigger phase more engaging and the action phase easier. By analyzing the *Desire Engine*, companies can trigger an addiction or habit in the users, and hence create super users that may promote the app through Word of Mouth.

# Chapter 6

## Osterwalder's Business Model Ontology

The definition of a business model vary depending on whom you ask, and there are several different descriptions flourishing on the Internet. This thesis uses Osterwalder's definition of a business model, and further his approach and framework to present a business model for the case study app, *Guess This Sound*. An overall description of a business model is, a representation of how a company buys and sells goods and services, and the cost and revenue related to this. To be more specific the definition of Osterwalder's business model ontology is as followed, *"a conceptual tool that contains a set of elements and their relationships that allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams"* [73].

The definition is based on his extensive studies through work within the field, and resulted in a complete business model ontology combining what he found to be the most important and necessary areas in his studies. This thesis focus on his business model ontology, because it gives a well defined and understandable way to present and analyze business models, covering most of the important aspects. This chapter provides an overall description of Osterwalder's business ontology. The ontology is presented in-depth in relation to the case study app.

## 6.1 Ontology

Osterwalder's research provide a framework for companies to analyze and present their business model, in other words an ontology used to accurately describe the company's business [73]. The business model ontology consists of nine building blocks (i.e. core capabilities, partner network, value configuration, value proposition, customer relationship, distribution channel, target customer, cost structure and revenue streams), which is categorized into four areas; *Infrastructure*, *Offer*, *Customer* and *Finance*, this is illustrated in Figure 6.1.

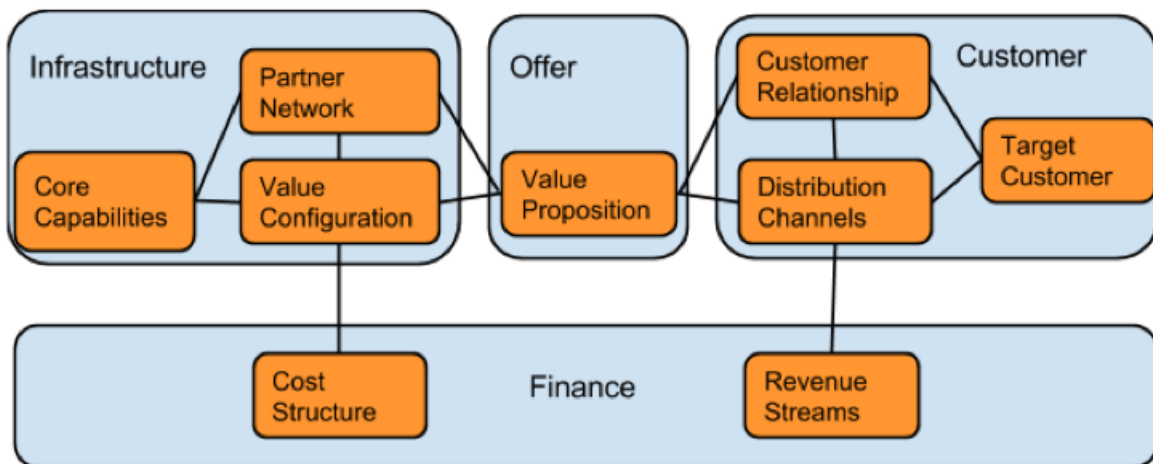


Figure 6.1: Osterwalders Building Blocks [18]

According to Osterwalder, the four areas are the fundamental elements in a business model, and are presented as followed [73].

- **Offer:** Represents what type of business the company operates in, and the products and value propositions it offers to the market.
- **Infrastructure:** Represents how and with whom the company efficiently perform logistical or infrastructural tasks.
- **Customer:** Defines the company's target customers, how to build a strong relationship with them, and how to deliver products and services to them.
- **Finance:** Describe the cost structure and revenue stream; the business model's sustainability.

### 6.1.1 Offer

The first area of the business model ontology is *Offer*. It covers all services and products the company offers to its customers, i.e. the company's livelihood, and thus the most important area in the ontology. The offer area contains one element; *Value Proposition*.

*Value Proposition*, is the collection of products and services a business offers to meet the need of its customers. According to Osterwalder, a company's value proposition is what distinguishes the company from its competitors. The value proposition provides value through different attributes such as performance, design, cost reduction, newness, risk reduction, price and usability. By analyzing these attributes, the company obtains a clear overview of its product's value and can compare it to its competitors. The company will also gain insight in the product on a more detailed level, and thus see new opportunities to improve it.

**Performance** is how well the product or service perform. The criteria for what a good performance is, depends on what kind of product or service to be assessed. For example, computers must be fast and reliable, while a banking software focus on the security and trustworthy.

**Design** is basically how the product looks like, for some product this has not a large impact on the customers' value, while other products such as cloths it is very important.

**Cost reduction** is the case when value is created by reducing the customer's cost after purchasing the product. The cost reduction does not need to be a reduction in money spent, it can also be a reduction in effort or time. For example the product can offer tasks that is less time consuming compared to the tasks that needs to be done without it, such as vacuum cleaners.

**Newness** is to which extent the product differ from existing products. In other words, why should customers buy the product compared to other existing products. The company needs to convince the customers, that its product is different and better than the products already available.

**Risk reduction** is the case when value is created by reducing the customer's risk. For example, by introducing an electronic payment system on a web page, the customer's risk is reduced during a purchase, due to the secure money transferring.

The **price** attribute describes the product's price model, and its price. 5.1 presents the three price strategies related to apps which is freemium, premium and paid. Other price methods implemented are IAPs and in-ads.

**Usability** is the last attribute and defines how user friendly the product or service is. Where, when and how to use it, are important criteria to analyze when creating the product. Apps are particularly vulnerable to this attribute, because users can delete the app if it is difficult to use or does not meet their expectations.

### 6.1.2 Customer

The *Customer* area is the second area in the ontology, and defines the relation between the company and its customers. This area provides the understanding on whom the target customers are, which distributions channels to utilize in order to reach them, and how the company maintains its relationship with them.

**Target customer** is the most important element in the customer area, and has a large influence on the whole business model. The target customers must be carefully analyzed with no or little misinterpretation. Misinterpretations can lead to inefficient distribution channels, miscalculations in the value proposition such as wrong pricing strategy or usability, or even wrong focus when developing the product. The target customers can either be consumers or other businesses. In relation to consumers as the target customers, different criteria are for example needs, gender, age, location and interests.

In order to reach the target customers through marketing, the company must utilize channels, i.e. **Distribution Channels**. The channels connect the company's value proposition with the target customers in order to generate value between them. The target customers are approached

either directly through sales team, or indirectly through third-party sellers. Distribution channels are used to trigger the *Customer Buying Cycle*, which contains the different phases a customer visits before and after a purchase. The company's Customer Buying Cycle represents how it interacts with the customer in different phases, and are as followed *Awareness*, *Pre-Purchase*, *Purchase*, *Implementation* and *Post-Implementation* [96], see Figure 6.2.



Figure 6.2: Customer Buying Cycle [96]

*Awareness* refers to the phase when the customer becomes aware of the product or service through the distribution channels. *Pre-Purchase* is the phase when the customer compare what the company offers with other competing products or services. To capture the customer's attention, the company needs to have sufficient information about the product easily available for the customers.

*Purchase* refers to the phase when the customer has decided to pay for the product or service. Because of the amount of information and security in a purchase, it is important to let customers choose between different payment options. Electronic billing systems, could lower the barrier by making it safe and easy for the customers to complete a purchase.

*Implementation* is the delivery phase of the product or service. In smaller deals the customers can simply pick up the product, whereas in larger deals the implementation process can take several months. For some businesses, this is very important because it builds brand satisfaction

and a satisfied user base. However, in the app market this phase is not relevant, because the customers receive the app the second they download it.

*Post-Implementation* phase is where the customers are using the product. This phase is about maintaining the customer relationship, i.e. solve problems and provide support through support channels. The phase is also concerned with acquiring new customers.

**Customer Relationship** is the third element in the customer area, and describes the relationship between the company and its customers. The goal is to optimize the acquisition of new customers, retain the existing ones and gain profits from sales over time. Since it is less expensive to retain customers rather than acquire them, the company must focus on providing good support and create a good relationship with its customers to increase the probability that they stay.

### 6.1.3 Infrastructure

Infrastructure is the third area in the business model ontology, and describes how a company creates value in order to provide value proposition and maintain the customer area. The infrastructure area contains three building blocks; *Partnership Network*, *Value Configuration* and *Core Capabilities*.

The **Partnership Network** represents the partnerships a company involves itself with, and how the resources are distributed amongst them. Examples of partnerships are investors and business to business agreements.

**Value Configuration** describes how the company configures its resources and activities in order to create its value i.e. *Value Proposition*. The main attribute in value configuration is *configuration type*, which describes the type of configuration used to create value. The three different configuration types that Osterwalder presents are discussed in 4.2; value chain, value shop and value network. Value configuration is divided into activities, where each activity is a specific task that the company perform. Activities have different levels to make the company distinguish be-

tween its primary activities and its support activities. All the activities are connected through the value configuration, where they collaborate to generate value.

**Core Capabilities** is the last building block in the infrastructure category. It describes how the company use their assets to create, produce and offer products and services to the market, normally in repeatable actions. The company provides its value proposition to its target customers by using their capabilities. The core capabilities can be divided into different resource types which is *humans*, *tangible* and *intangible*. Human resources is available through people-based skills and employees in general, and are usually the most important resource. Tangible resources are equipment or other physical values within the company, such as interior, product equipment and decoration. Intangible resources are non-physical values, such as patents and brands.

#### 6.1.4 Finance

*Finance* is the final area in Osterwalder's business model ontology, and consists of the revenue streams and cost structure of the company. The area is the basis for running a business, and the outcome of the configuration in the other areas explained. It represents how the company intends to make money and survive as a business. The **Revenue Stream** building block measures the company's ability to transform its value proposition into revenue. The building block describes the company's pricing strategy and how to increase the revenue. The **Cost Structure** is the final building block, and measures all the costs related to creating, marketing and delivering products to the customers.



# Chapter 7

## Guess This Sound - The Case Study

### Application

This chapter provides an overall description of the case study app, *Guess This Sound*, and later a complete business model for the app based on Osterwalder's business model ontology. Afterwards, the chapter presents an analysis of the different marketing approaches utilized and their effect. Further, an analysis of the case study app's network effects is provided, and the modified epidemiological model (SIR model) is successfully applied. At the end the app is analyzed in relation to the key performance indicators.

#### 7.1 The Game

*Guess This Sound* is the case study application in this thesis. It is developed based on the same idea as Draw Something except a few differences, players make a sound of the word they pick instead of a drawing. If the player choose the word lion, he records a sound he associates with a lion. He sends the sound to his opponent, that tries to guess the word picked (i.e. lion) based on the sound recorded. In Draw Something he had drawn a lion instead of recording a sound. Players in Draw Something can use bombs to remove letters in order to make it easier to guess the word, in *Guess This Sound* players can use notes. When a note is used, every second letter in the word are correctly filled in, making it easier to guess it. If the player guesses the correct word before the time runs out, he receives experience (i.e. points) which is determined by the time

he used and the number of rounds played with the opponent. When players receive enough experience, they gain a new level and might achieve a higher ranking among their friends in the game.

If the word is correctly guessed, the player that sent the sound receives coins depending on the difficulty of the word chosen to record the sound of. In Draw Something, players can use their coins to buy new drawing colors or bombs. In Guess This Sound players can buy experience, levels, notes or already recorded sounds. Players receive extra coins if they invite friends or share their sounds on Facebook, and thus Facebook's network effects are utilized. To give the reader a deeper understanding on how the game works, figures and descriptions of the app are provided in the next subsections. In some of the subsections, there are two pictures of the same view in the app, this is to show how the app's design has changed during its development.

### **7.1.1 Main Menu View**

The *Main Menu View* appears when a user correctly logs in. This is where the player creates a new game, or navigate to other views by clicking on the buttons *Games* or *Menu*. Figure 7.1 shows how the Main Menu View has changed in design.

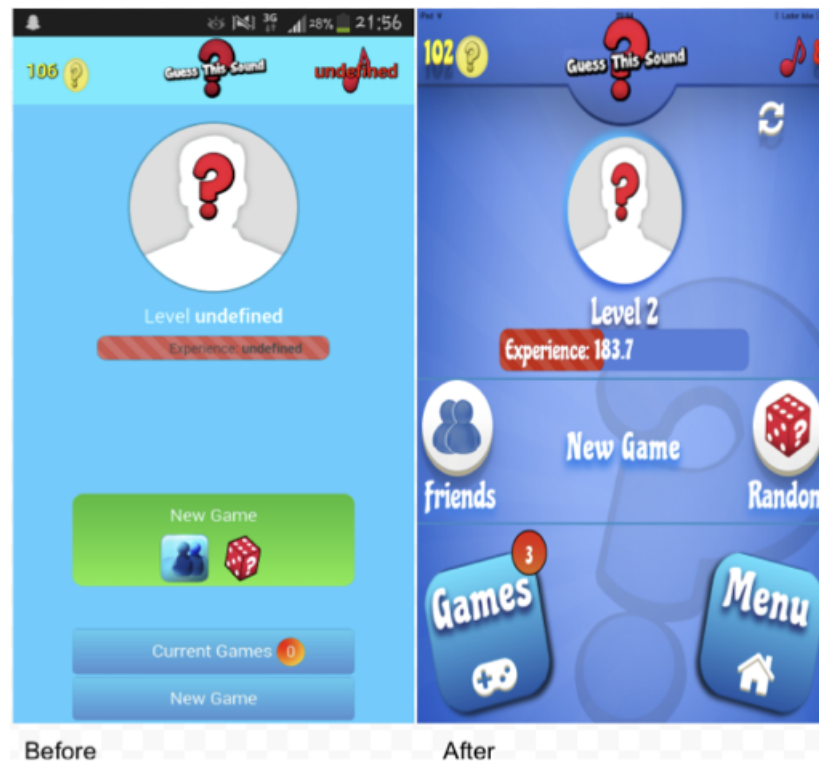


Figure 7.1: Guess This Sound Main Menu View

If the player clicks on *Friends*, *New Game* or *Random*, a new game is created with a friend or a random player. When the button *Games* is clicked, the *Game View* appears, which contains the player's current games. If the *Menu* button is clicked, the *Menu View* appears, where the player can change the game settings, open the game's shop, compare his rank with friends, or log out of the game. In Figure 7.1, the player's coins are represented in the top left corner, and the notes in the top right corner. The player's profile picture is located in the circle under the game's logo, Figure 7.1 shows the game's default picture. By clicking on the profile picture, players can upload their own picture. Below the profile picture, the player's level and experience are represented. The experience is calculated based on the time used to guess the correct word multiplied with the amount of rounds completed. Equation 7.1, calculates the experience achieved from the rounds completed, by dividing the rounds on 10 and plus the result with 1. The result is multiplied with the remaining time to guess the correct word, see Equation 7.2. Hence, the player receives more experience the more games he and his opponent have played. Players have 100 seconds to guess the correct word, and when the time is up the game is over.

$$\text{Round Experience} = 1 + \frac{\text{Completed Rounds}}{10} \quad (7.1)$$

$$\text{Total Experience} = \text{Round Experience} * \text{Time} \quad (7.2)$$

When enough experience is earned, the player achieves a new level. To make it harder to achieve new levels as the player levels up, I created an algorithm which is represented in Equation 7.3.

$$\text{Next Level} = \text{XP Last Level} + (\text{Current Level} + 1) * 100 \quad (7.3)$$

Equation 7.3 calculates the experience needed to achieve a new level. This is calculated by taking the player's current level plus 1, and then multiply it with 100. Thereafter, add the result to the experience needed for the last level. The algorithm increases the difficulty to achieve a new level proportionally with the players' current level, which is illustrated in Figure 7.8.

