Mobile OS: analysis of customers' values

Georgii Shamugiia

Haaga-Helia
University of Applied Sciences

Author(s)	
Georgii Shamugiia	
Degree programme	
Bachelor of Business Administration SAMPO18	
Report/thesis title	**Number of pages**
Mobile OS: analysis of customer's values	**and appendix pages**
	14 + 47

The rapid development of the mobile industry since the start of new millennium led to much more extensive usage of mobile devices than desktop computers. Fast-developing technologies of wireless networking led to the excessive need of a device, which can search any info on the web conveniently, be a decent communicational tool and be able to adapt to different needs of customers.

The device which fully fulfils this need is a smartphone, which is being widely used today by the majority of the global population. In this thesis, the author digests the tools, which allows smartphones to work appropriately, give consumers a pleasuring experience while using them and run all the operations and data stored on them. These tools are mobile operating systems – platforms, which allow all those things and even more. In this research, the author investigates the historical development of mobile operating systems, which put a mark in the history of the industry. By digesting three cases of Nokia, Blackberry and Microsoft, the author explains what were the selling points, that succeeded and managed to popularise each mobile operating system globally among consumers and gadget manufacturers and what were the reasons that caused their global downfall.

A separate chapter of this research is dedicated to a survey regarding customer values and customer opinions about mobile devices and mobile operating systems. This part is concluded to analyse what are the key features customers thrive on, and what do they value the most about the software they use daily. In the last chapter, the author discusses recent events around mobile operating systems development. By concluding all previous chapters and giving a subjective look based on given facts for those events, the author invites the reader to a discussion about the future of Mobile OS for the consumer market.

Keywords
IT, Mobile Operating Systems, marketing, consumer behaviour

Table of Contents

1 Introduction

This chapter is the overview of contents where reader familiarises himself with key-topics and methods this research uses.

1.1 Purpose of this research

The purpose of this thesis is to try to analyse the current values of the different customers in the process of buying and using their gadgets. The aspect which I will be focusing upon is Mobile Operating Systems which are developing rapidly today and being one of the most crucial selling points for the customers worldwide. In this thesis, I aim to identify what are the values of using mobile operating systems for general customers and B2B enterprises which use them in their tech-gadgets.

By using the case-study method of research, I will try to find significant milestones which changed mobile market numerous times and try to apply this knowledge to organise – what are the essential aspects of mobile operating systems for both companies and consumers. I will gather primary data by asking consumers about their needs and opinions towards their smartphone's operating system and experience they had. By using this data, I invite the reader to a discussion, which will focus on the significant trends for the future development of MOS's. The central question for this research is **how customers perceive Mobile Operating Systems?**

1.2 Aims and importance of the study

This thesis will not focus on the technical aspect of Mobile Operating Systems, mentioning only specific technical terms, essential for understanding why the particular part of the operating system was valuable for the customer or to understand the given topic. The principal aims of this thesis are to provide insights about how different platforms gained and lost consumer's trust; introduce the reader to concepts of customer-behaviour and Crackberry's hierarchy of smartphone needs; explain, what will be the primary focus for software developers for the nearest future.

The importance of this research is dictated by the current environment in IT-business filled with events which lead companies like Huawei to develop their own MOS, that are independent of Google (Schroeder, 2019). Customers concern over the security of their data which is exposed to third-parties more than it has ever been (Kelly, 2019). Overall duopoly on the Mobile OS market and any possibilities of new companies entering the mobile operating system market.

As any discussion on operating system "usability" and performance, this research can not be entirely objective as terms like design, value for money, the responsiveness of the software," user-friendliness" and the others are subjective to each user with his own needs, wishes and especially scenarios of using MOSs. As arguments for specific operating system failure or success, I will use secondary data such as market researches, sales sheets and customers feedback.

1.3 Data collection & research methods

This thesis is written based on a mixed method of research design. To examine what creates a value in the mobile operating system for consumers, I use a web-survey data collection method. To digest how original equipment manufacturers like Nokia, Blackberry and others were using mobile operating systems, I use the case-study method. Mainly, this paper is using qualitative data to analyse the material provided. Additionally, only official versions of the mentioned software acknowledged by their respective owners will be discussed. Therefore, any non-official releases of MOSs or modifications will not be mentioned (ex. Jailbroken IOS; custom firmware, developed by third-parties, various iterations of Android-based overlays such as MIUI, TouchWiz, ONE UI, ColorOS and others).

1.4 Key-concepts

App – Application – a program installed or pre-installed on PCs, smartphones and other devices that executes specific functions and performs user's tasks (Goodwill Community Foundations, 2020).

App distributor – a program, which allows software developers to distribute their applications to users, which they then can download on their devices (Peters, 2020).

B2B – business-to-business – customer-seller relations between two corporate entities/businesses (Chen J. , 2020).

B2C – business-to-consumer – a direct relationship between business selling products or services to individuals (Kenton, 2020).

MOS – Mobile Operating System – an operating system which powers mobile devices like smartphones, feature phones and tablets (Viswanathan, 2020).

OEM – Original equipment manufacturer - a company whose goods are used as components in the products of another company, which then sells the finished product to the end-customer (Kagan, 2020).

PC – Personal Computer – a computer, which can be used for multiple purposes by a single individual (George, 2020).

PDA – Personal Digital Assistants – pre-smartphone era gadgets, small tablets with typically come with a stylus (Conrad, Misenar, & Feldman, 2010).

SDK – software development kit – a pack of instruments, guides and tools for software creation (Glas, 2020).

Smartphone – a phone, which has computing features and the ability to connect to the internet (Computing Home, 2020).

UI - User Interface – a graphical interface, which the user interacts with to use the device (Android Developers, 2020).

UX - User experience – a reaction, emotion and reflection regarding using the product or service (Norman & Nielsen, 2020).

1.5 Project plan

The table below summarizes the whole project in one table and describe methods, with which given aims were achieved.

Table 1. Project plan

Project step	Aims	Design	Method of data collection
Theoretical framework	Understand basic concepts, around which all the other contents will re-volve	Gathering the secondary data	Books. Articles. Magazines.
Case-Study	Explain why com-panies succeeded and failed in work-ing with consumers and OEM's	Research the timeline of the development of three given MOS	Web-Archives. Public statistics. Reviews. Journalistic and professional opinions.
Web-Survey	Gather data on how consumers per-ceive MOS	Collect primary data	Internet-questionnaire. Other surveys and research materials.
Discussion	Explain the data gathered before and identify trends in modern MOS de-velopment	Summarize the previous data, give a subjective opinion toward MOS develop-ment for con-sumers	Previously given materials. Presentations. Educational videos. Public statistics.
Reflection	Describe the expe-rience of writing this thesis and sug-gest what could have been done differently	Reflect and grade the whole project	A critical assessment of the author on provided methods and given results.

2 Theoretical Framework

In this chapter, I define concepts which will be used further in this research and describe terms that are necessary for understanding customer's behaviour. By relating those terms to the Mobile OS market, I will try to identify the most applicable consumer-behaviour model.

2.1 Mobile Operating System

According to Avi Silberschatz and Peter Galvin, Operating System is a component which works as an intermediary between a user of a computer and the computer's hardware (Silberschatz & Galvin, 1994).

Therefore, mobile operating systems are intermediaries between users and mobile hardware. History of mobile operating systems and mobile computing started in 1984 with Psion Organizer, which was labelled as first Personal Digital Assistant. PDA's were the first devices which allowed internet connectivity, organising functions and included mobile operating systems. (Nosrati, Karimi, & Hasanvand, 2012)

Later, cell phones and PDA's merged into smartphones – devices which combined feature of both mentioned devices. From PDA's and feature phones to smartphones – Mobile Operating Systems played a vital part in this evolution of hardware and software.

Today's dominant software developers are Apple and Google with their iOS and Android representing them in MOS market. Together, they fill more than 90 per cent of worldwide MOS market. (StatCounter, 2020)

This dominance was established in May 2012 when both platforms overcame Symbian OS – MOS mainly used by the Nokia brand, which occupied more than half of MOS market in 2006-2007 (Statista, 2013).

To be fair, this system was not the only one who gained consumers' trust and occasionally lost it. To further identify how consumers perceived MOS through the decade, I will give three most compelling examples which define how quickly customer behaviour can be changed by lack of useful software, poor management, and bad business planning. However, first, let us identify how customers buy products which use MOS and who exactly are these customers.

2.2   Customer-behaviour models

According to Phillip Kotler and Gary Armstrong - customer buyer behaviour is the behaviour which refers to a selection of specific branded products or services which individuals and households are used to buy. There are four typical buying behaviour models which are applied in the practice of analysing customer behaviour. (Kotler, 2018, p.158-159)

Complex buying behaviour is a type of behaviour customers inherent when they are planning essential purchases. The most generic examples of those kinds of purchases are expensive products like automobiles, houses, flats, land purchase. In this type of behaviour, customers are patiently checking every feature of the product they are buying, due to the expensiveness of the deal. (Adcock, Halborg, & Ross, 2001, p 82-84)

Habitual buying behaviour is the behaviour type customers use in their day-to-day purchases. Majority of the products we buy daily like food products, petrol, beverages, magazines, drinks, are the result of habitual buying behaviour. Companies spend a tremendous amount of fortune on advertising brands of the products they sell to consumers in order to keep the image of the product in the buyer's mind. (Adcock & al, 2001, p 82-84)

An alternative to habitual buying behaviour is **variety-seeking buying behaviour**. This type of behaviour is adopted by customers, who are frequently in search of an alternative product to the one they bought earlier. This type of customers do not have brand preferences and buy products based on other aspects. A typical example of the product of variety-seeking behaviour is breakfast cereal, due to unlimited amount of flavours and brands which are currently available worldwide. (Adcock & al, 2001, p 82-84)

The most applicable to the topic of this thesis is **dissonance-reducing buying behaviour**. This type of consumer behaviour model is used when a consumer is involved in the decision-making process of buying a product, which is represented by many brands and have justification system with which consumer decides – what product they want or need to buy. (Adcock & al, 2001, p 82-84)

There are four significant aspects which they are focused upon: maximising decision accuracy, keeping low-level of effort while deciding, keeping as less negative emotions as possible during the process and maximising the ease of justification (Kotler, 2018, p.174-175). Figure 1 shows the distinctions between different customer-behaviour models, with various involvement scales and differences between brands.
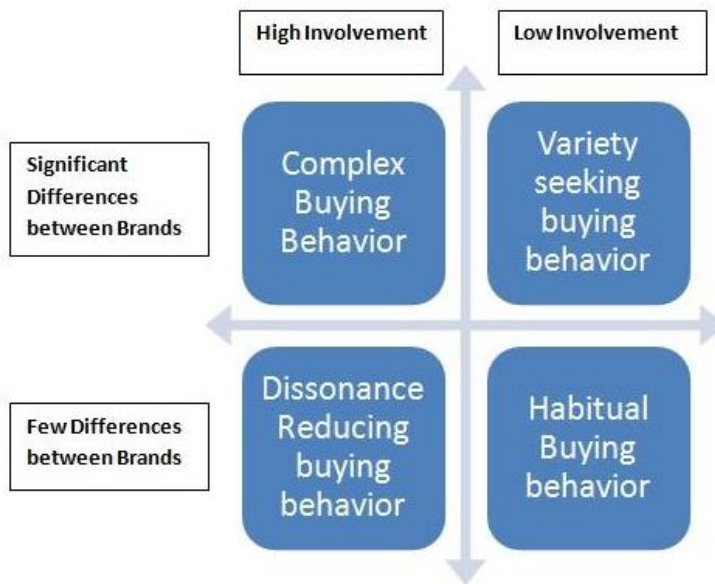
Figure 1. 4 Models of Customer Behavior (Kotler, 2018, p.174-175)

The argument for why dissonance-reducing buying behaviour is the most applicable to this research is a study performed in 2018 by Morning Consult where they asked more than 2000 respondents about the particular reasons, why they bought the smartphones they are using. Figure 2 shows that customers base their purchase decisions on aspects such as battery power, memory storage and camera quality. In this thesis, I want to understand what is the role of MOS in their buying decision. However, before that, let me divide the customer types MOS developers currently have. (Morning Consult, 2018)
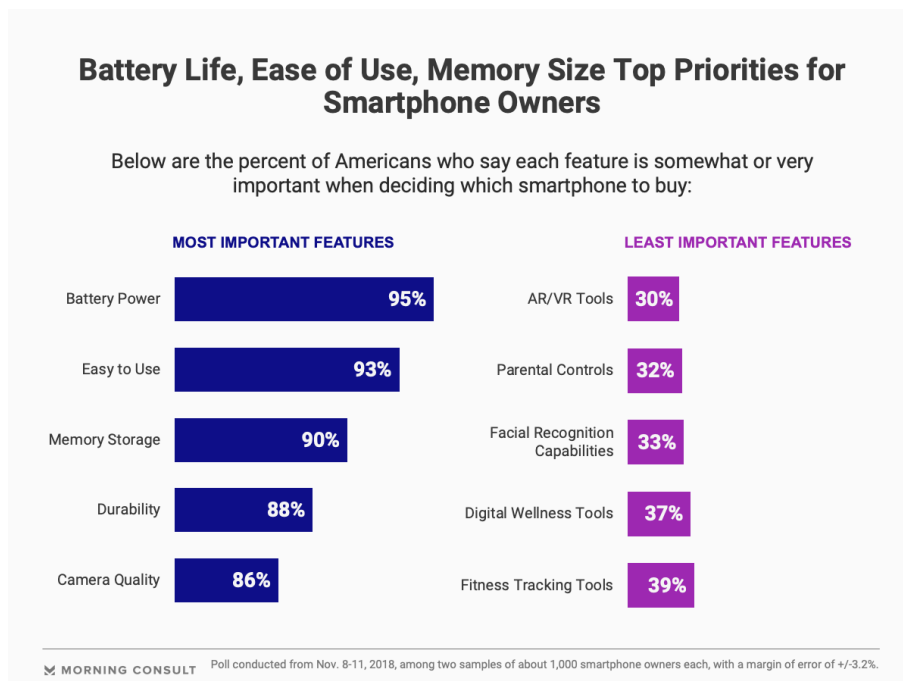

Figure 2. Morning Consult poll (Morning Consult, 2018)

2.3 Customer types

To better understand the customer-behaviour model with smartphones, we traditionally agree that there are customers with very different needs. Fundamentally, Portable PC, PDA and communicator markets were divided between two large target-groups – enterprise users, who use the device mainly at work and for professional purposes and mainstream customers, who use the device daily, in personal life. Today, these devices are all replaced with the smartphone, but these two large target groups of customers remain the same.

