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Lappeenranta University of Technology

School of Industrial Engineering and Management

Department of Industrial Management

Master's Thesis

FEATURES FOR MOBILE APPLICATIONS POPULARITY

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ABSTRACT

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Mobile applications market shows one of the highest growth rates for the market of intellectual products. The market is attractive to investors, despite the fact that the major companies of this industry already firmly consolidated its position. Experts predict the growth of the market for mobile applications with the development of mobile technologies in general. To demonstrate the explosive growth of the market and the scale of its impact, it is worth recalling the mobile game Angry Birds, which was able to achieve a huge reach and formed a full-fledged media brand, comparable to the film industry brands.

The reasons why some games become popular and others not, are important for understanding the driving factors of the games industry.

The Master's Thesis explores the factors for mobile games applications popularity and ranking and propose recommendations for mobile games app store optimization of app representation. It discovers particular features of mobile games applications and releases' influence on their popularity.

Also the study assumes usage of such business models as The Business Model Canvas by Osterwalder and The Lean Startup Methodology by Ries, and describes the best practices of mobile application development process and market positioning. Moreover, the Master's Thesis gives examples of multiple case studies about successful mobile apps developers.

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Lappeenranta, July 2014

Victoria Karaseva

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LIST OF ABBREVIATIONS

3G - Third Generation of mobile telecommunications technology

IT – Information Technologies

MVP – Minimum Viable Product

UI – User Interfaces

UX – User Experience (UX)

UI/UX – User Interface Design

PPC – Pay Per Click

PPD – Pay Per Download

SMS – Short Messaging Service

B2B – Business-to-Business

CEO – Chief Executive Officer

HP – Hewlett-Packard

OS – Operating System

PC – Personal Computer

CA – California

NY – New York

App - Application

1 INTRODUCTION

1.1 Background and research gap

Mobile applications have become one of the trends in the development of information technology due to the growth of smartphones' market and broadband on 3G mobile telecommunications networks (Delhumeau, 2013). If in 2008, the year of App Store's launch, mobile applications market just being formed, at the present time the market has entered a phase of active growth. Mobile applications are software products, designed specifically for mobile devices, smartphones, tablet computers and other mobile devices. Mobile applications are often distributed through app stores like: Apple App Store, Google Play, Windows Phone Store, BlackBerry App World, etc. Mobile applications aim at solving different needs of customers from navigation to games. (Flood D. et al. 2013)

The modern software ecosystems like Apple iTunes Store and Google Market allowed developers over the world easily release new applications and get access to a huge audience instantly. However, only few apps achieve a decent amount of downloads while the rest stays unknown and unprofitable forever.

Nowadays there are more than 850 thousand applications in Apple Store, and among all applications games is one of the most popular categories of apps. Games provide the biggest share of revenue, although there is a tendency of increasing of other apps types amount, which is shown on Figure 1 (Merel, 2014).

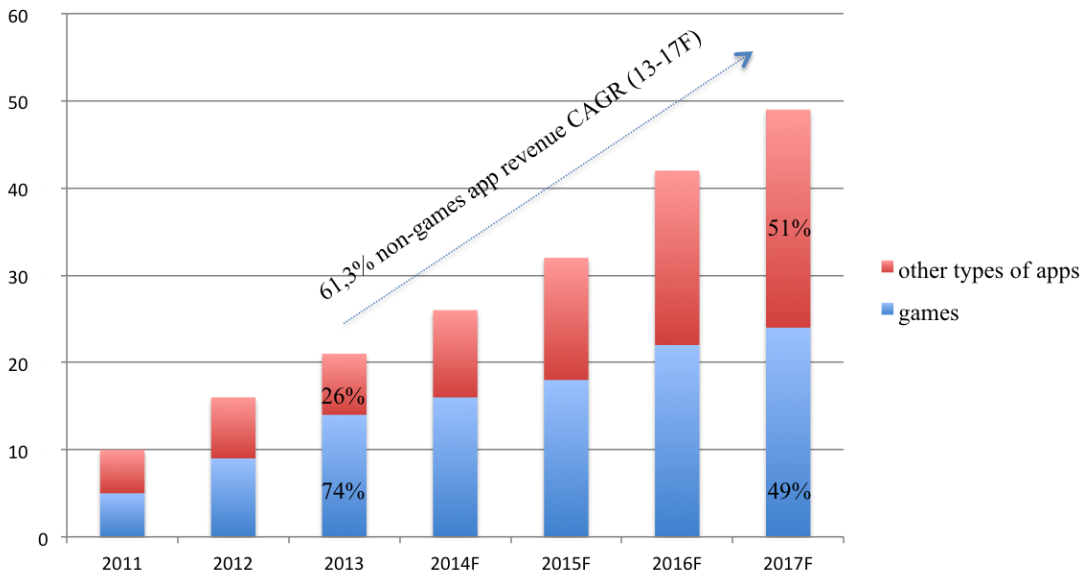

Figure 1: Global mobile apps sector revenue ($B) (Merel, 2014)

The reasons why some games become popular and others not, are important for understanding the driving factors of the games industry. The research gap is to figure out what features of mobile applications and their releases influence on apps popularity.

1.2 Research process

According to Mark Saunders' (2008) research onion model, there are different layers of research design. Model consists out of 6 layers, which are playing crucial role in the development of a clear and appropriate research process (Saunders et al., 2013). Figure 2 presents six following layers: philosophies, approaches, strategies, choices, time horizons, techniques and procedures.

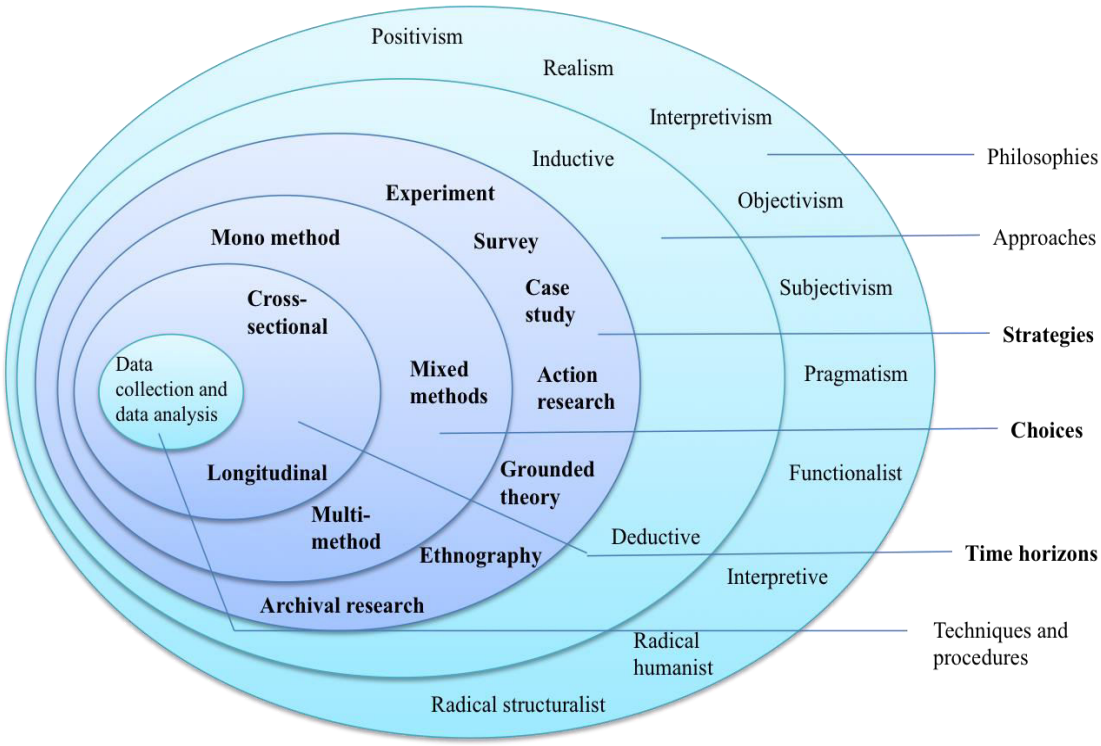

Figure 2: Research onion model (Sounders et al., 2008)

1.2.1 Research questions

The building of the current research design was based on the Mark Saunders' philosophy. Assumptions, which were approached to this study, are described in following sections of this chapter. They cover main layers of research onion model and tend to help to answer on the following research questions, which were identified for the current study:

1. Which characteristics of mobile apps influence on their popularity and position in the rating?
2. What types of changes do software companies introduce from one release to another?
3. How often do companies release new versions of their apps?

1.2.2 Research philosophy, approach and purpose of the research

The most appropriate philosophy for the current study is pragmatism. This type of approach allows using any of the methods, techniques and procedures typically

associated with quantitative or qualitative research. Pragmatism helps to solve the problem of limitations of research methods by complementing different approaches by each other. (Tashakkori et al., 1988).

The most suitable research approach for this study is building of new understanding of the theory.

Chosen research topic assumes usage of explanatory and descriptive studies. First of all, descriptive research gives the opportunity to use both quantitative and qualitative data in order to find data and characteristics about the phenomenon that is being studied. According the research questions it is necessary to collect the information about the current situation on the mobile applications' market. But as descriptive studies do not assume the conclusions out of collected data, the explanatory studies further will help to identify the actual reasons a phenomenon, which will occur after the data description. It will also help to look into future influence of occurred phenomenon and propose recommendations for further strategic development of mobile apps.

The purpose of the study is to find out factors for mobile games applications popularity and ranking and to develop recommendations for mobile games app store optimization of app representation.

1.2.3 Research strategy

For the chosen topic it is more suitable to use multiple case studies, which means combining of several case studies within one industry study. Aria of research is capturing the information technology and business spheres. It makes usage of case studies extremely required, and will be able to help to get the real state of affairs on mobile applications market. Furthermore the results of study require investigation of business development of most successful software companies and "providers" of platforms for apps placing such as Apple App Store, Google Play, etc.

1.2.4 Research methods

It is possible to use several research strategies in studies. To answer the research questions it is necessary to use the combination of quantitative and qualitative techniques. As quantitative method involve collection and analysis of numerical data, for such research question as "How often do companies release new versions of their apps?", it will be logical to assume the usage of this method.

But at the same time the following research questions – "Which characteristics of mobile apps influence on their popularity and position in the rating?" and "What types of changes do software companies introduce from one release to another?" make qualitative method the essential part of the research because of necessity of generation and usage of non-numerical data.

Current research assumes usage of quantitative and qualitative techniques in combination, and also the usage of primary and secondary data. This means that during the research process it will be necessary to analyze some quantitative data in a qualitative way and at the same time quantities some qualitative data for categorizing mobile applications.

1.2.5 Time horizons and limitations

As for this particular study it is necessary to understand what types of changes software companies introduce from one release to another and how often they release new versions of their apps; longitudinal approach will give more realistic and up-to-date information about concepts.

At the same time the time-horizon should not be very long and not take more than several months, because in IT industry changes are too fast and sometimes unpredictable. Usage of too old data will lead to inaccuracy in research.

The limitations of the study are as follows:

1.Time-related limitation. The data have to be collected during the period of 3-4 months; and one week for App Store data; therefore it is possible to get not up-to-date results and divergence in study.

2. Necessity of usage mainly resent sources of information, preferably written no early 2010.

3. Category of apps. There will be taken only “games” out of top iPhone apps represented in Apple Store.

4. No access to data about rating changes of the game after each release of new update.

5. The volume and time limits of master’s thesis do not allow gathering and processing of bigger amounts of data, than it was handled during this particular study.

1.2.6 Data collection and analysis

The research phases of the study reported here are as follows:

1. Representing theoretical background;
2. Creating the table of top 50 game apps and their characteristics from the Apple Store Top Apps;
3. Collecting the data about all releases of each app in the table;
4. Coding of release notes by their types (e.g. bug fixes, new features, performance improvements, OS update, and etc.);
5. Analysis of the data;
6. Reporting results;
7. Developing recommendations.

1.3 Structure of the thesis

The rest of thesis is organized as follows. Chapter two covers two theoretical frameworks - The Lean Startup by Eric Ries and The Business Model Canvas by Alexander Osterwalder. Chapter three is dedicated to related research regarding to Developers, App Stores, App Stores Developers Programs, Consumer Access Models and Business Models. Chapter four includes the results of the study. Discussion is given in Chapter five and recommendations and conclusion are in Chapter six. Additional materials are presented in Appendix.

The thesis structure is visualized in Figure 3.

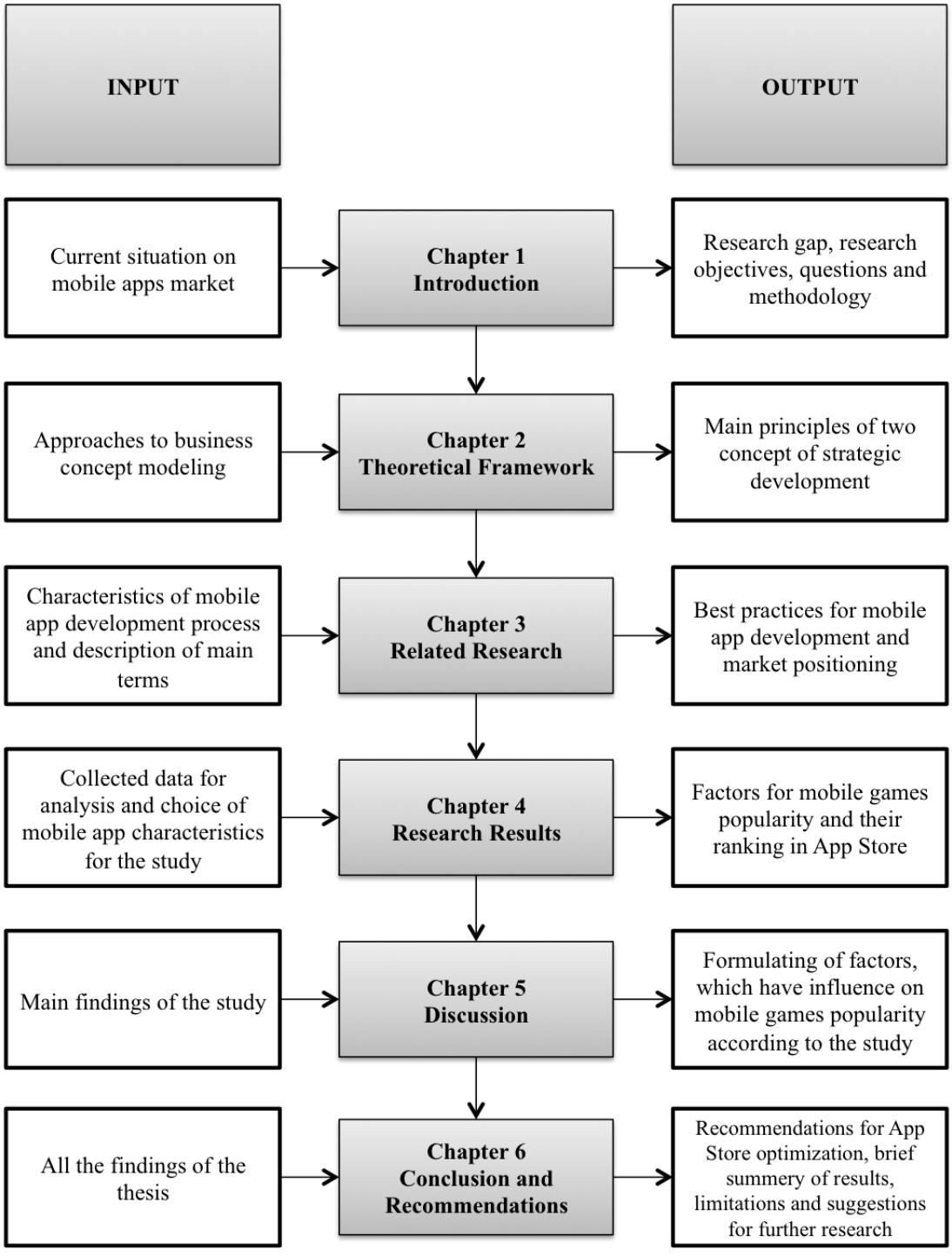

Figure 3: Structure of the thesis

The research was conducted in Lappeenranta University of Technology (LUT) during the period from February 2014 to July 2014.

2 THEORETICAL FRAMEWORK

2.1 The Business Model Canvas

Business model is characterized by how an organization could create, deliver and capture value (Osterwalder et al., 2009).

The Business Model Canvas proposed by Alexander Osterwalder illustrates a simple, relevant and understandable strategic management template, which helps to document and develop business model and to create new strategic alternatives. The model is based on nine essential blocks (Figure 4), which cover the main four area of business: value propositions, infrastructure, costumers and financial viability.