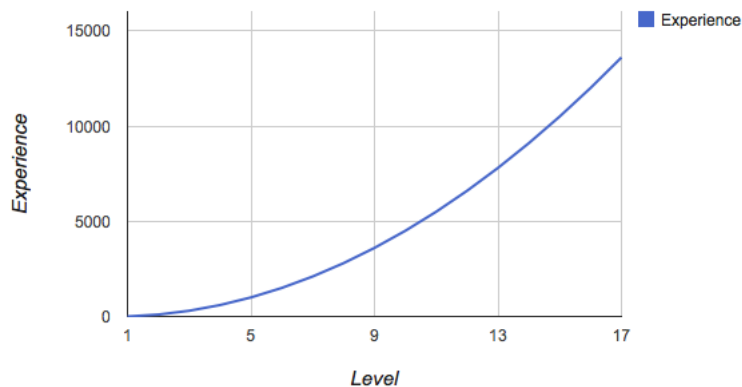


Figure 7.2: Experience Needed To Achieve a New Level

### 7.1.2 Menu View

When the player clicks on the button *Menu* in Figure 7.1, the *Menu View* appears, shown in the middle of Figure 7.3. The picture to the left in Figure 7.3, was the previous design of *Menu View*. If the *Settings* button in the figure in the middle is clicked, a window appears where the user can change email address and profile picture. The player can click on the *Ranking* button, in order to compare his experience with his friends in the game. By clicking on *Shop*, a new view appears

which contains the different items players can buy with the coins earned from playing, shown to the right in Figure 7.3. In this view, the players can also buy more coins with real money, through IAPs connected to Google Play and App Store.

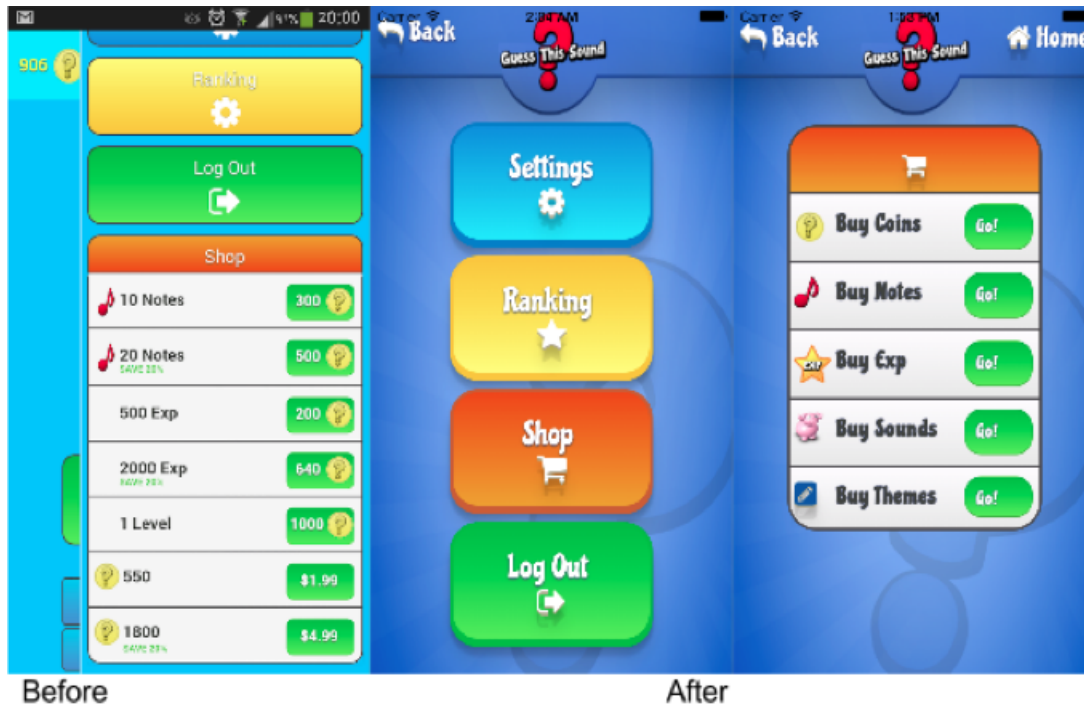


Figure 7.3: Shop View and Menu View

### 7.1.3 Game View

If the player clicks on the button *Games* in Figure 7.1, the *Game View* appears. This view presents the player's current games, see Figure 7.4 to the left. The view has two lists, one containing the games waiting for the player to play; *Your Turn*, and one containing the games waiting for the opponents to play; *Their Turn*. If the player clicks on a game in *Your Turn*, two things can happen. First, the *Pick a Word* window in the middle of Figure 7.4 appears, if it is the player's turn to record a sound. This is where the player picks a word between the tree random words displayed, and then record a sound based on that word. If the words are too difficult, the player can click on the *New Words* button in total three times, and receive three new words for each click. Second, the *Coin View* window to the right in Figure 7.4 appears, if it is the player's turn to guess the opponent's sound. The player receives coins because the opponent guessed the

correct word.



Figure 7.4: Game Views

#### 7.1.4 Guess The Word View

In the *Guess The Word View*, the player tries to guess the word by listening to the sound the opponent recorded, see Figure 7.5. The player has 100 seconds to guess the correct word, and can use a note to make it easier. In Figure 7.5 to the right, the guess is incorrect, but the player still has 56 seconds left to try other words (the correct word is eagle). When the time decreases, letters that are not part of the word disappears (four in total), which makes it easier for the player to guess the correct word. The two pictures in Figure 7.5 show how the design in the game has changed due to feedback from users. Figure 7.5 to the right is more intriguing than the figure to the left, thus it illustrates the importance of having a great design in order to increase the user experience.

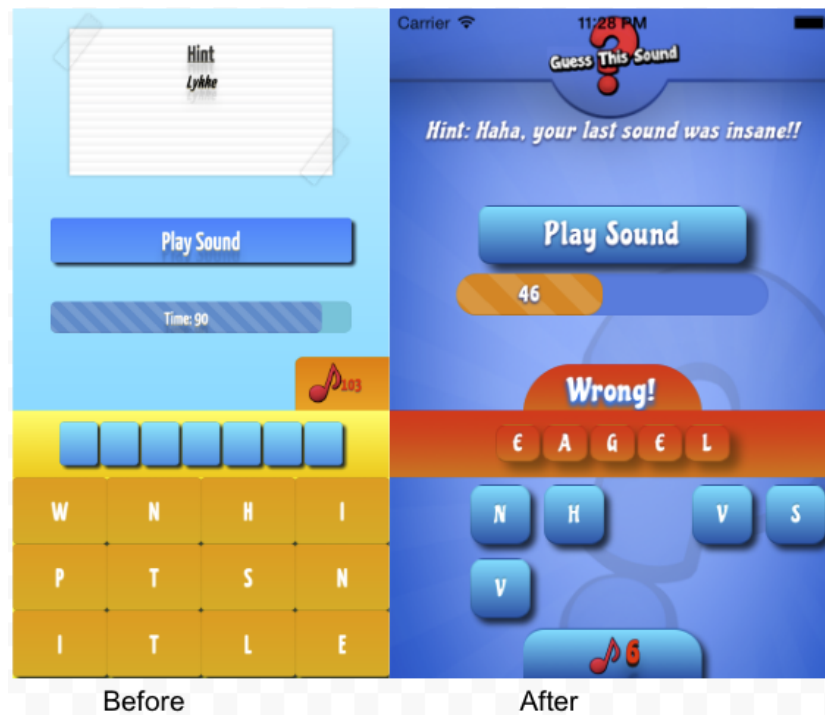


Figure 7.5: Guess The Word View

### 7.1.5 Recording View

When the player choose a word in the *Pick a Word* view, in the middle in Figure 7.4, the *Recording View* appears. In this view the player records the sound associated with the word picked, shown to the left in Figure 7.6. When the player clicks on the microphone, the circle starts counting down from 7 while the player makes the sound. When the sound is recorded, the player can listen to it, share it on Facebook, or send it to the opponent. When the sound is sent, a window appears with a fun fact. The fun facts are included in the app to “hide” the loading time if the network connection is bad.



Figure 7.6: Record The Sound View

## 7.2 The Business Model

Guess This Sound is a self-developed app, created for the purpose of obtaining the necessary data to analyze the app market in-depth. This section presents a complete business model for the app by using Osterwalder's business model ontology, the areas discussed are as followed *Offer, Customer, Infrastructure* and *Finance*

### 7.2.1 Offer

This section covers the products and values a company offer to its customers, through the *Value Proposition*.

#### Value Proposition

*Value Proposition* is the collection of products, services or value covering the customer's needs. The case study app provides two elements in the collection, the product (the game itself) and the support through the app's website, Facebook page and Twitter profile.



**Element One - The Game** The first element is the game itself, which is the core value offered to the customers. The game offers entertainment through the gameplay where players send sounds to each other, and later try to guess the word based on the recorded sound. The game also offers educational value to the users, since they need to type in the correct word for the sound, and thus practice spelling. The relevant attributes in the value proposition for element one are *design*, *newness*, *price* and *usability*. These attributes are what distinguish the app from other apps in the market.

When I developed the app, **design** was something I emphasized. The design had to be simple to make it user friendly, but also intriguing. Since the app is in category game, it was very important to create the design in a way that users felt like they were playing a game. Every detail, such as the buttons' design, the different fonts, and the gaming sounds were carefully considered. When developing an app alone, it is easy to overestimate its user friendliness, and thus feedback from the users are very important. The app has undergone a huge change due to feedback, which is evident by comparing the figures in 7.1. Because of limited experience on how to create a design, I hired a designer to design the background and the icons in the app. This made a large difference on the app's appearance, and developers with less experience in design should consider this.

**Newness** refers to the uniqueness of the app idea, and what distinguishes it from already available apps on the market. There exists a large number of apps with different word game concepts, but it is only one app that has the exact same concept as the case study app, which is *Make a Sound*. *Make a Sound* is however not functional, which makes the concept to Guess This Sound unique. To be the first app with an unique idea is a great advantage, because people tend to download the most popular apps when searching for new apps.

The third attribute in the value proposition is **price**. Guess This Sound is currently free, with no premium version available. The app's price has not been changed back and forth from free to paid as the example in 5.1.3. This is because of the limited time the app has been available, which made the free price strategy a necessity in order to obtain enough downloads and thus

enough data to analyze. In-ads and premium version are scheduled to be implemented later, if the app gains popularity. IAPs are implemented, and are analyzed in [7.2.4](#).

**Usability** is the last attribute for this element in the value proposition. The app's design has a large impact on how user friendly the app is. It is important to set the position of every button and text in relation to what users are accustomed to and how the human mind perceives things. The functionalities are also important, because the app must behave like the users expect it to. When the app was launched, a number of users complained about features they missed in the game. For example, when players guessed the correct word, they needed to continue the game by choosing a new word, record a sound of it and send the sound back to the opponent. If not, the game would not be updated on the servers, and thus the players had to start the game from the beginning and guess the word again. This limited the places players would play the game, because most players were not comfortable by making strange sounds among others. This was later fixed and it is now possible to guess the correct word, quit the game and send a sound back later. After adding this feature, the app's user activity increased significantly.

The three criteria in the usability attribute are *where*, *when* and *how*. The app is used on places *where* players can create sounds without finding it embarrassing, hence in their own comfort zone. Thus, the *when* criterion is when the players are in their own comfort zone. In the first version of the app this was a large barrier, because players had to record a sound after they guessed the correct word, and thus limited the app's usage to the players' comfort zone. However, after creating the feature that made it possible for players to guess the correct word and later send a sound back, it became possible to use parts of the app outside the comfort zone. For example, players could now guess their opponents' sounds and later when they entered their comfort zone create sounds and send them back. This removed some of the app's limitations, and thus increased the activity within the app.

*How* users use the app is the last criterion. In order to make the users interact with the app as I intended them to do, I created a tutorial. The tutorial provides a guide for first-time users of the app, to make them quickly understand how to interact with it. The design is also carefully im-

plemented to maximize the app's usability. However, the sounds users record are limited to their own imagination, and players do not enjoy the game if the sounds they receive are boring. In order to increase the probability for users to create good sounds, the random words they could choose from had to be fun and easy. Based on information gathered from the target customers, I was able to identify the four most popular sound topics; musicians, celebrities, human sounds and animal sounds. I collected in total 1,000 words that the players can choose from.

**Element Two - Support** The second element is the support I give to the users through my support channels; Facebook, the website, email and Twitter. The website<sup>1</sup> has a limited amount of functionalities. Its primary objective is to direct users to the rest of the support channels, and make it easy for them to download the app by clicking on either the Google Play icon or the App Store icon. Hence, the website is not a place to share information, rather a place that connects the support- and distribution channels. On the other hand, the Facebook like page *Guess This Sound*, is a place where users can post and receive information. When a user like the page, he can post and receive information from the page.

The Twitter profile *@GuessThisSound* has similarities with the Facebook page; users that follow the profile receive the messages posted in it, or can write messages that will appear in the profile. It is however two main differences between the Twitter profile and the Facebook page. Firstly, I can use the Twitter profile to follow others' profile, and it is approximately 15% chance that they will follow me back. Hence, the Twitter profile has the potential to gain a bigger audience than the Facebook page, because it is not possible to invite people you do not know to the Facebook page. Secondly, it is a limited amount of information and pictures the Twitter profile can be customized with, and thus it is harder to make an impression on people following the profile. Facebook and Twitter provide the app's users different value, and developers should therefore consider utilizing both. The last support channel is my email, and is used to answer direct complains about the app. The relevant attributes in element two are *design*, *price* and *usability*.

**Design** describes the design of the website, the Twitter profile and the Facebook page. To make

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<sup>1</sup>The case study app's webpage is [www.GuessThisSoundApp.com](http://www.GuessThisSoundApp.com)

people understand the app's concept without too much information, the support channels need to contain the best pictures of the app and a succinctly description. The website's design is simple with a large picture of the app's logo and icons that direct the users to the other channels. The Twitter profile has the app's logo as the profile picture, a brief description of the app and a link to the website. The Facebook page has more information about the app, the app's logo as the profile picture, pictures from the game and links to the other channels.

The **price** of the support channels is free to the users, because their feedback is crucial for further improvements of the app. The support channels' **usability** is important, in order to provide an easy way for users to give feedback. The usability also improves the users' first impression of the support channels.

### 7.2.2 Customer

This section describes the target customers in Guess This Sound, the distribution channels used to reach them and how to build and maintain the relationship with them.

#### Target Customers

When developing the game, the main focus was to make it fun and user friendly. The game's design and its functionalities needed to be facilitated in relation to the users it tries to attract. Therefore, I created the criteria for the game's target customers, in order to develop the game based on these criteria. The criteria are listed as followed.

- **Age:** From 13 to 25.
- **Gender:** Both male and female.
- **Language:** Understand English.
- **Location:** Places where people understand English, first of all Norway.
- **Need:** The need of having an app to use in the spare time.

I decided to focus on users in the age of 13 to 25, because they are usually interested in apps in the category game. I chose to develop the app in English, because I aimed to attract users inside and outside of Norway. The location is therefore limited to places where people understand English, and with Norway as the primary location, because it is easier to marketing from my own location. Users in the age of 13 to 25 do normally have a need of an app in their spare time, usually to pass time. Regarding the long tail concept in relation to the app's target customers, the app aims at the bottom of the head (i.e. the body) where Draw Something is placed in Figure 4.1. It is uncertain where the app eventually ends up, but currently it is in the long tail, approximately the same place as the *Meny* app.

When I developed the app suited for the criteria, I used friends and family that matched the target customer in order to receive inputs from a user's perspective. To attract the target customers, I made the app look like a fun game, where the buttons are skewed and randomly jumps up and down when hitting other buttons. The colors in the game are usually blue, white and red. About 70% of the design is blue, because according to research [88] blue is the most popular color. Soft blues calm the mind and aid concentration, while the red color gives a physical reaction. White stands for about 15% of the colors in the game, and is usually used on text and icons. White symbolize simplicity and clarity, but is also a very good combination with the blue color, and makes it look even softer. The last color commonly used in the game is red. According to [88], red grabs the users' attention first because it appears to be nearer than the other colors and is commonly used to signal danger. I therefore used red on buttons that delete or quit the game, making the users think twice before clicking on it. Buttons that continue the game have the color green. The app's sound effects from buttons and achievements in the game, are carefully picked out to strengthen the user experience. I studied popular games such as Mario and Draw Something to get inspiration for the sound effects to use in the app. An example of a sound effect in the app, is if a user guess the correct word a sound is played to emphasis that the guess was correct. The last think I was especially concerned with, was to integrate Facebook in the app. A high percentage of the target customers are active on Facebook, and this would let users invite friends or share the sounds recorded on the popular social networks. Thus, the app could benefit from Facebook's network effects.