There are B2B customers, as well - tech-manufacturers like Lenovo, LG, Nokia buy specific parts of their hardware from OEM's like Qualcomm and MediaTek, which produce processors, screen-panels like AMOLED-screens which are being made in large numbers by Samsung for their competitors and used in their gadgets (Duino, 2018). Just like hardware, the software is also a vital part of any tech-product.

At the beginning of the new millennium, there was only one large OEM which licensed MOS software to companies like Nokia, Siemens, Motorola - Symbian, which I will talk about in the case study. On the opposite side, there is proprietary software, which is developed by the company, which produces the primary product – a phone itself. An excellent example of such a manufacturer would be Blackberry, which made software for their mobile phones.

There are companies which decide not to license proprietary software like Apple, using it specifically on the devices, produced by them only. Another type of software is an opensource soft, which is available for everyone and free of personal and commercial use.

Android is a typical example of this kind of a platform, but still, all smartphone manufacturers must pay 40 USD for every phone they sell with Google's Android (Brandom & Kastrenakes, 2018). Why must manufacturers pay for a free platform? The difference is between Android and Google's Android.

The reason is a bundle of apps which come pre-installed with Google's Android called Google app suite. This bundle includes applications such as Google Chrome, Play Store, Gmail, YouTube, and the other Google-produced applications used by millions of customers around the world. Without this license, Android can still be used commercially, but Google will not support it and more importantly – will not be verified by them. It means that many applications, which use Google's software framework, will not be available as well.

To explain better, imagine a user who wants to order a taxi and uses Uber to do it. On a Google-licensed smartphone, the process is easy and straightforward – the user just puts his geolocation, end-destination and waits for the taxi to arrive. The opposite happens when we talk about a non-verified Android phone. Uber application simply refuses to work without Google services pre-installed, as we can see in Figure 3. It is the reason why tech-companies must pay Google for their pack of applications and verification. Google apps for many customers is a must and a basic need which all Android developers fulfil today, except for one today.
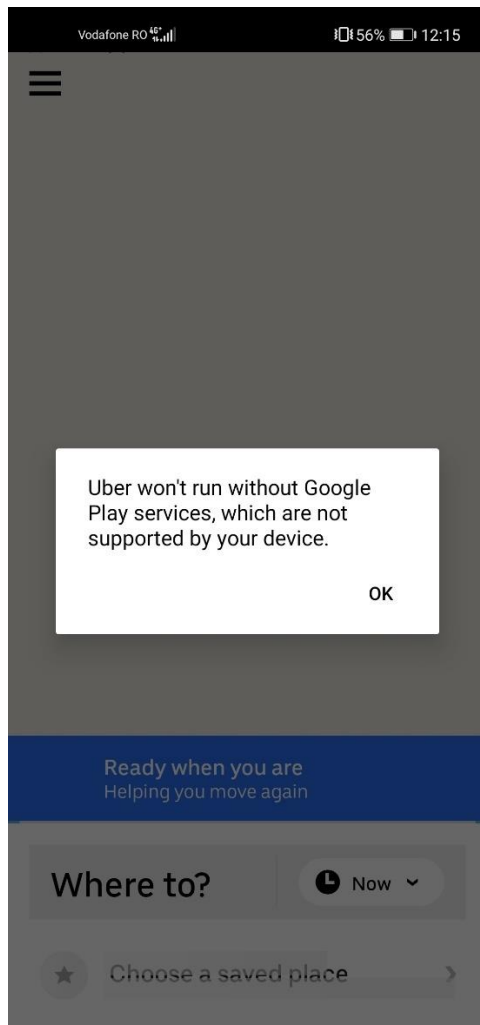
Figure 3. Uber not working without Google-services (Crubiogu, 2020)

Now, how could licensed MOS be made attractive for indirect customers? How to promote an operating system as a selling point and make tech-companies pay for the exclusive software features? To analyse that, I had a thorough look at two licensed MOS's in the second chapter of this paper. In conclusion - to make an operating system a significant selling point for the direct customers, the company first should focus on how to spread and popularise MOS among OEM's.

As we can summarise, licensed Mobile OS is a part of both B2C and B2B. If B2C customer-behaviour is relatively relatable for each user with his needs, B2B customer-behavior is conceptually different.

Since Google practically monopolised the licensed consumer MOS market, smartphone makers do not have any comparable alternatives today. Before the Android/IOS decade, in the 2000s, manufacturers could choose between three different large software-developers - Microsoft, Symbian, and Palm. (Gartner reports, 2019).

Today, there is only one OS which could be used on any mobile device, since Apple refuses to license its software, keeping all the manufacturing, and developing processes "in-house".

The secret to Android success lies in two key-aspects: distribution model and very customisable software. As mentioned previously, manufacturers still have to pay for Google-services installed on their devices. Still, being an open-source project, Android provides an open-source software development kit which can be used by anyone, which is a beneficial aspect for software developers and smartphone manufacturers.

For example, to use a Windows CE software, which was the core-program for Windows Mobile OS, manufacturers had to pay almost one thousand USD to get an SDK and 3 to 16 USD for a run-time license (Microsoft, 2003). Keep in mind that smartphones were not nearly as common as they are now, with Tablet PCs and PDA's occupying this niche. Also, consider the fact that they were innovative gadgets, which production costs were significantly higher compared to today's costs.

To continue, why one would decide to invent the wheel when there are a ton of ways to customise it? Android offers tremendous amounts of layouts, with sometimes exclusive features, developed by other than Google entities such as Samsung, Xiaomi, OnePlus, Meizu, HTC and other OEM's. Usually, they contain redesigned user-interface. Even if customers do not like these overlays, Android allows changing the user interface as they wish. Customers can make Android look like IOS by merely downloading a launcher through Google play store if they wish to.

By fulfilling different customer needs towards user experience customisation, gradual introduction of innovative features, optimisation of OS performance and a large number of available apps, Android gave value for consumers. Rapid expansion and aggressive distribution model which outlasted Microsoft, Blackberry, Palm, Nokia's developments, managed to monopolise the market for B2B customers and mobile developers. Today, there is no real alternative for smartphone manufacturers in terms of software.

2.4 CrackBerry Hierarchy of Smartphone Needs
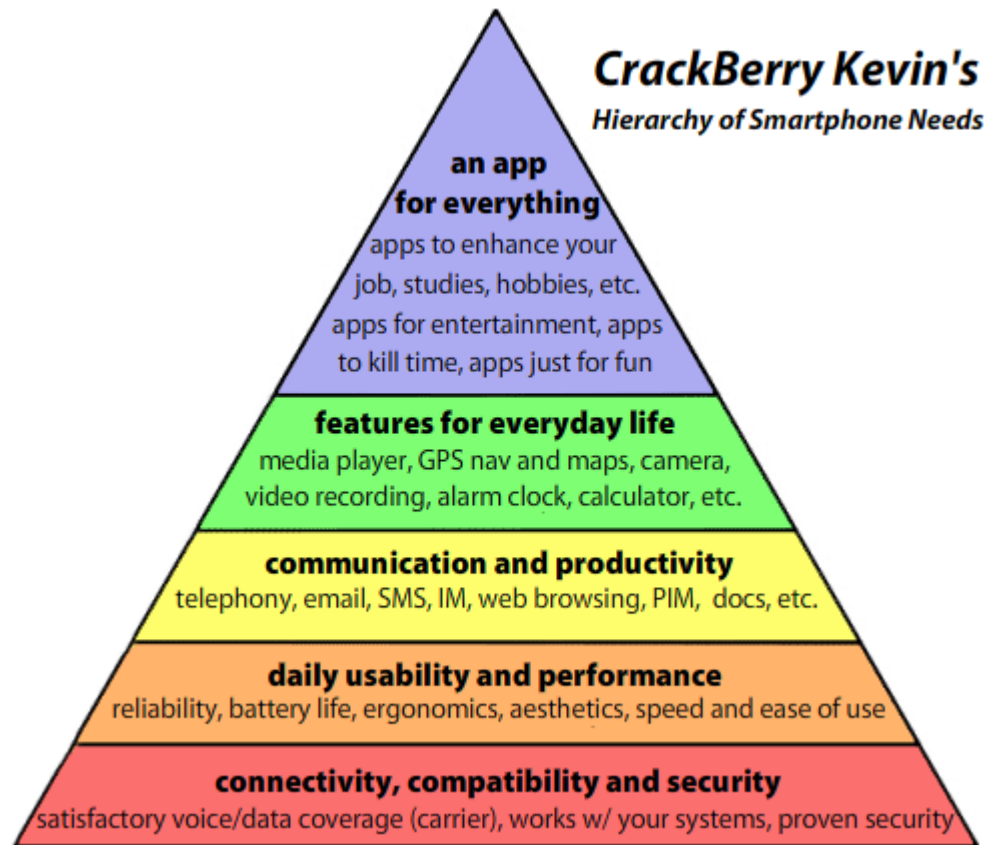
Figure 4. Crackberry's Hierarchy of Smartphone Needs (Kevin, 2009)

Kevin Crackberry introduced a hierarchy of smartphone needs, which is shown in Figure 4, in 2009. He adapted Maslow's theory of human needs pyramid and transformed it into the comparative model for smartphones. He redesigned the steps of the hierarchy, by changing the variables and aspects, with relation to smartphones software and hardware. The first stage for any kind of smartphone is an ability to deliver stable connectivity, provide security for user's data and calls and be compatible with other devices such as Windows PC or MacBook laptop (Kevin, 2009).

This is the first step of hierarchy because if the device does not meet this basic need of the customer – it will inevitably fail to deliver in all the other steps of hierarchy. It happens due to the dependency of other smartphone functions on the internet connection (Kevin, 2009).

The second step is the ability to provide a responsive user experience which will please customer by having a well-designed and responsive user interface. Better design of the mobile OS, faster response time of user's commands, slower battery draining while smartphone use – all of those aspects are related to the second step of hierarchy (Kevin, 2009).

The third step of the hierarchy is related to communications and productivity. This step refers to smartphone's functions which provide user's organisational activities. E-Mails, Notes, web-browsers, document managers – everything that is related to the production capabilities of a smartphone (Kevin, 2009).

The fourth step of the hierarchy describes features that makes smartphone an essential device, which replaces several other gadgets. Navigation, calculator, wallet with bank cards, camera – all the tools which before customers used to buy and use separately now replaced by a smartphone (Kevin, 2009).

The fifth and final step of the hierarchy is a universal app for every occasion. If the user wants to buy something, he does through an app for a smartphone. If he wants to play games, watch a movie, listen to music through streaming-service – he does it through an app on a smartphone. (Kevin, 2009)

Interestingly, the first two steps of the shown model are related to both hardware and software of the smartphone. Other steps are more related to software optimisation, the core of Mobile OS and applications which are available for the platform. Depending on these aspects, customer's builds opinion towards the device which he uses. In conclusion, this model describes the importance of software part of any smartphone and most importantly – a Mobile Operating System. Today, customer cannot decide which OS he wants to use on his smartphone, contradictory to desktop OSs which could be installed on any laptop or PC. It mainly comes since smartphones come with a pre-installed OS which gets updated by the manufacturer or the developer. Consequently, MOS is one of the most significant comparative aspects for consumers in their buying decisions which will be proven by my research and consecutive analysis of three cases using this hierarchy model.

The particular choice of this model for my research is that it was one of the first comparative models of Smartphone needs. There were several implications of the said model which came out after 2009, but ever since little has changed and just like Maslow hierarchy of needs, this model stays actual today. This model has been chosen for this research because it divides all the basic needs of the customer regarding MOS and gives a good understanding of what are the customers values about this aspect. Hierarchical structure allows us to digest which of these needs are the critical ones, which should be met in any case if you want to give the customer a pleasurable user experience.

Nonetheless, this model does not cover all aspects of MOS. Notably, this model does not allude to such part of MOS like User Interface, MOS designs, customizability, eco-system of smart gadgets (collaborative functions of smartphones with laptops, tablets and PCs). Additionally, this model was created at a time, when IOS, Android, Windows Mobile/Phone, Symbian, and Blackberry OS were still competing between each other, and there was a variety of platforms to choose from. Today, this model remains actual, but with much fewer platforms available to compare. It should be noted that the absolute majority of modern smartphones fulfil the first three steps of Crackberry's hierarchy, and the only comparative aspect is the last two steps.

3   Case-study research

In this chapter, I will analyse three cases which heavily influenced today's MOS market. Symbian, as once the most popular mobile platform worldwide; Blackberry, as the business-oriented platform with significant selling points on security and communicating and Windows Mobile/Phone as an example of giant enterprise failing to support their platform.

3.1   Research-method

This part of the research uses widely standard case-study design. The case study strategy is the research method, which focuses on digesting of the given case and understanding the dynamics present in this case. The case-study method could involve multiple cases and even multiple levels of analysis. Collection of information in this method typically includes interviews, archives, articles, questionnaires and observations but are not limited to them. The objectives of the case-study method usually are to give a description, test the theory or even generate one. (Eisenhardt, 1989)

In the case study, I focus mainly on the development of the MOS for the three companies mentioned above. In it, I focus on the software development aspects such as security, performance, app distribution and others. It means that I will not mention other reasons which could be more significant for failure or success of the products of said companies. This analysis will lead to understanding why these operating systems succeed and then systematically failed. The primary method for data collection is using web-archives, articles from IT-magazines, financial sheets and tech-journals. In the conclusion part, I will use Crackberry's model to define steps at which mentioned MOS's were underdeveloped or could not compete with Apple and Google.