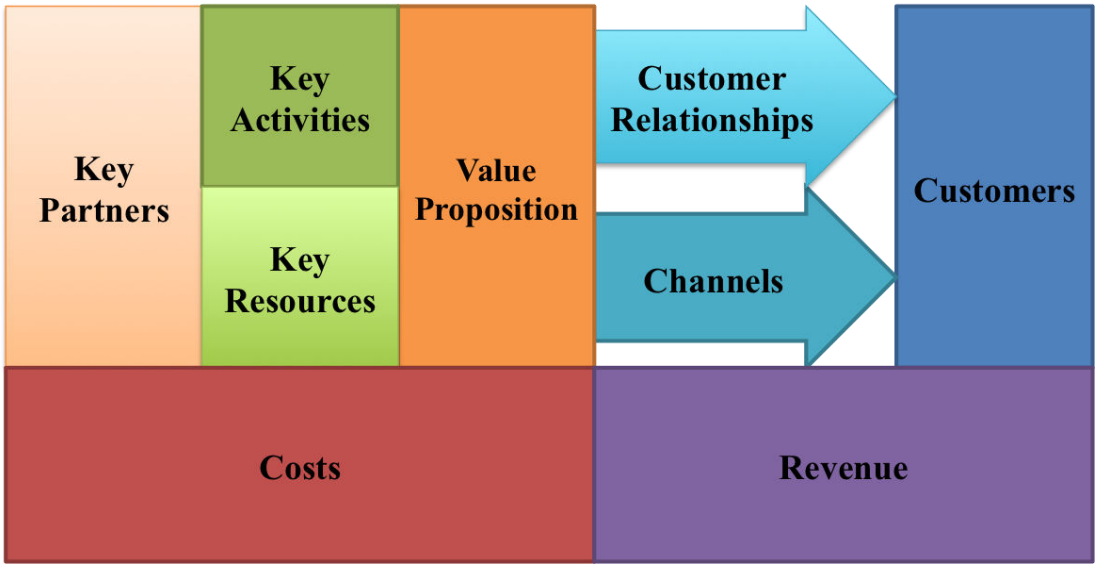

Figure 4: The 9 Building Blocks (Osterwalder et al., 2009)

The nine Building Blocks are described below.

1. ***Costumer Segments***

This block defines the various groups of people or organizations that the company targets and wants to serve in order to become more profitable. The costumers must be divided into heterogeneus segments, which have individual needs, behaviors and further attributes. The company has to make decisions about segments it wants to

reach and serve. Hereby, different strategies for each segment are needed. (Osterwalder et al., 2009)

There are different types of customer segments such as (Osterwalder et al., 2009):

Mass market: The segments are not distinguished; the company focuses on one large group, which has similar needs and problems. This type of business model is often found in the consumer electronics sector.

Niche market: Specific customer segments with individual requirements are targeted. Such business models are often found in supplier-buyer relationships.

Segmented: The groups of customers with similar need and problems are distinguished and individually targeted.

Diversified: Unrelated customer segments with very different needs and problems.

Multi-sided platforms: two or more interdependent customer segments.

2. Value Propositions

Value proposition is company's products and services, which create value for each customer segment by solving the costumers' problems and satisfying their needs. Values may be quantitative or qualitative. Elements such as Newness, Performance, "Getting the job done", Design, Brand, Price, Cost reduction, Risk reduction, Accessibility, Convenience may contribute to the value creation of the product or service. Some Value Propositions may be represented by new, innovative offers, while others may be similar to already existing ones, but with some added features and attributes.

Newness represents the satisfaction of absolutely new needs that customers did not have before because of not existence of similar offering.

Performance contributes to the value creation due to improvements of products or services.

"Getting the job done" can create value simply by helping a customer to get a certain job done.

It is very difficult to measure such characteristic of a product as **Design**. But superior design is able to make a product very popular.

Brand or status influence of product popularity and customers will to buy it. It happens because of good quality or other factors that usually accompany products of certain popular brand.

Offering of the similar product or service at a lower **Price** may provide the competitive advantage and make price-sensitive customers to prefer purchasing of this particular product.

Cost reduction may become a very good way of value creation. It saves customers from extra expenses and concerns.

Risk reduction is also one of the ways of the value creation (e.g., after-sales services, easy returning policy, etc.).

Accessibility makes products and services available to customers and creates value. This can result from business model innovation, new technologies, or a combination of both.

Convenience (usability) means that it is easier to use the product.

3. Channels

This block defines how a company reaches its customers and how it communicates with them. The firm delivers the value proposition to the consumer through the channels. These channels can be direct or indirect, as well as owned or partner channels.

Table 1: 5 Channel Phases (Osterwalder et al., 2009)

Channel Types			Channel Phases				
Own	**Direct**	*Sales force*	**1. Awareness** How do we raise awareness about our company's products and services?	**2. Evaluation** How do we help customers evaluate our organization's Value Proposition?	**3. Purchase** How do we allow customers to purchase specific products and services?	**4. Delivery** How do we deliver a Value Proposition to customers?	**5. After sales** How do we provide post-purchase customer support?
		Web sales					
	Indirect	*Own stores*					
Partner		*Partner stores*					
		Whole saler					

Table 1 shows that Owned Channels can be direct, such as an in-house sales force or a Web site, or they can be indirect, such as retail stores owned or operated by the organization. Partner Channels are indirect and span a whole range of options, such as wholesale distribution, retail, or partner-owned Web sites. Also there are 5 channel phases: awareness, evaluation, purchase, delivery, after sales. All those channels are very important and have to be managed.

Partner Channels usually provide lower margins, but at the same time they help to benefit from partner strengths. Owned Channels and particularly direct ones provide higher margins, but placing them and operating can be costly. The crucial part is to find the appropriate balance between the different types of Channels for better customer experience and maximizing revenues.

4. Customer Relationships

The company should determine which type of relationship it wants to establish for each customer segment. Boosting sales, customer acquisition and retention can drive these relationships. These are some examples for customer relationships: personal assistance, self-service, automated service, communities or co-creation.

Personal assistance is based on human interaction. The customer can get some help during the sales process or after the purchase is complete. This process can be supported at the point of sale, through call centers, by e-mail, etc.

Dedicated personal assistance involves providing a special assistance to an individual client. This type of relationship usually develops during a long period of time and includes deep and intimate communication.

Self-service does not assume any direct relationship with customers. It provides the opportunity for customers to help themselves by their own.

Automated services assume customer self-service with automated processes. Automated services can recognize individual customers and their characteristics, and offer information related to their orders or transactions.

Communities provide the opportunity for users to exchange knowledge online and solve appearing problems. Communities can also help companies with better understanding of their customers.

Co-creation of value is very popular nowadays and involves collaboration between customer and company. For example, some companies engage customers to assist with the design of new and innovative products.

5. Revenue Streams

This block represents the cash from each customer segment. The main question is how much the customer groups think the product or service is worth and how much they are willing to pay for it. In order to generate revenue streams the following approaches can be used by companies: asset sale, usage fee, subscription fees, lending, brokerage fees, licensing or advertising. Each revenue stream has a different pricing mechanism, which is shown in Table 2.

Asset sale assumes selling the ownership rights to a physical product.

Usage fee provides the usage of a particular service. The more customer use a service, the more he has to pay.

Subscription fees provide access to continuous assets for a limited time.

Lending (Renting/Leasing) revenue stream is created by temporarily granting someone the exclusive right to use a particular asset for a fixed period in return for a fee.

Licensing provides the permission to use protected intellectual property in exchange for licensing fees. Licensing allows rights holders to generate revenues from their property without having to manufacture a product or commercialize a service.

Brokerage fees come from mediation services performed on behalf of two or more parties.

Advertising assumes getting fee for advertising a particular product, service, or brand.

Table 2: Pricing Mechanisms

Fixed "Menu" Pricing *Predefined prices are based on static variables*		**Dynamic Pricing** *Prices change based on market conditions*	
List price	Fixed prices for individual products, services or other Value Propositions	*Negotiation (bargaining)*	Price negotiated between two or more partners depending on negotiation power and/or negotiation skills
Product feature dependent	Price depends on the number or quality of Value Proposition features	*Yield management*	Price depends on inventory and time of purchase (normally used for perishable resources such as hotel rooms or airline seats)
Customer segment dependent	Price depends on the type and characteristic of a Customer Segment	*Real-time-market*	Price is established dynamically based on supply and demand
Volume dependent	Price as a function of the quantity purchased	*Auctions*	Price determined by outcome of competitive bidding

According to Table 2 there are two types of pricing mechanisms. Fixed pricing, which means already predefined prices, and Dynamic pricing that means flexibility of price changes according to market conditions.

6. Key Resources

The Key Resources determine the most important assets, which are required to make the business model work. A product's key resources can be categorized in physical, intellectual, human, and financial resources and can be owned by the company or acquired from its partners.

Physical recourses are defined by manufacturing facilities, buildings, vehicles, machines, systems, point-of-sales systems, and distribution networks.

Intellectual recourses sometimes are even more important and include brands, proprietary knowledge, patents and copyrights, partnerships, and customer databases are increasingly important components of a strong business model. It is more difficult and expensive to develop intellectual resources, but they provide substantial value. **Human** recourses most likely are the most important type of recourses in whole organization. Employee's skills and knowledge lead companies to the success. **Financial** recourses include cash, lines of credit, or a stock option pool for hiring key employees, etc.

7. Key Activities

Key Activities block is the most significant, which company must do in order to operate successfully and profitability. As with key resources, key activities are also required to create value proposition, reach the markets, maintain the relationships and earn revenues. The production, the problem solving and the network define the categorization of key activities.

Production relate to designing, making, and delivering a product in significant quantities and/or of superior quality.

Problem solving activities relate to the ability of finding solutions for solving individual customer problems.

Platform/networks can be a key resource and dominated by associated key activities.

8. Key Partnerships

The block about Key Partnerships represents the network of suppliers and partners who are needed for a functioning business model. There are various reasons why a company has to set up partnerships, e.g.: optimization and economy of scale, reduction of risk and uncertainty, acquisition of particular resources and activities.

Furthermore, there are four types of partnerships:

- Strategic alliance between non-competitors
- Competition: Strategic partnerships between competitors
- Joint companies to develop new business
- Buyer-supplier partnerships

9. Cost Structure

The Cost Structure block determines all the incurring costs to operate a business model. They can be defined as a cost-driven or as a value-driven cost structure and have can be characterized by being fixed costs, variable costs, economies of scale and economies of scope.

Cost-driven business models focus on minimizing costs by all possible methods. For that the leanest possible Cost Structure is required, just as using low price Value Propositions, maximum automation, and extensive outsourcing.

Value-driven business models are directed to the value creation and usually characterized by high degree of personalized services.

Fixed costs as one of cost structure characteristics remain the same despite the volume of goods or services produced, e.g. salaries, rents, and physical manufacturing facilities. **Variable costs** vary proportionally with the volume of produced goods or services. **Economies of scale** assume cost advantages that a business enjoys as its output expands. **Economies of scope** assume cost advantages that a business enjoys due to a larger scope of operations.

2.2 The Lean Startup Methodology

The Lean Startup describes a scientific approach for startups establishment and management as well as providing a desired product to customers much faster. “It is a principled approach to new product development”.

It takes a lot of time from an idea of product to its implementation to the market. Start-ups usually do not communicate with potential customers during this process and finally fail because of lack of interest to their final products. (Ries, 2011)

Lean Startup approach assumes elimination of uncertainty by adapted management process and usage of certain methodology during the development of a product.

The Lean Startup methodology pushes start-ups to answer such question as "Should this product be built?" and "Can we build a sustainable business around this set of products and services?" And in case of first product success and interest from customers, manager will be able to establish his own campaign and get early adopters, new employees for further iterations and start to build the final product. And when time of wide distribution will come, there already will be established customers, and product will be able to solve real problems and offer detailed specifications for certain needs. So the main lesson out of it is “Work smarter, not harder” (Ries, 2011)

There are following principles of Lean Startup methodology (Ries, 2011):

1. Entrepreneurs are everywhere

It is necessary to mention that the concept of entrepreneur is often misunderstood. Entrepreneurship could be defined as a “human institution designed to create new products and services under conditions of extreme uncertainty”. It can include any sort of actions towards product creation that will be able to help other people with solving some problem. And it does not matter what in what industry person is operating.

That is why it is very important to be open to new connections and be ready to accept the opportunity to meet other entrepreneurs.

2. Entrepreneurship is management

A start-up is not an actual product of some company. Entrepreneurship is all about the people working behind the products. That is why the representation of product depends on those people and that is why management is extremely important. For start-ups it is necessary to associate with venture capitalists, business angels, customers and so on.

3. Validated learning

The main purpose of a startup is learning how to build a sustainable business. The more opinions you collect the more accurate your product can be. Collecting opinions from customers will help to sustain the process of product development. Entrepreneurs should adapt their plans and ideas incrementally and finally get the product, which customers want and will pay for.

4. Innovation accounting

The measurement of progress, setting up milestones, work prioritizing are also very important parts of successful business. Clear goals and specific accounting designed for startups make the work on product much easier. To improve entrepreneurial outcomes and hold innovators accountable it is important to pay attention to those factors.

5. Build-Measure-Learn

As it was mentioned before, listening to the customer is one of the main factors of getting a successful product. Such factors as turning ideas into products, analyzing customers' reaction and learning whether to pivot or persevere – are represent the "feedback loop". Figure 5 shows the build-measure-learn process. It is a core component of Lean Startup methodology.

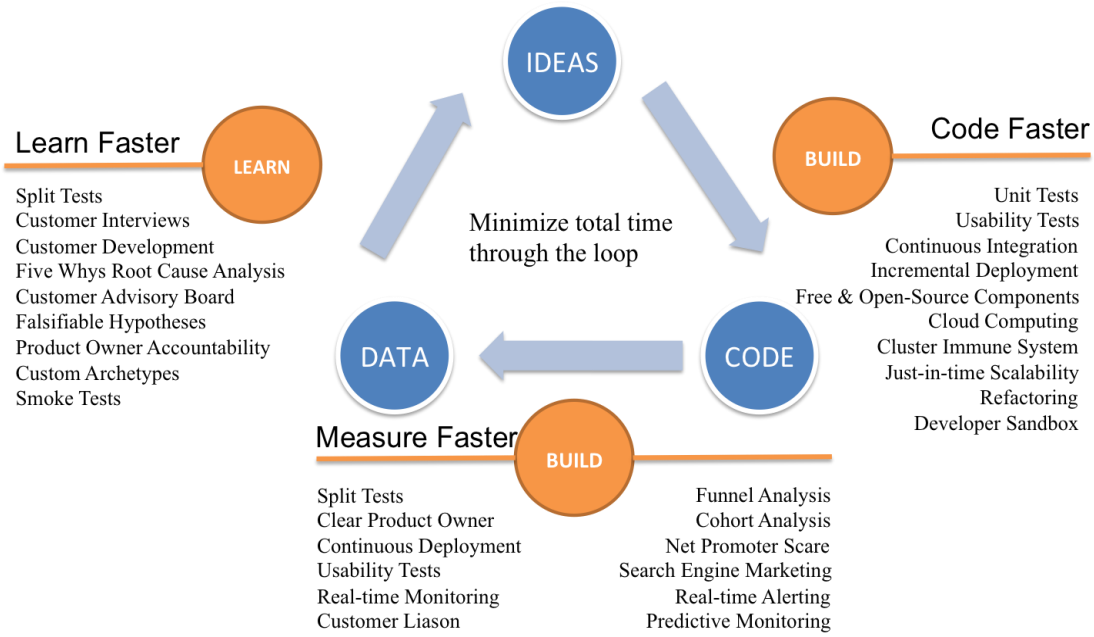

Figure 5: Build-Measure-Learn feedback loop (Ries, 2011)

The first step is figuring out the problem that needs to be solved and then developing a minimum viable product (MVP) to begin the process of learning as quickly as possible. When the MVP is established, a startup can continue with measurement step. The outcome of this process will bring cause and effect question. Learning from previous success or failure is leading to another cycle of loop.

The investigative development method of asking simple questions to study and solve problems right away is called "Five Whys". Repeating “why” five times can help uncover the root problem and correct it. It allows understanding is company moving the drivers of the business model or not. If not, it is a sign that the product, strategy or engine of growth requires some changes.

Several easy steps can describe the basics of learning process:

1. Start with a idea
2. Build the minimum viable product to address that question to the best of your knowledge at that time
3. Test your product and gather some data

4. Analyze your data and learn something about your product
5. Modify your product based on what you have learnt
6. Repeat steps 1-5 until you have no more questions left and are happy you have built what your customers really want.