### **Distribution Channels**

The target customers had a large impact on the determination of the distribution channels, and the conclusion was that the primary distribution channels to utilize were social networks, such as Facebook, Twitter and Instagram. The app's Facebook page and its profile on Twitter and Instagram were created and promoted before the app was released. The channels were effectively utilized before the release, in order to create a hype around the app for the day it was published. Other distribution channels I used to reach out to the target customers were app review sites, face to face and the media. Review sites usually write about apps they find interesting or drop in price, which Thomas Carter took advantage of in the paid to free analysis in 5.1.3. However, there are review sites where developers can submit their apps for free and get an honest review. The review sites have normally a large number of followers, and is an efficient approach to gain more downloads. The review's waiting time is however long, and developers must be prepared for a bad review.

When the app was published, I marketed the app through face to face by handing out flyers to the target customers on schools and shopping malls. Right after an app is released, the app has few downloads and people need more persuasion before downloading it. Therefore, face to face is a great way to promote an app at an early stage, and can give developers valuable feedback on how the target customers welcome the app. However, promoting face to face is time consuming and the number of people one can reach is limited. Therefore, I only exploited this approach actively at an early stage, and later focused on distribution channels with a larger reach i.e. Facebook.

Developers should consider to use bloggers or celebrities to promote the app, since they can have a big impact on the app's popularity. They usually have a large number of followers, that are interested in their daily lives. Hence, they influence people to a larger extent than normal marketing. However, they are usually expensive and the waiting time long. I experienced this myself, when I tried to make a friend with a popular blog to write about the app, it never hap-

pened.

The app's **Customer Buying Cycle** is rather simplified compared to the description in 6.1.2. The customers get *aware* of the app through the distribution channels described, and continue to App Store or Google Play if they become interested. The next phase is the *Pre-Purchase*, and this is where the app needs to attract the customers' attention in order to sell itself. To do this, I uploaded the maximum amount of pictures from the highlights in the app and wrote a succinctly interesting description of the app in both English and Norwegian. The Norwegian description is only visible on the Norwegian market. Afterwards, I created and added a tutorial video of the app, to easily illustrate the app's concept. The customers' first impression of the app is through the description and pictures on the app stores, and it is therefore important that developers carefully consider the type of information in this area. If the app's impression do not attract the customers' attention, they do not download the app, even if the app is a perfect match for what they are looking for. If they do download the app, they enter the *Purchase* phase. The case study app is free, and customers do only need to accept the app's requirements before downloading it. If they are accepted, the customers continue to the *Implementation* phase. This phase is not relevant for apps, because apps are delivered to the users the second they download it. Hence, the customers are now in last phase, the *Post-Implementation* phase. The customers are now users of the app and can provide useful feedback through the support channels. Feedback is highly valuable, because it provides insight in the app from a user's perspective. The Post-Implementation phase is also concerned with improvements in the app such as new design and functionalities.

### **Customer Relationship**

*Customer Relationship* focus on acquiring new customers, and to maintain the app's current customers. It is important to maintain the current customers, because loyal customers generate more money through IAPs and in-ads, than new customers. It is also far more expensive to acquire new customers. I maintain the customer relationship through my support channels, by replying on feedback, remove bugs, and provide users with information about the app, such as updates. To build customer relationship, I utilized my distribution channels. The impact from

each channels is described in 7.3.

### 7.2.3 Infrastructure

The *Infrastructure* area describes how Guess This Sound as a business can create value, in order to provide value proposition and maintain the customer area. This is done through the tree building blocks *Partnership Network*, *Value Configuration*, and *Core Capabilities*.

Due to the limited time I had to develop the app, I partnered up with two friends to make the job easier. The task allocation was evident, I developed the app and they were concerned with the marketing. We made a verbal agreement to share the app's profit among us three. Unfortunately, because of the lack of work ethics the partnership did not turn out as expected. The team consist now of me and one of my friends, but this will most likely change since I am still doing most of the work. No investors are currently acquired, but it could be relevant if the app becomes very popular. The *Value Configuration* for Guess This Sound as a business, is based on the *Value Chain* concept.

#### Value chain

The **inputs for application** is the first stage in the value chain, and is concerned with the app's idea generation and market evaluation. I had two criteria in my idea generation. Firstly, the app had to be in the category game, because the category has a high average download rate and it is easy to create virtual goods and thus implement IAP. IAPs were important in order to analyze the app from an economic perspective. Secondly, the app's concept had to be similar to a previously popular app. In this way, I could use the popular app as a guidance for the self-developed app. I came up with the idea of creating Guess This Sound, based on the concept of the popular app Draw Something. Then, I evaluated the market potential and decided the target customer for the app. The target customers represent a large part of the potential app marked, and thus the app could potential end up in the head of the long tail concept. Further, I searched for potential competitors to determine how I could differentiate my app from others. It was only one app with similar idea; *Make a Sound*. I tested the app and quickly discovered that it did not work. Competition from apps with the same concept was therefor strictly limited, and I continued to



identify other challenges. The main challenge was the time I had to develop the app, because I had to release it no later than April 1st, in order to obtain enough data to analyze.

The **application development** stage is concerned with the app's development and testing phase. I hired a friend with digital design experience to create the app's design, which had a large improvement of the app's appearance. I decided to develop an HTML5 app by using the programming language Javascript, with PhoneGap, Bootstrap and JQuery Mobile as frameworks. I developed the app in HTML5, because I had experience with HTML5 and the app could then run on both Android and iOS. I took advantage of both *Black Box Testing* and *White Box Testing*. However, I did not create automated tests, because from previous experience I knew it was very time consuming. I was rather thorough when I tested the app, and used several approaches to see how the code behaved. To get inputs from a users' perspective, I made friends and others test the app, which gave me useful information regarding how they interacted with it. However, I regret that I did not spend more time testing the app, since I had to correct several bugs after it was published.

The **application delivery** stage refers to the phase when developers publish the app, and reach out to the target customers through distribution channels. Before the app was available, I promoted it via the distribution channels to create a hype around it. When it was published on both App Store and Google Play, I utilized the distribution channels in different time periods in order to analyze their effect separately, the analysis is presented in 7.3.

The **market and sales** stage is the last stage in the app's value chain, and represents a larger investment in terms of money. Currently, this stage is not entered as only small investments have been performed. If the app becomes very popular, I will consider reaching out to investors to obtain funds to marketing and to develop a backend database<sup>2</sup> for the app. The **support layer** in the value chain represents my support channels, and the **end user layer** is my target customer.

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<sup>2</sup>A back-end database is a database that is accessed by users indirectly through an external app, rather than accessing the data stored on the app itself [91]

The *Core Capabilities* is the last building block in the infrastructure category, and describe the app's resources (*human, tangible* and *intangible*). The resource type *human*, represents my experience in relation to developing HTML5 apps and my limited marketing knowledge acquired through different jobs. Through the research in my thesis, I also gained insight in how the app market works, which I utilized regarding the case study app. The resource type *tangible* represents the physical values in the app's business, such as the computer I develop the app on, the servers storing the app's data, and my team member's father's copy center used to print free posters and flyers. The business has only one *intangible* resource; the name of the app.

## 7.2.4 Finance

*Finance* is the final category of Osterwalder's business model ontology, and contains the building blocks **revenue stream** and **cost structure**. Figure 7.7 illustrates the overall cost and revenue streams for Guess This Sound as a business.

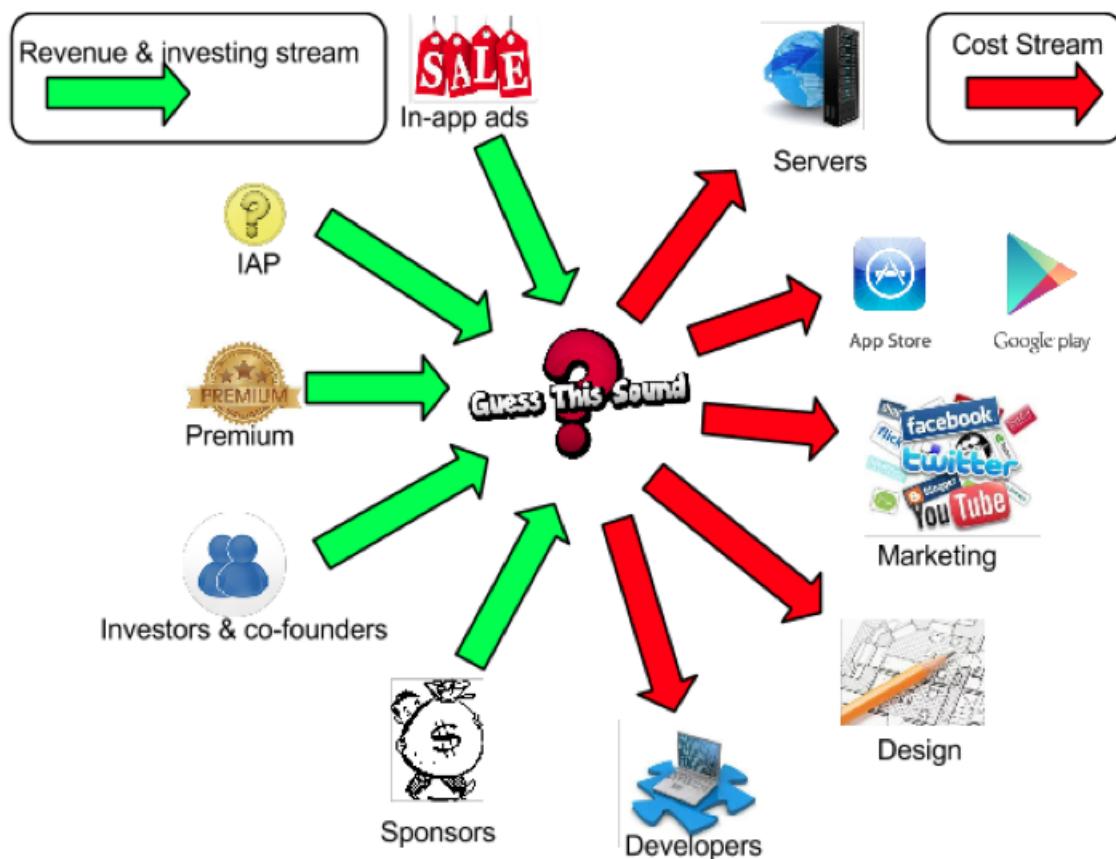


Figure 7.7: Guess This Sound - Cost and Revenue Stream

The **revenue streams** represents how I intend to generate money in Guess This Sound. Guess This Sound is currently a free app with no ads or premium version available. The only potential revenue comes from IAPs, but if the app becomes more popular I will display an ad for each time a player sends a sound. If Guess This Sound becomes very popular, a premium version will be considered, but this is currently not in focus. IAPs represent 76% of the total revenue on App Store in USA, and is the largest revenue stream in apps. Therefore, I chose to not ruin the user experience by adding in-ads, before the app became popular enough for users to be okay with it. The current total revenue from IAPs is only \$2.58, but this increases proportionally with the app's user activity, and thus the number of downloads. According to research [93], only 3% of the users spend money in popular apps, and they spend on average \$14. Table 7.1 provides a rough estimation of the increase in potential revenue for the case study app's entire lifetime. The numbers used in the calculation is collected from the servers, where I store all the data collected from the communication between the app and the server.

# Users	Push Notifications	\$ from in-ads	\$ from IAPs	Total \$ From Lifetime
7,000	11,436	\$106.3	\$2.58	<b>\$1,278.84</b>
70,000	114,360	\$1,106.3	\$5,418	<b>\$18,693.6</b>
700,000	1,143,600	\$11,063	\$54,180	<b>\$186,936</b>
7,000,000	11,436,000	\$110,630	\$541,800	<b>\$186,960</b>
70,000,000	114,360,000	\$1,106,300	\$5,418,000	<b>\$1,869,600</b>

Table 7.1: Expected Revenue

The app has not generated any revenue except the \$2.58, which makes the calculation somewhat speculative. Therefore, Table 7.1 do only provides an understanding of the factors that contribute to the revenue generated, and thus should not be viewed as a stipulated calculation for apps in general. I utilized the collected numbers from the server in relation to the 7,000 downloads Guess This Sound had on May 5h, to calculate the potential revenue relative to the user growth. With 7,000 users on May 5th, there were 11,436 notifications sent from April 5th to May 5th. In other words, there were 11,436 games played. In-ads (in the future) are displayed when a game is played, resulting in 11,436 ad impressions. Numbers from studies in 5.1.1, show that 1,000 ad impressions account for \$9.3 in revenue. 11,436 impressions therefore account for

\$106.35. The IAP revenues listed in Table 7.1 represents the total revenue from IAPs in the app's entire lifetime, where 3% of the users purchase goods in the game for \$2.58 each. The revenue calculated from in-ads is the revenue that CPM and CTR generate every month. The total revenue calculated from both in-ads and IAPs in Table 7.1, is based on the app's lifetime of one year, and thus 12 months with advertising. The revenue from IAPs will most likely be higher than the calculations in Table 7.1, because they are calculated based on an average of \$2.58, and not \$14 which is the average according to [93]. However, due to limited data obtained in relation to the app's revenue, I chose to use \$2.58.

There are two other revenue streams in Figure 7.7 not discussed; *sponsors*, *investors* and *co-founders*. Currently no money from sponsors have been collected, but I am waiting for response on my application to *Spark*<sup>3</sup> and *Ungdomsfondet*<sup>4</sup>. There are neither any investors obtained, and if this becomes necessary depends on the app's popularity. The money invested from the co-founders (me) is the substitute of the total cost; NOK 21,121.

The **cost structure** is the last of all building blocks in the ontology. Apps are digital goods, and thus the marginal cost for producing an extra entity is equal to 0. The costs in relation to developing apps is the time used, and optional cost such as design and sound effects. Developers must pay a registration fee in order to publish the app on App Store and Google Play, which is NOK 675 and NOK 150 respectively. App Store and Google Play also take 30% of the app's revenue, which is together with the registration fee, represented with the red arrow to App Store and Google Play in Figure 7.7. Hence, the costs are primarily related to maintaining servers and marketing the app.

The uppermost red arrow in Figure 7.7 represents the cost for maintaining and expanding the server capacity. The cost is usually minimal at the beginning, but increases proportionally with the app's user activity. I did not have the experience to develop a back-end database, and therefore utilized a service that did it for me, the service is provided by the company Parse. Parse

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<sup>3</sup>Spark is a support organization at NTNU that helps students starting up their own business

<sup>4</sup> Ungdomsfondet is a support organization in Norway that helps adolescent starting up their own business or realization of an idea

offers a free solution for developers that do not have the time or the skills to create their own back-end database. Developers can easily integrate Parse in their app, and let Parse handle all the communication between the app and the server. The service is free as long the server communication limitations are not exceeded. With the free version, the app can each month store in total 20GB of data on the server, transfer 2TB of data between the server and the app, send a total of 1 million push notifications, and the server handles 30 requests (communication between the app and the server) per second. Table 7.2 shows Parse's pricing structure if the free limits are exceeded, the numbers are collected from [109].

<b>Service</b>	<b>Price</b>
File Storage	\$0.03/GB extra
Data Transfer	\$0.10/GB extra
Push Notifications	\$0.05 per 1000 extra
Request per second	\$100 per 10 request/second extra

Table 7.2: Parse's Pricing Structure

By utilizing the service Parse provides, developers can create apps and see if they become popular without investing too much money. If an app becomes popular, the revenue stream easily subsidize the server costs, which is illustrated by comparing Table 7.1 and Table 7.3. By using the numbers collected from the server, an estimation of the increase in cost in relation to the user growth can be calculated (see Table 7.3).