3.2   Symbian OS

Symbian OS emerged from EPOC - the last developed OS made by Psion PLC – a company which designed the first PDAs in 1984, mentioned previously in this paper. After Psion failed to compete with its much bigger competitors, they joined Nokia, Ericsson, and Motorola in a joint venture. Eventually, EPOC was renamed as Symbian OS. After rallying to survive and get funded by these companies, Nokia bought the majority of shares and later, in 2008, purchased the entire stake, which consisted the control over Symbian OS. Nokia became a global-wide phenomenon on the phone market, though, it was not the only company which used Symbian as their primary MOS. Finnish company dominated its competitors and was leading phone-manufacturer brand at a time. Occupying 65 percent

of all Mobile Operating Systems back in 2007 - a year in which the first iPhone was presented - Symbian was the most used MOS in the world. Every second phone which was sold around the world had the Nokia logo on it and operated on Symbian OS. (Jowitt, 2018)

The most successful period of Symbian OS started at the beginning of 2000s and continued until 2007. There were many reasons why this MOS was so successful. One of the major ones would be that Symbian originally was a software alliance between Nokia, Sony, and Motorola created simply to compete with Microsoft – the biggest software developing company. (Jowitt, 2018)

Paired with remarkable Nokia's hardware production capabilities – Symbian quickly outpaced Microsoft and their Windows Mobile platform. Mobile manufacturers were able to customise their version of Symbian in any way they want, just like Android can be customised today. Additionally, Symbian was a intuitive platform, and even the person who never held a phone in his life could have understood how to use a Symbian phone. (Lein, 2012)

The turning point for Nokia happened when Apple introduced the iPhone. At a time, Nokia owned more than 40 percent of the global phone market, which is more than any smartphone manufacturer holds today worldwide (Statista, 2013).

Symbian was the most popular MOS, and in 2008, at 10th anniversary of the Symbian Limited, company announced an open-source version of their OS (Jowitt, 2018).

This move would allow them to compete with Android, but the initial release happened only after two years after the announcement, in 2010. Consequently, Symbian entered an "open-source" competition much later than Android and Microsoft. Nokia was still focused on feature phones, which were still selling in large numbers. (Greengart, 2010)

Genuine attempt to compete with Android and iOS on the smartphone market was Nokia N8 based on Symbian Anna – MOS explicitly designed for this smartphone. The image of Nokia N8 is shown on Figure 5.

Figure 5. Nokia N8 (Nokia Museum, 2010)

As Vlas Savov from The Verge stated, Nokia N8 looked like a flagship smartphone from the future. Design-wise Nokia N8 looked like iPhone 6, which was released four years after. Covered in aluminium with the best camera on the market – this smartphone looked like it came from the future. (Savov V. , 2014)

The only problem with Nokia N8 was the software it was based on. Quoting Vlad Savov:

- The N8 design was ready to go in early 2010 when it would have been among the first with 720p video recording, but repeated delays of the new Symbian version pushed its release to September. The hardware was getting kneecapped by the software, which a Nokia employee told me at the time was being developed in separate silos that would not be integrated into a single operating system until the final weeks before launch. (Savov V., 2014)

Initially, the Nokia N8 was released with the newest version of Symbian. Customers were unhappy - the MOS, that was good on button-operated feature phones felt outdated and poorly optimised on the full touchscreen-based smartphone. Symbian was not delivering, as an OS, which came out at a time when using the internet on a smartphone was the customer's everyday need. Instead, it had many indicators that this OS is underdeveloped. On the long list of things, that touch-based Symbian was bad at are poor typing optimisation; outdated pre-installed web browser; misleading system indicators (i.e. battery indicator); user-interface which could not compete with any MOS at a time in providing good user experience. (Terence, 2010)

In the end, Nokia attempted to reclaim consumer's trust with Nokia N9, which was based on an entirely different platform – MeeGo. It solved the majority of problems created with Nokia N8, but users did not believe that the OS that did not have any significant number of third-party apps could compete with Android and iOS. (Terence, 2010)

Symbian market share declined drastically in 6 years and reached 3 per cent in 2013 (Statista, 2013).

It was one of the most fast-paced market losses which happened to the mobile market. From 40 to 3 per cent in three years and essential losing of other smartphone manufacturers, Symbian now lives on as an example of how quickly consumer behaviour can change. After accepting Symbian's failure, Nokia's smartphone business was bought by Microsoft, which believed that it would consolidate their success as a leading software developer in both desktop and mobile areas.

3.3 Blackberry OS

History of Blackberry OS starts with Research In Motion company and their famous pagers (Blackberry 900 series) which allowed to send and receive text messages and had a basic pack of pre-installed data such as calendar, notepad and reminders list. It had a monochrome display and was popular among business and regular consumers for its simplicity, easy-to-use technology and qwerty-keyboard the brand "Blackberry" will be famous for. Blackberry pagers marked their first versions of Blackberry OS. (Jowitt, 2017)

The next version of their MOS was one of the most significant improvements with a large variety of new features and applications. The most significant change was that Blackberry OS 2.0 offered a PDA, instead of a pager. The screen got more prominent while remaining monochrome. Blackberry OS 2.0 was the entry point for the PDA market and focused on business customers with a pre-installed package of apps which now included a fully-functional web-browser. The third version of Blackberry OS did not have as many chances as the second one, adding only Java-based application support and mobile phone features. (O'Boyle, 2020)

Blackberry 4.0 offered multicolour-display support and offered a faster built-in web-browser. This version stayed relevant for about four years being supported up until 2008. Mainly, it had design changes, adapted to colourful displays. The most significant upgrade of Blackberry OS since the second version were Blackberry 5.0 and 6.0. They provided

the user with reimagined user-interface and pack of social apps since now it did not focus only on the business segment.

Blackberry remained one of the most fast-growing MOS's, reaching more than 13 million Blackberry smartphones shipments worldwide and becoming fourth-largest smartphone worldwide vendor (IDC, 2020).

Initially, after reaching the highest sales point in 2011, RIM will decline its position in the following years and eventually will sell its Blackberry brand. To put simply – the main reason for failure was the inability to change.

The models which are shown in Figure 6 is possibly one of the most successful line-ups of Blackberry phones in history. The last smartphone in this series ran Blackberry 7.0, which added Radio, NFC-support, Wi-Fi hotspot feature and many other improvements. Nevertheless, most notably famous Blackberry OS 7.0 was for being the last version of the Blackberry OS, which were used in smartphones with the physical keyboards. The next version will be the last version of the Blackberry OS in general. (Savov V. , 2016)

The reasons are that happened are that RIM tried to do the impossible – they tried to keep their business segment of customers satisfied, by not removing the keyboard which covers half of their smartphone and not changing the design in slightest. They missed a shot at appealing to new customers who were choosing Apple, Samsung, HTC devices over Blackberry. (Savov V. , 2016)

Figure 6. Blackberry Bold series (Blackberries, 2012)

While developing 10th version of their OS, which were delayed several times due to company's overall poor management, they had to support current platform which at a time, significantly conceded to both Android and IOS. (Hicks, 2012) Galen Gruman, in his comparison of Android 4.0, IOS 5, Windows Phone 7,5 and Blackberry 7.0 concluded:

   – RIM orphaned existing BlackBerry users when its new models came out last summer and the company says these new models will not run the BlackBerry 10 OS expected late this year. Would-be Android and BlackBerry buyers thus should think twice. The other lowlights for application support are the BlackBerry's low app catalogue and generally clunky core apps. (Gruman, 2012)

Fastly RIM started to lose customer's trust with their policy of not updating recent smartphones that they just released and delaying the BB OS 10 – the OS, that meant to change everything but came as last Blackberry OS in the history. There were three primary reasons why BB OS 10 did not save RIM but only doomed it.

Firstly, their release of BB OS 10 happened in January 2013. By that time, Android already occupied more than 1/3 of the MOS market, and Apple took 25.85 per cent with IOS. Symbian OS still had 20.79 per cent combined. Only MOS that had a smaller market share than Blackberry was Microsoft Windows Phone. By the time, customers denied Blackberry branded smartphones; competitors had time and resources to occupy the market. (StatCounter, 2020)

The second reason would be the situation with Blackberry support of the platform. CNBC released an article in 2015, which they stated that RIM would leave their OS, instead of using Google Android as a desperate measure against dominant competitors. One of the primary reasons for that was user experience, which was significantly worse compared to IOS, Android and feeble support of third-party apps. (Kharpal, 2015)

PCMag concluded that only 34 per cent of 102 most popular apps on Android and IOS had Blackberry equivalents (Segan, 2013).

The third and final reason would be Blackberry policy on user's privacy and security. They introduced full device encryption and advanced app permissions management first, much earlier than Apple and Google did. Even in previous versions of BB OS, they always focused on strict regulation for app developers concerning user's privacy. Small user-base at the start did not help this situation at all, so, many developers ditched Blackberry OS as a platform. However, there was one thing, which Apple and Google capitalised on that Blackberry refused to do, and that thing was target advertising with data mining. (Crump, 2020)

They refused to collect user data and sell it in the form of targeted ads like Google successfully does it to this day, and they also refused to let anyone else do it while getting 30 percent cut like Apple does through their strictly controlled App Store policies. By actually handling security in the right way for the consumer, they doomed themselves by not having a stable source of income from their software possible advertisement income. (Crump, 2020)

In the end, to this day – the future of Blackberry phones remains unclear. The story of Blackberry OS, however, is straightforward. This platform lost consumer's trust because it focused only on one group of customers, realised too late that there is much more immense growth potential, tried to manage several projects at the same time which led to a catastrophic decline from 15 per cent of whole MOS market in 2011 to 3 per cent in 2013. (StatCounter, 2020)

3.4 Windows Mobile/Windows Phone

Windows Mobile was made on Windows CE kernel and was named as Windows Pocket PC OS at first, made specifically for mobile devices and PDA's; it was released in April 2000. Microsoft licensed Windows Mobile to tech-companies like Samsung, HTC, LG and even Palm and that made their business of growing their market shares a lot easier, considering that there were millions PDA's shipped with Windows Mobile on them. (Jowitt, 2016)

Windows Mobile reached its pick of popularity in 2004, reaching 23 per cent of worldwide smartphone sales with this MOS on them. At one point, there was a prediction of Windows Mobile completely consume Symbian and overtake it, being the dominant MOS on the market. On corporative market Windows Mobile was well-established and known but competing against Blackberry and Nokia's Symbian was the turning point in which Windows Mobile lost to them. (Jowitt, 2016)

It never achieved the heights that the desktop version of Windows did. By 2008 Windows Mobile was struggling to return to the numbers it had in 2004, having only 11 per cent of global MOS market (Chen B. X., 2009). Why the tech-giant failed to compete with companies which were much smaller in terms of financial, technological, and human resources?

Peter Hoddie – the CEO of Kinoma – company, which was responsible for developing mobile media browser for Windows Mobile - stated that the primary reason for failure was an unoptimized and uninspiring pack of pre-installed apps which Windows Mobile was packaged with. Especially the web-browser, which was the biggest problem for the majority of customers.

- The sad part for Microsoft is that in terms of operating systems, they have a great one, and they had it long before anyone else did. Their first problem is the built-in apps are uninspiring, so that sets a shallow bar for developers who are coming to the platform. (Chen B. X., 2009)

Another problem from his perspective was segmentation. It is also applicable to Android today but, segmentation at its core is the problem for both developers and consumers. When the user has one MOS that operates on countless numbers of devices with different hardware, the developer must adapt his apps to each model. As a result, if a developer did not adjust the particular application for the exact model, the consumer received an application which did not work correctly, getting negative impression not only from the application he tried to launch but overall, the device he used. So, when Apple had one MOS installed on millions of similar devices with similar hardware, developers had a much easier time to develop their apps for IOS instead of Windows Mobile. Not even mentioning that the customer base of Apple was rapidly growing when Microsoft's was falling. (Chen B. X., 2009)

Eventually, when Google started to giveaway its Android OS for everyone to increase their market share – tech-brands started to drop WM as its primary platform. Microsoft needed a fresh start, something completely new that would appeal to not only corporative customers but to the mainstream audience as well. This start, or better to call it to restart, was Windows Phone – platform, which was introduced in 2010 and which mission was to return Microsoft as one of the leading MOS developers. (Jowitt, 2016)

Windows Phone had all the aspects and signs of a competitive MOS. The redesigned user interface, massive support from the developer at first and brand support from Nokia, which smartphone business Microsoft acquired in 2013 (Kovach, 2013). With the introduction of iPhone and Android, MOS industry reached a turning point, similar to one that happened at the beginning of the decade when Nokia started developing feature phones on Symbian and companies shifted for creating PDA's and first smartphones. Android and IOS became two dominant forces which many companies tried to challenge. Firefox OS, Lineage OS, Tizen, Ubuntu Touch, Sailfish OS, Fire OS, just to name a few attempted to enter the market and failed. The most notable try at entering MOS market was Windows

phone which officially stopped being supported by Microsoft only a year ago but lost its positions much earlier. (Holt, 2019)

Like Apple, Microsoft strictly controlled all the processes related to their Mobile OS. This means that they had very high requirements regarding hardware, which mobile manufacturers had to put in the smartphone. Then again, unlike Apple, Microsoft never produced its hardware. Those requirements made an appeal of Windows phone much lower, compared to Android for OEM's. Nonetheless, back in 2008, when Microsoft was engineering Windows Phone, it was ahead of both Android and IOS in terms of user experience. Windows Phone user-interface was both unique and innovative. It was one of the very first systems, which offered interactive app icons – blocks, with changing data which you can see on Figure 7. Customers could easily access the applications they wanted and see quick data, which was useful for their daily activities such as weather, to-do reminders, interactive notifications, and other data. Additionally, the performance of the OS was much better – thanks to hardware which allowed swift interaction between different applications and overall speed of the MOS. (Dyck, 2019)