3 RELATED RESEARCH

Mobile applications nowadays are a major growth sector of the information and communications economy. (Delhumeau, 2013)

"App Era" can be divided into three stages:

1. Maximizing Downloads
2. Monetizing Usage
3. Increasingly Sophisticated Marketing

During the first age of the App Era (Maximizing Downloads) companies such as Rovio, RedLaser, and Doodle Jump were sticking to simple business model and were selling their high quality apps for just 0.99$. This model was working very well from 2008 through mid 2011, and paid downloads were bringing the main part of revenue. But for smaller developers it became very tricky to break into the Top 100 and get all advantages of popular developer. This situation forced developers to let free downloads of their apps, and try to generate revenue through other channels. This change became a beginning of a Second Era of apps that changed a focus on downloads to the engaging and retaining users and monetizing usage. For supporting this process developers had to learn such tools as segmentation, retention and funnel analysis. So eventually, the business models based on in-app purchases, subscription and commerce within the app started to be the main ones among the most successful app publishers. However, this change has also brought some challenges, in particular, how little app developers knew about their customers. For example, who are my most valuable customers and where are they coming from? Which features are increasing engagement of users? (Aggarwal, 2013)

Nowadays we can see the Third Era. Developers have to invest in marketing quite a lot and in a smart way if do not want to get left behind. Just the ability do develop an app means nothing and it is possible to succeed only if you perfectly understand users' needs and will be able "to maintain a profitable long-term relationships with them". (Aggarwal, 2013)

It is possible to make a list of main parts of the mobile applications market, which involves (Delhumeau, 2013):

1. Developers
2. App Stores
3. App Stores Developers Programs
4. Consumer Access Models
5. Business Models

3.1 Taxonomy of Mobile Applications

Mobile application-taxonomy is grounded in the interaction of the user and the application. The interaction may revolve around the access of information or involving financial transactions. (Nickerson et al., 2009)

The taxonomy may be defined in dimensions, as in - major characteristics of interactions between application and user. These dimensions are narrowed down to include the mentioned characteristics (Nickerson et al., 2009):

- Collective exhaustion. Every mobile application falls into one category within a dimension.
- Mutual exclusiveness. No application can be taken into more than a single category per of a dimension. The majority of dimensions consist of binary categories, enabling this.

In order to be of adequate use, taxonomy should consist of the following, favorable characteristics (Nickerson et al., 2007):

Conciseness. There shall not be too many dimensions or categories within the dimensions, since extensive classification may become difficult to comprehend and apply in that case.

Inclusiveness. There shall be enough dimensions and categories to be of relevance. Taxonomies consisting only of a single dimension and two categories within are neither useful nor of interest. This may conflict with the conciseness characteristic.

Comprehensiveness. There shall be a classification provided for all current applications.

Extendibility. There shall be allowance for additional dimensions and new categories in case of new types of applications.

Below, there is a list, consisting of dimensions of mobile application taxonomy (Nickerson et al., 2007):

Temporal dimension. The user is able to interact with the mobile application in real time, that is that the users' request will be processed instantly, whereas communication between application and user may be deferred in other cases. The temporal dimension revolves around the time of interaction between user and application.

- Synchronous: user and application interact in real time.
- Asynchronous: user and application interact in non-real time.

Communication dimension. Information may be directed between user and application (uni-directional), or bi-directional. This dimension relates to the way information takes between the user and the application.

- Informational: information is transmitted from the mobile application to the user only; uni-directional transfer of information to the user; information push from the application to the user.
- Reporting: information is transmitted from user to mobile application only; uni-directional transfer from the user; information pull by the application.
- Interactional: information is transferred in both directions between user and mobile application; bi-directional transfer between user and application; information push and pull.

Transaction dimension: Mobile applications often provide capacity for purchases, regularly through financial transactions, whilst others do not. The transaction dimension captures this characteristic.

- Transactional: user may purchase goods or services through the application.

- Non-transactional: user cannot purchase goods and services through the application.

Public dimension: Mobile applications may be created for public access, or access may be limited to specific groups. The public dimension relates to the applications availability.

- Public: the application can be used by any user; access may be limited to groups, however each user is able to self-select participation of these groups.
- Private: application is to be used by pre-selected (by a third party) group of users only.

Participation dimension: Although simultaneous usage of mobile applications by multiple users is possible, users are often not aware of this characteristic and regard the usage of the application as singular. Some applications, such as multiplayer games, create awareness of this aspect for the user. The participation dimension captures this concept:

- Individual: one user; user experiences the application as if being the sole user.
- Group: multiple users; users view use of the application as part of a group.

Location dimension: Sometimes, mobile applications include personalized information or functions, depending on the users' locations, whereas others do not use location as a functioning factor. Location dimension deals with whether the location of the user is used to modify the application.

- Location-based: mobile application uses location-data.
- Non-location-based: mobile application does not use location-data; even though certain mobile applications may track location-data, this data is not used to modify the functionality.

Identity dimension: Again, some mobile applications adjust functionality based on the input concerning the users' demographics, whereas others do not. The identity dimension relates to whether the identity of the user is used to modify the functionality based on users' demographics.

- Identity-based: mobile application applies users' demographics
- Non-identity-based: mobile application does not apply users' demographics; note that the mobile application may be aware of users' demographics, yet is not using these to modify functionality.

3.2 Mobile apps' development process

Mobile application development is a complex and distinctly organized process, which is very similar to the technology of computer software programming. It is based on compliance with certain algorithms, and the goal is the creation of a simple for understanding and useful program for mobile users.

Figure 6 shows six stages of mobile application development process. These states are:

1. Concept
2. Prototyping
3. Development
4. Testing
5. Deployment
6. Release

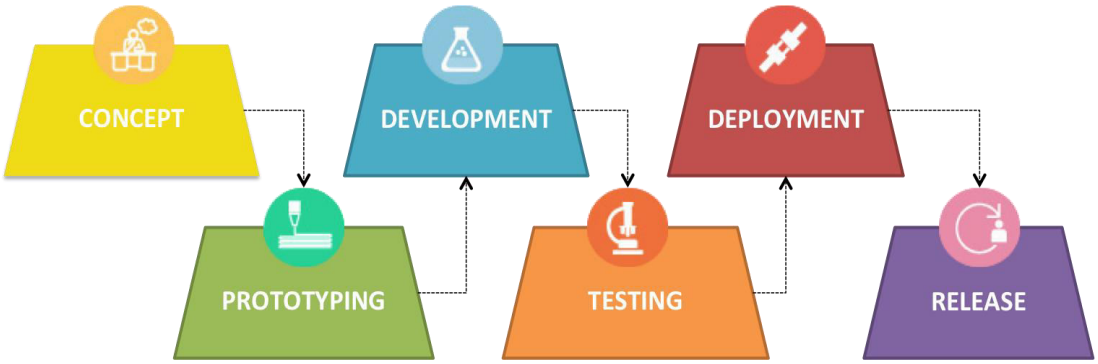

Figure 6: Mobile application development process

As Lean Startup methodology describes the "build-measure-learn" process, the mobile application development process shows the same pattern of necessary activities. Each of six stages of app development requires constant evaluation of

results, fixing mistakes and retesting of outcome. Successful product comes due to the “feedback loops” and necessary adjustments. So not only the already developed software product, but also all stages of app development process have to pass “build-measure-learn” procedure.

3.2.1 Concept

Any mobile app development project starts not only with preliminary market research. There are several concept development phases, required for understanding the direction of project development.

Understanding of the target application’s audience

Owners of mobile devices represent a wide audience with different interests preferences, they distinct by age, interests and social status. It is not possible to please all of them, so it is necessary to " narrow " the characteristics of the target user and try to create a psychological profile of the "ideal user" who will be interested in buying, understanding and applying the application in real life. Usually communication in forums may help to understand the psychology of the target users and adjust the functionality of the application to them.

Analyzing of similar applications from competitors and their commercial success

It is about the study of the competitive environment, which is becoming tougher in today's market for mobile applications. A large number of commercial companies and freelancers operates in this business segment, and annually offers thousands of new applications. Today it is difficult to create something entirely unique, and most likely developer’s project will have to compete with a number of analogues. That is why for developer it is important to study these analogs and their commercial success, and identify the benefits and the degree of uniqueness of their own design and to calculate the best options for technical support and appearance.

Defying of unique characteristics and benefits of project

Developer has to attract potential users by the uniqueness and originality of his project. There has to be clear features and advantages, which will distinct a particular

application from other developers' ideas.

Calculation of time, required for the project

Release dates of application influence on costs of the project and should be minimal if developer is relying on commercial success. If the application will require more than three months for development and correction, it might be too expensive and uncompetitive. It is necessary to look for the technology, which will help to reduce the cost while the quality and uniqueness of design will stay the same.

3.2.2 Prototyping

Development of technical specifications

This stage specializes on determining the technical features of the future product. Omitting even the seemingly insignificant item and not laying it in the architecture of the application, can lead to the need of remaking it from scratch.

User Interface Design (UI/UX)

User Interfaces (UI) and User Experience (UX) are extremely important factors that determine the success of mobile application. User Interface Design (UI/UX) involves an integrated approach to the user's interaction with interface. An intuitive User Interface Design is an integral attribute of mobile product. (Kujala et al., 2011)

UX is a psychological and behavioral form of user's interaction with software that incorporates a variety of aspects: ease of use, user's involvement, the visual appeal of the product, etc. (Garret, 2002)

User Experience has four elements (Guo, 2012):

1. Value – is the application useful for the user.
2. Usability – is it easy to use the application.
3. Adoptability – is it easy to start using the application.
4. Desirability – is app fun and engaging for the user.

UI is the set of means and methods by which the user interacts with the device

(Adelsberger et al., 2008).

(UI/UX) consists of several layers of elements, which provide the interactive communication that user experience simultaneously (Cummings, 2010). Those elements are shown on Figure 7.

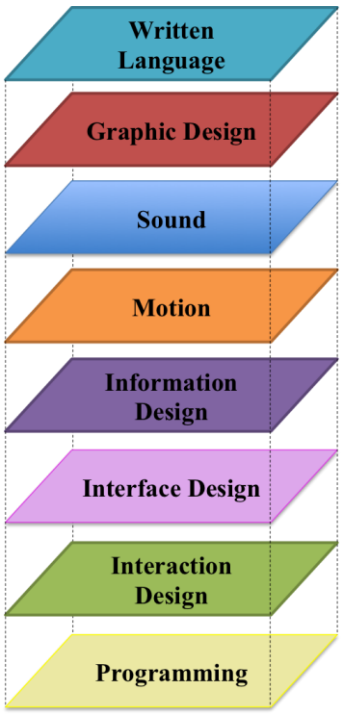

Figure 7: User Experience Design Diagram (Cummings, 2010)

The elements, shown on Figure, have the following meanings (Cummings, 2010):

Language – English, Spanish, Mandarin, etc.

Graphic Design – graphic treatment of interface elements (shape, symbolism, line, color, special composition, texture, dimension, and other factors of visual rendering).

Sound – music or spoken word (audio).

Motion – animation, change, time, rhythm, calculus.

Information Design – designing the presentation of information to facilitate understanding (textual style, graphics, and composition for information structure, meaning, relationship and user comprehension).

Interface Design – graphical and information design elements utilized to indicate controls of data manipulation and facilitation of user's interaction with functionality.

Interaction Design – development of application flows to facilitate user tasks, defining how the user interacts with application functionality (task flow, system flow/behavior, and human comprehensibility of controls by the user interface).

Programming – "front-end" (client executed) or "back-end" (server executed) code for data input, processing and retrieval.

3.2.3 Development (Coding, Programming)

This stage assumes actual implementation of ideas and design into practice due to coding using certain programming language and platform.

Most of app stores provide programs and support to encourage third-party developers to use their platforms. This support contains different components (Delhumeau, 2013). First of all, distribution of revenue is weighted to favor developers. This means that usually developer gets 70 percent of the revenue and other 30 percent goes to the app store, although there are no particular access restrictions or qualifications.

Second, access to the software development kits - developer gets the opportunity to use native software language of the app store. Also it assumes access to the forums, guidelines and other support mechanisms.

Also there is a whole range of other encouraging factors, such as: low start-up costs ("Three of the largest app stores provide developer support programs for $200"), availability of marketing information and user analytics, secure payment mechanisms are provided, access to already prepared customer base.

Moreover, advertising of the app stores to consumers is provided by device manufacturers and, in some instances, network services providers. There is a possibility of individual mobile applications advertising in an app store, and an opportunity for developers for extra payment to get a feature of placing the mobile application in the special section in the app store.

3.2.4 Testing

Mobile application testing is a process, which assumes verification of functionality, usability and consistency. (Pradhan, 2011)

Unlike the traditional software testing, mobile apps testing assumes usage of special techniques. The testing becomes more challenging because of the variety of mobile technologies, platforms, networks and devices. (Dumaresq et al., 2010)

There are many technical issues that are specific to mobile applications that need to be considered. For testing mobile applications it is better to consider additional test cases and to answer on following questions (Dumaresq et al., 2010):

- How much battery life does the application use?
- How does the application function with limited or no network connection? As a minimal requirement - the application at least should not crash; but perfectly, user should not even notice a difference.
- How fast is the application? Even if mobile device has slow processor or there is a slow network, user expect fast work of application.
- How quickly can users navigate the application? Intuitive and easy navigation is one of the most important requirements for good application.
- How much data will the application need? User has to have the opportunity to use the application without large internal storage and access to the sided sources.
- Will peripheral devices affect the application?

Methods of mobile application testing:

Usability Testing. This includes text visibility in the selected language, availability of navigation from one screen to another, verification of functionality with and without access to the network (online and offline), feedback from interaction with system. (Zhang et al., 2005)

Compatibility Testing. This means testing the application for different mobile devices, OS versions, screen sizes and resolutions. Also it assumes checking if

integration server changes and checking for the app isolation with other apps on the particular device. (Kumar et al., 2013)

Interface Testing. Testing of a graphical user interface to ensure correct behavior of each screen, buttons, text inputs, navigation flows. (Dumaresq et al., 2010)

Services Testing. This means that application has to be checked for not to act as a server, also checking if a service takes too long or it is possible to be used offline. (Kumar et al., 2013)

Low Level Resource Testing. This means checking the threats of overuse of memory and not releasing it. Also it is possible that app temporary files not cleaned, local database growing too big, and the garbage generation occurs. (Kumar et al., 2013)

Performance Testing. This method assumes checking the connection changes to Wi-Fi from 2G/3G or vice versa, application response time, code optimization for the CPU cycle, battery consumption, memory leaks, resources like GPS, camera usage, etc. Performance testing is important for understanding the mobile application scalability. It is useful for identifying performance bottlenecks in high use applications. (Kim et al., 2009)

Operational Testing. This assumes the information back-up necessity checking, the recovery plan in case if battery of the device goes down, data safe in case of app upgrade from app store, app exit if user gets alarm, call, message, reminder, etc., and battery power usage while app is being accessed. (Kumar et al., 2013)

Security Testing. This means the usage of encryption/decryption techniques for sensitive data protection, checking the multi-user support (in case of this feature) without interfering with the data between them, checking for access to files saved in the app by any other users except the owner of device, detecting the possibility of receiving some malicious content from side sources. (Kumar et al., 2013)

3.2.5 Deployment

Software deployment is a general process of customization and adaptation of software system according to specific requirements or characteristics of the user in

such processes as release, installation, adaptation, reconfiguration, updating, activating, deactivating, removal, and retirement. (Hall et al., 1999)

Deployment of mobile applications is different from desktop applications by following parameters: online apps are less usable but easier to deploy; disconnected apps are more usable but difficult to deploy; mobile apps create additional security challenges; mobile applications deployment requires centralized: application and data provisioning; application install and upgrade; remote diagnostics repair and lockout.

3.2.6 Release

Application release it is not only the publication of the app in the app store. This process includes different stages, which are very important for the app success and described below (Roebuck, 2011).

App Store optimization

App Store Optimization is a process of improving the visibility of a mobile application in the App Store. App Store Optimization is closely linked with search engine optimization. In particular, the optimization of the App Store includes the process of improving the position of applications in the search results or the top charts. (Graaf, 2012)

App Promotion

Application promotion is one of the most important steps after app creation. It assumes letting to the target users know about the new application and due to marketing tools also make them to like and to buy the product (Gauchet, 2013):

- Product image creating (name, icon, category choice, screenshots, keyword selection, description);
- High-quality promo website development;
- Surveys and press releases publication (including thematic websites);
- Promotion through social networks;

- PPC advertisement running;
- Campaigning in mobile advertising.

Monitoring

Monitoring after the app release assumes following steps (Ravindranath, 2012):

- Analysis of the results;
- Tracking application lifecycle, monitoring statistics;
- Determine the most effective advertising channels and correction advertising company;
- Application updates.

3.3 Providing the availability of apps

The Business Model Canvas represents "Channels" as one of essential blocks. In this particular study, app developers represent market players, who are trying to reach their customers and communicate with them through app stores – the main channel of mobile apps distribution.

3.3.1 App developers

App developers are independent or employed by organization creators of applications (Bloor, 2014).

Third-party developers create mobile applications, but don't work directly for the app store, device manufacturer or network service operator. There are several kinds of such developers (Delhumeau, 2013):

- Hobbyist, for whom development of mobile applications is not a primary occupation. And out of 18,5 million developers there are 7, 5 million "hobbyists" (Jackson, 2013)
- Professionals, who use mobile applications development as a main source of income, either alone or as part of a business centered on mobile application development

- Contractors, who develop mobile applications “on behalf of another entity or individual”.

Developers are attracted to the App Store due to increasing of mobile apps popularity, so the number of third-party developers has also significantly increased during last years. (Delhumeau, 2013)

3.3.2 App Stores

There is quite big range of different application stores nowadays. It is possible to divide them into following types (Delhumeau, 2013):

Device manufacturers. Among them there are Apple App Store, Ovi by Nokia, App World by Blackberry. These kinds of stores provide services only for consumers of the appropriate manufacturer’s device and certain mobile software.
Operating system developers. It mainly includes Android Market, Microsoft Windows Mobile and Apple iOS. Consumers can access these stores only through with devices with certain installed operating system.
Mobile network operators. Among them there are such network operators as Telstra, Verizon, Optus. These stores provide cervices for the consumers with contracts from these network operators. But at the same time consumers can use multiple handset brands to access these stores.
Independent. There is a number of app stores, operating as independent commercial concerns or as developers such as GetJar and Mobango. Access to these stores is not dependent on the brand of device used, service provider or proprietary software.