<b>Users</b>	<b>File Storage</b>	<b>Data Transfer</b>	<b>Notifications</b>	<b>Request/S</b>	<b>Total to pay</b>
7,000	700MB (Free)	40MB (Free)	11,436 (Free)	0.017 R/S (Free)	<b>\$0</b>
70,000	7GB (Free)	400MB (Free)	114,360 (Free)	0.17 R/S (Free)	<b>\$0</b>
700,000	70GB (\$1.5)	4GB (Free)	1,143,600 (\$7.2)	1.7 R/S (Free)	<b>\$8.7</b>
7,000,000	700GB (\$20.4)	40GB (Free)	11,436,000 (\$521.8)	17 R/S (Free)	<b>\$542.2</b>
70,000,000	7,000GB (\$209.4)	400GB (Free)	114,360,000 (\$5668)	170 R/S (\$1400)	<b>\$7307.4</b>

Table 7.3: The Server Cost Increase

The numbers calculated in Table 7.3 are somewhat speculative, especially request/seconds.

However, Table 7.3 illustrates the two server cost bottlenecks, number of push notifications sent and the file storage capacity. The file storage is a bottleneck, because the servers stores the sounds in the game. A sound is approximately 110KB large, and with an average of 3 games per player, each player contributes with 330KB. With 7,000,000 users this is in total 231GB of storage. Push notifications are the main server cost bottleneck, and represents the majority of the server costs in 7.3. However, a large number of push notifications sent, results in a large number of in-ad impressions. The cost for every 1,000 push notifications sent is \$0.05, but the revenue generated is \$9.3 from in-ads.

The red arrow pointing at the design icon in Figure 7.7, represents the cost related to the design and sound effects in the app. Guess This Sound has 10 sound effects purchased from the Internet, for a total cost of NOK 375. The sound effects were purchased at *www.pond5.com* where the average price per sound is \$2. The total cost of the design was NOK 2,200, and then the designer created the app's icons, background pictures and GIFs<sup>5</sup>. The red arrow at the bottom in Figure 7.7, represents the cost for hiring new developers. Currently this has not been an option, but could be of interest if the app becomes popular.

The last red arrow in Figure 7.7, represents the cost stream for marketing the app and is the largest cost so far. This section does not describe in detail what the money went to, only provide an overall description of the allocation of the money in the different marketing areas, shown in Table 7.4. Section 7.3 provides the cost structure in detail, and analyze the effect of each approach.

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<sup>5</sup>GIF short for Graphics Interchange Format, is basically many pictures that are shown very fast to make it all look like an animation.

<b>Marketing Service</b>	<b>Total Costs</b>
Facebook	NOK 12,658
Twitter	NOK 150
App Review Sites	NOK 620
Fiverr	NOK 840
Flyers and Banners	NOK 0
Others	NOK 2,750
<b>Total</b>	<b>NOK 17,018</b>

Table 7.4: The Market Cost Allocation

Table 7.4 shows that Facebook accounts for 74.4% of the total marketing cost, but it has also been the most cost-efficient approach. The biggest cost in term of time is however the development of the app.

### **Time Consuming**

I used in total four months (from December to April) to develop Guess This Sound, where I worked on average 11 to 12 hours a day, hence between 1,320 to 1,440 hours in total. When developing an app alone it is easy to overlook flaws and become dependent on own limited knowledge. Thus by having more than one developer on the team, contributes to more manpower and a broader area of knowledge to utilize. My experience before I developed Guess This Sound was obtained through five years of school, in my spare time and at work. At NTNU I had three programming courses, which provided me knowledge regarding the fundamentals in programming languages. I also achieved experience through two summer internships where I learned to develop HTML5 apps. After the first internship, I started to develop small and less complex HTML5 apps on my own. After the second summer internship in August 2013, I continued to develop a couple of days a week until I started to develop Guess This Sound in December the same year. Based on my former knowledge, I presume I was a place between little and average experienced when I began developing the app. However, now when it is finished I assume I am above average experienced. To give the reader a better understanding of the time required to develop an app Table 7.5 is provided.

Experience	Team	Total Hours	Total Days (8 hours each day)
Low	No	2,640 hours	330 days
Average (Me)	No	1,320 hours	165 days
High	No	924 hours	115.5 days
Low	Yes	2,376 hours	297 days
Average	Yes	1,188 hours	148.5 days
High	Yes	831.6 hours	104 days

Table 7.5: Expected Time Used To Develop An App

Table 7.5 shows the expected time used to develop an app in relation with different levels of experience, and if the app is developed by one or two persons. The experience level *low* represents developers with little or no experience of developing apps, and limited experience with programming languages. Because of the large amount of information and knowledge developers need to understand before developing an app, I estimated the total time they would use to be twice the time I used. The experience level *high*, represents developers with wide experience from developing apps and are familiar with other programming languages. To calculate the expected time for developers with a high level of experience, I multiplied the time I used with 70%. This is because it takes time to establish the fundamentals in an app and there are usually delays because of the design. To calculate the impact an extra team member has, I multiplied the total time with 90%. 90% is a good assumption, because the team members can utilize each others experience and knowledge, and reduce the number of bugs by having an extra pair of eyes on the code. More time can be saved if the work can be done in parallel, however this is not elaborated because it would result in too much speculations on the percentage of tasks that could be performed in parallel. Working in parallel has also several disadvantages, for example merging the code tend to create complications.

The time estimated in Table 7.5 is calculated based on a HTML5 app. If the app had been developed specific to Android or iOS, it would take shorter time because HTML5 apps require several tweaks to make them suitable for both Android and iOS. If the app had been developed native for both Android and iOS it would take longer time, because then the work had to be done twice



with two complete different programming languages. However, there is no correct answer for how long time it takes to develop an app, because it depends on the app's complexity and the developer team. Table 7.5 therefore only provides guidance to the reader, in order to illustrate the large workload behind apps. According to a survey of 100 developers [112], it takes 18 weeks for a team to develop a native app. Guess This Sound took 33 work weeks (divide 165 by 5) to develop, which is almost twice the time compared to the survey. However, the survey addresses developers that develop native apps in a team consisting of other developers with a high level of experience. Thus by multiplying 33 weeks with 70% (highly experienced) and 90% (work in team), the result is 20.8 weeks. This prove that the calculations presented in 7.5, is not too speculative.

## 7.3 Marketing

This section provides an analysis of the effect from the different distribution channels used to marketing the case study app. Before the app was released, I created a marketing plan that determined the cost allocation for each channel. I was concerned about building a hype before the app was released, and concentrated on making the support channels well known before marketing the app. This section provides an analysis of the distribution channels; *the web page, Twitter and Instagram, Facebook, and other*

### 7.3.1 Web Page

The app's web page works as a support channel that ties together the other support- and distribution channels. The web page is the first thing that appears when a user search for the app on the Internet. In order to create the web page, I bought the domain *www.GuessThisSoundApp.com* for NOK 68 from the web service *goddady.com*. After the web page was developed, I paid GoDaddy NOK 400 for hosting it one year. The impact the web page has on the amount of downloads is difficult to estimate, but it is probably low. However, it is important as it connects the support- and distribution channels.

### 7.3.2 Twitter and Instagram

Twitter and Instagram are popular marketing channels for apps, and if the Word of Mouth concept is obtained, the app's popularity can increase significantly through these channels. I focused on increasing the number of users on both Instagram and Twitter, in order to increase their impact on the marketing. My team member had the control of the Instagram profile while I managed the Twitter profile. Sadly, he gave no effort and the Instagram profile remained unchanged. Therefore, I do only have enough data to analyze the Twitter profile.

#### Twitter

Twitter is a great way to share information through short messages. The messages are however limited to the profile's followers, and thus the effect depends on the number of followers the profile has. Acquiring followers can be rather difficult if you are not a famous person, but it is one method that significantly increases the number of followers. The method is simple; follow many people and they might follow you back. From my experience about 15% of the profiles I followed, followed me back, and thus rapidly increase the amount of followers I had. However, it is only possible to follow 1,000 new users a day, and in the beginning no more than 2,000 in total. The upper limit of people to follow, increases with a secret rate multiplied with the number of followers your own profile have. Therefore, in order to follow 1,000 new profiles a day without reaching the upper limit, you have to unfollow the users that do not follow you back.

I utilized this method to increase the amount of followers on the app's Twitter profile. However it is very time consuming to follow and unfollow almost 2,000 profiles a day, and I therefore purchased a service from the web service *Tweepi*. The service let me follow and unfollow 100 profiles in just one click. The service costs NOK 40 each month, and can be purchased at [www.tweepi.com](http://www.tweepi.com). Figure 7.8 shows follower growth in a time period of five weeks, from April 16th to May 21st.

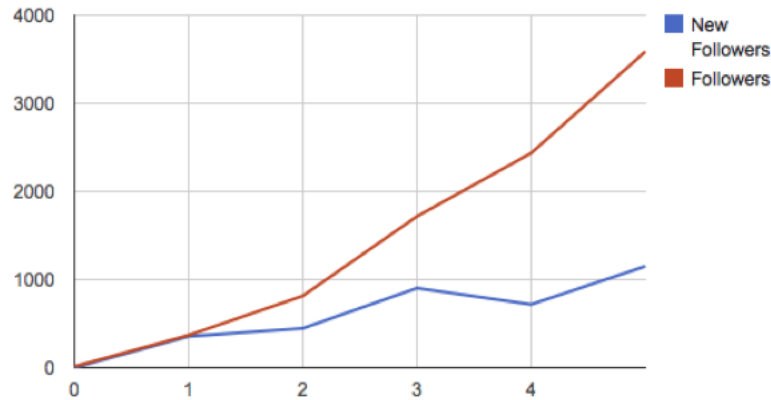


Figure 7.8: The Increase of Twitter Followers

Figure 7.8 shows the effect of the method, resulted in an average of 100 new followers a day. The blue line shows the number of new followers, while the red line shows the profile's total number of followers.

It is hard to calculate the impact Twitter had on the number of downloads, because I did not witness any increase when I promoted the app through messages on Twitter. However, Twitter provides an easy way to communicate with users, and if the Word of Mouth concept is obtained, the app could benefit largely from it. Fun Run, and Flappy Bird are examples of apps that became popular due to Word of Mouth on Twitter. Thus, developers should consider to utilize Twitter as a distribution channel.

### 7.3.3 Facebook

In order to create a hype around the app, I created an agreement with one of Oslo's most popular nightclubs, *Raspoutine*. I created a release party for the app at the nightclub and invite everyone I knew. I received 50% of the money from the entrance fee, the people I invited paid, and could promote the app with banners and flyers at the nightclub. I created an event on Facebook, invited all my friends to it, and made them do the same. The number of invited quickly increased and the total amount became 14,000 people. However, many invitations do not necessarily results in many arrivals, and only 200 attended. However, I earned in total NOK 6,000, which was later used on marketing. The Facebook event still exists, which I utilized to reach out to the

14,000 invited users during the marketing of the app. The event created a hype around the app, and when the app's Facebook page became available the next day, 143 liked the page. When a user likes the Facebook page, he joins it and thus receives information from it. The next day, April 1st, the app was published. Figure 7.9 shows the increase in total downloads from April 1st to April 14th.

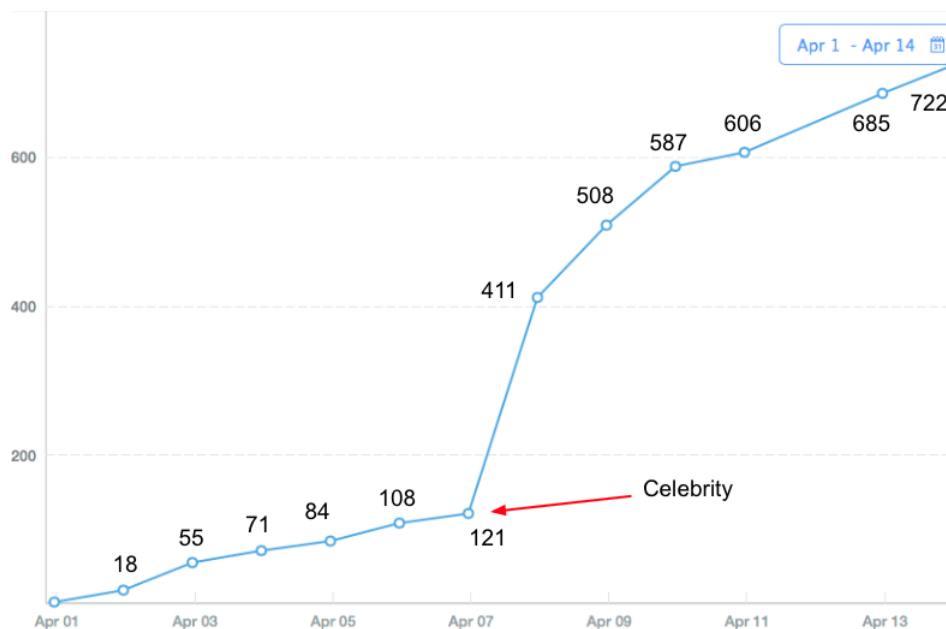


Figure 7.9: Increase In Number of Downloads Period 1

In the beginning, the download rate was low with an average of 21 daily downloads. In order to increase the publicity around the app, I created a competition on the app's Facebook page with an iPad mini as the reward. The competition was scheduled to start April 7th and last to April 30th. To join the competition, people had to share the competition further on their own Facebook profile, hence making it visible for all their friends. Their friends could also join the competition by sharing it further, and thus create a positive network effect. However, only users that liked the app's Facebook page would receive information about the competition when it was initiated, and thus I had to increase the number of likes. I promoted the app's Facebook page through ads on Facebook from April 2nd to April 7th. I paid in total NOK 5,000 which resulted in 560 new likes (NOK 8.93 per like), and thus an average of 112 likes a day. I customized the ad with the target customer criteria shown in Figure 5.6. The potential reach of the ads were 154,000 people.

To achieve a large number of people sharing the competition on Facebook, I created a marketing plan. First, my friend behind an app called *Mattilbud* with more than 130,000 downloads, took part in the competition. Thus, we could share the cost of the iPad Mini, and benefit from each other's network to promote both apps. He advertised the competition in *Mattilbud*, on Twitter and on *Mattilbud's* Facebook page. I spread information about the competition once a week through Facebook, Twitter, Instagram and push notifications in the app. Instagram and Twitter had however no effect, and are therefore not analyzed. I joined a large number of popular groups on Facebook, and shared the competition in these groups once a week. There were an average of 20,000 members in each group, and by posting the competition in 10 groups each week, it became visible for a large number of people. The effect of posting the competition in these groups was good, and resulted in an average of 20 new users joining the competition every time. On April 7th, when the competition was released, I managed to get a Norwegian celebrity to post the competition on Instagram to his 34,000 followers. This resulted in 290 downloads that day, and from the whole week after a total of 601. This is an average of 86 downloads a day, and thus an increase of 497% compared to the week before. 30 users did also join (i.e. share) the competition that week.

Facebook offers an opportunity to spread messages posted in the app's Facebook page further for a small cost. By paying NOK 30, the message will reach 650 to 1,700 more users, which increases for each purchase. I took advantage of this service on the most important messages I posted. For example, I paid in total NOK 100 to make the competition reach out to 1,435 extra Facebook users. Another approach utilized to reach out to users regarding the competition was push notifications. Push notifications had a great effect on the number of people joining the competition. By sending push notifications with information about the Facebook competition, to all the case study app's users (approximately 7000), 30 new users joined the competition.

From April 18th to April 23rd, I handed out flyers and hung up posters where the target customers were located, such as schools and shopping malls. Thereby, I could inform them about the app and the competition on Facebook. The result was good, with a total of 53 users joining

the competition and 200 new downloads. When the competition was finished April 30th, 281 users had shared it on Mattilbud's Facebook page, and 174 on Guess This Sound's. Through the 174 shares, 10,732 people saw the competition and thereby the information and pictures of the app. It is hard to calculate the exact effect the competition had on the number of downloads, because I utilized installation ads on Facebook twice during the time period. However, I did not utilize installation ads in the time intervals April 7th to April 14th, and April 18th to April 23rd, and thus can calculate the effect in these periods. The number of downloads in the first time interval, were 601 with an average of 86 daily downloads. The number of downloads in the second time interval were 200, with an average of 40 daily downloads. Combined, the competition contributed to 801 downloads, and thus an average of 57 daily downloads. The competition was therefore a great way to achieve more downloads and to promote the app to the general public.