Figure 7. Windows Phone 7 Home screen (Learmonth, 2010)

Due to high requirements for the hardware for Microsoft, smartphone manufacturers chose Android as their preferred platform. With much merciful control over the hardware, Google attracted the majority of mobile manufacturers. Microsoft was left with the right product, which no one wanted to use. The only company which Microsoft attracted to their newly developed platform was Nokia, thanks to the managerial change in their company. CEO of the company was ex-executive of Microsoft, who announced that Nokia would replace Symbian with Windows Phone as their central platform for smartphones. Why was Windows Phone adopted by Nokia, while other companies did not? The answer is the billions of USD Microsoft invested in Nokia, as the platform supporter. (Dyck, 2019)

De-jure Nokia was paying 500 million USD as licensing fee for the Windows Phone (Tung, Nokia paying Microsoft €500m for using Windows Phone, 7). De-facto it received more than 250 million USD every quarter, which covered much more than licensing fee. Other companies which produced smartphones saw that as an unfair advantage and ultimately refused to develop their smartphones on Microsoft's platform. Why would any smartphone manufacturer pay a licensing fee and develop a smartphone with strict control over hardware and lower popularity compared to Android and IOS, when Nokia did it for free, and Google offered much more flexibility? By 2013, Nokia stock price fell by 75 percent, which led to unpleased stakeholders threat of abandoning Microsoft's platform which will, in conclusion, resulted in 7,6 billion USD deal of Microsoft buying Nokia's smartphone business. (Dyck, 2019)

For direct customers, Windows Phone was also a flop. In one of the very first versions of the OS, there was no background app multitasking, Adobe Flash technology which YouTube worked at a time was not supported, applications for Windows Mobile were unsupported, and there was not even copy/paste function for text. Some of these issues will be changed in the next iteration of the Windows Phone - 8.0, but there comes another reason for the customer is not to trust Microsoft. (Keating, 2010)

Microsoft cut support for the owners of Windows Phone 7 smartphones and told them that they would not be able to update their devices to the next versions due to hardware limitations. Instead, they would receive a trimmed version of the update, which was named Windows Phone 7.8. (Sullivan, 2012)

One of the ex-engineers of Nokia revealed four key-reasons, why Windows Phone was not as appealing to customers, as other platforms were. The first reason is underestimating Google's open-source strategy and particularly undervaluing Google services such as YouTube, Gmail and others. (Tung, 2019)

The second reason is the attempt to combine both desktop and mobile user-interfaces on very different devices. I specifically relate to failed Windows 8 interface, which contained block-style "Windows Metro" user-interface that looked a lot like Windows Phone OS. After the release of Windows 8, its negative feedback transferred to Windows Phone, which looked similar. (Tung, 2019)

The third reason was the hatred of software developers towards Microsoft. It was not mainly because of Windows Phone, but because of the overall Microsoft public image (Tung, 2019). A significant part of this negative image was coming from notorious Antitrust charges, which insured solidifying competition, forcing Microsoft not inflate prices on their products and monopolise the software market. (Beattie, 2020)

To conclude, Nokia's ex-engineer said that customers already chose the OS they preferred and were not sold on the idea of adopting a platform, which did not have any exclusive selling points (Tung, 2019). By 2015 the CEO of Microsoft - Satya Nadella admitted that Nokia's deal was a failure and laid off up to 7800 employees, which mainly were from phone segment of Microsoft business. (Fiegerman, 2015)

All the mentioned cases lacked something from Crackberry's model. To better digest which features did not meet the needs of customers, let us review each stage and how successfully, Nokia, Blackberry and Microsoft passed it.

The first stage of the hierarchy has been passed successfully by all companies. They managed to provide substantial connectivity, having a stable phone call and internet connectivity. They were compatible with any PC and provided a substantial security measure towards customers data. It must be specially noted regarding Blackberry OS, which was one of the most secure platforms ever developed on the MOS market.

The second stage of the hierarchy was daily usability and performance. It is the stage where the problem starts to show for Nokia's Symbian. As mentioned previously, user experience was lacking in ease of use and responsiveness of the user interface. Windows Mobile also lacked at this stage, but after the release of Windows Phone fully solved this problem as well. Blackberry's daily usability was more than satisfying, but with the underdeveloped release of Blackberry 10, they went with the reliable and fast OS, too buggy and poorly optimised one.

The third stage is the key-point, where all mentioned companies starting to lose the competition to Android and Apple. Mainly it relates to poor web-browsing experience compared to Safari and many available browsers for Android. Working with documents on small screens which were common at the time, ranging from 3,5 to 4,7 inches, was not as comfortable as it is today. Still, only Microsoft managed to catch up to competitor's, while both Nokia and Blackberry abandoned their platforms.

The fourth stage is considered with applications which come pre-installed with the phone. This need was satisfied by all developers, with the exception of Nokia. Even the pre-installed applications were slow to load, and UI used to design those apps was outdated.

The fifth and final stage was probably one of the most important reasons why all mentioned platforms failed to compete with Apple and Google. It is also the reason why both of them solidified themselves as the only dominant Mobile OS manufacturers for mobile devices. Lack of third-party app support was among one of the most valid reasons why each Blackberry, Windows Phone and Symbian failed. Currently, Android has more than 2,90 million available apps for all kinds of users. Apple's App Store has 1,85 million available apps for iOS. (Clement, 2020)

To compare these numbers, let us digest each app distribution channel. Blackberry World, which is official Blackberry's app store, had more than 120,000 available apps. 1/3 of those apps was developed by the same Vietnamese company - S4BB (Andreiko, 2013).

Currently, Blackberry World is officially closed. Nokia Store had the same approximate number of available apps in 2012 for its Symbian phones (Nokia Developer Global Statistics, 2012).

The most recent number for Windows Phone store is 669,000 apps available back in 2016 (Protalinski, 2016).

Let us try to compare the numbers from both Apple's App Store and Google's Play Store in 2012,2013 and 2016 in Table 2.

Table 2. Number of available apps from App Store and Play Store (Clement, 2020)

App distributor	2012	2013	2016
Apple App Store	452,974	715,364	1,975,112
Google Play Store	700,000+	1,000,000+	2,600,000+

As we can see, both Apple and Google were no match for these three companies in terms of fulfilling the fifth step of Crackberry's pyramid. As said before, to provide pleasurable user experience, smartphone manufacturers have to fulfil every step of the pyramid gradually. Creating an attractive platform for developers is a complex process which these three companies could not manage. Figure 8 shows the same stages at which companies lacked, compared to Google and Apple.
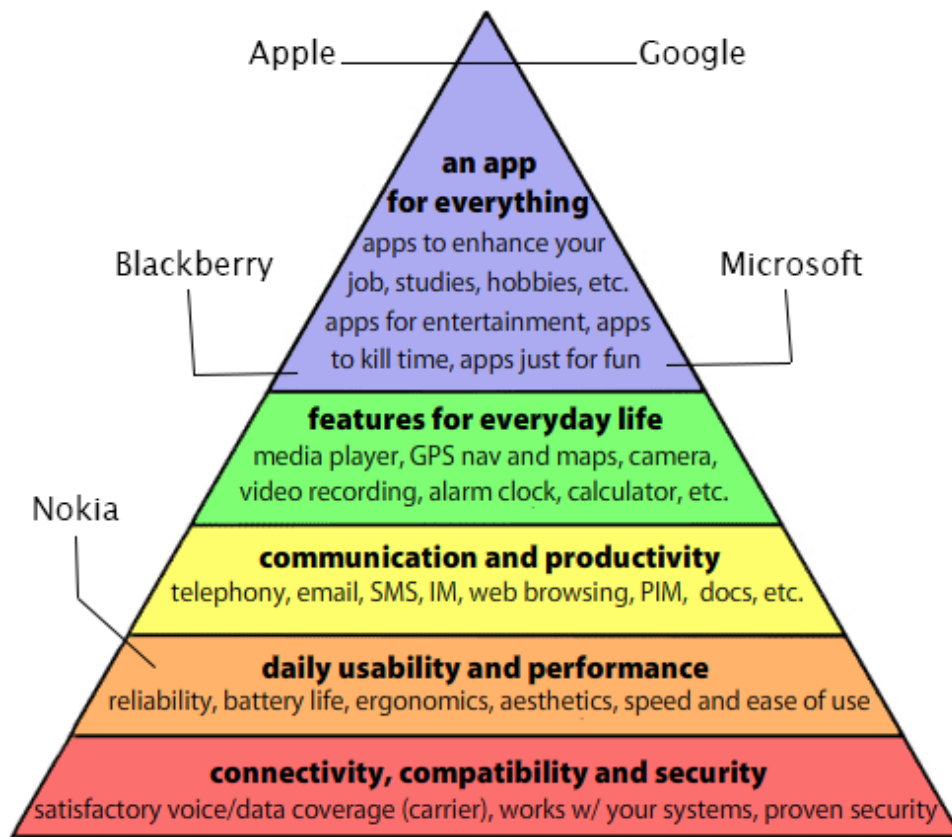

Figure 8. Crackberry's pyramid with mentioned companies (Crackberry, 2009)

To summarise, there were two groundbreaking stages, in which Nokia, Blackberry and Microsoft lacked, in comparison to Apple and Google. The second and fifth stage of Crackberry model were the weakest parts of these mobile platforms. By providing better user experience on these stages, Apple and Google divided the MOS market and made any attempts to enter it close to impossible.

4   Web-Survey

This chapter of the paper depicts the gathering of primary data by the survey, which has been created and designed to find insights regarding MOS usage by customers and value which they seek while using it.

4.1   Objectives

In the previous chapter, I used Crackberry's model to describe main issues with MOS's of the past and what was the reason behind their failure (Crackberry, 2009). To summarise everything mentioned in a previous chapter, we can outline three main issues that developers faced during the development of their OS – security, performance and app distribution of the operating system.

Security was one of the major selling points of Blackberry OS, but it also led to the absence of income from the advertisement, which currently is based on customer's preferences and data of their interests. Apple's ad revenue, for example, could hit more than 11 billion USD in the year by 2025 (Bell, 2018).

Performance and OS stability was one of the weakest parts of Symbian OS. App distribution and third-party app support was a problem for all mentioned platforms. The central research question for this research: **what the customers' values are during using different mobile operating systems?**

Consequently, in order to identify current customer values towards buying a new gadget with MOS, I want to identify the following issues:
1. How do customers perceive security for their mobile devices?
2. What are the major selling points of MOS which are valuable for the customer?
3. How valuable are third-party app support for the customers?
4. What role does MOS play in customer's buying behaviour?
5. Did customer ever change to another MOS, and what were the reasons for it?

4.2   Methodology

The method of conducting my research and gathering primary data is data collection through web-survey. In this method, I create a web-survey which is then sent to a collection of respondents who answer this survey and give me data for further analysation. There are several advantages and disadvantages to this type of data collection.

Typical advantages for the online surveys compared to traditional paper surveys are access to unique populations, time and cost. Current technological advancements allow populations to be categorised by interests, hobbies, attitudes and beliefs. Same can be said when researchers are targeting the population of a specific country or even the city. That gives researchers a broader vision towards sensible topics, like data security. Many people might be hesitant to discuss face-to-face but give their opinion much more comfortable with the pre-made survey (Wright, 2017).

In my research, I will target one country's population without any specific interests towards IT or application development, describing respondent only from the customer's point-of-view.

Time is the second advantage of online surveys. Researchers are saving time by reaching out to hard-to-reach populations. There are many platforms today, which allow to create a survey and distribute it through various channels like e-mails, websites, group chats, social networks allowing researchers to receive data fast (Wright, 2017).

Cost is another advantage, as well. Survey creation and distribution are significant money-saving in terms of resources needed. Paper surveys are usually more expensive, even if the researcher describes a small sample of the population. Online surveys eliminate costs for paper, printing, postage, data entry (Wright, 2017).

As any research method, web-based surveys contain disadvantages which are inherent in traditional surveys but have unique ones as well. The first and probably the most common disadvantage is the sampling problem. There could be small, sometimes none, information regarding respondents' characteristics. Only information researchers get demographical data which also could be questioned as well. Once there are established e-mail list which survey will be sent to, there is no guarantee that multiple e-mails addressed do not belong to one person or one receiver of the survey will send multiple responses. Probability of sending the survey to inactive e-mails also has to be considered (Wright, 2017).

Another issue of online survey is usually when someone receives such e-mail; they treat it as spam and consider this type of behaviour rude. It is one of the most common reasons for the low response rate through traditional e-mail channel of distribution. However, this issue is solved if the researcher uses a platform which does not require compiling e-mail data, sorting it out and distributing it through e-mail. (Wright, 2017)

In my research, I used the service, which exactly solves this problem by providing chosen demographics and respondents for my research.

The service which I used while conducting this research is Zoho survey. This platform gives an advantage over others because it packs all the features that I needed on one web-service.

Zoho Survey allows user to create several types of surveys with any kind of questions and answers, including dropdown questions, matrix choice, multiple-choice question and others. User is also able to integrate the created survey into an e-mail, Facebook page or website. There is a feature to print a paper version of the survey as well to distribute it offline. (Zoho Survey, 2020)

A unique feature for many researchers and marketers is research panels which Zoho provides. It is paid feature that allows user to configure the target group for research by country, age, household income, marital status, primary education, employment status and industry sectors and then sends this survey directly to them for a response. (Zoho Survey, 2020)

Figure 9 shows the Zoho survey creation model with exact stages and steps towards the creation of my survey.