Among all characteristics of the mobile applications market there is a number of common ones across all app stores (Delhumeau, 2013).

That includes low barriers to entry. Apple, Android and Blackberry provide the opportunity to develop applications with software development kits for low fixed costs.
Strong competition is another characteristic of the mobile applications market. There is a huge amount of sellers and mobile applications available to customers (more than 300,000).

At the same time there are low barriers to exit. Mobile applications market provides the opportunity to enter and leave it quickly.

To deliver the application to the end-user there are various platforms, which build the supply chain. Customer services can fall across several different organizations or individuals, and this makes the relationships between service providers and end-users more complex. So the extended value chains with multiple players arises.

Global nature of mobile applications market is very obvious characteristic. All over the world it is possible to get the access to app stores through smartphones and other devices, it leads to the existence of a global consumer base. But at the same time the major market players have managing companies based in North America (Apple, Google, Blackberry, Microsoft Windows and Palm). As a result of this fact, "there are associated cross border and trans-jurisdictional market implications".

It is quite difficult to predict the financial viability of certain mobile applications and it is very variable and makes revenue unpredictable. The top 10 percent of mobile apps achieve about 75,000 downloads and have a big successes, with million revenues per month. However, almost half of all mobile barely achieve 1,000 downloads and, after the payments to the app store, developers earn up to $2,500 on average.

3.4 Mobile apps' monetization

Revenue streams, as one of the main blocks of The Business Model Canvas, are represented by seven mobile apps' monetization ways, described below.

If the developers' goal lies within the monetization of his app or mobile website, there are several options that are viable for this scenario. Both the choice of general app/mobile-website commercialization as well as the type of it shall best be made as early in the process as possible, in order to direct the development in a favorable direction. (Bloor, 2014)

Monetization of apps and mobile websites can be done by (Bloor, 2014):

1. Pay per download
2. In-app payment
3. Mobile advertising

4. Sponsorships
5. Revenue sharing
6. Indirect sales
7. Component marketplace

The aspects of each of the seven mentioned methods are explained below.

Pay Per Download

In case an app is distributed using the pay per download (PPD) scheme, the app is sold once to the user, as it is being downloaded and installed on the mobile device. The payment itself is either handled by the app store, either mobile operator or a custom-made mechanism by the developer. (Doshi et al., 2010)

Distribution via app stores, such as Google Play, is a common way of handling the monetization. Hereby, the store handles the payment for the developer. In return, the store takes a share of the revenue, oftentimes a percentile of the total revenue, on all sales. Fixed margins, or matrix' of such are another option given out by stores when choosing to distribute the app in a range of countries. Here, local currencies are taken into consideration (US$, €, etc.). (Bloor, 2014)

The payment for downloaded apps can be handled in two ways: Credit-card payment, or operator billing.

Credit-card billing is used by Google, Amazon, Apple (among others). In the cases of Google and Apple, the provision of credit-card date prior to download is required and supposedly, as noted by analysts, key to increase monthly per-app-revenue, in contrast to stores without this requirement.

Operator billing is another option of PPD-payment in which the customers' operator books the sales as receivables and incurs them on either the monthly phone bill or by requesting the sending of Premium SMS. More rarely, billing is handled by the app-store itself (such as in the case of Google Play), where operator billing is supported for a range of carriers worldwide. Operators normally incur a percentile of the sales price as revenue (~30% - 65%, sometimes with extreme outliers of up to 95%).

Further diminished returns are gained in case services such as aggregators are used. (Bloor, 2014)

Another option is the usage of a customized payment option, set up by the developer himself. Hereby, a website is created for the purpose of commercialization where the customers acquires the application and then pays via PayPal (to only name one alternative). (Bloor, 2014)

Pay Per Download is a comfortable option if payment is being handled by the app store itself. Hereby, the developer simply needs to agree upon the arbitration of either a percentile, or a fixed rate, of the sales revenue to be received by the store in return for its service. This is the main contra, as the developer is not able to use the full monetary potential of his app. However, this option offers great visibility for products on the store. Creating a website/payment option solely for one app or developer may leave the ability to earn the greatest return on investment, however will lead to only as much product awareness, as the developer himself is able to generate.

In-App Payment

In-App Payment refers to applications that are download- and useable for free, either for a limited (trial) period of time, or unlimited but with restricted functionality. This means that an app has the complete and full functionality as always but only works up until a specific point in time is reached (e.g. 30 day trial), after which the purchase of the app is required or, the app only offers limited functionality, e.g. a game-app that only features 10 levels for free out of 100. In this case, the app will function for an unlimited period of time, yet only allow access to the complete content (levels, videos, removal of ads, additional features, etc.) post purchase. (Nordlund et al., 2012)

App stores generally offer In-App Payment options, and according to Distimo, have become the leading monetization model in many markets, especially among so-called "freemium" games, that use the free content to generate interest in the full product among their audience. 2013 saw 92% of global iOS app revenues and 98% of Android app revenues come from the in-app purchase-model. (Bloor, 2014)

Normally, app stores do not allow apps that use third-party payment options as in-app payment, in order to prevent the usage of the store as a means to both advertise and distribute the app for free only to later incur the revenue without paying the store's revenue share, as outlined in the PPD-paragraph. (Nordlund et al., 2012)

In-App Payment statistically generates the highest level of awareness among prospect customers, as the download of the free trial/basic-version does not require any payment up front. This generally leads to higher conversion rates as a result and, thanks to the convenience of the app store's payment methods, there is no need to enter credit card information, or other credentials to acquire the product.

Mobile Advertising

Mobile advertising refers to the display of banners, logos and other means of advertisements as is common on websites. Monetizing the app by means of mobile advertising is by far the easiest option there is. There is a broad range of parties that offer mobile advertising. However, due to the range of options available, there are aspects to be regarded such as the type of device to be advertised on, the country as well as the capabilities of the provider. There is the option to use the services of mobile ad aggregators though, which are specialized in optimizing ads from a high number of mobile ad networks. These normally take a share of 30% - 50% of advertising revenue and the aggregators themselves incur another 15% - 20% on top. (Bloor, 2014)

Another option, that is reserved for those apps that sell well and have a large volume in specific regions, may be to sell ads directly to advertisement agencies or brands, which is called Premium advertising, or simply hire a media agency to take on that task.

Oftentimes, app stores offer pre-set mobile advertising services as part of the store and are, in some cases, even a pre-requisite to be allowed to include the application to said store.

Mobile advertising requires special care from the side of the developer, as both the design and code of the application requires to be compatible to present

advertisements, as well as have opt-out mechanisms. If the advertising becomes too intrusive, the abandon-rate of customers will rise. On the other hand, making the advertisement too subtle and irrelevant, means a diminished return from advertisements. (Boudreau, 2013)

Mobile advertisements are an easy way to make money with apps, given that the coding and design of the app allows for the usage of such and given that the ads themselves are chosen to be appealing to the audience. Contra points can be seen in both the miss-handling of the criteria mentioned above, as well as the reduction of full monetization-potential due to the expenditure that is to be had on the usage of ad networks and aggregators.

Sponsorships

Apponsor, a German startup, offers a way of earning money on apps without the necessity to display ads or charge a fee. The app is downloadable free of charge, however the user is asked to sign-up for a newsletter of the sponsor. In return for the sign-up, the developer is paid an amount for each registration. Apponsor offers to pay 40€ per subscriber on the sponsor's newsletter. It thus depends on the developer whether or not this method can be used both non-intrusive and monetary appealing. (Bloor, 2014)

Indirect Sales

This option is designed to drive sales in other branches but the actual app.

The general idea behind it is, that the app or website is distributed free of charges but includes mechanisms that are either affiliate programs that promote paid apps within the free app. These may be third party products or simply other apps of the developer. (Bloor, 2014)

Another option is to track and sell data to interested parties. This information however, should only be anonymous and consolidated in report as for obvious, legal and privacy reasons. (Bloor, 2014)

The app may lastly be used to trigger sales in the real world. Examples here may be apps that revolve around certain cars, magazine apps, as well as apps that focus on brands such as Burger King or Starbucks. This method is often applied by coupon applications such as Groupon. (Bloor, 2014)

Indirect sales can freely be combined with other methods of monetization mentioned before. However, one should be aware of the consequences of such involvements, as e.g. overly intrusive brand-advertisement may quickly lead not only to a high percentage of abandoning customers, but also to a reputation as a "sellout".

Component Marketplace

The component marketplace refers to the option of monetizing a developer's product by selling software components to other developers. Such a software component is a program with defined functionality. (Leiss, 2013)

These components have to compete to open-source software that is, as the name implies, free of charge with complete interchangeability of code. Component software offer two major advantages in contrast to open-source software though: Other than open-source software that oftentimes requires the user to open source their code when being used, component software does not legally require this, unless specified. Furthermore, component software-markets are an easy way to find and download components. Marketplaces such as .NET for Windows, as well as componentOne and Infragistics are well known examples that allow for a reliable and highly frequented marketplace. (Leiss, 2013)

This option can basically be described as the Business-to-Business (B2B) marketing of the app-world, where professional components of software with defined functionality are distributed to persons/developers interested. This approach requires a more specialized approach to sales however, as the clients are likely to be more knowledgeable in their field and thus demanding.

The favorable method of monetization

The choice of the most favorable method of monetization in regard to the app-market highly depends upon the following variables to be regarded (Bloor, 2014):

- What size of user base is wanted? (Free applications tend to attract a larger number of people: e.g. These may be enhanced with in-app purchase options, or advertisements to be disabled post purchase)
- What is the degree of trust in the product? (A product in high demand may easily incur several thousands of dollars per day when monetized using the PPD strategy. Other than that, competition or miss-assessment may lead to diminished returns.)
- What is the value of the product? (This can easily be determined using a trial-period product in which the customer determines the value of the product; Lean Startup-methodology used by apps)
- What is the type of the app? (e.g. Gaming-apps may be monetized by either being an ad-laden version for free, or a "freemium" type game that highly focuses on the sale of premium-content)
- Is the app sovereign or an extension? (e.g. If the app is used as a means to accelerate sales of physical or virtual products, offer the app for free and earn from increased revenue of the tangible products)

3.5 Key characteristics of mobile apps

Customers' segmentation and understanding of their needs are one of the essential blocks of business model development (Osterwalder et al., 2009). Understanding of users needs leads to key characteristics, which they will be expecting in mobile apps and which will have to fit to their needs.

All applications have common characteristics, although the performance level of these characteristics is different. Among all those presented in applications features there are several ones, which are most important for defining the successful and high-quality mobile applications. Startup time, Responsiveness, Focused Purpose, Customized Interactions with Off-Device Information Sources, Consistency of

Experience, Portability, Convenience, Localization, Security – all these characteristics are extremely important for mobile applications. (Rabi'u et al., 2012)

Startup Time

Startup time of applications is a vital characteristic, as users tend to use mobile devices frequently, yet for short bursts of time, the time to start up a mobile application is of importance. Whilst it might be a minor annoyance having to wait several seconds for programs to start, mobile applications that take several seconds to start are being regarded as a waste of time. Stating this, it can be said that time of usage of applications shall well exceed the session time of a mobile application-usage. Since mobile applications are used for a limited amount of time only, in contrast to e.g. desktop-applications, the startup times acceptable are proportionally shorter. This is a critical aspect, since users tend to run applications intermittently and for short amounts of time only. (Salmre, 2005)

Responsiveness

Since users of mobile applications tend to regard mobile devices as physical tools, feedback from the device is necessary, since a physical response is expected. In case of a missing, instant response, users tend to tap the device multiple times, which leads to unwanted results, as in the startup of another application or the procession of the second input within the application chosen originally. Thus, it shall be stressed, that users shall receive a type of acknowledgment upon performing an action on the device. (Salmre, 2005)

The most favorable type of response is the completion of the requested action. This is followed by the acknowledgement that the request is being processed. The third best response may be viewed as being a loading cursor or similar - the application not being responsive, yet giving an indication of procession in the background. The worst response is to do nothing and leave users wondering whether their action was registered.

Focused Purpose

Focused purpose revolves around the application consisting of a clearly defined set of things it does very well; these things shall be accessible with a minimum number of taps or other gestures; these must be processed quickly. The importance of focused purpose can be exemplified by the usage of designated buttons and icons that are assigned to specific tasks (a button used to display a database, an icon viewing schedules, etc.). (Salmre, 2005)

Any good mobile application should identify the tasks it is able to simplify. This yields true for high-level features as well as low-level tasks that are performed on a regular basis.

Regular mistakes in building mobile applications can be observed when it comes to writing as little code as possible with the intention of keeping the application-size as low as possible. This may not be done at the expense of functionality. A good middle ground shall be achieved and functionality always stands above size-requirements.

Customized Interactions with Off-Device Information Sources

It is vital to understand that mobile applications do not solely revolve around the code that runs on the device, but the off-device software that the mobile application interacts with must also be taken into account. (Salmre, 2005)

Information sources exposing services to mobile devices shall be considered carefully in the application's design to make sure that information backflow is appropriate for mobile usage. E-mail services for mobile devices may be used as an example. Such applications require server- and client-side software. The client accesses the server to receive information concerning his account and afterwards downloads relevant content. Since mobile devices tend to work with network connections that are intermittent in availability, distribute at lower bandwidth, and often more expensive than regular desktop-computer usage, the e-mail services for mobile devices shall be meeting those constraints. This might concern the limitation of size of content downloaded or specifying filters to identify information truly of use to the user. A server operating service designed for conservative use may need to

extend to effectively support mobile usage. Moreover, configuration mechanisms must be designed to run on servers, desktops, or the mobile devices themselves, letting users specify information needs and adjust the information filters to meet these requirements. (Salmre, 2005)

Consistency of Experience

Due to mobile devices being compact and self-containing, they are regarded as a single, unified experience. Normally, successful mobile applications are not regarded as discrete applications but rather as feature extensions of the mobile device. Due to this, the following of style guidelines for specific devices is important. The way users interact with the application (e.g. starting, stopping, navigating through and answering common inputs) are highly specific and specific behaviors unique to the device. Users unconsciously adapt their behavior to match the variables a mobile device's user interface requires; deviations from these patterns become uncomfortable. Mobile applications often only offer one way to accomplish a given task, the user being implicitly trained on how to achieve the results. It is by far more favorable having multiple different versions of a device application, rather than having a general application that does not integrate well into any device comfortably. (Salmre, 2005)

Portability

Portability concerns with the quality of the procession of a given application on different mobile devices, being measured. This can be done by running the application on different mobile devices, presenting a wide range of models and, thus, the application's ability to run on a large number of devices, is important. This ensures continuity and omnipresence of the application, in case of the user changing devices. (Rabi'u et al., 2012)

Convenience

Simple design and handling (one-handed) guarantees high acceptance. Applications that adapt to changes of context and situations (changes in light and noise, unsteady movement of the device, etc.) are favorable. It is therefore vital to design the

application with the intention to create a simple, joyful flow of interaction in mind. Analyzing users' needs and creating a useful idea out of such a framework is essential of course. (Rabi'u et al., 2012)

Localization

Localization and the usage of location-based information is a critical feature adding value und practicability. These features show the specific thought of the users' context. Naturally, this feature might not be applicable for every application, yet localization is not necessarily a big task. Simply by offering location-based feedback may already suffice for many applications. It can be useful creating a good user-experience. (Rabi'u et al., 2012)

Security

Security consists of several bullet points. Data transferred over the network must be encrypted through the carrier network. Since many applications synchronize data online, the storage of said data on servers must be secured. Moreover, the data stored on the device itself must be guarded, since it might be easily accessible for third parties (e.g. in terms of financial data). (Ivan et al., 2010)

It is difficult to say which of mentioned characteristics are more important and which less. For different categories of users importance of certain characteristics will have different level. That is why understand of customer's needs and preferences, one of the crucial parts of any product development, and mobile applications are not an exceptions.

3.6 Applications updates

The process of figuring out how and when to update a mobile application is a crucial part of the mobile app development process. (Joorabchi et al., 2013)

Update Stages

If to talk about software versioning (assigning a version number to the application as it exists in a unique state), the most common and simple scheme is to assign a major

version number with e.g. a number 1, followed by a point the number of release with minor updates, and sometimes followed by a second point the number of release with a revision or bug fix. (O'Brian, 2007)

In this case version numbers typically represented like "major.minor.revision" pattern. These numbers indicate what type of update an application has received and how many times. (O'Brian, 2007)

The Bug Fix

The most common types of application updates are usually introduced by bug fixes. This type of updates is typically covered in "revision" or "bug fix" part of the pattern. Bug fixes don't change the represented app features or its structure. Instead, these updates support the correct work of application according to the designed performance. (Cheung et al., 2013)

No matter how much beta or user testing a developer does before releasing an app, there are always going to be problems, bugs and issues that only show up after the app is used more broadly. Even with big amount of testing procedures, it is not possible to create perfect application right away, because anyway after broad usage some issues and problems will always appear. (Cheung et al., 2013)

Bug fixes updates is a way to keep the integrity and structure of the app unimpaired, while ensuring more optimal performance and smooth work without crashing.