### **Installation Ad Campaign**

On April 14th, I initialized the first installation ad campaign on Facebook. Installation ads are only visible on Facebook through the users' phone, and not from the computer. This makes it possible for a user to click on the install button on the ad, and then be redirected to App Store or Google Play depending on the OS running on the phone. I customized the ad with the settings in Figure 5.6, and chose Android to be the platform the ad should appear on. I set the duration of the campaign to be from April 14th to April 18th, with a budget of NOK 1,500. The result was average, with 389 total downloads where 161 of them were paid (users clicked on the ad), which is NOK 9.31 per download. The average daily downloads was 78, and thus an decrease of 4.9% from the week before. Therefore, I decided to try an extensive advertising campaign, to see if I could breach a threshold for the app to market itself through Word of Mouth. The campaign started on April 23rd and lasted to April 29th. The goal was to achieve a good rank for the app, and thus benefit from the App Store's network effects. I customized the ad with the target customer attributes and the platform iOS. I invested NOK 5,500 that one week, and thus created an extensive advertising where the daily budget was NOK 785.7. This had an huge effect on the amount of downloads, see Figure 7.10.

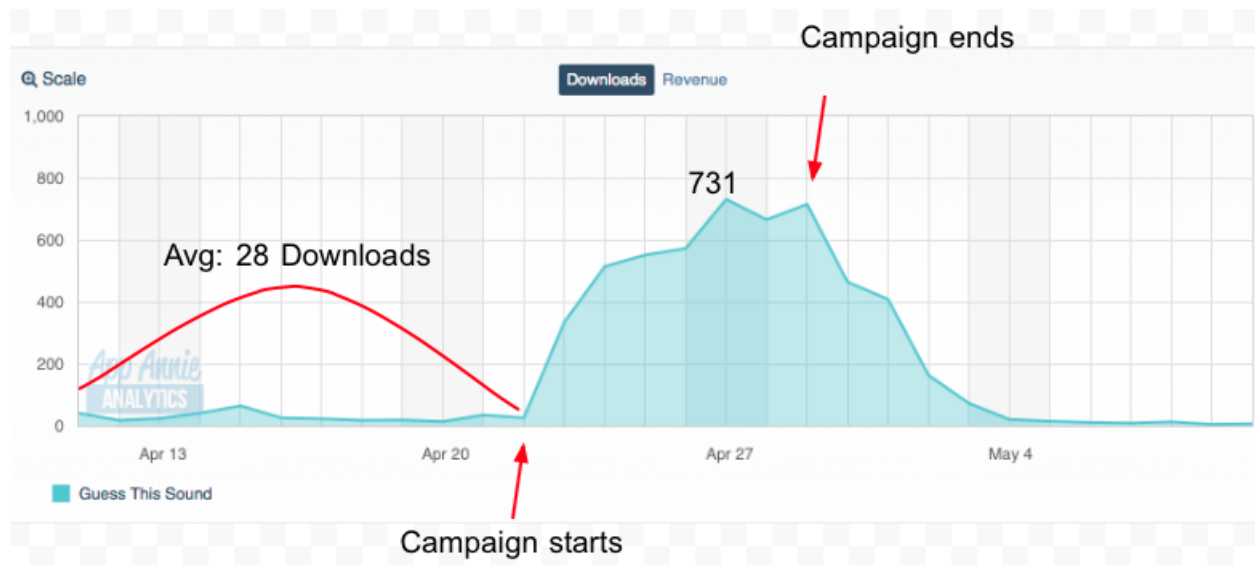


Figure 7.10: Number of Downloads on App Store.

Figure 7.10 shows the number of daily downloads on App Store from April 10th, to May 10th. The average number of daily downloads on App Store before the campaign, was 28, while during the campaign it was 562, with a peak of 731 downloads on April 27th. The total number of downloads from the campaign was 3,932. The ad campaign stood for 1,972 downloads, and thus the cost was NOK 2.78 per download. Hence, 1,951 downloads were not from the campaign which is an average of 279 daily downloads. This is an increase of 896.4% free downloads from the week before, which is due to the good rank the app achieved during the campaign. The reason for the large decrease in number of daily downloads after the campaign ended, was because I completely stopped the marketing in order to see the effect from the app's rank, which is analyzed in 7.4.

### 7.3.4 Other

When the app gained popularity, I approached the media in order for them to create a case about the app, this was successful and I conducted three interviews. The newspaper *Byavisa*, interviewed me regarding this thesis, see Appendix B. The interview became the headline in the newspaper's business section, and was a great way to promote the app and gain outreach

experience. The effect the interview had on the download rate was rather small. Later on, I was interviewed by the American company *Serenity App Solutions* about their book *Mobile App Growth Hacks*. The interview's topic was about the life of a developer, and the challenges in relation to developing apps, see *Appendix C*. The book has so far not contributed to any increase in download rate. The last interview I conducted was with the Norwegian TV channel *TV2*. The interview's topic was the case study app and this thesis, it was sent every hour on May 30th on their news channel *TV2 Nyhetskanalen*. The interview had more effect than the others, and both the download rate and the app's user activity increased that day and the next week. The app gained in total 1,068 downloads that week, with an average of 153 daily downloads and a peak of 228 downloads the day the interview was sent. Compared to the week before when only a total of 111 downloaded the app, the number of downloads increased 862.16%. The app's rank also increased, from an overall rank of 1,405, to be ranked as the 108th most popular app on the Norwegian App Store.

Table 7.6 shows the three most efficient marketing approaches in terms of number of downloads. First, the Norwegian celebrity's post on Instagram. Second, the interview with TV2. Third, the last installation ad campaign on Facebook.

<b>Marketing Approach</b>	<b># Total Downloads</b>	<b># Average Daily Downloads</b>
Norwegian Celebrity	601	86
TV2 Interview	1,068	153
Installation Ad Campaign	3,932	583

Table 7.6: Number of Downloads From Three Most Efficient Marketing Approaches

By comparing the interview with the Norwegian celebrity's post, the interview had an increase of 77.91% in daily downloads. Further, the Facebook ad campaign had an increase of 267.3% in daily downloads compared to the interview, and 577.9% compared to the Instagram post. In other words, the ad campaign on Facebook was the most efficient marketing approach I conducted.

Other marketing approaches conducted were through app review sites and a web page called



*Fiverr*. The effect from these approaches is however low and will not be discussed, only a brief description of them is given. App review sites are as the name implies, a website containing a large number of followers that are looking for new apps. By having the app in these websites can increase the download rate if the app receives a good review. I submitted my app on several review sites, which I recommend since they are a cheap and could attract new users. *Fiverr* ([www.fiverr.com](http://www.fiverr.com)) is a web page that collects cheap (usually \$5) services people offer. I paid in total NOK 500 for services that promoted my app through different channels, such as Facebook and Twitter. For example, I paid \$40 to make a person promoted my app 10 times one week, through messages on his school's Twitter profile with 260,000 followers. However, the service did not result in any large increase of downloads.

## 7.4 The App's Network Externalities

The more daily downloads an app has, the higher the app is ranked, and the higher the rank the more daily downloads it receives. The main objective for the last ad campaign on Facebook, was to achieve a good rank on App Store Norway in order to analyze the effect. With 334 downloads the first day (April 23rd) and 514 the day after, the app climbed fast in rank, see figure at the top of Figure 7.11.

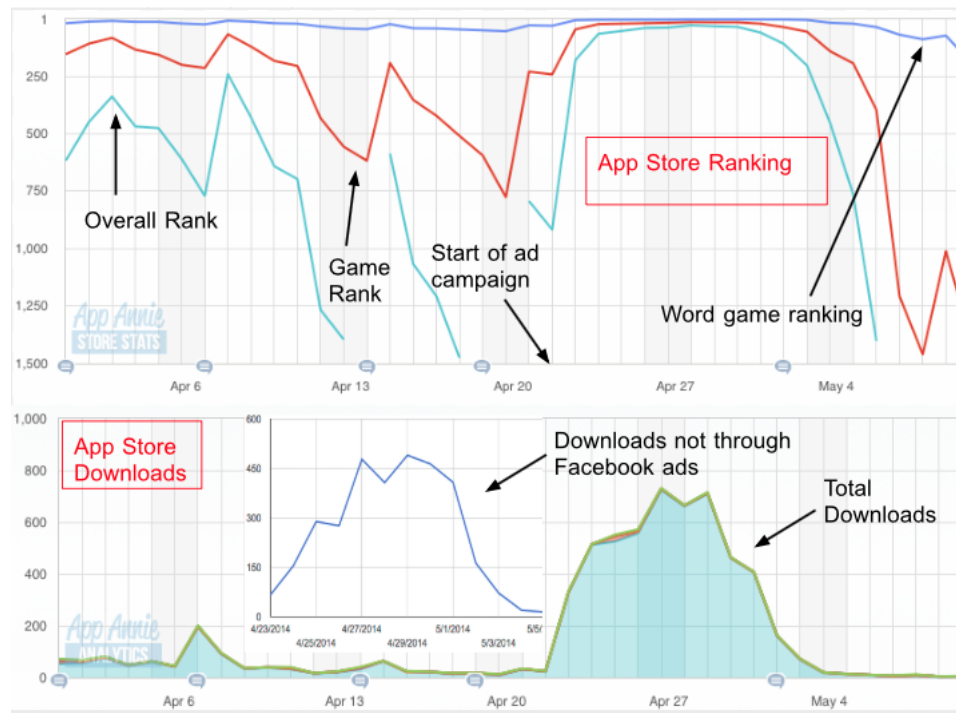


Figure 7.11: Comparison Number of Downloads With Ranking on App Store

The app went up from an overall ranking of 917 April 23rd, to be ranked as the 64th most popular app on the Norwegian App Store on April 25th. The best result the app achieved, was to be ranked as the 26th most popular app on the Norwegian App Store, on April 28th. That day, it was also ranked as the 2nd most popular word game. When the app increased in rank, more people saw it and downloaded it. The blue graph to the left in the figure at the bottom in Figure 7.11 shows the number of downloads that were not paid for during the campaign. By comparing the two other figures, one can see the impact the rank has on the number of daily downloads. When the ad campaign ended April 29th, the number of daily downloads was 490, before it suddenly dropped down to 163 on May 2nd and on May 5th only 14 downloads. Table 7.7 shows the rank in relation to daily downloads when the app's popularity began to decline.

Date	Overall Rank	Word Game Rank	Daily Downloads
29.04 (End of Campaign)	31	2	490
30.04	34	2	464
01.05	59	2	408
02.05	108	2	163
03.05	202	4	72
04.05	453	16	20
05.05	764	20	14

Table 7.7: Number of Downloads Compared To The Case Study App's Rank

Table 7.7 shows that the number of daily downloads was high while the app had a good overall rank, while the rank in the category word game had less impact. By looking on the overall rank, it almost doubled each day from April 30th, while the number of downloads was more than halved. By looking on Table 7.7 from the opposite perspective, a double in amount of daily downloads increases the app's overall rank almost twice as good. This illustrates the importance of a good overall rank, because users tend to look for new popular apps in the overall top lists rather than a specific category list, such as word games. It is difficult to know whether it exist a threshold for number of daily downloads or rank the app needs to achieve, in order to promote itself through Word of Mouth without investing money on marketing. However, if the app obtains enough daily downloads in order to reach a good overall rank, it will benefit from it and create a positive feedback loop, which is illustrated in Figure 7.12.

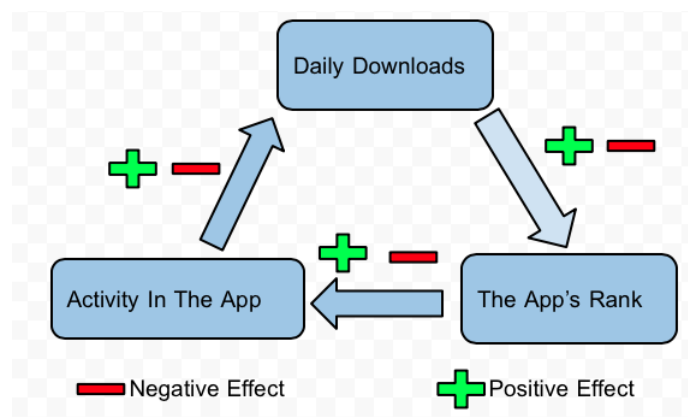


Figure 7.12: The App Marked's Positive Feedback Loop

The plus and the minus sign in Figure 7.12 illustrates the positive and negative effect from an increase or decrease in daily downloads, the app's overall rank and the app's user activity. A small change in one of the areas results in an increased change in the other areas. This loop does not last forever, as the effect can rapidly change from being positive to negative and vice versa. Thus, the positive feedback loop illustrates the lack of stability in the app's popularity. In order to make the positive feedback loop continue positive without investing too much on marketing, the app relies on Word of Mouth. Since super users are the largest contributors to Word of Mouth, I decided to exploit a *desire engine* to increase the probability to create more super users.

### 7.4.1 Psychology

To **trigger** the users, I utilized my distribution channels to attract their attention, and thus make them download the app. When they open the app, they enter the **action** phase. In this phase, the user creates a new player and logs in. When the user is logged in, a tutorial is displayed to guide the user through the app. This increases the probability that the user will use the app as intended. After the tutorial is displayed, the user will in most cases click to play with a random, and the window *Pick A word* in Figure 7.4 appears. When a word is chosen and the sound is recorded and sent, a push notification is sent to the random player. The push notification works as a *external trigger*, because it notifies the player that he needs to open the app and guess the word. If the guess is correct, the player is rewarded with experience while the other player is rewarded with coins. This is the **variable reward** phase, where the reward (experience) depends on the amount of time used to guess the word and the number of rounds completed. The next phase is the **commitment** phase, which is where the player must contribute to increase the value of the desire engine. In relation to Guess This Sound, this is usually by continuing the game and send a sound back, and thus trigger the other player with a push notification. Other commitment work is to invite friends from Facebook or share the sound recorded. This increases the app's value, and the player receives extra coins when he does it. When a player receives a push notification it works as an external trigger, and thus trigger the first phase in the *desire engine*. Internal triggers are created when the player opens the app by own initiative. This self-trigger occurs when a player has evolved an addiction or habit through successful iterations through

the *desire engine* cycle.

Numbers from Parse's servers show that there are approximately 100 of the 7,000 users (0.7%) in the app that have reached level 5 in only two weeks. In other words, they have played a large amount of games in a short time period, and can be categorized as super users. Every super users have invited on average four friends, which is in total 400 new users. This indicates the impact super users have on the app's number of downloads, and thus popularity. By improving the *desire engine*, one can increase the probability for a user to addicted, and thus create more super users.

#### 7.4.2 Negative Network effects

The thesis has explained the positive network effects behind the app's rank and super users, but not the negative effects from players leaving the game. The app has a large weakness; the opportunity to play with a random person. Although this is a great feature, because new users tend to play several rounds with a random player before they decide if they like the app or not. The way this works, is that if a player clicks to play with a random, the player is added to a list on the server and is listed until another player is added. When another player is added, a new game is created between the players and they are both deleted from the list, making the list empty. In this way, only the players that want to play with a random, can create games with each other. This works perfectly when there are a large number of users that are searching for randoms to play with, because games are then created instantly. Thus, when few users do it, it takes longer time before a game is created. Users usually have limited patience when downloading an app, and will most likely delete the app if the waiting time before a game is created is too long.

Another weakness is the app's network effects. If a user stops using the app, all the games to that user can no longer be played, because it takes two players to play a game. The effect is illustrated in Figure 4.8. When a user leaves, all the connections (games) to other users are useless, and thus reduce or even remove the value for other users connected to that user. Therefore, only users that still have games with other active users will continue to play until they lose interest, which is illustrated in Figure 4.8. According to the definition of network effects, the value of the app

from a user's perspective is dependent on the number of others using this. In other words, if the activity within an app declines, the value do too. This is important because the less connections a users has, the less value the app provides that user, and thus the incentive to leave becomes bigger. This creates a positive feedback loop which can determine the app's popularity. Guess This Sound's user activity is shown in Figure 7.13.