Creation of the survey
- Define objectives
- State the questions
- Design the survey

Choose participants
- Calculate needed number of respondents
- Configure target groups
- Send the survey

Analyse
- Receive the data
- Analyse the validity of the data
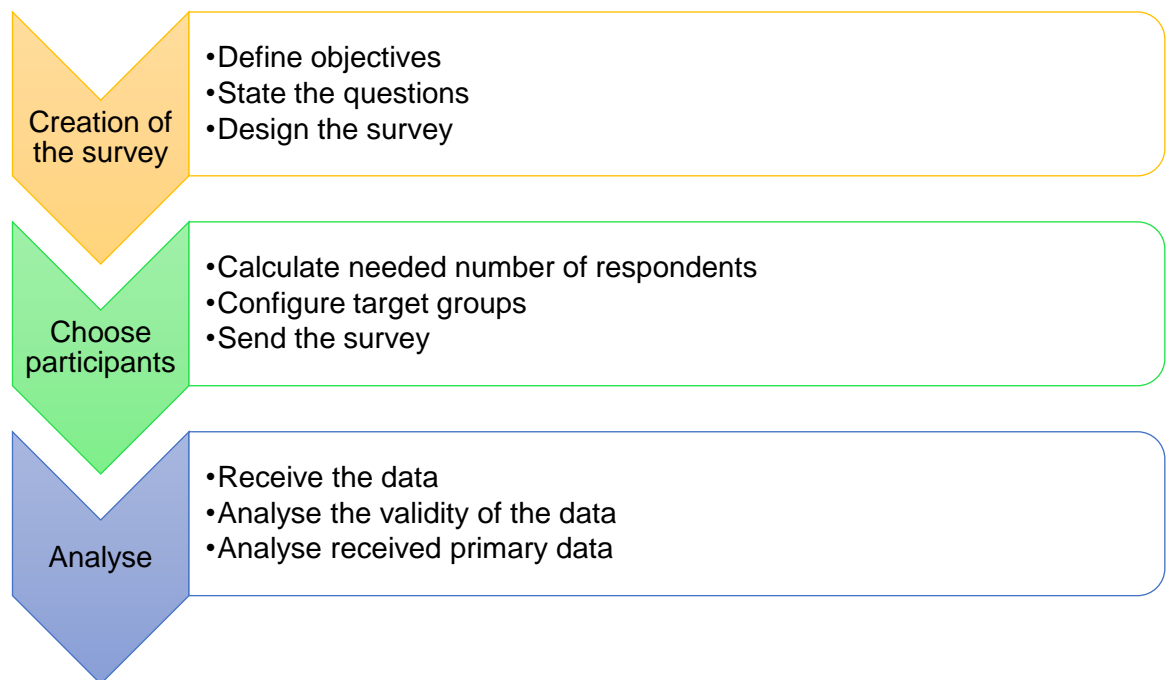- Analyse received primary data

Figure 9. Zoho Survey creation model with research panels (Zoho Survey, 2020)

Zoho allocates responses by a summary of all respondents and each response. Summary of responses is shown in the form of graphs and diagrams, while an individual response is focused on when, how and who took the survey individually. Every individual response contains IP address which has been used to participate in the survey, time which has been taken to finish it. Individual responses are divided between partial and fully completed responses. It means that if the respondent stopped answering the survey at some point, it would keep track of questions which he answered.

To understand – how certain vital aspects of MOS are and what aspects customers prioritise more than others, most survey questions use the Likert scale. Likert scale is a five-point bipolar response which was developed in 1932 (Allen & Seaman, 2007).

In my research, the Likert scale will be used to identify how certain statements are relatable to customers opinion.

An example of the typical case of Likert scale usage will be the answer to the question "How important is the number of available apps on MOS for the customer". There are several pre-made answers which respondent could choose from. After choosing the option he relates to the most, he uses the Likert scale, which includes a range of opinions from 1 to 5: from "Strongly disagree" to "strongly agree". There was always a "neutral" option in case respondent would not know how to answer.

4.3 Results

The survey was sent to customers from the Russian Federation.

The rapidly growing smartphone market dictated this particular choice of the Russian market. In 2019 alone, the mobile market grew by 12 percent, with the total amount of smartphone shipments reaching 34 million. Primary reasons for this growth were the country's stable economy, ongoing replacement of feature phones and increasing variety of budget smartphones. (Ahrens, 2020)

126 respondents in total responded to this survey. Gender distribution consists of 58 males and 61 females; 7 respondents preferred not to specify their gender. 89 of mentioned respondents used Android-based smartphones, while 42 respondents used iPhones. Age distribution goes as follows: 42,86 % of respondents are in age group of 18 to 29; 29,37 % respondents are from 25 to 34; 19,05 % respondents are in the age group from 35 to 44; 6,35 % of respondents are in group of 45 to 54; 2,38 % are belong to 55-75. Table 3 includes this data in compact format.

Table 3. Demographic variables

Age		Gender		Smartphone	
18-24	42,86 %	**Males**	46,03 %	**Android**	69,84 %
25-34	29,37 %	**Females**	48,41 %	**iPhone**	31,75 %
35-44	19,05 %	**Preferred not to say**	5,56 %	**Other**	2,38 %
45-54	6,35 %	**A number of all respondents combined.**			
55-75	2,38 %	126 respondents			

Top-ranked features of the smartphones were brand, mobile operating system, camera, and design. The design was the most critical feature for 24,6 percent, MOS for 22,22 percent, camera for 7,94 percent and brand for 17,46 percent. The least essential feature was durability, which was placed last for almost half of the customers, ranking as the least important for 42,86 percent. Table 4 ranks the smartphone features by importance; from the most important, to the least important.

Table 4. Importance of smartphone features ranked

Customers rankings towards smartphone features (respondents, who put the item in the top 3)	
Brand	56,35 %
Design	53,17 %
Camera	42,86 %
Mobile Operating System	42,85 %
Battery Life	33,34 %
Hardware	30,95 %
Price	23,81 %
Durability	16,66 %

More than 58 percent agreed that privacy is an essential part of the MOS. 66,66 percent answered that performance is essential as well. Particularly half of the respondents stated that customisation is crucial for them. Eco-System was important for 46,83 percent of respondents. Lastly, the brand was important for 51,59 percent of respondents. Table 5 ranks the MOS features; from the most important, to the least important.

Table 5. MOS feature rankings

Opinion towards MOS feature importance (respondents who agreed or strongly agreed with the statement)	
Performance	66,66 %
Privacy	58,73 %
Brand	51,59 %
Eco-System	46,83 %
Customisation	50 %

Security issues were answered mainly by neutral opinions as well. 43.66 percent of respondents were insured in their data safety. 39.68 percent agreed that their data was only partially secured. 38.89 percent did not believe in their data safety at all. Table 6 compresses all the opinions towards the security of the smartphones.

Table 6. Opinions towards Security among customers

Opinions towards security (respondents who agreed or strongly agreed with the statement)	
Fully secured	43,66 %
Partially secured	39,68 %
Not secured at all	38,39 %

Table 7 shows customer opinions on app distribution; number of available apps was a crucial point for 32,54 percent of respondents. About 60 percent agreed that they had a typical pack of apps which they use daily. More than 31 percent of respondents used pre-installed applications and did not care about the number of available apps at all. Ta

Table 7. Customers opinion towards app distribution

Opinion towards app distribution (respondents, who agree or strongly agree with the statement)	
I have a typical pack of mobile apps which I use daily. If those apps are available for the Mobile OS - I am happy.	60,32 %
I regularly check new apps and games. If there is not enough content for the Mobile OS, I probably will not use it.	32,54 %
I use pre-installed apps and rarely download something which is not already installed on the phone. The number of available apps does not matter to me.	31,75 %

Exactly 55 respondents never migrated from their preferable MOS. Many people skipped this question or did not provide any suitable answer. 12 respondents switched from IOS to Android, and 13 changed to IOS. Table 8 shows all the data received from this question.

Table 8. "Migration" table

"Migration" table from one MOS to another			
Never migrated	**From Android to iOS**	**From IOS to An-droid**	**Not answered**
55	13	12	46

There were no significant differences between what kind of smartphones different genders use. More than 70 percent of both females and male respondents used Android. There were no significant differences between feature rankings in terms of genders. For both males and females, MOS, design and brand were the most critical aspects in their buying decisions. More females agreed that privacy was the essential part of the Mobile OS - 53,45 percent for male respondents and 67,21 percent for female respondents.

4.4   Analysis

Survey shows that majority of the respondents who participated in this survey were using Android devices. According to statistics, worldwide share between IOS and Android are 24,98 percent for IOS and 74,44 percent for Android (StatCounter, 2020). The dominant position of Android is due to the considerable OEM's support and smartphones with lower prices compared to IOS phones.

My hypothesis about the importance of MOS in buying behaviour of customers was partially proved by the fact that it was rated as the second most crucial aspect when buying a smartphone. The only more important factor for buyers was design, which is understandable because smartphones design has not evolved significantly in almost a decade. Only a year ago tech-giants like Samsung, Huawei and Motorola introduced a new form factor of foldable smartphones.

Readers of AndroidAuthority also proved design importance. This resource shared the results of the poll about the importance of the design in smartphones, which was answered by 877 respondents. 85,97 percent of respondents said that design was necessary, while 37,97 percent saying that it is one of their top-priorities in buying a new smartphone. (Westenberg, 2020)

Privacy and performance were the two most essential features of MOS, and the majority of the respondents also answered that they fully-believe in the security of their smartphones. Nonetheless, in the results of my survey, some users might not be aware of the status of their phone's security. It comes due to some respondents agreeing with contradicting statements.

One of the very recent studies proposed a model, which counted how many users were aware of the security and privacy of their smartphones and also introduced a level of awareness. In their research, 3,424 respondents answered questions about several aspects of their smartphone use. They concluded that on average, 60 percent of people are not aware of the level of the security of their smartphones, and only 50 percent are aware of their security on 9,49 percent level. (Ali, Rahman, & Jahan, 2019)

It might be the answer to a mixed response to the question regarding security awareness in my survey.

In order to adapt the Crackberry's pyramid, I summarised all the responses received from this survey and put it into the pyramid of MOS needs. Instead of digesting all the aspects of smartphone values to the customer, I added the results from my survey regarding the importance of smartphone features. More specifically, I focused on the values of MOS for the customer. As a result, in the pyramid shown in Figure 10 – the basic need for all customers is the performance of the OS without which all other needs will not be fulfilled. Other parts of the pyramid are put according to survey results.
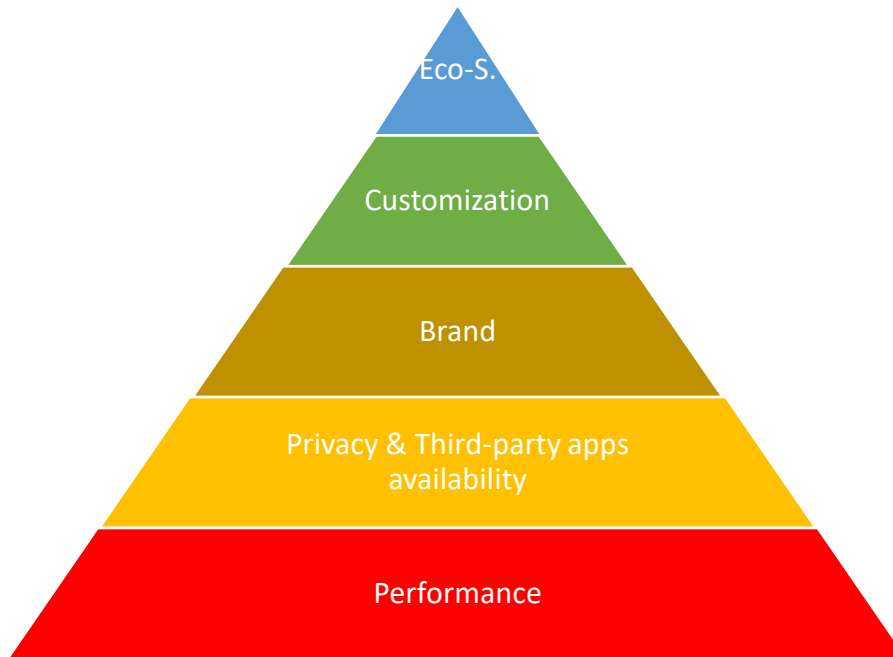

Figure 10. Smartphone MOS needs; adapted from Crackberry's theory of smartphone needs

Last open-ended question was about changing one MOS for another. People who changed Android for IOS decided to do so because they felt that it is faster and better looking. Respondents who changed IOS for Android did so because they saw better value for price and more adaptability to each user's needs.

Another source regarding this issue comes from PCMag. They asked 2,500 US respondents about the reasons behind their change of MOS. Initially, they found out that 71 percent of the respondents never switched to another OS, 11 percent migrated from IOS to Android and 18 percent in the other direction. 47 percent of respondents who moved from Android to IOS claim that they received better UX with the change while only 30 percent of IOS-Android movers said the same. One of the critical reasons for the change was prices for smartphones – 29 percent of" IOS to Android" movers stated that they saved money with that change. (Griffith, 2018)

My research has the same tendencies, compared to research made by PCMag. Users rarely switch to their preferred MOS. In case they decide to make a switch, as a typical example of dissonance-reducing buying behaviour mentioned in my theoretical framework, they justify it with better opinions towards overall user experience or better value for money.

Following the results of this survey and all materials above, let us put some topics which will be somehow influential for the development of the MOS's. In the next chapter, I invite the reader to a discussion on specific issues which customers or companies are facing now or may face in the future.

5 Discussion & reflection

In this final chapter of this thesis, I summarise all the information from previous chapters, give topics for discussion for the reader which will inevitably influence the development of MOS's and give my reflection on writing this thesis.

5.1 Reflection on research results and theoretical framework

In my case-study, I reviewed cases of Blackberry, Nokia, and Microsoft. Their examples gave me the image of what were the reasons why OEM's neglected supporting their software.