Google's update policy with the market based on Android platform allows developers to make updates whenever they want. Such companies as Amazon, Apple and Microsoft, have an approval process for updates just as if it would be submitting of an application to the app repository in the first place. Although Apple has a policy with the App Store that allows developers to fast-track an important or crucial bug or security fix without waiting for approval of update. Anyway these exceptions are reserved for cases when an application has either consistent crashes or it is potentially insecure. (Clapsadl, 2012)

Because of these procedures many developers try to introduce several updates and

bug fixes together in one release. At the same time this process limits the number of new downloads for the user and don't make the developer to wait necessary approvals. Developers should decide the problem with bugs according to the amount of complains from users, and also by the severity of a problem they cause. (Clapsadl, 2012)

Adding or Removing Features and Updating UI

Much more significant updates comparing to bug fixes are adding or removing features from an app. It is very important process in the application development process. It is very important to take into account the feedback from the users, when it comes to adding some features. If enough users request some features, it is better to try to provide those new functionalities. (Murphy-Hill, 2013)

Just as important as adding features is removing some of them. Usually developers provide multifunctionality, but very often users don't like or use some features, or that it doesn't work as expected.

Also sometimes features have to be removed because of performance, stability, compliance or other issues. The fact of the removing of some feature will impact on users, but if the feature is causing performance problems or it's not being used, it is worthwhile to remove it. (Murphy-Hill, 2013)

Major Update or a Whole New App

A number of a major version shows that the application has some significant changes into its features, User Interface or both. And the very important question arises for mobile apps developers – is the major update will be a new app version, or it is already the time to release a brand new application. (Mansoor, 2013)

For the traditional software developers can charge some upgrade pricing, but this is not the case for mobile apps. Apple allows offering upgrade of apps only for free.

That is why the issue of new app release become very important – either developer is ready to provide new features for free, either he will decide to make of them different application and release it. Both strategies have their pros and cons. (Bloor, 2014)

Pros and Cons of Releasing an App Update (Bloor, 2014):

- **Pro**: Users, which already have the application, will be glad to get the update for free.
- **Pro**: App promotion and update will not require any changes of links to the App Store.
- **Con**: The development costs for the new version of the application will be due to potential new customers and their payments for app purchasing.
- **Con**: Users are forced to update the app.

Pros and Cons of Releasing a New App

- **Pro**: The developer has the opportunity of potential income from application purchases.
- **Pro**: Users are not forced to upgrade the app.
- **Con**: Users might not notice the new application or be not interested in purchasing a new version.
- **Con**: Migrating settings can be difficult or unsuccessful.
- **Con**: Application promotion might be difficult.

Most mobile app developers do not release a new version of their app, but simply update the existing one. For promotion of a new release some developers at first few days after the app release offer to purchase it with a discount.

In-App Purchase as an Update Tool

For developers of games for example, it is common to release new level packs and bonus options via in-app purchase. This is quite easy way to extend the game without forcing customers to buy and download a new version. But this kind of approach does not work with all apps. (Bresnahan et al., 2013)

4 RESEARCH RESULTS

4.1 Factors for mobile games popularity

The data from Apple Store Top Apps about 50 games was analyzed to answer the research questions.

Apple provides only limited range of games characteristics but with rather clear level of specifications. It is possible to assume that available characteristics represented in Apple Store are the most important ones for users, because Apple Store tends to be a source of clear information about all available software products and also a platform for purchasing those products. According to the availability of information about games and users' preferences the most informative and important for the study results will be following characteristics:

- Developers of mobile applications.
- Pricing policy.
- Genre of game.
- Availability of trial version of game app.
- Languages, available in the game.
- Number of rates.

The list of these characteristics covers significant part of data about mobile games, which can prove or refute the possibility of influence of those characteristics on popularity of the game and its position in the rating.

4.1.1 Developers

To achieve the stable position on the mobile applications market developers have to find the right strategy to be able to attract attention to their product or to be already popular due to strong competitive advantages, e.g. financial stability, experience.

Among all developers, presented in top 50, there are the several of most popular ones. It is proven by much higher amount of their games represented in top 50 if to compare to others and their stable position in the rating. These developers are

Electronic Arts Inc. with games NBA JAM, TETRIS®, Plants vs. Zombies, MONOPOLY, THE GAME OF LIFE Classic Edition; and Rovio Entertainment Ltd with games Angry birds, Angry Birds, Angry Birds Star Wars, Angry Birds Star Wars II.

Two cases further will represent the description of the success of Electronic Arts and Rovio. They show what kind of factors influenced on these companies' success and explain features of games that became important for getting high positions in the rating.

Rovio cases

The story of Rovio company is very simple and started from the enthusiasm of several students from Helsinki University of Technology - Niklas Hed, Jarno Väkeväinen and Kim Dikert. They decided to try to win a contest organized by Nokia and Hewlett-Packard. And their game "King of the Cabbage World" brought a victory. Being one of organizers of the contest from the side of HP, Peter Vesterbacka, who now is a chief marketing officer at Rovio, paid attention to the young developers and gave them the advice to continue making games. So the first step was the opening of their own business. Thus the company Relude was born, but two years later, in 2005 it changed its name to more familiar to everyone - Rovio Mobile. Mikael Hed, a cousin of one of the founders, became the CEO. (Rigney, 2010)

Michael's father, a successful businessman Kaj Hed, plaid a big role in the life of Rovio. He financially supported this initiative and now his stake in the company is about 70%. Kaj Head invested in Rovio one million euros, which have been successfully "lowered into the pipe" in the next few years. However, fortunately, Michael had his own funds. And after the first iPhone with a touch screen launching, programmers came up idea Angry Birds, Michael Nicklas persuaded him to invest in a new game 25 thousand euros. (Rigney, 2010)

The game "Angry Birds", which had been introduced in the end of 2009 by, became popular very quickly. After game launching, it was downloaded 2 million times in two months. And after a year this number was 50 millions. And this numbers become

more impressive if to remember that Angry Birds is paid game, which cost is $0,99 and $4,99 for iPad version. (Chen, 2011)

In 2011 the number of downloads exceeded half a billion, and in May 2012 it was more the billion. And newly released report on the financial activity of the Rovio Company says that 260 millions active users monthly play Angry Birds. (Jordan, 2011)

Before the releasing Angry Birds, Rovio Mobile already had an extensive experience in creating games. Since its inception in 2005 and before Angry Birds release, the company introduced 51 games. (Rao, 2011)

Experience from previous runs gave to developers quite much, but above all - understanding the interests of consumers. According to the Angry Birds' developers, before starting this game for a long time they were analyzed content of Apple Store. But the choice of the main characters of Angry Birds was almost accidental. So it turned out that the chief designer Rovio was good at drawing birds, so they have become the main characters in the game. And the "opponents" to them became pigs, because "nobody likes them". (Jordan, 2011)

Initially, the project was launched only for the Apple devices. When Angry Birds appeared on other platforms (Android, webOS, Symbian, MacOS, Linux, Windows OS), the game was for free. After the appearance of the game on different mobile operation systems, the real boom of "Angry Birds" started among owners of smartphones and tablets. According to the developers, the company has not spent a penny on advertising and promotion of the game Angry Birds - «Birds» themselves promoted, became the "viral" product. (Cheshire, 2011)

Today the series of Angry Birds game consist of lots variations in characters and several storylines:

1. Angry Birds. The first game was released on iOS on December 10, 2009. In the game, players use a slingshot to launch birds at pigs stationed on or within various structures, with the intent of destroying all the pigs on the playing field. As players advance through the game, new types of birds become available, some with

special abilities that can be activated by the player. Rovio Mobile has supported Angry Birds with numerous free updates that add additional game content, and the company has also released stand-alone holiday and promotional versions of the game.

2. Angry Birds Seasons. It was first released on October 21, 2010 for iOS. Versions for other devices appeared later. It has been updated to add several holiday-themed episodes and has four seasons of episodes.

3. Angry Birds Rio. Angry Birds Rio was released on March 22, 2011. The game is a marketing tie-in based on the 20th Century Fox animated film Rio. And from 2014, the game has been updated with new levels based on the sequel, Rio 2.

4. Angry Birds Space. Angry Birds Space was released on March 22, 2012. The game features elements from the preceding Angry Birds games as well as new gameplay mechanics. The stage is no longer flat, instead comprising several different planets, each of which has its own gravitational field that affects the trajectory of the birds after launch.

5. Angry Birds Star Wars was released on November 8, 2012. Merchandise related to the game was released on October 17. The game is a crossover with the Star Wars original trilogy, and casts the Angry Birds as the Rebels and the Piggies as the Empire.

6. Angry Birds Friends was first released as a Facebook app in May 2012 and was later released for mobile devices on May 2, 2013. The game features six-stage tournaments that change every week.

7. Angry Birds Star Wars II was released on September 19, 2013. The game is compatible with Hasbro Telepod technology to allow the player to summon a specific bird or pig into the game. The game is a crossover with the Star Wars prequel trilogy, and for the first time allows players to be either on the Bird Side as the birds or the Pork Side as the pigs.

8. Angry Birds Go! is a kart game released on December 11, 2013. The downhill racing game features birds and pigs from the Angry Birds series as racers, each with unique powers.

9. Angry Birds Epic. On March 12, 2014, Rovio announced Angry Birds Epic, a role-playing game that will feature turn-based fighting and a crafting system. It was soft released in limited countries on March 17, 2014.

10. Angry Birds Stella. On February 13, 2014, Rovio announced Angry Birds Stella, which takes on a markedly different approach to the other games in the series. This entry will focus on characters and adventure, and is described as being "about inspiration, empowerment and other real issues, without forgetting entertainment and quirky fun."

Why such a guileless game like Angry Birds, has turned into such a major game and user phenomenon? Involvement in the process of interaction with the game - that's where the answer lies. And this process is much bigger than it seems at first glance. Here only the main components that caused the UX (User eXperience) success of Angry Birds (Mauro, 2011):

- Simple and involving principle of interaction

Model of game action in the Angry Birds is fairly simple, while it is moderately diverse and active for attention attraction and differentiating of game results by using the same method of interactions. Here lies an important lesson for many developers that it is no good to complicate the level of user experience and interaction mechanisms with any application, not just gaming.

- Response time

Programmers, who worked on Angry Birds, could make the flight speed of birds as quickly as possible, but they did not for a reason. Instead, they made quite a smooth flight, and even track the birds' flight and added visual effects to fall and destruction. It slowed response time, but decided the issue of errors correction and slow processing of graphics on many smartphones (that expanded the circle of those who can run the game on their devices).

- Management of short-term memory

Angry Birds is an example of how to show resourcefulness in using human short-term memory during the work with application. At the start of each new game level user can quickly see the overall picture and remember it for the next few minutes, until he will pass the level. Repeating of such cycles on the one hand "cleans" short-

term memory, and on the other hand - fits into a pattern that is suitable for short-term memory mechanisms.

- Riddle is the key to attract the attention

Just as the gadget or architectural monument attracts the attention of millions, so application, which is designed taking into account such a mystery, is able to collect millions of views and downloads . Angry Birds is full of surprises and mysteries. For example, why suddenly in the frame small bananas and other fruits appear, and for accidentally getting into them you are reworded by extra points? Why in the beginning of each level pigs are slightly jiggling?, etc.

- Soundtrack

In Angry Birds' sound scale laid out in details and emphasizes the essence of the conflict between the characters.

- Appearance environment: association with positive UX and sales

Angry Birds has its own visual style. It represents a transitional stage from animation to video - quality graphics, and it has its own proprietary features, which other applications don't have. This applies not only to characters, but also to the environment and accompanying projects related to this game.

EA Games cases

Electronic Arts Inc. (EA Games) - the second largest developer and publisher of computer video games for various platforms, known for his sports simulators (FIFA, Madden NFL, NHL), as well as a series of popular franchises (Need for Speed, The Sims, Battlefield). The company is registered in the United States, Delaware, and operates worldwide through offices in North America, Latin America, Canada, Europe, Asia and Australia. (Rowe, 2011)

EA Games includes console games of various genres for a wide audience: Battlefield, Dead Space, Need for Speed, Mass Effect, Dragon Age and Star Wars: The Old Republic. Combines studio: BioWare (Canada, USA), Criterion Games

(England), DICE (Sweden, USA), Ghost Games (Sweden), Visceral Games (USA) and has partnership with companies Crytek, Respawn and Insomniac Games.

EA SPORTS develops racing simulators (Madden NFL, FIFA, NCAA (football), NHL (hockey), NBA LIVE (basketball), Tiger Woods PGA TOUR (golf and UFC) and a series of sports arcades. Key game developers of EA SPORTS are EA Canada and EA Tiburon (USA).

Maxis specializes in creating games for mass audience, in particular, such EA franchises as The Sims and SimCity.

PopCap creates a casual and entertaining game with a flexible payment system. Among of the studio developments such hits as Bejeweled, Plants vs. Zombies, Peggle and Bookworm.

All Play specializes in web and mobile games and develops interactive, casual games, which are available on Pogo.com. Exclusive contract with Hasbro allows EA to release the game on the basis of such hits as Monopoly, Scrabble, Game of Life.

EA brand portfolio covers many genres (strategy, shooters, action games, simulators, race) and includes proprietary games (Wholly Owned), and games, which are acquired from third parties and distributed under license (Licensed).

Major platforms that are the focus EA game are focused on such platforms as game consoles from Sony, Microsoft and Nintendo; Personal computers (PC); mobile devices (smartphones, tablets, readers); social networks (Facebook).

By the number of games for various platforms, EA portfolio for November 2013 looks as follows (Rowe, 2011):

- PC (129).
- Console: Xbox 360 (128); PlayStation 3 (120); Wii (74); Xbox One (9); PlayStation 4 (7).
- Mobile devices: iPhone (127); iPad (81); Android (41); Windows Phone (16).
- Social Networks: Facebook (7).

EA Games clamed that by the recent fiscal quarter earned the most money on the collaboration with Apple, selling their own games for iOS in App Store.

Statement is a true testament to the huge scale in the vast popularity of EA in App Store. According to EA, the company has earned over $ 90 million due to mobile games, although it was not stated how much of this amount was brought exactly from sales in App Store. EA COO said that revenue from mobile games many times exceeds the amount of money, received from the sales of the main products of the company.

Plants vs. Zombies

In 2009, the company PopCap Games has released a computer game called Plants vs. Zombies for Mac OS X, and Windows. A year later, the game comes to the platform iOS, which includes iPhone and iPod Touch, and in April of the same year there was a version for the iPad. Incredible popularity Plants vs Zombies gained after the game was released for the products of Apple company.

Plants vs. Zombies after nine days of sales in App Store earned one million dollars. It turns out that the developer company PopCap has sold over three hundred thousand copies of the game, which cost at that time $2.99.

But the most interesting and important story is adaptation of Plants vs. Zombies in China.

Before Plants vs. Zombies 2 has become one of the most lucrative mobile game in China, studio PopCap had to rethink the strategy of working in this region. Studio managed to defeat piracy, Fragmenting platforms, as well as unfair competition. Kun Liu, the head of EA Mobile China, told about all these trials during a speech at Game Developers Conference 2014. (Inoyori, 2014)

According to Liu, China is a big and powerful mobile market. However, to work in this area is not easy. Among the main problems EA called unfair competition. Other companies manipulated the game ranking in App Store to dissuade people from buying.

Plants vs. Zombies 2 successfully debuted in iTunes App Store in China and took the first place in the overall chart. However, a few weeks 5-star rating dropped to 2 stars. PopCap did not expect that someone would be lowering the rating of the project in purpose. It turned out that the manipulation of ratings is very common in China.

Deal with such activities EA was able by working closely with Apple and journalists. The company offers to all independent developers, who are entering the Chinese market, immediately write letters and contact the store administrator to stop unfair practices. (Inoyori, 2014)

Another test for PopCap was piracy. According to Liu, Plants vs. Zombies 2 was first launched in Australia and New Zealand. The stolen copy of the project appeared on pirate resources of China a couple of hours after the soft-launch. Five days later, on jailbroken devices in China, game was downloaded more than 6,000,000 times.

To fight piracy was not easy. To achieve sales, PopCap has decided to undertake a global localization of the game. Developers have modified the game by introducing a 3-star levels, added to the game new plants that can be unlocked as you progress through (you need to collect the pieces of the puzzle). The experts had to make serious changes in the game economy. Unlike the western version, the Chinese version requires the use of hard currency for the purchase of the sun, coins, stargate and gestures. Appropriate payment solutions, which would appeal to Chinese users also had to be select. Xsolla advises to use local e-wallets, which remain one of the most popular ways of online payment in the country. (Inoyori, 2014)

Developers of the game also added to the peach tree, which has big importance in Chinese culture, and kung-fu zombies. Local content was extremely important for the local audience. “Kung-fu master zombie” were drunk and super-popular in China.

So the mane reasons of Plants vs. Zombies popularity are:

- High quality of graphic, music and gameplay, controls are easy and convenient.
- Clear and easy plot.