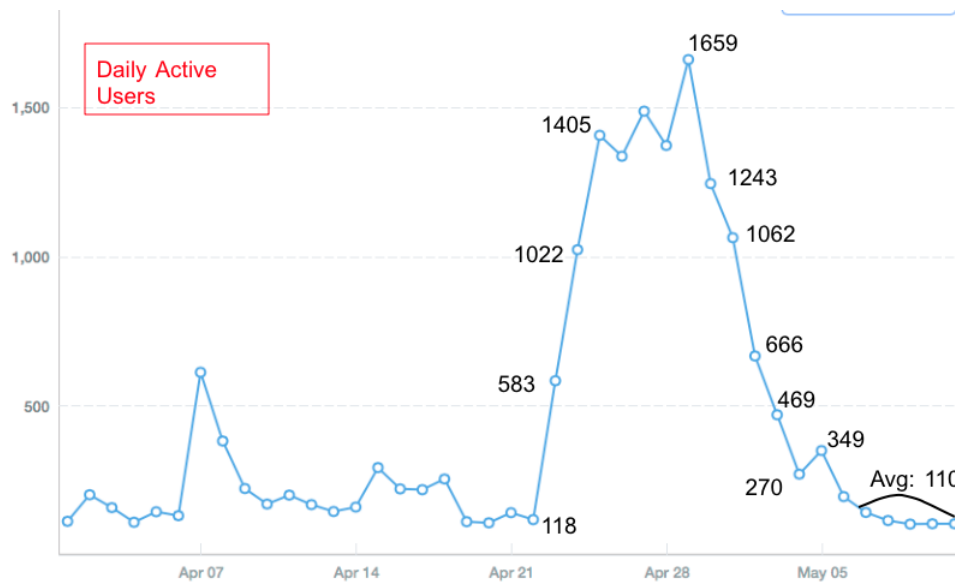


Figure 7.13: Daily Active Users

Figure 7.13 shows that the average number of users still playing the game is 110, which is almost the same number of super users calculated in 7.4.1. Figure 7.13 illustrates the importance of marketing, especially if the app has not exceeded enough users to promote itself through Word of Mouth. The figure also illustrates how rapidly the app's user activity increases and decreases, due to the network effects from people joining and leaving the game. This can be modeled by applying the irSIR model.

### 7.4.3 irSIR model

Figure 7.13 is surprisingly similar to the irSIR model in Figure 4.6. To check if the irSIR model applies to the case study app, the app's user activity has to be analyzed by using Equation 4.5. Because of the extend of the analyze, the equation is presented again.

$$I' = \beta S \frac{I}{N} - \gamma I \frac{R}{N} \quad (7.4)$$

Equation 7.4 deserves a brief description in the light of the app. The  $\beta$  represent the rate of acquiring new users, which is the average percentage of users joining the app from when the activity in Figure 7.13 started to increase on April 20th. The  $S$  represent the total number of potential users downloading the app, which is the total number of downloads the app had from April 20th to May 10th, hence 4,700 users. This number declines as the number of users downloading the app increases.  $\frac{I}{N}$  is the fraction of active users (the average retention rate) from the total amount of potential users  $N$ .  $N$  is equal to  $S$ , hence 4,700.  $\frac{I}{N}$  is the network effect related to active users in the app, and the higher the retention rate (the number of active users) the bigger the effect. On the other side of the subtraction sign in Equation 7.4 is the users leaving the app, hence no longer active users.  $\gamma$  is the average number of users leaving the app; the average churn rate.  $I$  represents the number of users still active, and by multiplying  $I$  with  $\gamma$ , we get the number of users leaving that particular day. This is multiplied with the percentage of users that have stopped using the app, which is  $\frac{R}{N}$ . Equation 7.4, therefore calculates the app's user activity rate by applying the irSIR model, which the red line in Figure 7.14 illustrates. The blue line in Figure 7.14 is the original activity, similar to Figure 7.13. The numbers used to plot Figure 7.14 are collected from the calculations in *Appendix A*.

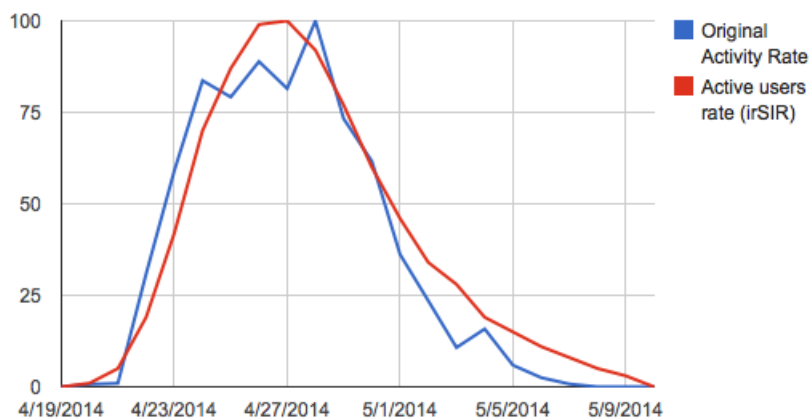


Figure 7.14: irSIR modeling of Guess This Sound.

The variables  $N$  (the total number of potential users) is 4,700, and  $\beta$  (the average acquiring rate)

is 4.76%. All the potential users will finally be acquired (100%), and thus the average acquiring rate can be calculated by dividing 1 by the number of days in the time period which is 21, and this equals 4.76%. The variable  $\gamma$  (the average churn rate) is calculated by dividing the total churn rate by the number of days. The total churn rate is 100% minus the total retention rate. The total retention rate is the number of users that remains active at the end of the period, divided by the total users downloading the app which is 4,700. The number of active users on May 10th is 103, and thus the total retention rate in this period is 2.19%. The total churn rate is therefore 97.81%, and the average churn rate is 4.66%.

The equation calculates the app's user activity rate  $I'$  in relation to the potential number of users downloading the app, the retention rate and the churn rate. This will either be an increase or decrease in percentage of the app's user activity, which is then normalized and used to plot the red line in Figure 7.14. To normalize the results in the range of 0% to 100%, Equation 7.5 was used.  $NI'_j$  in Equation 7.5, represents the normalized activity rate of  $I'$ . This is calculated by using the activity rate  $I'$  at day  $j$ , minus the minimum activity rate from the whole time period, which then divided by the variance of the activity rates.

$$NI'_j = \frac{I'_j - \min(I')}{\max(I') - \min(I')} \quad (7.5)$$

The normalized original activity within the app is illustrated with the blue line in Figure 7.14. The blue line has almost the same pattern as the irSIR model (the red line). They do not overlap to the same extent as MySpace did in Figure 4.6, but this was rather not expected as it is a higher degree of network effects in social networks compared to apps. However, the two lines in Figure 7.14 do have similarities, which indicates that irSIR models can be used in order to analyze network effects in apps. In Figure 7.14, the app's user activity declines on April 27th. This is the first time the fraction of users leaving the app  $\frac{R}{N}$ , becomes bigger than the fraction of active users  $\frac{I}{N}$ . In other words, there are more users leaving the game than playing it, which is the same effect illustrated in the SIR model in Figure 4.5, where the number of infected and recovered tangent. This clearly shows the impact network effects have on the case study app, and that the irSIR model can be successfully applied. Therefore, the key factor for preventing the activity to decrease and thus the popularity of the app to exponentially decline, is to always have



the number of active users larger than the the number of users leaving in relation to the total amount of potential users. This is obviously, because if more users leave the app compared to the users still using it, the curve declines. However, what is not obviously is the large impact this has on the rapidly decrease in the percentage of active users. Developers should therefore try to minimize this effect by reducing the number of users leaving, which illustrates the importance of maintaining the acquired users. The threshold for an app to spread through Word of Mouth, is therefore not necessary only relied on the number of downloads it gets, rather more dependent on the app's user activity. Equation 7.6, represents the break point from where the activity within the app (retention rate) gets lower than the number of users leaving the app (churn rate).

$$\frac{S}{R} < \frac{\gamma}{\beta} \quad (7.6)$$

If Equation 7.6 is satisfied,  $I$  will be less or equal to 0, meaning it is more users leaving the app rather than using it. By dividing the average churn rate  $\gamma$  by the average acquiring rate  $\beta$ , we get 0.98. The calculations in *Appendix A*, shows that  $\frac{S}{R}$  is bigger than  $\frac{\gamma}{\beta}$  until April 28th, which is the same day the number of active users starts to decline. From April 28th, Equation 7.6 is satisfied and the app's user activity rapidly declines. According to [38], when Equation 7.6 is satisfied for social networks, the acquiring rate  $I$  can never increase. Thus the social network's user activity declines until it no longer exists. This is not the case for apps, because their popularity are not determined based on the market trend to the same extent as social networks. It is however more difficult to make the app's user activity increase more than once, especially for apps that already have obtained a large percentage of the target users. According to [48], the first two weeks of an app's life are crucial and will likely determine its future visibility in the app stores. The most popular apps develop popularity within two weeks of release, and since apps have a tendency to drop in rank position over time, the quicker the marketing starts, the bigger the impact. In other words, the difficulty for an app to become popular increases with time. Numbers from *Appendix A*, show that the average increase in the app's user activity from April 22nd to April 26th is 32.66%, with a peak of 47.43% on April 24th. The average decrease in activity from April 28th to May 2nd is 22.69%, and with a peak of 30.43% on April 30th. This shows how quickly the app goes from having a large number of active users, to reduce the number significant in a few days with a percentage change in activity of 55%.

Developers have to set the number of potential users themselves when using Equation 7.4, and thus it can be hard to apply the irSIR model. However, Equation 7.6 shows that the more people leaving the app, the smaller the left side of the equation will be and the larger the right side. Therefore the number of people leaving the app has the largest impact on whether Equation 7.6 is satisfied or not. This is the main reason why Guess This Sound had the extreme decrease in activity from April 27th, because the number of users leaving became too big, which caused Equation 7.6 to be satisfied. If the ad campaign had lasted longer, the app would obtain a larger number of active users and thus reduce the right side of Equation 7.6. This could make the app grow even further and perhaps diminished the decrease in activity within the app. Although it is possible for the app's user activity to increase again, it is much more difficult and cost inefficient compared to the first time.

## 7.5 Guess This Sound's KPI

This section provides an analysis of the case study app in relation to the general app Key Performance Indicators (KPIs) described in 5.2. The KPIs analyzing the revenue generated from apps will not be discussed, since the case study app has not generated any revenue and it would be too speculative to use the hypothetical revenue calculated in 7.2.4. The KPIs presented are therefore *Customer Acquisition Cost (CAC)*, *Usage* and *Retention Rate*.

### 7.5.1 Customer Acquisition Cost KPI #1

CAC is the average cost to acquire a new user, and is calculated by using the total marketing cost in a given time period and divide it by the number of users acquired that period, see Equation 5.1. Because of the limited time the app was available, two cases are presented. The first case analyze the CAC when no paid advertising was exploited, which is from when the app was released on April 1st to April 14th, and from April 19th to April 23rd. The second case is the time period when the ad campaigns were used, which is from April 14th to April 18 and from April 23rd to April 29th. This case includes the number of downloads after the campaign until May 5h, because they aroused due to the network effect from the campaign.

The number of downloads in the first case is 921, and was obtained through Twitter, *Fiverr*, App Review Sites, flyers and posters, and the other distribution channels discussed in 7.3.4. They accounted for a total cost of NOK 4,360, and thus the CAC in the first time period is NOK 4.73. The number of downloads in the second case is 4,828, and was obtained through the installation ad campaign on Facebook and its network effects. The total cost was NOK 7,000, which results in a CAC of NOK 1.45. If the downloads obtained after the last campaign ended are excluded, the number of downloads was 3,932, and thus a CAC of NOK 1.78. The CAC from the first case is more than twice the size compared to the second case, and thus the strategy of choice is the installation ad campaign on Facebook.

### 7.5.2 Usage KPI #2

This KPI is a combination of the *Usability* attribute in Osterwalder's ontology, and the app's target customers. To describe the KPI, a brief summary of the usability attribute and the target customer is presented. The target customers are users in an age of 13 to 25 that understand english. The app is normally used in the users' comfort zone, and they can potential use it whenever they are in this zone and have a need of an app to pass the time. This KPI was helpful in order to achieve a greater understanding of the app's usage, and thus develop new functionalities within the app to strengthen it from the target customers' usage perspective. The functionalities added are described in 7.2.1.

### 7.5.3 Retention Rate KPI #3

Retention rate is the last KPI analyzed in relation to the case study app. As Figure 5.5 shows, the app category *games* has an average retention rate on 30%. However, by looking on the retention rate in Figure 7.15 collected from Parse, my app has not experienced the same rate.

		Days after downloading the app					
Downloading Date		1	2	3	4	5	6
April 16th	28 days ago	14.5%	10.1%	1.4%	4.3%	0.0%	0.0%
April 23th	21 days ago	20.7%	10.8%	4.0%	2.0%	1.2%	3.6%
April 30th	14 days ago	12.0%	6.4%	4.1%	2.0%	2.8%	0.8%
	8 days ago						0.0%
	May 7				0%	6.7%	0.0%
	May 8				0%	0.0%	0.0%
	May 9	9.1%	0.0%	9.1%	9.1%	0.0%	
	May 10	20.0%	0.0%	20.0%	20.0%		

Of the 11 users who signed up on May 9, 1 (9.1%) were active on May 10.

There may be too few users to reliably measure retention.

Figure 7.15: Retention Rate Parce.com

Figure 7.15 shows the percentage of active users on the number of days after they downloaded the app. For example on May 9th, there were 11 users that downloaded the app, and 9,1% of them were active on May 10th (1 user). The best retention rate the app had in relation to the number of users downloading it on a particular day, was on April 23rd. Then 251 downloaded the app, and 52 of them were active the day after (20.7%). However, the retention rate quickly shrunk to 10,8% (27 active users) the next day, and then 4.0% (10 active users). The overall retention rate from all the users in Figure 7.13, is fortunately a lot better. From April 1st to May 5th, the average overall retention rate was 17.7%. The best retention rate was on April 28th where 39.97% of the 4,151 total users were active, thus 1,659 active users.

# Chapter 8

## Experiences and Challenges

This chapter presents the different experiences and challenges developers encounter during the developing and marketing of apps. The chapter's objective is to give developers a guidance, in order to increase the probability for their apps to become popular. This chapter presents three sections. First, the requirements relative to developing apps. Second, criteria for what it takes for an app to become popular. Third, a collection of my experiences in relation to developing and marketing the case study app.

### 8.1 Users' Requirements

Several challenges occur due to high user requirements, and since apps easily can be downloaded and deleted, they have to work perfectly and provide a good first impression. The criteria required are [95]; *User Interface, Network Connection, Performance, Flaws and Error Handling and Security*.

The **User Interface** criterion describes how the app is perceived by its users. The important factors in this criterion are *design, navigation, screen sizes and screen rotation*. *Design* is important for the app's user friendliness, and developers should spend time to create the design easy to understand and interesting to interact with. The design needs to be thoroughly tested, to see if the users interact with it as the developers intend them to do. The next factor is *navigation*. The app needs to behave as the users expect it to do, if not it might lead to confusion and irritation

which make them delete the app. A tutorial can be of great help to make the users understand the app's navigation and design. The last factor in the user interface is related to the design and is how the app appears on different screen resolutions and if the the screen is rotated. If the design is not modified to support screen rotation, this feature must be disabled as the app's design will change dramatically. This factor is especially important for Android developers as it exists a large number of different screen sizes and screen resolutions.

The **Network Connection** criterion is concerned with how the app utilize the network connection. If the app needs network connection to function, developers must take this in consideration when developing the app. The strength of the connection vary depending on the user's location. Thus, if the connection is slow, a loading icon or an informative message must appear, to make the users understand that the network connection is slow and not the app. This is important in Guess This Sound, because it can take seconds to uploaded the recorded sound to the server if the network connection is bad.