In the case of Nokia, I identified that giving the customer a pleasant user experience by providing easily accessible user-interface and adapting MOS is one of the first things company should be worried about. By rushing the development process and using underdeveloped software, Nokia buried themselves as a leading phone manufacturer.

Microsoft's case proved that investing a tremendous amount of money in software development and buying one of the largest phone manufacturing companies does not guarantee success. Unattractive licensing regulations and the policy of donating Microsoft's funds only to Nokia made Windows Phone unpopular choice for phone manufacturers, which then led to a small percentage of non-Nokia Windows Phone smartphones. Additionally, software developers were not that interested in developing applications for the OS which user-base was not big enough.

Finally, Blackberry's case showed that the company needs to find a balance between their philosophy and market trends. Executives of the Blackberry brand were too focused on selling smartphones for business customers, with the same design and features. Moreover, even when they were producing the most secured smartphones at a time, they abandoned the opportunity to gain money on selling user data and advertisements built-in the MOS.

Google managed to capitalize very successfully on selling their services and applications, but the key reason why Android remains as the only viable choice for OEM's is its customizability. Since the introduction of Android, there was no single company which presented something radically different. Thanks to its flexibility, Android will remain as the only global licensed MOS for the next 5-10 years.

A good example of sticking to the company's philosophy is Apple's IOS. Subjectively, Apple designed the best possible user-interface in 2007 and since then, kept improving it. The power of exclusivity and brand enforces iPhone sales and makes them the only alternative for Android.

Web-survey which I executed confirms that. Even though the majority of respondents agreed that their smartphones are secured, people generally do not have a clear understanding of which parts of their smartphones are secured and which are not. To put it simply, customers have general knowledge about which data they provide and how their MOS secures their data.

Surprisingly for me, the brand was the most important part of a customer's buying decision. This could be explained with the customer's trust and loyalty towards one manufacturer, which fulfils all their needs in smartphone design, performance, and other aspects. It can be said that some customers do not have the knowledge or care enough about such aspects as camera, battery, MOS and base their buying decision on a trusted brand. At the same time, I proved that MOS is one of the major aspects of their buying decision as well.

All the mentioned parts of my research solidify the argument that smartphone buying is related to dissonance-reducing buying behaviour. This model fits perfectly to this research and can be used in other kinds of studies which relate to smartphones buying desicion. Due to the small number of differences between smartphones and low price of the purchase - customers base their buying decision on a few arguments, but highly involved in the comparison of different brands and manufacturers.

Kevin Crackberry's pyramid of smartphone needs was introduced in 2009. At a time, when there were 4 to 5 companies which were competing in developing their software. At that time, this pyramid significantly contributed to assessing how different smartphones fulfilled the customer's needs. Today, it remains as one of the best comparative models for smartphone comparisons, but due to technological advancements and overall adaption of Android, making a well-performing smartphone, which software and hardware collaborate nicely, is not as hard as it was in the 2000s. It is tough today to find a smartphone from an established brand which does not fulfil almost all the needs of Crackberry's pyramid to some extent. Still, due to the factor of different smartphone pricing and exclusive features of specific brands, Crackberry's pyramid remains valid today.

To summarise all findings from this research, we get an understanding of how successful mobile operating system needs to look like. It has to be easily accessible, provide a typical pack of applications which current customers use daily, have a suitable balance of providing an adequate level of security, explain what kind of user data is shared with third-parties and provide a good value for money. The creation of an entirely new mobile OS is a very hard challenge for any possible newcomers. To look on this further, let us dive in on the discussion of how the future of mobile operating systems might look like.

5.2   Future of MOS development

As we have understood, there are only two major companies which are developing their mobile operating systems. Since the start of the previous decade, Apple and Google ferociously competed between themselves and with other software developers. The moment which determined the future of the smartphone market was when Symbian lost its position as leading Mobile OS. After that moment, Android and IOS have not seen any comparable competition. Regardless, it does not mean that there were no attempts at entering this duopolistic market.

I talked about three competing companies in my case-study, but there were many more companies, which tried to enter the smartphone market.

One of the leading Android smartphone makers – Samsung – tried to use alternative Mobile OS called Tizen OS. It is still used in Samsung's smartwatches, smart tv's, but it never really took off on smartphones. Tizen, just like Android, was open-source software, but there were no other mobile vendors who would have supported the platform, beside Samsung. The last smartphones with this OS were sold in India, Russia and some other countries and were positioned as an ultra-cheap solution for corporate users. (Shcherbakov, 2019)

Additionally, there was an attempt of adapting Linux-based MOS's for smartphones. First, it was LiMo – a foundation of smartphone manufacturers, which was meant to provide software for the members of said foundation. The second attempt was Ubuntu Touch – an adaptation of the desktop version of Mobile OS with redesigned UI. Both of those projects failed but for different reasons. LiMo, in comparison to Android, did not offer a Mobile OS but instead offered a kernel, with which manufacturer had to work with to create the user interface, apps and other components of the operating system. Ubuntu Touch was a very ambitious project which aimed to collect 32 million USD in a month through crowdfunding to manufacture smartphones with this MOS. Developers failed to reach this number, and

then this project was slowly disbanded. Ubuntu failed to provide new features in comparison to Google and Apple, did not have any significant support from OEM's and was closed in 2017. (Scherbakov, 2019)

So, how mobile operating systems will develop in the future, considering the minimal competition and inability for the new companies to compete? To be fair, there are not many companies which could seriously compete with Google and Apple, considering the size and financial capabilities of these firms. Facebook, Amazon and Windows in the US and Samsung, Huawei, and Lenovo in Asia. Thanks to current political tensions, one of those companies were forced to develop their own MOS.

Currently, governments heavily influence gigantic tech-companies. In 2018 the European Commission fined Google 4,3 billion € for illegal practices regarding strengthening the dominance of Google search engine. What Google has done is that company has forced smartphone vendors to pre-install Google services in order to license Google's Play Store; paid global manufacturers like Apple to exclusively pre-install Google search as their default app/search engine; limiting the development and distribution of Android-based operating systems. The commission required Google to stop and not ever engage in any mentioned practices (EU Commission, 2018).

A similar probe was started against Apple and their App Store policies and Apple Pay system (Kelion, 2020). Nonetheless, it is nothing compared to how much attention Apple's app distribution policies got after the complaint of one of the leading game developing companies.

Epic Games – the creators of Fortnite videogame – filed a lawsuit against Apple, which were antitrust and anticompetitive allegations that Apple refuses to provide alternative payment methods, besides transactions through App Store which forces third-party developers to pay 30 % commission to Apple. The same thing happened to Google. It was a consequence of removing Fortnite from App Store, and Play Store after Epic Games allowed players to buy in-game currency through their payment system for 20 % cheaper, than if they would buy them through Play Store or App Store (Statt, 2020).

Currently, the investigation is still ongoing, and companies such as Spotify and Facebook cited with Epic Games and supported their complaints. (Malara & Rana, 2020)

Some countries are even trying to find alternative solutions towards "monopoly" on the Mobile OS software market. One of such countries as Russia, which officials were concerned over the security of IOS and Android. They funded Jolla, the creators of Sailfish mobile OS. In 2018 Nikolay Nikiforov – Minister of telecommunications in Russia – stated that the deal is done and now Sailfish can officially be labelled as "Russian Mobile OS" (Arguments & Facts, 2018). By the end of 2021, Russian officials expect to transfer 8 million members of governmental structures to this platform. (Kommersant, 2018)

To summarise, how these events will influence the development of Mobile OS for customers and how it will change in the following years? The world of mobile operating systems is a winner-takes-all market. It means that the best performers, which are currently Google and Apple, will be the prevalent force on the market and even if any other company can enter the market, it will be left with tiny market share compared to these two. (Hayes, 2020)

Even entering this market, in general, is hard enough task, mainly due to 4 actors of MOS development shown on Figure 11, which are connected, rely on each other and work in the cycle. (TechAltar, 2017)
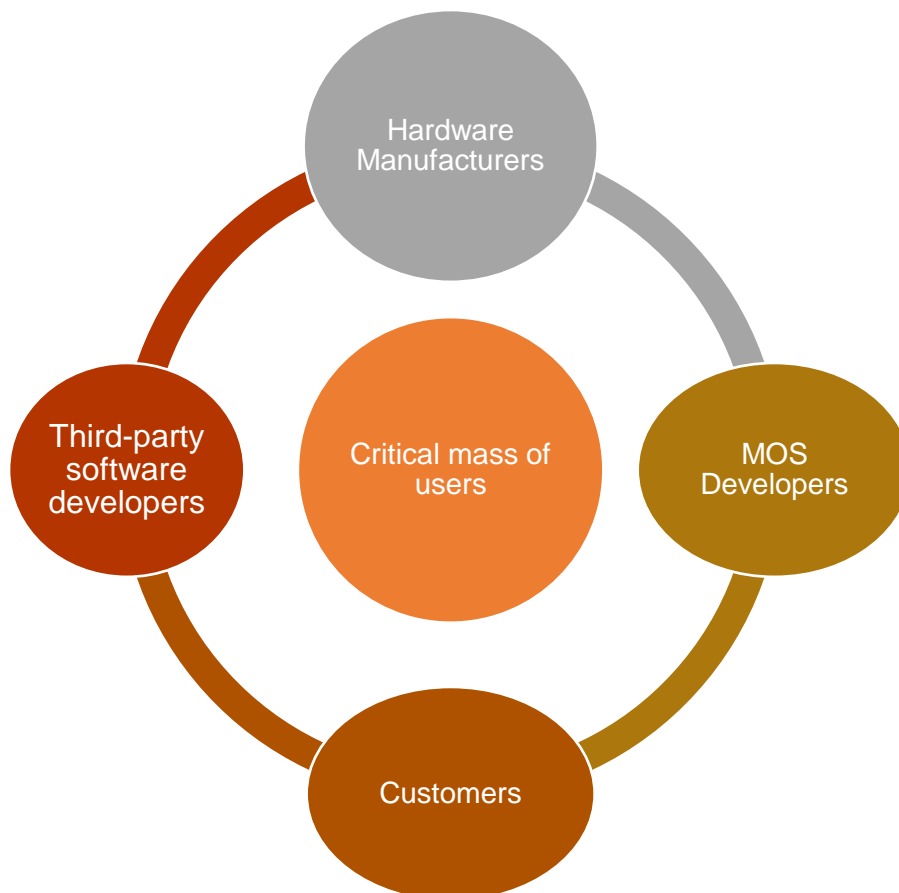

Figure 11. 4 actors of MOS development (TechAltar, 2017)

In the development of the MOS, the number of customers, who use this OS is the critical aspect which determines how popular will it be among software developers and hardware manufacturers. If the OS is used by large user-base, more software developers will be attracted to developing applications for this OS. If more applications are developed than hardware manufacturers would choose this OS in the smartphones, they produce since they want to target the bigger group of customers. The money, which comes from software developers and hardware manufacturers will be used in improving the platform, which all actors use in this process. The major actor in this cycle is the critical mass of users of the OS. After reaching this number, more software developers will recognise the platform, which in order will launch this cycle. To achieve that, the company needs tremendous financial power, significant human resources, and cooperation with a massive number of soft makers. There is a minimal number of companies which can do that. (TechAltar, 2017)

Consequently, if nothing will change, the MOS market will remain a duopoly, with very similar patterns to the desktop OS market. Currently, Windows and Mac OS occupy more than 90 percent of this market (StatCounter, 2020). These two companies were the only ones, which were competing in the consumer market of desktop operating systems.

Another case is if there would be a company, which could try to enter the MOS market and compete with Google and Apple. Facebook is developing its OS to reduce its reliance on Google services (Porter, 2019). Samsung still has the Tizen OS, which they could potentially continue developing. The most ambitious development, however, is currently being produced by Huawei. It is called Harmony OS.

5.3   Harmony OS

On 15 May 2019 president of United States of America Donald Trump issued an executive order which commanded complete ban on the use of telecommunications equipment from foreign firms which threaten national security. The order did not mention Huawei. Regardless, the Department of Commerce created the entity list, which included the companies which are de-facto banned from working in the US. Huawei was on this list. It did not only mean that Huawei could not sell any of their products on the territory of USA, but it also meant that all partnerships which American companies might have with Huawei have to be terminated. (White House, 2020)

Google was one of the first companies which responded to this order. On 19 May 2019, they confirmed that they would comply with the issued document by cutting off Huawei

from every digital product owned by Google. It meant that all smartphones and tablets released after 19 May would not get Google services, will be unverified and will not be supported by Google. Huawei practically lost a pack of applications, services and products used by millions of users around the world. (Brown C. S., 2020)

After the ban, several tech companies, despite cutting off business relationships with Huawei, supported them, commenting on how big the company is and the damage of this issue might bring to US companies. Nonetheless, the damage has been done, and Huawei was left with pure Android and no alternatives to work with. (Brown C. S., 2020)

At this point, we must take a look why Huawei was imposed to such sanctions and why it is possibly the only company, which might be able to compete with Google and Apple in terms of software development. To start with – Huawei is the largest provider of network equipment in the world with more than 190,000 employees around the world. At the beginning of this year, Brand Finance ranked Huawei as 10th most valuable brand of 2020. Despite all limitations Huawei had to face, it managed to sustain their positions as second-largest smartphone manufacturer. (Huawei, 2020)

On the other side, Huawei was accused continuously of having security breaches, that might be used for cyber-attacks or Chinese espionage. In the early 2000s, Huawei was suspected of spying in India, Britain, US, claiming intellectual property, having vulnerabilities that might be exploited by hackers or other entities. (Staff, 2006)

Additionally, there are constant debates over whom Huawei belongs to. Officially, Huawei positions itself as a company owned by the employees. Currently, the ownership scheme looks like this: Huawei Technologies is wholly owned by the holding company Huawei Investment & Holding, which, in turn, has two owners. One of them is Ren Zhengfei, the founder of the company; he owns 1.14% of the shares. The remaining 98.86% belongs to an organisation called Huawei Investment & Holding Trade Union Committee. Employees own only "virtual shares" - they give the right to receive part of the profit before the termination of the employment contract, but cannot be sold and do not give the right to participate in the management of the company. In other words, Huawei is not "employee-owned" company they claim to be. (Balding & Clarke, 2019, 2-6)

Of course, Huawei denies every accusation it receives by expressing the lack of evidence. Frankly, to this day, there is no public evidence that Huawei spied, hacked, or somehow influenced any other countries or companies via their equipment, software, or technologies.