- Reasonable price.
- Humour in the game.
- Diversity of levels and attributes.
- Localization (for Chinese market).

4.1.2 Pricing

Pricing issues are very important, because the price influence on willing of customer to buy the game and to purchase in-app extra features (Carpenter et al., 2010).

For publishing and selling an application in the Apple App Store developers have to stick to Store's rules. Apple provides the following opportunities:

- To pick the price
- To get 70% of sales revenue
- To receive payments monthly
- No charge for free apps
- No credit card fees
- No hosting fees
- No marketing fees

Among 50 top games there is a big difference in pricing, including Pay-Per-Download and In-App Purchases models.

Figure 8 shows that 42% is fall to the apps for price $0,99 and offered in-app purchases. 20% games are offered for price $0,99 for pay-per-download option. And less than half of apps are priced higher. This means that users prefer not to "overpay" for games and buy the cheapest ones.

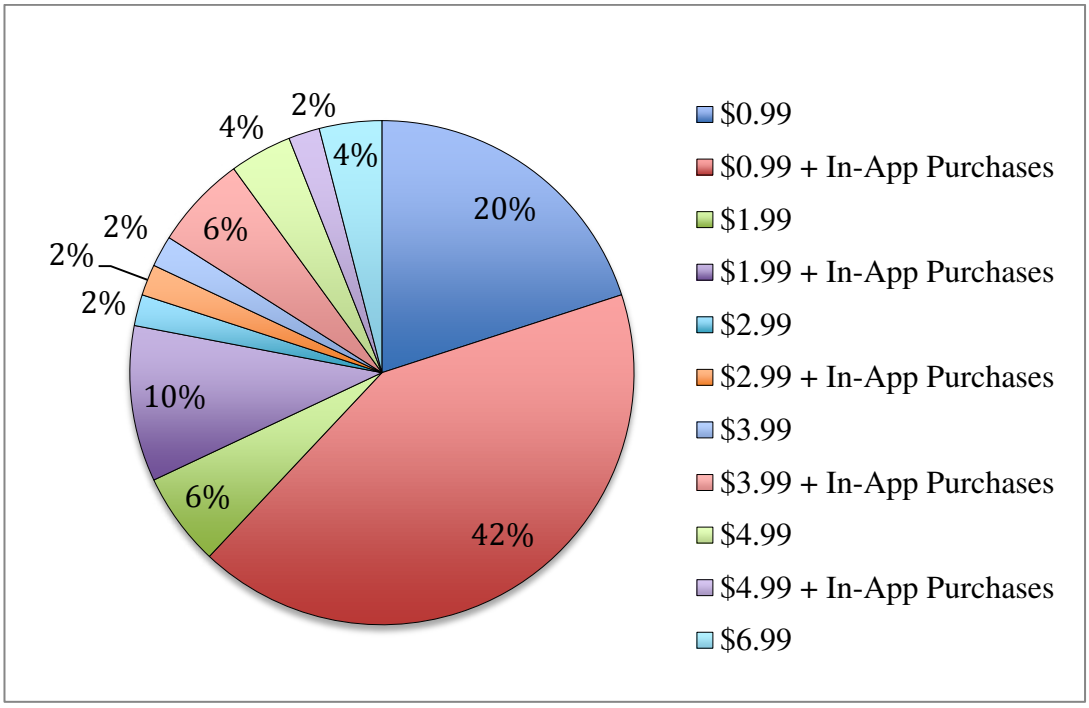

Figure 8: Prices differentiation

If to compare 2 models represented among top apps, In-App-Purchases are much popular. Figure 9 shows that only 38% of games are simple offered for download, and 62% provides the opportunity to get some benefits by making purchases during the game. This means that developers are trying to gain profit mainly through charging for extra options.

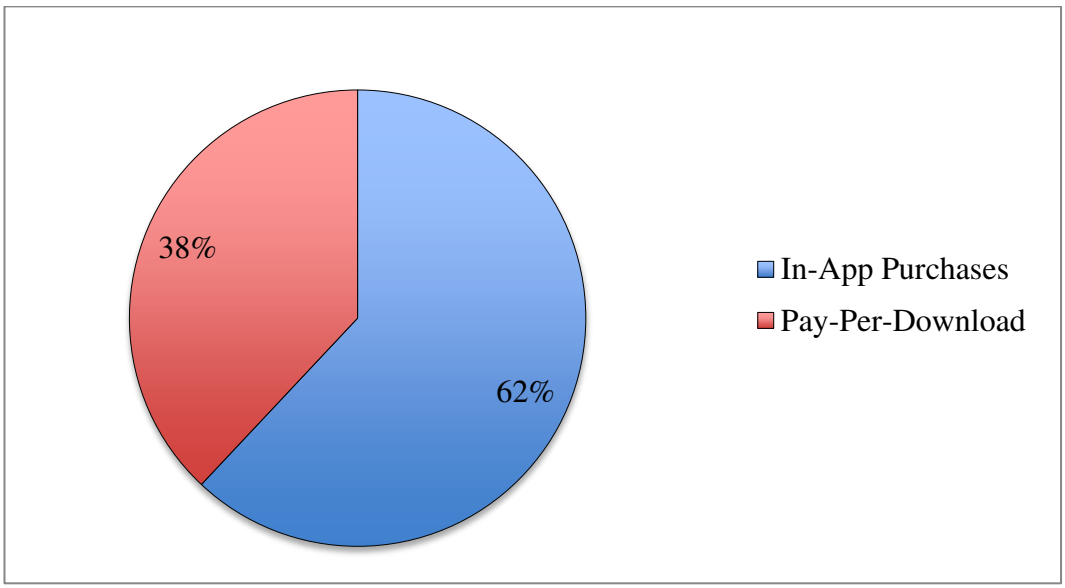

Figure 9: Correlation between In-App Purchases and Pay-Per-Download models

Though pricing policy is a big issue for developers, there is no direct correlation between price and number of app in the rating, as we can see from the bar chart (Figure 10). The game, which ranked second in the rating, costs $6,99. And there are many apps for fewer prices ranked lower.

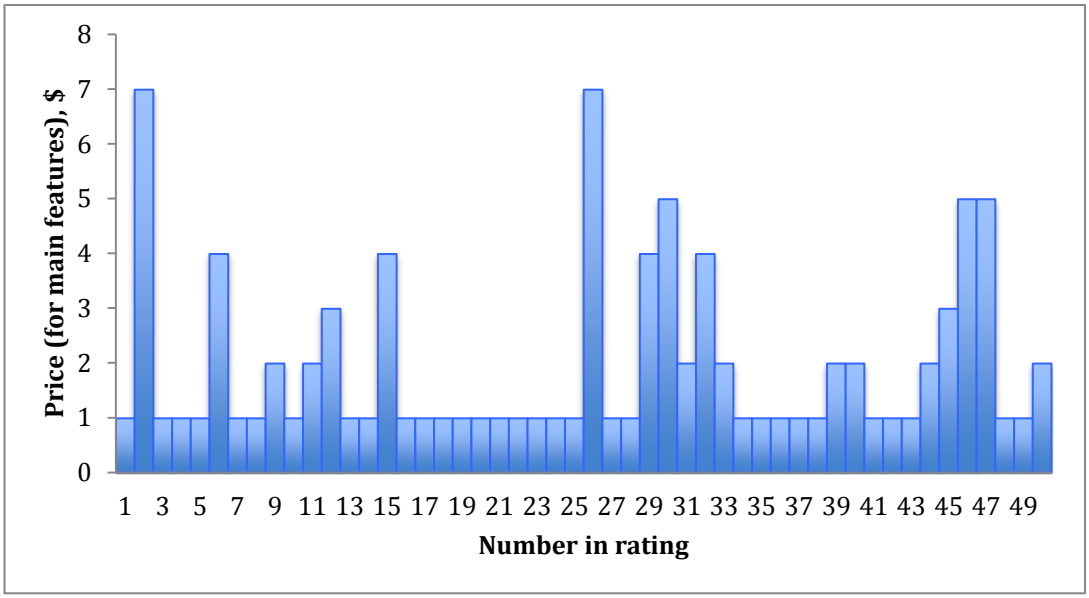

Figure 10: Correlation between app's price and its number in the rating

4.1.3 Genre

Genre of a game represents another feature of game and influence of its popularity. There are 10 main genres of games presented in top 50:

- Action - genre of games, in which player's success mainly depends on its rate of reaction and the ability to make quick tactical decisions. The effect of such games is very dynamic and requires intense concentration and rapid response to events, occurring in the game. Weapons usually used as primary means of progress in the game. (Adams, 2010)
- Arcade - game in which player have to act quickly, relying primarily on his reflexes and reaction. Gameplay is simple and does not change during the game. Arcade games have well-developed system of bonuses: scoring, gradually unlockable game's levels, etc. (Adams, 2010)

- Simulation - games with the possibility of simulation and control of some real-life processes. (Apperley, 2006)
- Puzzle – genre of games, which purpose is to solve logic problems. It requires from player engagement of logic, strategy and intuition. (Apperley, 2006)
- Adventure – game-story in which the player control the character, which is moving through the story and interacting with the game world through the use of objects, communication with other characters and solving logic problems. (Adams, 2010)
- Strategy – the meaning of such games is to convert some resource into an advantage over the enemy using the operational plan, developed with the changing situation. (Adams, 2010)
- Card – imitation of real card games.
- Board – imitation of real board games, which are based on manipulation of relatively small set of items that can accommodate on the desktop or in the hands of players. (Apperley, 2006)
- Sports – imitation of a sports game.
- Racing – the genre of game, in which player controls a car.

Most of the represented games are represented as combination of several genres.

Figure 11 shows that the most popular games are actions and arcades; less popular are simulations, puzzles and adventures. But in general, genre doesn't influence on app's number in the rating.

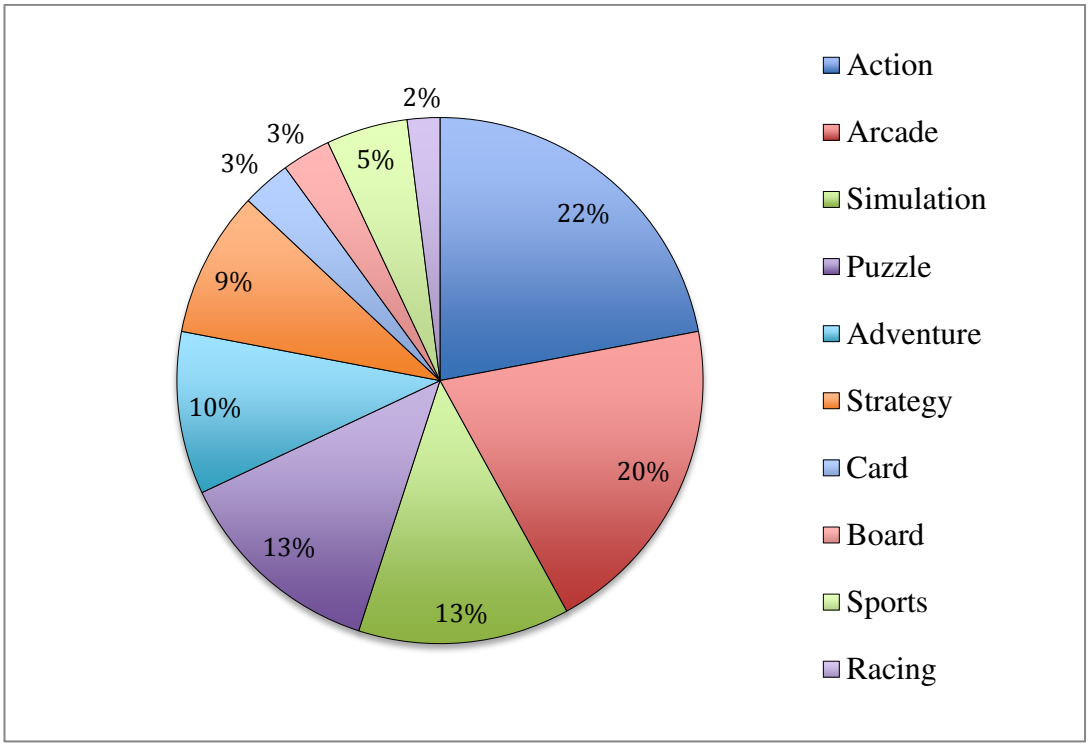

Figure 11: Genres differentiation

4.1.4 Availability of free trial version

Developers sometimes publish two versions of an application: a free version with limited functionality or banner advertisements, and a paid version with full functionality or no advertisements (Felt et al., 2011).

Figure 12 shows that in top 50 games the majority doesn't offer free demo version of games. Though 40% of developers provides the opportunity to try game for free, but, but in most cases it that assumes the very limited functionality and usually game contains or interrupts by advertisement.

There was an experiment by Verizon Communications, which even proved that free versions of games cannibalize paid consumption (Tercek, 2007).

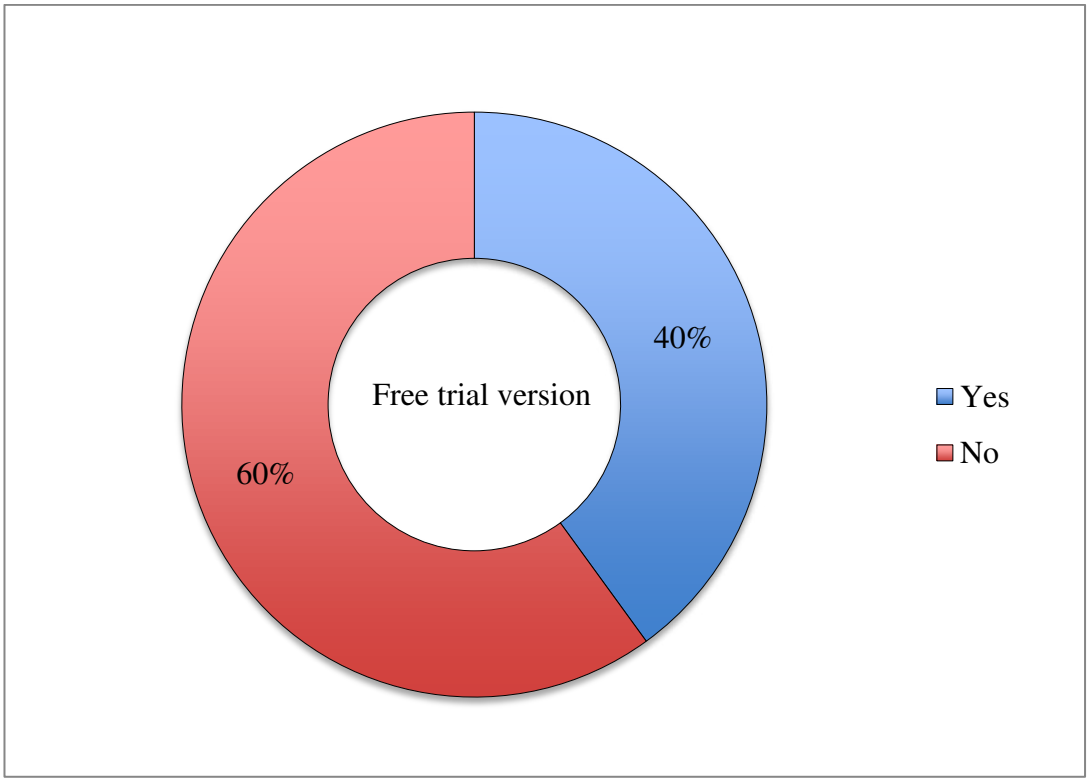

Figure 12: Percentage of free trial versions of games

4.1.5 Languages

App Store operates in lots of different countries, but the finale decision about the translation (localization) of an application depends only on developer and his will to target certain countries.

According to Distimo (app analytics platform for developers) publication on the impact of app translations the most important findings are:

- "In the Apple App Store in the top 200 for iPhone and iPad in the 12 largest countries support English language", so English is by far the most important language for applications.
- The implementation of extra language to application increases downloads and revenue, although this situation is more significant for iPhone apps.
- China is the only exception in the pattern of dominating of English language. The biggest percentage of downloaded apps in China introduced by those, which support Chinese language.

- Asia brings the largest share of total revenue by downloads of applications with native language, but other countries provide the most revenue due to applications with English content.
- Adding a native language to the application raise the number of download on 128% and revenue on 26% for iPhone. But it doesn't influence on number of downloads of apps for iPad and increase revenue only on 5%.

As figure 13 shows, the main language of all applications is English and the amount of localized applications is significantly less than amount of applications, where the only one language is English.