The **Performance** criterion is concerned with the *responsiveness*, *memory usage* and *code optimization*. The app needs to be *responsive*, if not users will find it slow. Therefore, it is important to make the app do the heavy work in the background, while things appear in the foreground. Hence, developers need to think carefully about the order of the code, because by changing it the app might seem faster than it really is. Another way to increase responsiveness is to remove animations and heavy design, and replace them with less fancy design and functionalities. The app's responsiveness and performance are more important for the users than the design, because it does not matter how nice the app looks, if it does not work properly. *Memory usage* is normally not a problem, because smartphones today have a large storage and RAM. If the app is very memory consuming, developers can release the app's memory usage with only a few lines of code. When developing less complex native apps, *code optimization* is not an important factor. However, it is important for HTML5 apps because the Javascript code is slower than the native code. There are several ways to optimize the code in different programming languages, and developers should consider this if the app is slow on older phones. I spent several hours optimizing the Javascript code in Guess This Sound, and improved the performance approxi-

mately 150%.

The **Flaws and Error Handling** criterion refers to the testing of the app, and the informative messages sent to users if errors occurs. It is no need to emphasis the importance of testing again, but developers must remember to use good time in this area because the app's first impressions is everything. If the app has several bugs, it can lead to bad reviews, which makes it harder for the app to achieve a good rank when the bugs are fixed.

**Security** is the last criterion and is importance for apps with sensitive user information, such as bank apps. These apps must encrypt the information and have a secure channel to transfer it on. Guess This Sound does not need security and it would only cause lack of performance if it was implemented. However, developers that develop apps with sensitive information must take this into account, as the consequences can be huge.

## 8.2 What Does It Take

This section presents what it takes for an app to become popular, if the requirements provided in the last section are present. I created an app with a great design, good performance and followed every requirement listed in 8.1. I studied the app market and how to efficiently marketing an app, before I marketed Guess This Sound. However, I was not able to maintain the app's popularity after it peaked. There are several factors that have an impact on the app's popularity, such as the right timing, the target customers, the app idea etc. However, it is especially one factor this thesis emphasis which needs to be present in order for the app to become popular; Word of Mouth. If an app experience a large degree of Word of Mouth, it will benefit from the network effects related to this concept and spread without any further investment in marketing. Word of Mouth can be obtained through oral or digital communication. However, digital has the largest reach, especially through social networks. Fun Run is an example that became incredible popular due to digital Word of Mouth on Twitter. In order to increase the probability to obtain the concept, developers must be aware of the following criteria; *uniqueness* and *the psychology*.

To obtain users' attention an app has to be unique, if not the users rather download another app which is more popular. However, it is not the app's idea that needs to be unique, it is the app's concept. Apps are usually developed based on existing ideas, and in order to become unique and thus interesting, they need to change the existing concept and increase the usability. For example, the idea about Twitter is that users can post short messages that their followers can see. This is exactly the same concept as Facebook's posting of status. However, Twitter is centered around this one idea, and creates a more simple and easier way for users to post their interests without all the others functionalities. Thus, Twitter fulfills users' needs by providing a unique service based on an already existing idea. Flappy Bird is another example that is built upon an already existing idea; *Helicopter Game*, developed by David McCandless in 2000. *Helicopter Game* never generated any revenue, but other apps like Flappy Bird have copied the idea and generated large revenues [100]. Flappy Bird was published on App Store on May 24th 2013, but did not enter the top 10 list in US before January 10th 2014.

Flappy Bird became popular due to people's addiction through their irritation. People posted hateful messages on Twitter saying that the app was miserable and that people should stare away from it [101]. Hence, Flappy Bird is an app that got popular and later deleted due to the *psychology* in the game; addiction. The psychology factor also refers to apps that have a purpose of adapting the users' daily routines. In order to do so, the app needs to solve a user's need which can be everything from grocery shopping (i.e. *Mattilbud*), a simple picture app (i.e. Snapchat), or to pass the time, for example games. To adapt the users' daily routines, the app has to create a desire for the users to continue using the app. Desire can be created by utilizing the desire engine described in 5.3.2. The desire engine's objective is to exploit the users' emotions or habits, in order to create this desire.

The users' requirements in 8.1 and the criteria listed in this section, increases the probability for an app to obtain the Word of Mouth concept. However, apps that are influenced by network effects such as the case study app, also rely on the app's user activity. In relation to the case study app, if users struggle to create new games with others due to low user activity within the app, they will most likely never use the app again. Hence, the app needs to exceed a certain thresh-



old of daily active users in order to create games immediately when players click to play with a random. The threshold is hard to estimate, but one efficient approach to obtain a large number of users rapidly, is to exploit the positive feedback effect from the top ranking lists. Guess This Sound was ranked as the 26th most popular app on the Norwegian App Store, which had a great effect on the number of downloads. However, if an app is ranked in the top 10 list it becomes visible at the front page of App Store, and thus attracts a lot more users. In order to test the app's viability, developers could therefore focus on an extensive marketing where the goal is to achieve a rank in the top 10 list. In this way, the app obtains a large number of users, and thus several super users that increases the probability for the app to be spread further through Word of Mouth. If this approach fails, the app will most likely never achieve a sufficient Word of Mouth effect. Developers should thus return to a marketing at a much lower level, and hope that the app gain popularity as time passes.

According to Forbes [102] only 0.01% of all available apps become extremely popular, and are normally developed by large enterprises. If an app manage to defy the odds, the time is of the essence as the app's average lifetime is 1 to 1.5 years. A metaphor that can be used to describe the app's life cycle is the mayfly concept, which is as followed [103]. Mayflies live most of their lives (2 years) in the water as nymphs, where they evolve slowly to mayflies. During this time, they are exposed to threats from fish and other larva-eating species, as well as the temperature in the water. Few of them survive this process, but the ones that do becomes a *subimago*<sup>1</sup>. The subimago phase is very short (about 24 hours), and they are during this phase exposed to birds and fish depending on if the subimagos are on land or on the water surface. When this phase is finished the subimagos left become mayflies. The mayflies live only one day before they circle back to a water where they lay their eggs and die in the process. This is analogous to the app market, because developers use several weeks on developing the app, which is analogous to the nymphs phase in the mayfly's life. When the app is finally published it competes among a large number of other apps, where the probability to become popular is extremely low. There are several factors in this phase that determine the app's popularity, this is analogous to the subimago phase. The last phase is when the app has become popular, and is analogous to the

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<sup>1</sup>The second-to-last stage in the development of a mayfly. The subimago has wings, but is not sexually mature.

last phase in the mayfly's life; the mayfly phase. If an app becomes popular, it has a short time to exploit the benefits from a large number of active users, and thus generate substantial revenues. The app's KPIs are therefore important to analyze in this period, in order to locate the app's strength, increase the users' engagement, and thus maximize the monetization and thereafter the profit.

### 8.3 My Experience

This section summarize the most important experiences I have obtained, excluded the ones already discussed in this chapter. First, be selective when choosing team member, look for the right knowledge, experience and work ethic. This may have a large impact later in the process. Create a *Desire Engine* in the app by examining user's daily routines and emotions. This increases the probability to create super users, who are the main users in terms of revenue generated and marketing through Word of Mouth. Implement push notifications to increase the retention rate, and trigger the desire engine. Decide the target customers early in the process and develop the app in relation to their needs and requirements. When the target customers are defined, it is easier to determine the most efficient distribution channels. Consider to publish the app for a flat fee the first weeks and then switch to free, this might increase the downloading rate as several web pages promote apps that drop in price. When the app becomes free, implement IAPs if possible and less intrusive in-ads. Thus, if the app never becomes popular, it still generates a small portion of revenue in its most popular period. Choose an extensive marketing strategy in a short time period, to increases the number of daily downloads and thus the app's rank. When the app has achieved a good rank, reduce the marketing and try to maintain the rank. Be aware of Equation 7.6 when the popularity increases, in order to avoid strong negative network effects.

# Chapter 9

## Conclusion and Recommendations for Further Work

This chapter presents the conclusion and thereafter recommendation for further work.

### 9.1 Conclusion

This section presents a brief summary of the main results from this thesis, and a conclusion for the objectives described in 1.2.1. The case study app did not generate any revenues or server costs in the time of writing this thesis. This part of the conclusion is therefore based on extensive studies and analysis of the app market. The objectives are provided in the beginning of each subsection.

#### 9.1.1 The Economic Perspective

*1. What are the costs related to apps, and how do they generate revenue? Are there any digital economic key-aspects relative to apps?*

Applications (apps) are digital goods, and thus the marginal cost for producing an extra entity is 0. The main cost is in terms of time, which is the time developers use to create the app (on average 18 weeks). Costs in terms of money depends on the app, and can be equal to 0 if no

marketing is utilized and the app does not communicate with a server. If the app communicates with a server, it generates costs based on the amount of communication where the main factor is the app's user activity. The revenue increases proportional with the user activity, and thus easily subsidizes the generated costs. Hence, the app market from an economic perspective is a win-win situation where developers only risk their own time. Costs in relation to marketing depends on how much developers are willing to pay for promoting of the app. The desired objective with marketing is to obtain the Word of Mouth concept, in order to spread the app for no costs through the app's users. This concept eventually determines if the app becomes popular or not. Word of Mouth is basically passing of information from person to person by oral or digital communication. Another cost which is related to the revenue, is that Google and Apple collects 30% of the app's revenue.

Apps can generate revenue through a flat installation fee (paid apps), paid premium versions, advertisings (in-ads) or purchases of virtual goods in the app (IAPs). The app market is in favor of free apps (no installation fee), and studies in 5.1.3 indicates that this will continue as free apps will represents 92% of all apps in 2015. There are two main reasons why most developers choose the free pricing strategy. First, customers do not pay to download an app if they can find a similar free app, thus free apps achieve a larger percentage of downloads. Second, due to the larger percentage of downloads, free apps generate more revenue than paid apps. This is because the revenue generated from IAPs and in-ads, exceeds the revenue from the installation fee. Thus, the optimal monetization for apps is no installation fee with IAPs and in-ads implemented.

Digital economic key-aspects relative to apps, are for example the key performance indicators (KPIs) elaborated in 5.2. They are used to analyze the app's strength and weaknesses in order to increase the user's engagement and thus maximize the revenue by focusing on the most profitable customers. The KPIs are also concerned with apps ability to maintain and acquire new users, by utilizing the most efficient distribution channels.

### 9.1.2 The Influence Of Network Externalities

*2.To what extent are apps influenced by network externalities? Are there ways to model these effects, and thus learn how to benefit from them?*

There are especially two network externalities that influence apps' popularity to a large extent; network effects and positive feedback loops. Word of Mouth is the main factor in relation to network effects, and usually determines if the app becomes popular or not. It is too costly to market an app to millions of users, and thus developers rely on users marketing the app for them through Word of Mouth. Studies in 5.3.1, shows Word of Mouth additionally influence people to a larger extent than all other marketing.

The top lists on the app stores are influenced by a positive feedback loop. When the app's number of daily downloads increases, it achieves a higher rank. When the rank improves, the app becomes more enticing and thus increases the download rate. This again increases the app's rank. Hence, apps benefit greatly from a good rank, because the number of downloads increases proportionally with the revenue and the probability to achieve Word of Mouth to a larger extent. The case study app experienced this effect and enjoyed an exponential increase in number of daily downloads until it peaked as the 26th most popular app in Norway. However, the app did not gain enough daily downloads to maintain the rank, and thus due to the positive feedback loop it resulted in an exponential decrease in both downloads and rank.

Apps' network effects can be modeled and analyzed by applying a modified epidemiological model (SIR model). From studies in 4.3.3 and the analysis of the case study app in 7.4.3, the thesis presents an in-depth examination of network effects from a mathematical perspective by applying a modified SIR model. The model provides equations that can be used get more control of the network effects, and thus learn how to benefit from them.

### 9.1.3 Requirements And Challenges

3. *What are the requirements and challenges in relation to developing and marketing apps? What does it take for an app to become successful?*

There are numerous of challenges and requirements in relation to apps, and it continues to grow as users' expectations increases proportionally with the number of apps available. Apps are deleted if they do not satisfy the users' expectations, thus the app's first impression is everything. During the development, developers need to emphasis especially four criteria. First, the app has to be user friendly. If users do not understand how to interact with the app, they become confused and irritated, and then delete the app. Second, the app has to be responsive and have good performance. Users have limited patience and will quit the app if it too slow. Third, the app must be thoroughly tested. Errors leads to unsatisfied customers and reduce the first impression, even if everything else is perfect. Fourth, the app must solve a need of the users in order to create desire, and thus take part of the users' daily routines through their emotions or behavior. The app can increase the probability to create desire by utilizing a *desire engine* within the app. *Desire engines* are elaborated in 5.3.2 and analyzed in relation to the case study app in 7.4.1.

Challenges in relation to marketing apps, are centered around one concept; Word of Mouth. Word of Mouth has to be present in order for the app to increase and maintain its popularity. Word of Mouth is usually created by the apps' most active users (i.e. super users), and the concept has the biggest effect when it occurs digitally, for example through social networks. Apps' average lifetime is 1 to 1.5 years, and thus the concept has a limited time to arise in order for the app to generate revenue worth the investment. To increase the probability for an app to obtain Word of Mouth, marketing is a common approach. However, marketing only boost the app's popularity, it does not maintain it. Therefore, developers rely on the users to spread the app further via Word of Mouth. To increase the probability for Word of Mouth to occur, the requirements regarding the app's development, especially the app's ability to create desire, needs to be present. The desire increases the app's user activity, and thus the revenue.

In order for an app to become successful, it needs to have a large number of active users and an

efficient monetization method implemented. An app can have a large number of downloads, but still be worth nothing if the activity is extremely low. However, if the activity is low, developers can utilize the key performance indicators to increase the users' engagement, and thus the revenue.

## 9.2 Recommendations for Further Work

The thesis has a broad scope as it analyze every important factor in relation to the case study app and apps in general. Therefore, only an overall description is given on some of the topics. Hence, this sections presents the topics that are less elaborated, and thus recommended for further work.

### 9.2.1 Super Users

This thesis emphasis the importance of super users as they are the biggest contributors in relation to revenue generated and the marketing through Word of Mouth. This is obvious as they are the most active users, and thus increase the revenue from in-ads and IAPs. However, the thesis does not analyze the impact or the importance they have on digital goods in-depth, and the topic is therefore recommended for further work. The objectives are listed as followed:

- What impact do super users have on digital goods with emphasis on their ability to spread information about them.
- Are there ways to simulate or model this behavior?

One way to approach these objectives is to create a simulation and differentiate between normal users and super users. One can distinguish the simulated users by using different values in relation to the impact they have on marketing and revenue. By creating different scenarios, the student can analyze the impact a large number of super users have on digital goods in relation to revenue and marketing.

### 9.2.2 Word of Mouth

Word of Mouth is a common concept in the app market, and developers usually referred to the concept as the most important factor when marketing an app. This thesis acknowledge the importance of Word of Mouth through analysis of the case study app, and from other research materials obtained. However, similar to the super user topic described, the effect is not analyzed in-depth. The two topics share some similarities, and thus they can be combined if desired. The objectives are listed as followed:

- What is the impact from Word of Mouth?
- Do this concept need to be present in order for a digital goods to become popular?
- The concept is known from as communication between individuals, has the social digital world affected this to an extent?

One way to approach these objectives is to do an extensive search for studies that analyze the concept. Word of Mouth can also be simulated or modeled by using the same method described in the super user topic. Social networks such as Twitter can be analyzed to see the effect messages about a specific product have on the product's popularity. Fun Run is an app that became very popular due to Word of Mouth through Twitter, and the student should approach the developers to gain more insight.



# Appendix A

## Guess This Sound - irSIR Model

The first table in this appendix uses Equation 7.4 to calculate the irSIR model for the case study app, which is later used to plot the red line in Figure 7.14. The blue line in Figure 7.14 is collected from the second table in this appendix. In order to make the reader understand the numbers calculated in the first table, a short description is given. The variables  $N$  (the total number of potential users) is 4,700, and  $\beta$  (the average acquiring rate is) 4.76%.  $\beta$  is 4.76% because all the potential users will finally be acquired (100%), and thus the average acquiring rate can be calculated by dividing 1 by the number of days in this time period which is 21, this equals 4.76%. The variable  $\gamma$  (the average churn rate) is calculated by dividing the total churn rate by the number of days. The total churn rate is 100 minus the total retention rate. The total retention rate is the number of users that remains active at the end of the period, divided by the number of downloads that period which is 4,700. The number of active users on May 10th is 103, and thus the total retention rate in this period is 2.19%. The total churn rate is therefore 97.81%, and the average churn rate is 4.66%.