There might be many debates over whom Huawei belongs to, how damaging their products can be in terms of security and privacy. However, there is a simple fact: Huawei is the gigantic enterprise, capable of mass production of any type of IT products, possessing tremendous human resources and being the most popular smartphone brand in China (Counterpoint, 2020).

Being number one in China, and number two worldwide gives very comprehensive capabilities for innovation and room for software development. The dispute over who loses more on Huawei ban – Huawei, which lost access to Google verification and services – or Google, which lost a considerable amount of money which Huawei was paying as licensing fees – has the right to exist—especially considering that US government might have created the most ambitious competitor for Android in the form of Harmony OS.

On 9 August 2019 Huawei unveiled the first version of Harmony OS, which meant to be used in smart-TVs, smart wearables, and cars. It could also run on smartphones and tablets, but Richard Yu – Executive director of Huawei – said it could easily replace Android as a leading operating system in Huawei's gadgets if tensions between Huawei and US will not settle down (GSMArena, 2019). One year later, Harmony OS is announced to be tested, replacing Android in Huawei smartphones (GSMArena, 2020).

What is Harmony OS? In general, it is new, completely different from Android, Mobile OS with an outstanding level of flexibility in terms of adapting this software to different kinds of hardware. This MOS could be used practically anywhere, from smartphones, smart wearables, and tablets, to kitchen appliances, cars and speakers. Huawei focuses on seamless integration of their software on multiple kinds of devices and advertises smooth collaboration of all gadgets run on Harmony OS. (Chen C. , 2020)

Currently, there is no information on how this OS looks in terms of UI on smartphones. Beta-testing is planned to start in December this year, and by 2021, Huawei might start releasing smartphones for sale on Harmony OS. (Brown C. , 2020)

Application development for this platform is one of the most challenging aspects of adopting this OS for the consumer market. Even though Celia Chen writes that the process of adapting Android apps for the Harmony OS takes "one-two days", developers first need to be attracted to this platform by the user-base which is large enough even to consider developing anything for Harmony OS. (Chen C. , 2020)

Additionally, criticism that Huawei endured for the last 20 years is not going anywhere. Customers need to be convinced in their data's safety and privacy. Additionally, in order to make this OS global, they have to work with developers from other countries which they started doing recently. For instance, Huawei announced that they would cooperate with 1500 software staff members from Russia. (Doffman, 2020)

To summarise, entering the Mobile OS market is very hard. There might be a valid stand-point that due to specifics of this market, there are no real chances that even tech-giant like Huawei, given limitations that it was forced to meet with, can popularise this platform in China, let alone outside of Asia. Limitations, like cutting off any business deals with even non-American hardware manufacturers, will inevitably force Huawei to turn to local hardware providers. Even then, if local hardware chipmakers will partially use any American technologies, they would need to be licensed by the US first (McGregor, 2020). Now, why this project has any chances of being successful?

There are different opinions towards Harmony OS and its potential for competing with IOS and Android. Simon Baker – the program director for mobile phones and consumer devices at IDC EMEA – states that presentation of Harmony OS is admitting that ban, imposed by the US, the damaged value of Huawei-produced gadgets outside of China. At the same time, if the Chinese government would have supported Huawei's platform and started implementing it on a national level. The Chinese government would need to attract the other Chinese large smartphone brands such as OnePlus, Xiaomi, Oppo and Vivo, which still were not imposed by any US sanctions. It is possible due to "Made in China 2025" country plan to get more technically independent. Nevertheless, considering that it is hard enough by itself, the political climate which dictates this trade war does not seem to get better. 2020 US elections, regardless of the winner, will not ease up the sanctions Huawei faced (Baker, 2020).

A recent survey executed by Android Authority which was answered by 2687 respondents shows that more than 83,47 per cent of Huawei branded smartphone users would consider ditching Android for Harmony OS (Walker, 2020).

It should be stated that if Huawei decided to integrate Harmony OS on already existing Huawei smartphones, it would be possible to do it (Dassanayake, 2020).

Subjectively, entering mobile OS market in 2010, when Symbian was the dominant platform, and there was the number of different firms which were competing between each other, was much more manageable, than it is now, with two established leaders. Google

built eco-system of their services and products, and as we can see from research and surveys which were suggested in this thesis, customers rarely switch between their preferred platforms. However, my point is that if Huawei would not be able to develop and engineer the MOS, with their resources both in software development and in R&D, then the tiny number of companies will ever be able to.

5.4   Reflection on writing this thesis

The story of coming up with the idea for this thesis started occurring to me in the middle of 2019. In the final moments of the spring semester at Haaga-Helia University of Applied Sciences, I asked one of my coordinators who have supported and guided me along with my studies – Yucel Ger – how do I prepare for writing a thesis and when should I decide on the topic which thesis will be about. It was a time when I already studied in Haaga-Helia for one-and-a-half years, so I was in the middle of my studies. He told me that I could start coming up with the ideas for my thesis during the summer. So, I started doing just that. I decided for myself that the period of thesis writing would be the Autumn semester of 2020. I had several scenarios about what kind of thesis would it be, and I outlined two scenarios.

The first scenario included thesis commissioner and a cooperative project which I would work on together with him. The second scenario was my own thesis, written based on my individual interests. As of January 2020, I planned to find my thesis coordinator in the summer of 2020. Personally, I would love to work with any company, which would relate to sales & IT. Then, COVID-19 happened.

I had to travel back to my hometown by the end of March since Haaga-Helia was going locked down for quarantine and I had to think about how would I write my thesis because, obviously, the chance of finding a commissioner during the global pandemic would not be that high.

There were two topics which I would be motivated the most to write about. First – is the one that you are currently reading right now. The second topic was related to banking and debt substitutions for small and middle-sized organizations. After some consultations with one of the Branding course coordinators – Anna Vähäsalo – I have made up my mind.

Initially, this thesis would have been probably longer by 20-30 pages. I was planning to cover every Mobile OS starting from Apple Newton, including Palm OS and other software which came out more than 15 years ago. The problem was that I could not define the

clear goal of why I would write that amount of material, besides loving to dig in old geeky tales about technologies of the past.

Thanks to my thesis coordinator – Marika Alhonen – she defined the focus, which I should follow by reminding me that I am studying business administration and international sales and marketing. From that moment, I decided to cut off all the technical details which average user of a smartphone would even be interested in and prioritized writing about MOS from the perspective of the customer. Both B2C and B2B.

Starting with my choice of companies for the case study – I believe that examples of Nokia, Blackberry and Microsoft are very demonstrative. Even if the company had the biggest market share like Nokia did, even if the company designed the most secure smartphones which Blackberry had, and even if you are the biggest software company in the world like Microsoft was and still is – the mobile market is driven by simplicity of the product and emotions customers experience in the process of using the device. Furthermore, these three companies did not manage to provide positive ones by the end of the lifecycle of their mobile software.

One of the biggest problems during the times of the pandemic was the primary data collection method. I did not know how I would gather enough responses to analyse the data if I could not even leave my flat. When I found the Zoho platform, I instantly start checking the clarity of the data they provided from their research-panels. I had suspicions that the respondents who will be receiving my survey would be bots, but after I received all the responses, I understood that all the responses were valid. At the same time, I identified my biggest mistake - I should have created a Russian version of the web-survey. I believe that the data quality would be higher, and the answers which I received would be more evident. To my mind, this is the weakest part of my research.

In the discussion part, I wanted to bring up recent themes, which I believe were the most important for the development of Mobile OS. With expanding mobile market and raising concerns over user's data safety and privacy – the political and governmental involvement in the development of MOS's became evidently clear. This involvement is only getting bigger in the future, and the projects like Harmony OS might be the first of a kind, which emerged with the help of the government. Overall, I believe that I could have done this thesis better, especially in designing the web survey and getting primary data. Nonetheless, I am satisfied with the result which I got, considering all circumstances I faced while writing this paper. I believe that I tried my hardest to provide accurate material, including as less personal value judgement as possible. In my theoretical framework, I provided the

key models which I thought were the most suitable for this kind of research. I would grade myself 3,0 as my personal evaluation for this paper.

As for final words of this thesis, I would like to thank my personal thesis advisor – Marika Alhonen. Without her feedback and constant assessment, I probably would never finish writing this paper and would never find the models which would be suitable for this research. I want to thank my parents for giving me a chance of studying in this university which gave me an immense amount of positive emotions, study-methods and my first working experience in Finland (which hopefully will not be the last). Finally, I would like to thank all the people I met during my studies which helped me to adapt to the local culture, with whom I shared all my best academic achievements and whom, I believe, became close friends for me. ჯგირობუა!

<div align="right">Shamugiia G.</div>

References

4PDA. (24. August 2020). *What are you looking after while deciding on a smartphone?* 4PDA.ru URL: https://4pda.ru/2020/08/24/374715/ Accessed: 01.11.2020

Adcock, D.;Halborg, A.;& Ross, C. (2001). Teoksessa A. H. Dennis Adcock, *Marketing: Principles and Practice*, Pearson Education. Accessed: 01.11.2020

Ahrens, A. (5. May 2020). *Huawei overtakes Samsung to take the lead in the Russian smartphone market in the second half of 2019* . URL: https://www.omdia.com/resources/product-content/huawei-overtakes-samsung-to-take-the-lead-in-the-russian-smartphone-market-in-the-second-half-of-2019 Accessed: 01.11.2020

Ali, M. N.;Rahman, M. L.;& Jahan, I. (2019). Security and Privacy Awareness: A Survey for Smartphone User. *International Journal of Advanced Computer Science and Applications*, 5-6.

Allen, I. E.;& Seaman, C. A. (July 2007). *Likert Scales and Data Analyses.* Quality Progress URL: http://rube.asq.org/quality-progress/2007/07/statistics/likert-scales-and-data-analyses.html Accessed: 01.11.2020

Andreiko, A. (13. August 2013). *50 thousands apps from Blackberry World are made by one company.* URL: https://habr.com/ru/post/191094/ Accessed: 01.11.2020

Android Developers. (8. September 2020). *User Interface & Navigation.* URL: https://developer.android.com/guide/topics/ui Accessed: 01.11.2020

Arguments & Facts. (18. May 2018). *Nikolay Nikiforov: We will continue to advocate for our digital sovereignty.* URL: https://aif.ru/society/web/nikolay_nikiforov_my_budem_i_dalshe_otstaivat_svoy_cifrovoy_suverenitet Accessed: 01.11.2020

Baker, S. (16. September 2020). *Industry Voices — Baker: What chance does Huawei's new Harmony OS have?* URL: https://www.fiercewireless.com/devices/industry-voices-baker-what-chance-does-huawei-s-new-harmony-os-have Accessed: 01.11.2020

Balding, C.;& Clarke, D. (2019). *Who owns Huawei?* URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3372669 Accessed: 01.11.2020

Beattie, A. (30. March 2020). *Why Did Microsoft Face Antitrust Charges in 1998?* URL: https://www.investopedia.com/ask/answers/08/microsoft-antitrust.asp Accessed: 01.11.2020

Bell, K. (15. November 2018). *Apple ad revenue could hit $11 billion a year by 2025.* URL: https://www.cultofmac.com/666134/apple-ad-revenue-11-billion-2025/ Accessed: 01.11.2020

Blackberries. (30. August 2012). *Blackberry Bold 9000, 9780, 9790, 9900.* URL: https://blackberries.ru/2012/08/30/blackberry-bold-9000-9780-9790-9900-vse-modeli-v-nalichii-v-nashem-internet-magazine-2/ Accessed: 01.11.2020

Bohn, D. (4. August 2020). *Android's 'Nearby Share' file sharing feature is finally launching.* URL: https://www.theverge.com/2020/8/4/21353020/android-nearby-share-file-sharing-feature-launch-airdrop Accessed: 01.11.2020

Brandom, R.;& Kastrenakes, J. (19. October 2018). *Google app suite costs as much as $40 per phone under new EU Android deal.* URL: https://www.theverge.com/2018/10/19/17999366/google-eu-android-licensing-terms Accessed: 01.11.2020

Brown, C. (10. September 2020). *Huawei HarmonyOS 2.0 beta release dates revealed to battle Android and iOS.* URL: https://www.slashgear.com/huawei-harmonyos-2-0-beta-release-dates-revealed-to-battle-android-and-ios-10637612/ Accessed: 01.11.2020

Brown, C. S. (25. August 2020). *The Huawei ban explained: A complete timeline and everything you need to know.* URL: https://www.androidauthority.com/huawei-google-android-ban-988382/ Accessed: 01.11.2020

Chen, B. X. (17. November 2009). *How Microsoft Blew It With Windows Mobile.* URL: https://www.wired.com/2009/11/microsoft-windows-mobile/

Chen, C. (7. October 2020). *Harmony OS: everything you need to know about Huawei's Android alternative.* URL: https://www.scmp.com/tech/gear/article/3104176/harmony-os-everything-you-need-know-about-huaweis-android-alternative Accessed: 01.11.2020

Chen, J. (29. May 2020). *Business-to-Business (B2B).* URL: https://www.investopedia.com/terms/b/btob.asp Accessed: 01.11.2020

Clement, J. (11. August 2020). *App stores - Statistics & Facts.* URL: https://www.statista.com/statistics/266210/number-of-available-applications-in-the-google-play-store/#:~:text=The%20number%20of%20available%20apps,under%20the%20name%20Android%20Market. Accessed: 01.11.2020