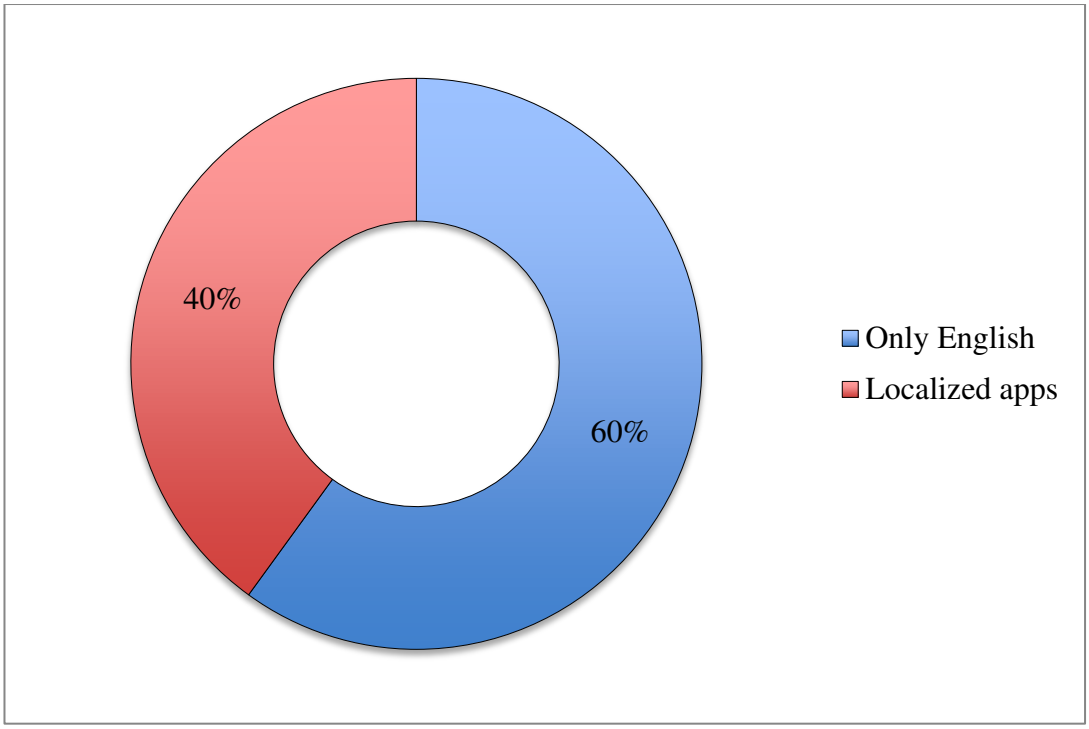

Figure 13: The correlation of localized and non-localized games

4.1.6 Amount of rates per month

To count the influence of number of rates on popularity of app, it was necessary to count an average amount of rates per month.

Each vote for the game from users builds the rating of app. Figure 14 shows that number of rates doesn't influence on position in the rating.

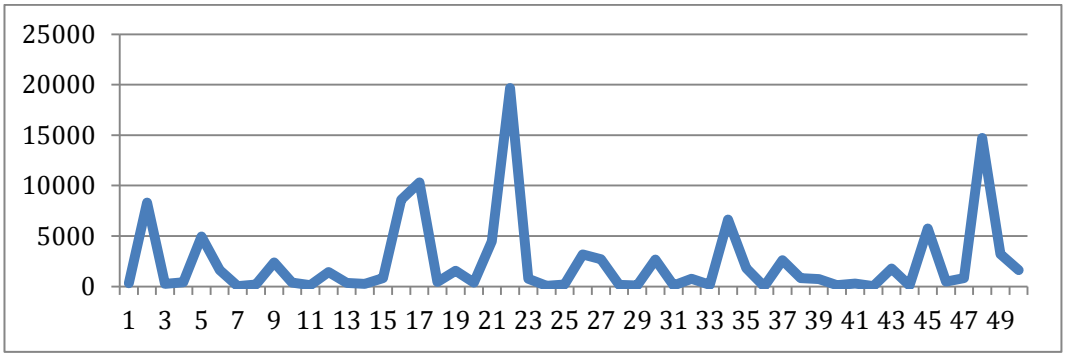

Figure 14: Number of games' rates per month

4.2 Types of changes, represented in games' releases

All releases of games is possible to divide into three groups:

1. Bug fixes.
2. Performance and features improvement.
3. iOS updates.

These changes' analysis shows their amount and structure in games' releases.

4.2.1 Bug fixes

Bug fixes and code updates are common to any software, and in the application development cycle it is very important to make the application as more stable and operative as possible before the release (Jannach et al., 2009). Figure 15 shows that out of all releases almost half consists bug fixes. There almost wasn't any game, which wouldn't have bug fixes at least in one of the releases, and which is process of work would be absolutely smooth.

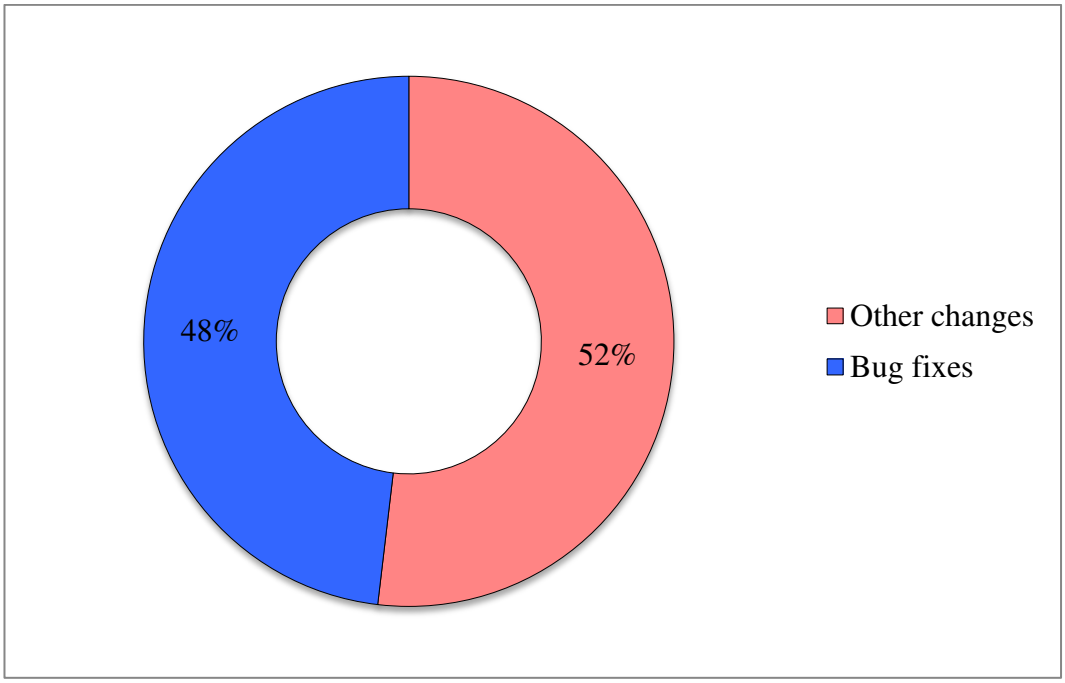

Figure 15: Percentage of bug fixes in all changes

According to the figure 16 the amount of bug fixes doesn't relate to the number in rating. Although it is not possible to claim that amount of bugs doesn't influence on popularity of mobile application. We can only assume that small number of bug fixes means that game was well-developed from the beginning or it's life-cycle was too short to make them appear.

Among all problems elimination, the most common out of top 50 games were:

- Controls improvement;
- Physics engine optimization;
- Visualization (graphics) improvement;
- Game balance improvement;
- New phone models and Retina display support;
- Battery consumption reduction;
- Memory space optimization;
- Load time improvement

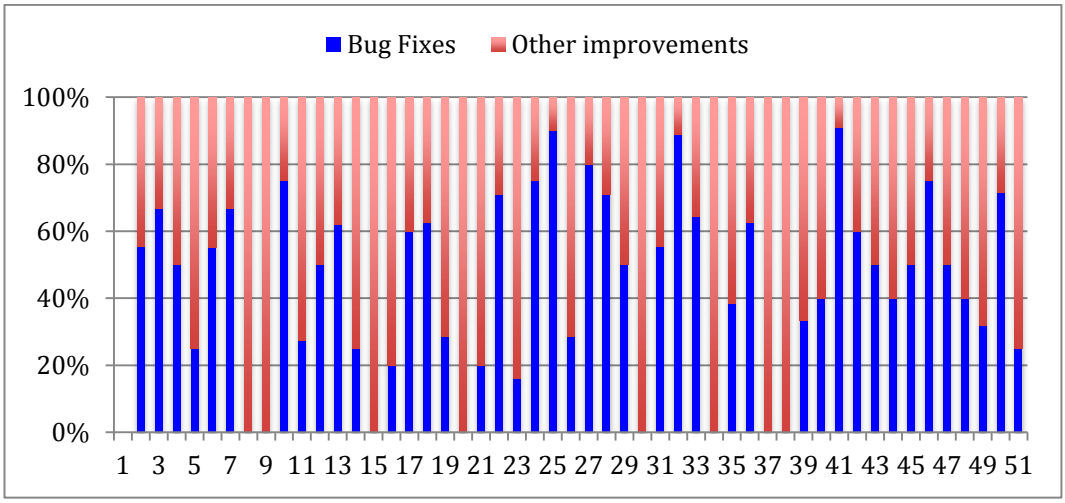

Figure 16: Percentage of bug fixes in all changes for each game

4.2.2 Performance and features improvement

Performance and features improvement take place in 69% of releases that is shown on the Figure 17. Operative and functional characteristics play very important role for the user. Obviously developers are trying to improve usability process as much as it possible. Also, among all improvements in this direction, it is possible to distinguish the following:

- New levels and modes of the game;
- Connection to social networks (Facebook, Twitter) and Youtube;
- AirDrop sharing support and iCloud synchronization;
- Sound effects, music options;
- Interface improvements;
- New languages support (localization);
- Tutorials and help system;
- Multiplayer options;
- Screen rotation support;
- Bonuses, statistics, score system improvements.

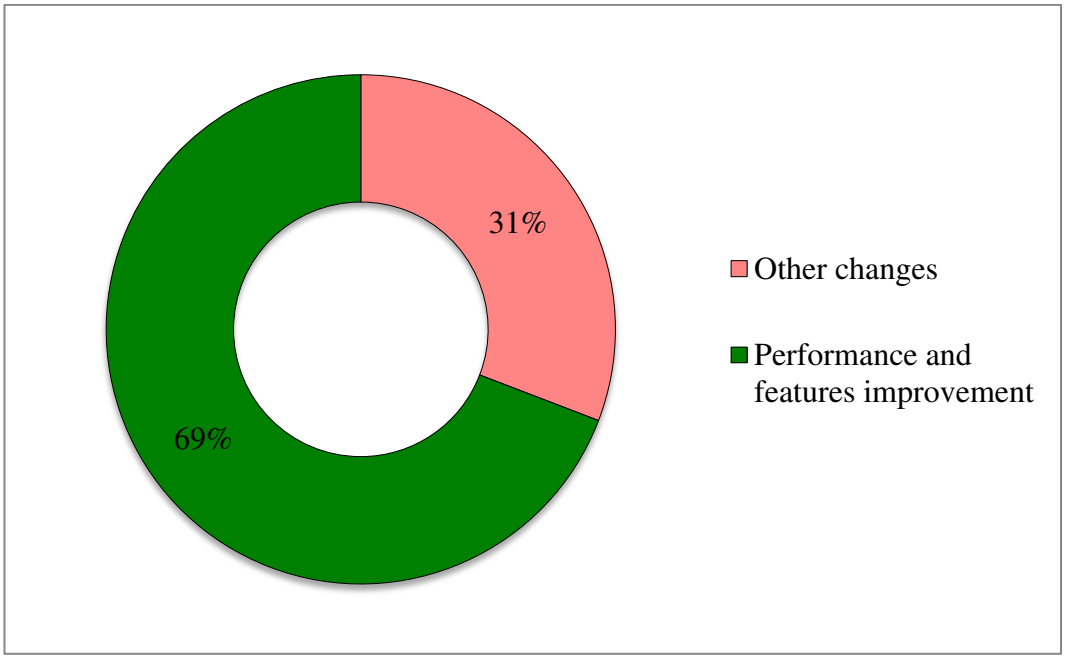

Figure 17: Percentage of performance and features improvements in all changes

Figure 18 shows that among all top 50 games almost all have high level of features improvement, although there is no clear tendency of rating dependence from this factor.

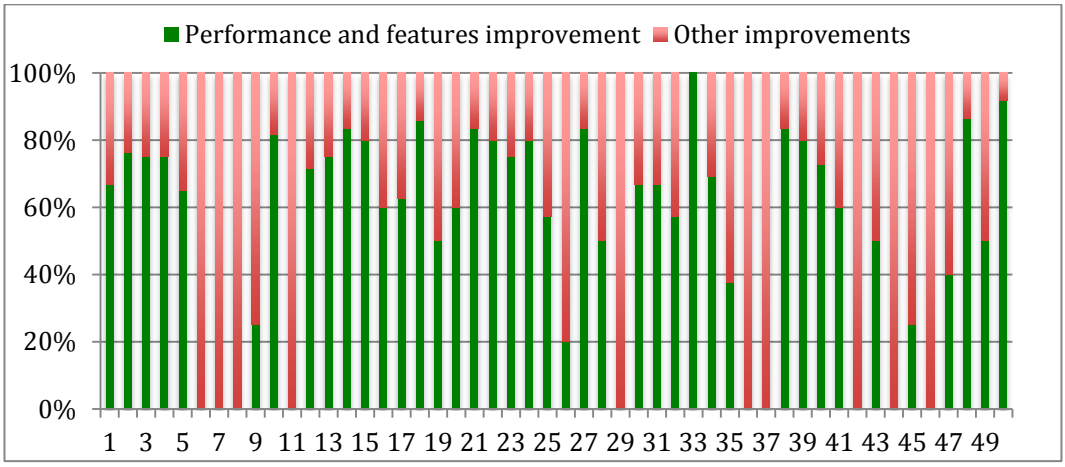

Figure 18: Percentage of performance and feature improvements in all changes for each game

4.2.3 iOS updates

Compatibility with operating system is very important for the application. Developer has to understand that changes in software for the mobile phone also have to be considered during the application development (Reijers et al., 2003)

There are only 4% of iOS updates among all changes introduced in realizes of games from top 50, as it shown on the Figure 19. There are several reasons of this fact. Applications were released in different time, and there are many relatively new ones among them. And as Apple introduce new versions of iOS with different intervals of time.

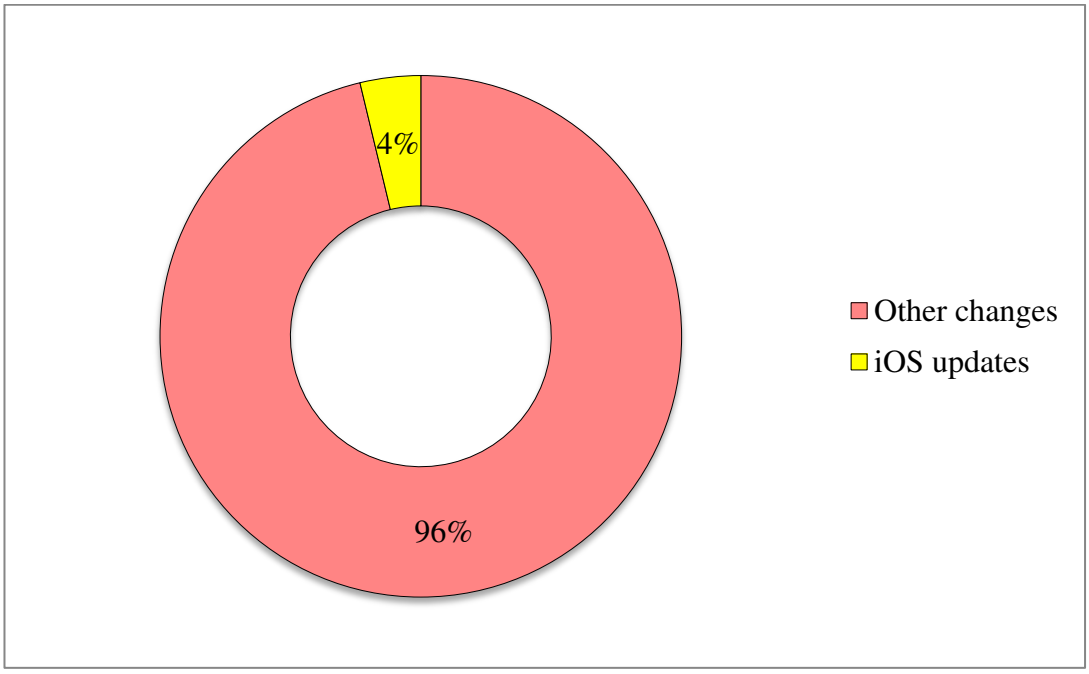

Figure 19: Percentage of iOS updates in all changes

The "youngest" game in the rating is from 15th of March 2009. Since that time it was released 5 different iOS with various variations inside them. Percentage of relatively new games (released 2013-2014) comparing to older ones is shown on the Figure 20. So it is exactly the same amount of new and old games in the rating. But in this case amount of iOS updates has to be relatively higher, and this means that developers don't pay necessary attention to these kinds of updates. It is quite risky, because

incompatibility of operating system and game may cause such problems as hanging of the game, its crashing, inability to run, etc.