The result of the equation gives the user activity rate  $I'$  within the app in relation to the potential number of users downloading the app, the retention rate and the churn rate of these users. This will either be an increase or decrease in percentage of the activity within the app, which is normalized and used to plot Figure 7.14. To normalize the results in the range of 0% to 100%, Equation A.1 was used.  $NI'_j$  in Equation A.1 represents the normalized activity rate of  $I'$ , and is calculated by using the activity rate  $I'$  at day  $j$  minus the minimum activity rate from the whole

time period, which is then divided by the variance of the activity rates.

$$NI'_j = \frac{I'_j - \min(I')}{\max(I') - \min(I')} \quad (\text{A.1})$$

At the end of the first table the *Graph Numbers* are calculated and later normalized to plot the red line in Figure 7.14. The Graph numbers are calculated by using the  $I'$  from the day before plus the  $I'$  for the next day. The first table shows that Equation 7.6 is satisfied on April 28th, which is when the app's activity starts to decline drastically. The second table contains the irSIR numbers calculated from the first table, and the normalized activity within the app. The activity is collected from Figure 7.13 and later normalized by using Equation A.1. The result is used to plot the blue line in Figure 7.14.

Date	S	S x B	I	I/N	Y x I	R	R/N	I'	Graph Numbers	Normalized	S / R
4/19/2014	4700	223.72	0	0.00%	0.00	0	0.00%	0.00%	0.00	0.00	0.00
4/20/2014	4660	221.82	114	2.43%	5.31	0	0.00%	5.38%	0.05	0.05	0.01
4/21/2014	4609	219.39	118	2.51%	5.50	0	0.00%	5.51%	0.11	0.11	0.05
4/22/2014	4295	204.44	583	12.40%	27.17	0	0.00%	25.36%	0.36	0.36	0.19
4/23/2014	3859	183.69	1022	21.74%	47.63	0	0.00%	39.94%	0.76	0.76	0.42
4/24/2014	3333	158.65	1405	29.89%	65.47	0	0.00%	47.43%	1.24	1.24	0.70
4/25/2014	2800	133.28	1335	28.40%	62.21	565	12.02%	30.38%	1.54	1.54	4.96
4/26/2014	2268	107.96	1486	31.62%	69.25	946	20.13%	20.19%	1.74	1.74	2.40
4/27/2014	1706	81.21	1371	29.17%	63.89	1623	34.53%	1.63%	1.76	1.76	1.05
4/28/2014	1094	52.07	1659	35.30%	77.31	1947	41.43%	-13.64%	1.62	1.62	0.56
4/29/2014	677	32.23	1243	26.45%	57.92	2780	59.15%	-25.74%	1.36	1.36	0.24
4/30/2014	370	17.61	1062	22.60%	49.49	3268	69.53%	-30.43%	1.06	1.06	0.11
5/1/2014	229	10.90	666	14.17%	31.04	3805	80.96%	-23.58%	0.82	0.82	0.06
5/2/2014	151	7.19	469	9.98%	21.86	4471	95.13%	-20.07%	0.62	0.62	0.03
5/3/2014	108	5.14	270	5.74%	12.58	4322	91.96%	-11.27%	0.51	0.51	0.02
5/4/2014	97	4.62	349	7.43%	16.26	4274	90.94%	-14.45%	0.37	0.37	0.02
5/5/2014	77	3.67	195	4.15%	9.09	4448	94.64%	-8.45%	0.28	0.28	0.02
5/6/2014	57	2.71	142	3.02%	6.62	4511	95.98%	-6.27%	0.22	0.22	0.11
5/7/2014	47	2.24	115	2.45%	5.36	4564	97.11%	-5.15%	0.17	0.17	0.01
5/8/2014	21	1.00	103	2.19%	4.80	4587	97.60%	-4.66%	0.12	0.12	0.00
5/9/2014	10	0.48	104	2.21%	4.85	4589	97.64%	-4.72%	0.07	0.07	0.00
5/10/2014	0	0.00	104	2.21%	4.85	4596	97.79%	-4.74%	0.03	0.03	0.00
Average increase in activity from April 22th to April 26th is (163.30% divided by #days) 32.66%											
Average decrease in activity from April 28th to May 2th is (-113.47% divided by #days) 2.69%											
<b>B = The average acquiring rate = 4.76%</b>											
Since all of the potential users gets required (100%), the average acquiring rate is 1 divided by the time period which is 21 days, and thus B is 4.76%											
<b>N (the total number of potential users) is 4,700.</b>											
Number of active users on May 10th was 103, and thus the total retention rate is 2.19%. The total churn rate is therefore 97.81%, and thus the average churn rate is 4.66%.											
<b>Y = The average churn rate = 4.66%</b> is calculated by dividing the total churn rate on the number of days. The total churn rate is 100 minus the total retention rate. The total retention rate is the number of users that remains active on the end of the period, divided by the total users that have been active which is 4,700.											
The Graph numbers are calculated by using the I' from the day before plus the I' for the next day. On this way I can calculate the irSIR graph by looking on the increase/decrease in activity I' within											

Figure A.1: The numbers used to calculate the irSIR model to Guess This Sound

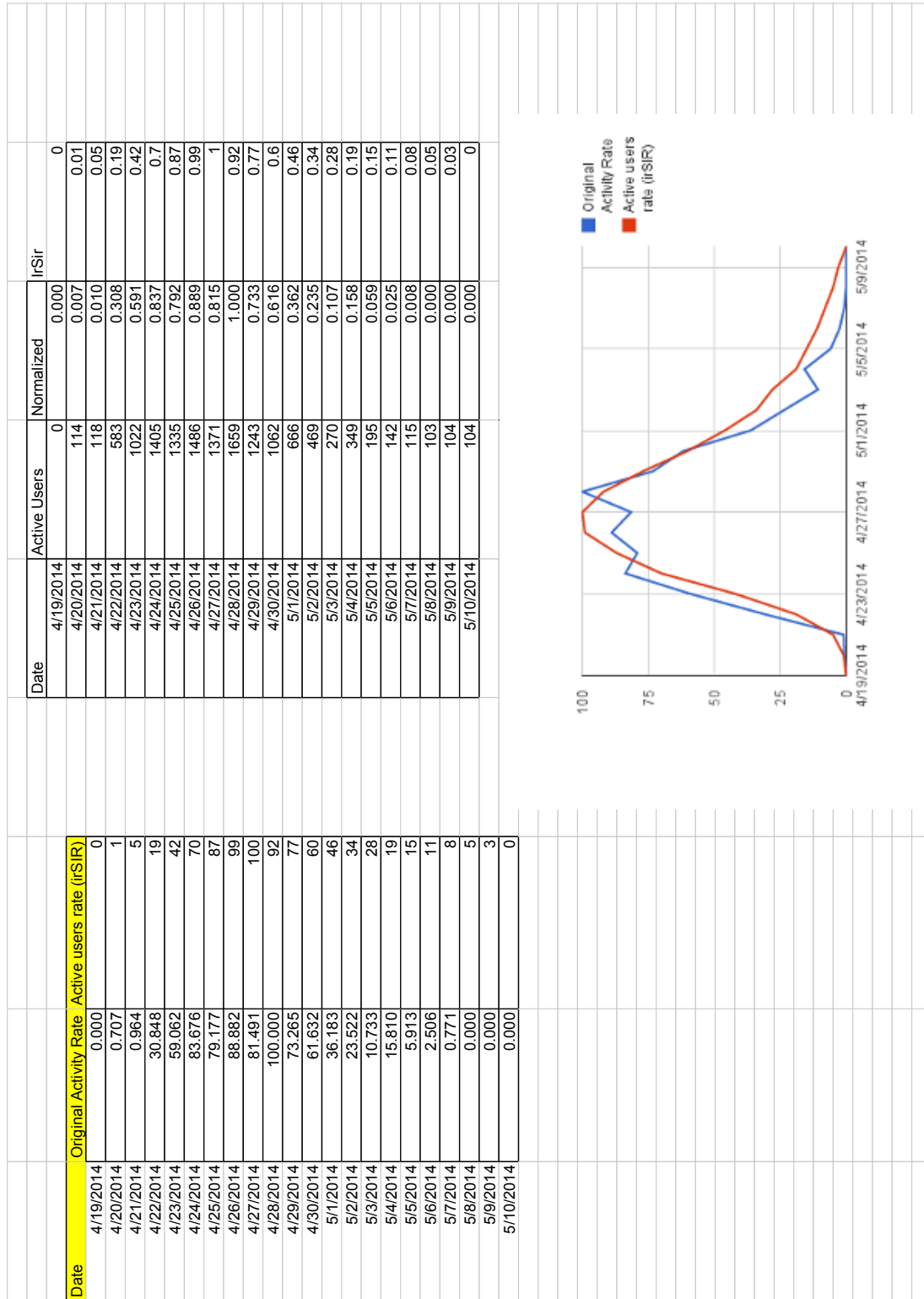


Figure A.2: Numbers calculated for the original activity and the irSIR model

# **Appendix B**

## **Interview With Byavisa**

This Appendix provides the interview I had with the newspaper *Byavisa* in relation to the case study app and this thesis.

## ● Masteroppgave om mobilapplikasjoner



**How to.** Mastergradstudent ved NTNU, Thomas M. Tveten har sett på hvordan lansere og tjene penger på mobilapplikasjoner.

# Oppskrift for å lykkes med mobilapp

**Innovasjon:** NTNU har etablert sin egen AppLab. Flere applikasjoner som Fun Run og Wordfeud er blitt unnfanget i og rundt dette miljøet. – Jeg analyserer app-markedet og hvordan man kan tjene penger.

Tekst: **ODD RAGNAR MYHR**  
E-post: [odd@byavisa.no](mailto:odd@byavisa.no)

– I forbindelse med masteroppgaven har jeg lagd appen «Guess This Sound», for å kunne innhente data jeg trenger for å gå i dybden. Og kanskje tjene noen kroner i tillegg, sier Thomas M. Tveten.

Han er snart uteksaminert siving ved NTNU, på studieprogrammet kommunikasjonsteknologi.

**APP-STYRT LIVET.** Vi omgir oss med apper i større grad enn det vi trolig er klar over: Til parkering, bussbillett, banktjenester – og til avkobling i form av spill. En stromløs mobil legger store hindringer i hverdagslivet...

Men mange apper dør fort ut. Ideen kan være god, men responsen blant mobilbrukerne laper. To forhold melder seg hvis app skal slå an.

– Enten må den være underholdene eller inneha en hverdagsverdi lik appen «Mattilbud» eller «Smartpark». Når det gjelder spill er de gjerne adskillig vanskeligere enn forsteintrykk tilsier. Lik Flappy Bird, sier Tveten.

Fenomenet Flappy Bird ble fjernet fra App Store av utvikleren selv grunnet samvittighetskvaler for

**– Hvis en app som tidligere har kostet penger blir gratis, øker popularitet og omtale raskt**

folks avhengighet. Han skal daglig ha tjent 300.000 kroner på reklamer i appen.

**JUNGELTELEGRAFEN GJELDER.** Det er to måter å tjene penger på hva mobilapplikasjoner gjelder. – Enten krever utvikleren betaling for nedlasting av appen. Eller den er gratis, men åpen for reklame. Selv om det dreier seg om noen få kroner, viser det seg at forbrukere er skeptisk til å kjøpe apper, sier masterstudent Tveten.

De som koster gjør det ofte dårligere, og genererer dermed mindre inntekter.

– De fleste suksessrike apper har spredt seg organisk, via jungeltelegrafene. For å skape ekstra akselerasjon knytter mange av appene seg opp til sosiale nettverk, hvor de frister med ekstra poeng eller andre tilleggstjenester for at appen skal spre seg fortere.

**FRA EKSKLUSIV TIL ALLMENN.** I bakgrunnsmateriale til masteroppgaven har han sett hvordan enkelte mekanismer fungerer.

– Hvis en app som tidligere har kostet penger blir gratis, øker popularitet og omtale raskt. Enkelte apper har gjentatte ganger vekslet mellom å ta betalt og å være vederlagsfri. Da ser man ser at populariteten ofte restarter. Dog på et mindre nivå enn ved første runde, forteller Tveten.

**MÅ PUSHES FREM.** Hanna Aase (30) mottok 600.000 kroner fra Innovasjon Norge til å videreutvikle «Wonderloop»; en mobilapp som lar brukeren laste opp 20 sekunder lang videosnutt av seg selv. Samtidig investerer rederfamilien Ugland et tilsvarende beløp.

– Selv om jungeltelegrafene er viktig, ser jeg fra lansering av egen app at popularitet faller fort hvis man ikke lengre promoterer produktet, gjennom nett og nettverk, sier Tveten.

Han anslår at gjennomsnittlig levetid for en app ligger fra ett til halvannet år.

– Skal du tjene penger på en app, har du det travelt. Utbredelsen skjer ofte fort og eksplosivt, for den faller dramatisk igjen.

**– Skal du tjene penger på en app, har du det travelt. Utbredelsen skjer ofte fort og eksplosiv**

**HOW-TO-OPPSKRIFT.** Etter å ha sanket inn data, ser han et soleklart moment av rulett i det å lansere en app.

– Du må treffe med *timing*en. Hva folk ønsker å spille, eller apper de føler forenkler hverdagen – er svært vanskelig å forutsi.

Han tror masteroppgaven kan være nyttig lesestoff for app-utviklere, for de lanserer produktet

– Oppgaven følger en *how-to-oppskrift*: Prosessen bak utviklingen av en app, og hvordan markedsføring og andre strategivalg (gratis eller betalende) påvirker appens potensielle utbredelse og inntjening, avslutter Tveten.



# **Appendix C**

## **Interview In Mobile App Growth Hacks**

This Appendix contains my interview from the book *Mobile App Growth Hacks* written by Michelle Nunez, the CO-founder of the American company Serenity App Solutions.



**Developer Name:** Thomas M. Tveten

**Most Successful App(s) to Date:**

## Guess This Sound



***How long have you been developing apps and how did you get started?***

I have developed apps for about two years. I started to develop an HTML5 app when I worked at Cisco as a summer internship in 2012, and another HTML5 app when I worked at a Norwegian company called Visma as a summer internship in 2013. After the summer 2013, I started to develop some basic stuff on my own, until I started developing Guess This Sound in December.

***What do you love most about being an app developer?***

The things I love the most is that I can decide my own work hours, promoting something I have created myself and see the effect of it. The learning curve is also exponential, at least at the beginning, which is very cool except of course the days when you really hit the wall. I would say that the one thing I love the most is that you can see other people actually love what you have created.

Figure C.1: My Interview Part 1



**What's the biggest challenge you face when trying to market your app(s)?**

The biggest challenges when it comes to market is to gain a user base fast with a very strict budget. This is my first app which I really try to promote, and by starting on scratch with 0 user on the like page on Facebook, few followers on Twitter, and a limited budget it is really hard to spread the word especially in Norway which is not that large and people tend to be very skeptical to new things.

**Is there anything you would like to see changed or done differently in the App Store?**

The developing guide to App Store is chaos, it is an inception of documents and it is very hard to get started there. I recommend searching for other tutorials. App Store also has a review process on approximately 1 week, this is of course good for the users because they carefully review the apps, but for developers this is sometimes very annoying. Especially when you develop an app all alone, one need to be very carefully when submitting the app, since bugs cannot be fixed before a week after.

**Any advice you would give to developers who may just be starting out?**

When developing an app, make it user friendly. It is very easy to get blind on your own design and functionalities, thinking that it is much easier to use than it really is. Create an tutorial to be sure all the users understand it. The other thing as I mentioned above is to be very carefully when submitting the app. Users hate bugs, and they will delete your app and/or give it bad rating if it does not meet their expectations. One thing to remember is that users tend to rate the app 1 star or 5 star. From the first day the app gets published on App Store, start the marketing aggressively, the longer it is on App Store with few downloads, the harder it is to get the users attention. Therefore, if the app has many bugs or it is not user friendly, it could actually be very destructive for your app in the future.

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