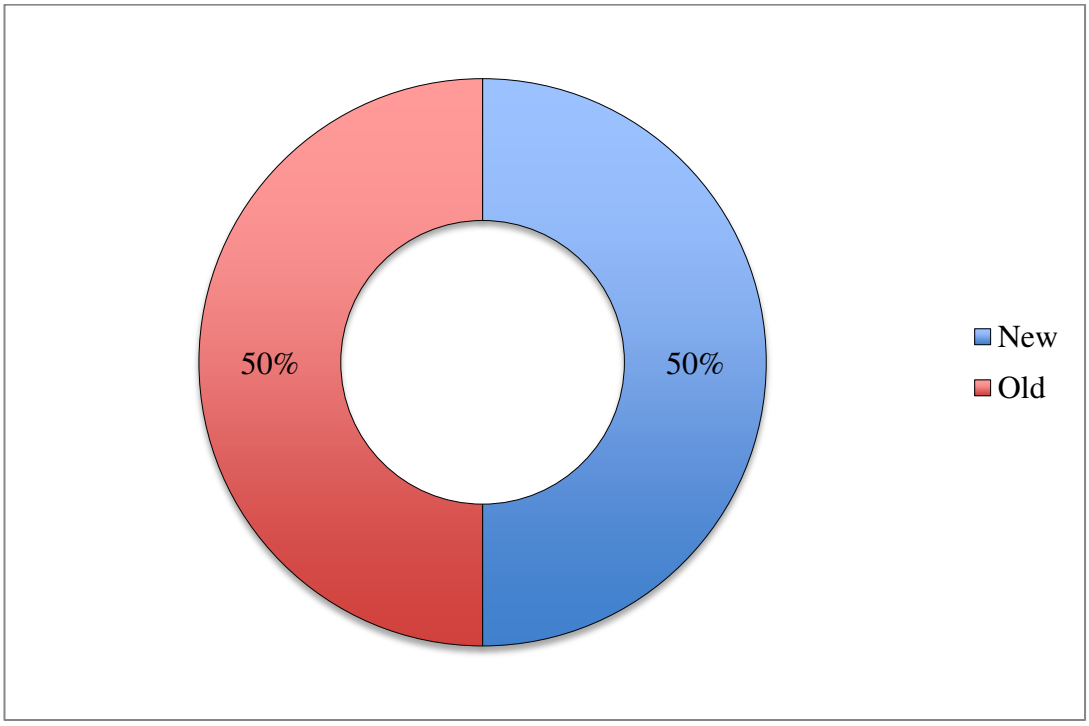

Figure 20: Percentage of relatively new games (released 2013-2014) comparing to older ones

Figure 21 shows general comarison of all types of changes in releases. So it is very clear that performance and features improvements almost in all games is the main component of all releases. This means that developers are trying to interest and impress gamers with new options, levels, game modes, etc.

Quite big amount of bug fixes can be viwed from two points. First of all, it is a good tandancy that developers are trying to make the game process smooth, but second, it says that new games, which they release, are in a very “row” condition and need quite a lot improvements.

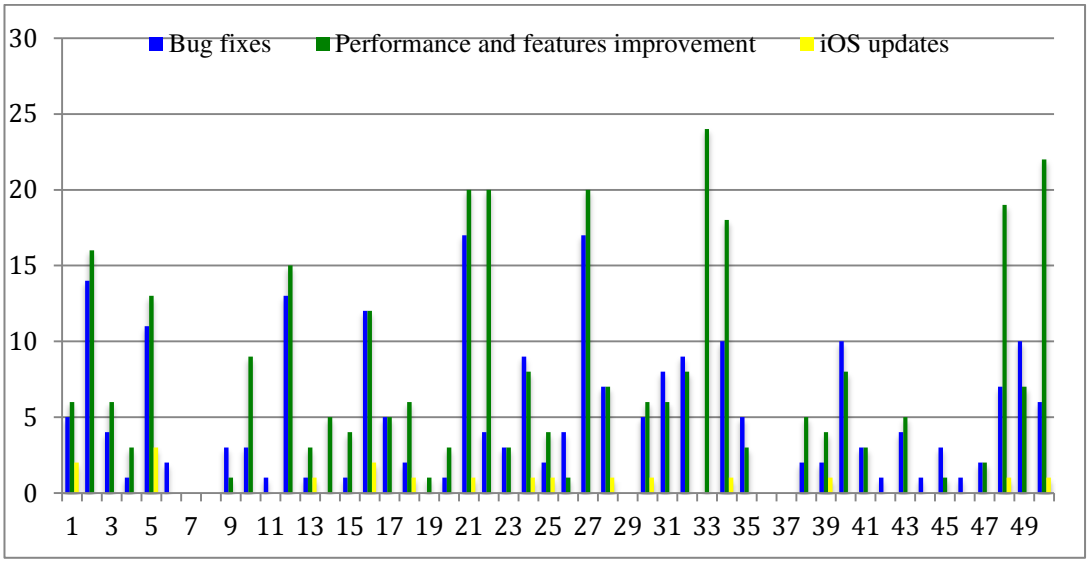

Figure 21: Correlation of all types of changes among each other

4.3 Frequency of releases

All games from the rating have different duration of existence and different number of releases. So for information about frequency of releases it is necessary to divide the total number of months since game was release for the first time to the number of releases. Due to calculations we will get the average number of releases per month for each game from the top:

$$\text{Frequency of releases} = \frac{Number\ of\ months}{Number\ of\ releases}$$

Frequency of releases for each game is shown on a Figure 22.

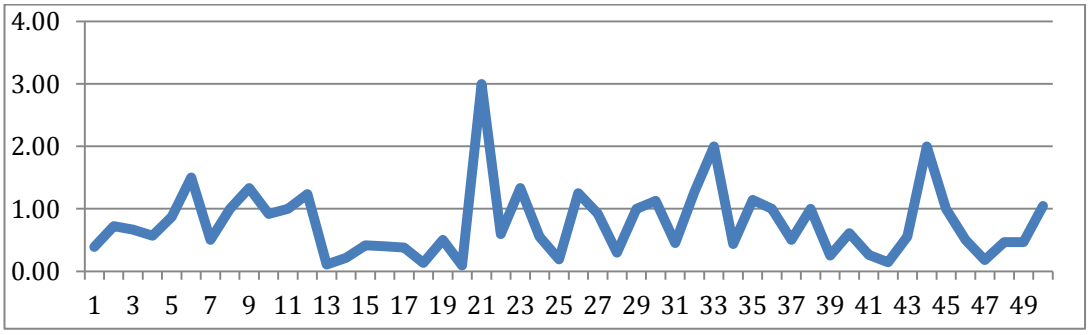

Figure 22: Frequency of releases for each game per month

According to the colculations, the highest frequency is approximately 3 releases per month and the lowest is about 1 release per year. But if to take into account the fact that some of games, represented in top 50, are not new ones and the period of active updates for them ended some certain time ago depending on particular game, and developers don't update them anymore. So according to observation it is possible to say, that avarage amount of updates is 1 release per month.

From the figure it is understandable that frequency of releases doesn't influence on number in the rating. Because the games with highest friquencies and lowest friquenses ranked absolutely not regularly. Big amount of releases may say as about positive characterestics of the game, such as features and performance improvement, but also about negative performance, such as big amount of bugs, which developer have to fix from one release to another.

5 DISCUSSION

This study revealed that only few factors have much influence on the popularity of mobile games while the influence of other factors still needs to be studied.

First of all, the mobile application developer popularity plays quite important role. Users pay a lot of attention to those developers, who are already popular either due to years of the experience in the industry, either due to the luckily or smartly chosen marketing policy.

For example, Rovio created a game that encourages users to use the app over and over again. The company comes up with regular updates; also it provides the opportunity to get free versions of the updates. Angry Birds is now not just a mobile game, it is a brand, which is more or less popular all around the world.

Also nowadays mobile app developers and some companies arrange partnerships. Developers implement popular and well-known brand ideas to the mobile application, e.g. movie and cartoons themes, heroes of comic books, popular toys such Lego, etc. And due to popularity of some huge corporations new games releases instantly become very popular. However, the app developer in this situation, most likely will be enjoying only a small share of the revenue, because the main percentage of the profit will go to the rights holder.

Another feature of the mobile apps, which is influence of their popularity, is the genre. The conducted research showed that people prefer to play in quite active mobile games, which assumes attention to the process and high level of involvement. The most popular genres are action and arcade, and simulation and puzzle games follow them.

Although it is necessary to mention that usually games represent the mixture of several genres, and it will be not very correct if not to say that puzzle and adventure games do have a wide range of admirers.

Pricing policy is also one of the most important factors, which influence on game popularity and buyers will to purchase it. Users prefer not to spend more than $0,99

for one game. And at the same time they are not afraid to give this small amount of money even without opportunity to try game for free.

Moreover, users spend much more money on in-app purchases. Very often it is the main source of revenue for developers of paid games. People prefer not to pay much at first, but better spend some money on bonuses and extra features.

If to say about games updates, e.g. bug fixes and features improvements, most likely the have indirect influence on mobile game popularity and its rank position. Of course users will not be satisfied with a game, which crashes all the time and doesn't provide nice gameplay. But the fact that good game or any other good mobile application does not have bugs is taken for granted. So it will not be able to impress users just with bugs-free app.

Much stronger affect is coming from features updates. Even if users really enjoy playing game, after some time it might start to be boring to have just the same old options and levels. So app developers can impress their apps' users by introducing new features and improving game performance.

The research did not show that other selected factors have influence on mobile games popularity and ranking. Although it does not mean that they are completely unimportant and in another circumstances will not make any difference for mobile game position in to charts.

If to look at the study results from the points of two theoretical frameworks – The Lean Startup and The Business Model Canvas – it is possible to say that during mobile app lifecycle all nine building blocks which cover the main four area of business: value propositions, infrastructure, costumers and financial viability, are involved in a process. But not all of the developers stick to the "build-measure-learn" process, and rarely are able to collect, analyze and react on users' feedback with proper adjustments.

6 CONCLUSION AND RECOMMENDATIONS

6.1 Recommendations for Apple App Store optimization of app representation

App Store optimization is a necessary tool for getting the higher rank in an app store's search results. App Store optimization helps to achieve following goals (Ganguly, 2013):

- Increase discoverability. People easier find application in Apple Store, it can increase organic downloads on 30-100%.
- Increase the conversion of uploads. People who came to the application page will make installation of an application 1.5-2 times more due to more attractive page.

Below there is a description of application optimization for the App Store.

Application Name

Keywords in the title are the most important factor in ranking in the search results of the App Store, as well as in Google Play, so it is necessary to add them to the title. (Haig, 2013)

Application Lingualeo calls "English with Leo", that is why it is shown in the App Store in top 3 apps for search with a key word "English".

In addition, the name must be clear what the application is about, so it is useful to write a short description next to the name.

Figure 23 shows that keywords in title increase the ranking on 10,3%.

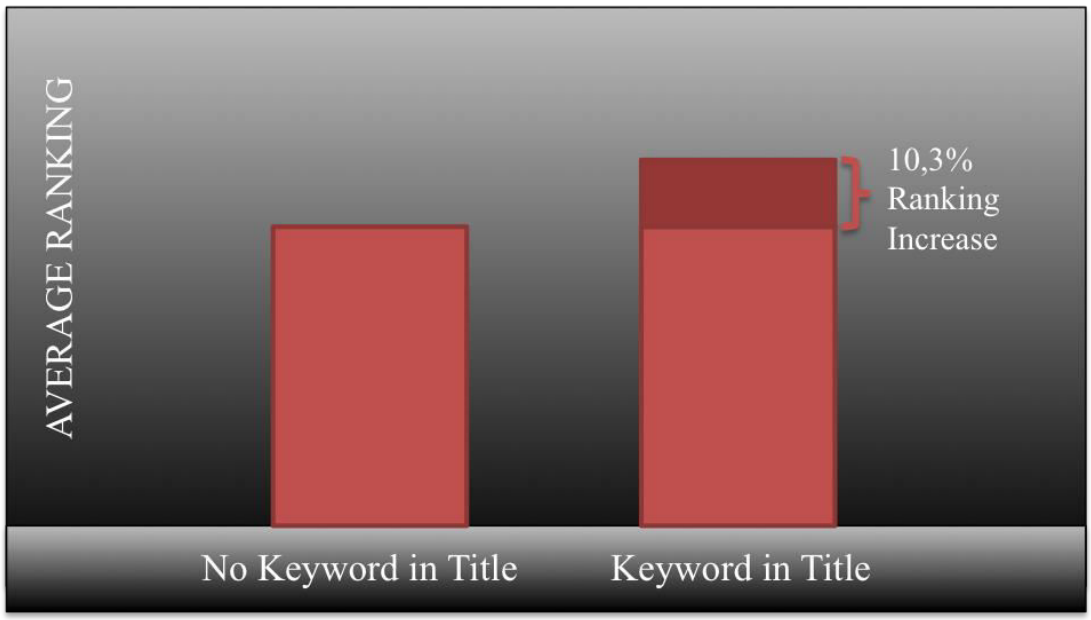

Figure 23: Influence of keywords in title on application ranking (Haig, 2013)

Keywords

Keywords are the most important factor after the title, which affects the position of the application in the search. (Klein, 2014)

In the App Store for keywords is a separate field, and it is very important to fill it correctly (Klein, 2014):

- There are only 100 characters, including commas.
- It is possible not to use spaces to save space.
- In each country it is necessary to use different keywords, this means that they should be fully adapted to each country.
- It is necessary not to repeat the keywords that are already in the application name or the name of the developer.
- If you want to enter the phrase, use separate keywords.
- Until the application does not have enough downloads, it is better to use more diversified keywords.

Application Icon

It is obvious that icon should be beautiful. It has to attract the attention and force users to download the application.

Screenshots

It is necessary not just to place application screenshots, but also add a short explanation, highlighting key features of the application. So it is preferable to follow recommendations:

- Select and highlight 4-5 main advantages and features.
- Make screenshots showing these features.
- Label these features on these screenshots;
- In App Store the first screenshot is especially important - it is first demonstrated for a user during the search. That is why the most important feature has to be on the first screenshot.

Description of the application

More than half of all users read the description, so it is very important to work it out as good as possible. First it is shown only the first 2 lines of description, so it is important to make user immediately interested.

In general, it is better to describe consistently all the major issues starting with the most important that user might be interested in. Long description it quite good, because those users, who will read it through, most likely will install the application and also will start to use it actively.

“What's new”

Instead of “dry” “bug fixes” description it is better to tell a little story. It will appeal to current users and will attract new ones, which only read the description.

Here is the example how developers of the game Plants vs. Zombies pay users attention to the improvements: “We're working day and night (and pool, fog and

roof-top) to bring you a ton of new zombie smashing goodness over the coming months. Watch out for new game modes, a bunch of extra achievements and a pixel perfect Retina version of your favorite game featuring plants and zombies."

This type of description is much more interesting and exciting than simple ascertaining of facts.

Rating

It is difficult to overestimate the importance of rating. Applications with 4 "stars" users download more often than 3-stars apps. So it is necessary to make high-quality applications and encourage users to post positive reviews.

Reviews

Over 60% of the users before download the application look at the reviews.

It is clear that the ideal situation is when all reviews consist only of good feedbacks, but it happens rarely.

Reviews are a great feedback. Constantly analyzing the reviews, it is possible to improve an application till perfection. If people ask something or if they are dissatisfied with something, it might make sense to fix this in future updates.

6.2 General conclusions

The main purpose of the study was to find out factors for mobile games applications popularity and ranking and to develop recommendations for mobile games app store optimization of app representation. According to the findings, developer's popularity, genre and pricing policy are the main factors for mobile games popularity. Also quite often those characteristics influence on rank position of the game.

Such changes as bug fixes and features improvements have indirect influence on mobile game popularity and its rank position. But much stronger affect is coming

from features updates. Direct effect on rank or popularity of the game of those characteristics has not been discovered.

Nowadays smart marketing campaigns and promotion are one of the most important tools on mobile apps market. Brand loyalty appears not only within device choice, but also in software products. That is why for developers, who proved themselves and achieved big sales, it is much easy to win not only new customers but discover new markets due to the stable position and proper strategy choice.

This study also suggests recommendations for mobile app representation in App Store. This factor is very important, because App Store represent the platform, through which product (mobile application) can attract customers and be delivered to them. Moreover, this platform offers convenient options for the app development process and makes monetization of the application much easier.

Even though this study contributes significantly to the research of features for mobile applications rating, this topic requires further research. Because of the mentioned in Chapter one limitations of research it was not possible to cover all related topics and get more detailed results. That is why there were developed suggestions for the further research:

- Research of other categories of applications, including the data represented in other app stores. There is big amount of app stores except Apple App Store, such as Google Play Store, BlackBerry World, Windows Phone Store, Amazon Appstore, SlideME.

- Collecting and analyzing the data about apps' rating changes due to releases of new versions. This means simultaneous process of collecting data from several sources about influence of changes in new app releases on the rating of particular app.

- More detailed research about visual representation of applications in app stores. Influence of certain app parameters changes, represented in app store.

- Extension of time boundaries for data collection about rating changes of a particular game for more detailed results.

- Conducting the same type of research for other types of applications.

There is a possibility that conducting of another study using mentioned suggestions may influence on results and list of the features for mobile application rating, and give more clear results and increase reliability of research.

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