Computing Home. (3. June 2020). *Smartphone.* URL: https://www.computerhope.com/jargon/s/smartphone.htm Accessed: 01.11.2020

Conrad, E.;Misenar, S.;& Feldman, J. (2010). Chapter 8 - Domain 7: Telecommunications and network security. Teoksessa E. Conrad;S. Misenar;& J. Feldman, *CISSP Study Guide* (ss. 255-327). Elsevier Inc. URL: https://www.sciencedirect.com/topics/computer-science/personal-digital-assistant Accessed: 01.11.2020

Counterpoint. (17. August 2020). *China Smartphone Market Share: By Quarter*. URL:
    CounterPoint: https://www.counterpointresearch.com/china-smartphone-share/
    Accessed: 01.11.2020

Crubiogu. (6. August 2020). *[Tutorial] A different way to use Uber on Mate30 Pro ,P40 Pro
    and P40 lite*. URL:
    https://consumer.huawei.com/uk/community/details/%5BTutorial%5D-A-different-
    way-to-use-Uber-on-Mate30-Pro-%2CP40-Pro-and-P40-lite/topicId_27623/
    Accessed: 01.11.2020

Crump, D. (17. February 2020). *Why BlackBerry Phones Failed*. URL:
    https://medium.com/@dallincrump/why-blackberry-phones-failed-1a32718769ea
    Accessed: 01.11.2020

Dassanayake, D. (11. October 2020). *Huawei to replace Android with HarmonyOS and
    P30 Pro and P40 Pro owners could be first up*. URL:
    https://www.express.co.uk/life-style/science-technology/1345907/Huawei-Android-
    HarmonyOS-P30-Pro-P40-Pro Accessed: 01.11.2020

Doffman, Z. (21. September 2020). *Huawei Turns To Russia For Its Game-Changing New
    Android Alternative*. URL:
    https://www.forbes.com/sites/zakdoffman/2020/09/21/why-your-huawei-
    smartphone-will-get-russian-software-as-android-is-replaced/?sh=62e4ed8c78e8
    Accessed: 01.11.2020

Duino, J. (17. December 2018). *If your phone has an OLED display, Samsung likely made
    its screen*. URL: https://www.androidauthority.com/samsung-oled-display-market-
    share-935303/ Accessed: 01.11.2020

Dyck, J. (8. October 2019). *Why Windows Phone Failed — And How They Could've
    Saved It*. URL: https://medium.com/bc-digest/why-windows-phone-failed-and-
    how-they-couldve-saved-it-35efc19861ee Accessed: 01.11.2020

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *The Academy of
    Management Review*, 532-550.

EU Commission. (18. July 2018). *Antitrust: Commission fines Google €4.34 billion for
    illegal practices regarding Android mobile devices to strengthen dominance of
    Google's search engine*. URL:
    https://ec.europa.eu/commission/presscorner/detail/en/IP_18_4581 Accessed:
    01.11.2020

Fiegerman, S. (8. July 2015). *Microsoft subtly admits the Nokia deal was a failure and
    7,800 employees will lose their jobs*. URL:
    https://mashable.com/2015/07/08/microsoft-layoffs-nokia/ Accessed: 01.11.2020

Gartner reports. (9. October 2019). *Most Popular Mobile OS 1999 - 2019*. URL:
    https://www.youtube.com/watch?v=MMyMB4zm9so Accessed: 01.11.2020

George, A. (20. January 2020). *What Is a PC?* URL: https://www.lifewire.com/what-is-a-pc-4780849 Accessed: 01.11.2020

Glas, G. (2020). *What is an API and SDK?* URL: https://www.app-press.com/blog/what-is-an-api-and-sdk Accessed: 01.11.2020

Goodwill Community Foundations. (2020). *What is an application?* URL: https://edu.gcfglobal.org/en/computerbasics/understanding-applications/1/ Accessed: 01.11.2020

Greengart, A. (25. August 2010). *Nokia's Featurephone Problem*. URL: https://www.slashgear.com/nokias-featurephone-problem-2598931/ Accessed: 01.11.2020

Griffith, E. (23. August 2018). *Why Do People Switch Between Mobile Operating Systems?* . URL: https://www.pcmag.com/news/why-do-people-switch-between-mobile-operating-systems Accessed: 01.11.2020

Gruman, G. (4. January 2012). *Smartphone face-off: iOS 5 vs. Android 4 vs. Windows Phone 7.5 vs. BlackBerry OS 7*. URL: https://www.infoworld.com/article/2618126/smartphone-face-off--ios-5-vs--android-4-vs--windows-phone-7-5-vs--blackberry-os-7.html Accessed: 01.11.2020

GSMArena. (9. August 2019). *Huawei introduces HarmonyOS, its cross platform alternative operating system*. URL: https://www.gsmarena.com/huawei_introduces_harmonyos_will_run_on_multiple_devices-news-38595.php Accessed: 01.11.2020

GSMArena. (10. September 2020). *Huawei announces HarmonyOS 2.0, coming to smartphones in 2021*. URL: https://www.gsmarena.com/huawei_announces_harmonyos_20_coming_to_smartphones_in_2021-news-45202.php Accessed: 01.11.2020

Hamblen, M. (24. June 2008). *Nokia announces foundation to make Symbian OS open source*. URL: https://www.computerworld.com/article/2534485/nokia-announces-foundation-to-make-symbian-os-open-source.html Accessed: 01.11.2020

Hayes, A. (30. April 2020). *Winner-Takes-All Market*. URL: https://www.investopedia.com/terms/w/winner-takes-all-market.asp Accessed: 01.11.2020

Hicks, J. (21. February 2012). *Research, no motion: How the BlackBerry CEOs lost an empire*. URL: https://www.theverge.com/2012/2/21/2789676/rim-blackberry-mike-lazaridis-jim-balsillie-lost-empire Accessed: 01.11.2020

Holt, K. (18. January 2019). *Microsoft ends support for Windows 10 Mobile this year*. URL: https://www.engadget.com/2019-01-18-microsoft-windows-10-mobile-support-ending.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS

91cmw_c2E9dCZyY3Q9aiZxPSZlc3JjPXMmc291cmNlPXdlYjZjZD0mY2FkPXJqY
SZ1YWN0PTgmdmVkPTJhaFVLRXdpbjdKMkUxS1hzQWhXdGxzL0tI Accessed:
01.11.2020

Huawei. (26. January 2020). *Huawei named one of top 10 most valuable brands by Brand
Finance.* URL: https://consumer.huawei.com/ca/press/news/2020/news-200126/
Accessed: 01.11.2020

IDC. (12. August 2020). *Smartphone shipments by vendor worldwide from 4th quarter
2009 to 2nd quarter 2020* . URL: https://www-statista-com.ezproxy.haaga-
helia.fi/statistics/271490/quarterly-global-smartphone-shipments-by-vendor/
Accessed: 01.11.2020

Jowitt, T. (5. November 2016). Tales in Tech History: Windows Mobile URL:
https://www.silicon.co.uk/mobility/mobile-os/tales-tech-history-windows-mobile-
200232 Accessed: 01.11.2020

Jowitt, T. (20 October, 2017). Tales In Tech History: BlackBerry URL:
https://www.silicon.co.uk/e-innovation/science/tales-tech-history-blackberry-
223557 Accessed: 01.11.2020

Jowitt, T. (12 January, 2018). Tales In Tech History: Symbian URL:
https://www.silicon.co.uk/mobility/smartphones/symbian-mobile-history-227097
Accessed: 01.11.2020

Kagan, J. (28. July 2020). *Original Equipment Manufacturer (OEM).* URL:
https://www.investopedia.com/terms/o/oem.asp Accessed: 01.11.2020

Keating, T. (10. February 2010). *What's Wrong with Windows Phone 7?* URL:
http://blog.tmcnet.com/blog/tom-keating/microsoft/whats-wrong-with-windows-
phone-7.asp Accessed: 01.11.2020

Kelion, L. (16. June 2020). *Apple faces two EU anti-competition probes.* URL:
https://www.bbc.com/news/technology-53066518 Accessed: 01.11.2020

Kelly, G. (22. December 2019). *New Security Warning Issued For 'Tens Of Millions' Of
Smartphone Users* . URL:
https://www.forbes.com/sites/gordonkelly/2019/12/22/new-security-warning-
issued-for-tens-of-millions-of-smartphone-users-updated/#509b9aee1aaf
Accessed: 01.11.2020

Kenton, W. (11. July 2020). *Business-to-Consumer (B2C).* URL:
https://www.investopedia.com/terms/b/btoc.asp Accessed: 01.11.2020

Kevin, C. (18. December 2009). *CrackBerry Kevin's Hierarchy of Smartphone Needs.*
URL: https://crackberry.com/crackberry-kevins-hierarchy-smartphone-needs-
smartphone-round-robin Accessed: 01.11.2020

Kharpal, A. (20. August 2015). *Why BlackBerry could ditch its own OS for Android*. URL: https://www.cnbc.com/2015/08/20/why-blackberry-could-ditch-its-own-os-for-android.html Accessed: 01.11.2020

Kommersant. (6. August 2018). *Sailfish getting included in the budget.* URL: https://www.kommersant.ru/doc/3706552 Accessed: 01.11.2020

Kotler, P. A. (2018). *Principles of marketing (17 e. Global edition.). .* Harlow, England.

Kovach, S. (3. September 2013). *MICROSOFT BUYING NOKIA'S SMARTPHONE BUSINESS FOR $7 BILLION*. URL: https://www.businessinsider.com/microsoft-buys-nokia-devices-2013-9 Accessed: 01.11.2020

Learmonth, I. R. (28. October 2010). *Windows Phone 7*. URL: https://iain.learmonth.me/blog/2010/2010w434/ Accessed: 01.11.2020

Lein, A. Z. (12. May 2012). *Why People Love(d) Symbian*. URL: https://pocketnow.com/why-people-loved-symbian Accessed: 01.11.2020

Malara, N.;& Rana, A. (14. August 2020). *Epic Games wins support from 'Fortnite' gamers, firms on Apple standoff*. URL:https://www.reuters.com/article/us-apple-epic-games/epic-games-wins-support-from-fortnite-gamers-firms-on-apple-standoff-idUSKCN25A21J Accessed: 01.11.2020

McGregor, G. (20. August 2020). *This chipmaker was a winner in the U.S. crackdown on Huawei. Now, it's another victim*. URL: https://fortune.com/2020/08/20/us-huawei-ban-restrictions-chipmaker-mediatek/ Accessed: 01.11.2020

Microsoft. (2003). *Licensing Model for Windows CE.* URL: https://docs.toradex.com/102564-windows-ce-5-0-run-time-comparison.pdf Accessed: 01.11.2020

Morning Consult. (2018). *National Tracking Poll #181114*. URL: https://morningconsult.com/wp-content/uploads/2018/11/181114_crosstabs_BRANDS_Adults_v1_AP.pdf Accessed: 01.11.2020

Nokia Developer Global Statistics. (10. August 2012). *90%of the visitors use their local language on Nokia StoreNokia Store is localized into 32 languages*. URL: https://web.archive.org/web/20120810110440/http://www.developer.nokia.com/Distribute/Statistics.xhtml Accessed: 01.11.2020

Nokia Museum. (April 2010). *Nokia N8*. URL: http://nokiamuseum.info/nokia-n8/ Accessed: 01.11.2020

Norman, D.;& Nielsen, J. (2020). *The Definition of User Experience (UX)*. URL: https://www.nngroup.com/articles/definition-user-experience/ Accessed: 01.11.2020

Nosrati, M.;Karimi, R.;& Hasanvand, H. A. (2012). Mobile Computing:Principles, Devices and Operating System. *WAP journal*, 399-402.

O'Boyle, B. (19. August 2020). *The history of Blackberry: The best BlackBerry phones that changed the world*. URL: https://www.pocket-lint.com/phones/news/137319-farewell-blackberry-os-here-are-the-23-best-blackberry-phones-that-changed-the-world Accessed: 01.11.2020

Peters, K. (12. September 2020). *Apple's App Store*. URL: https://www.investopedia.com/terms/a/apple-app-store.asp Accessed: 01.11.2020

Porter, J. (19. December 2019). *Facebook is working on its own OS that could reduce its reliance on Android*. URL: https://www.theverge.com/2019/12/19/21030043/facebook-os-custom-operating-system-android-reliance-self-sufficiency-ar-glasses Accessed: 01.11.2020

Protalinski, E. (30. March 2016). *Hey Microsoft, how many apps are in the Windows Store?* URL: https://venturebeat.com/2016/03/30/hey-microsoft-how-many-apps-are-in-the-windows-store/#:~:text=Back%20in%20November%202014%2C%20the,tablets%20in%20the%20Windows%20Store. Accessed: 01.11.2020

Savov, V. (22. September 2014). *Nokia saw the future, but couldn't build it*. URL: https://www.theverge.com/2014/9/22/6826051/nokia-saw-the-future-but-couldnt-build-it Accessed: 01.11.2020

Savov, V. (30. September 2016). *BlackBerry's success led to its failure*. URL: https://www.theverge.com/2016/9/30/13119924/blackberry-failure-success Accessed: 01.11.2020

Scherbakov, A. (29. May 2019). *Ubuntu Touch: Story of bith and death of mobile operating system*. URL: http://android.mobile-review.com/articles/60599/ Accessed: 01.11.2020

Schroeder, S. (9. August 2019). *Huawei launches its own operating system called HarmonyOS*. URL: https://mashable.com/article/huawei-harmonyos/ Accessed: 01.11.2020

Segan, S. (14. March 2013). *BlackBerry, Windows Phone Still Lack Popular Apps*. URL: https://www.pcmag.com/news/blackberry-windows-phone-still-lack-popular-apps Accessed: 01.11.2020

Shcherbakov, A. (19. September 2019). *History of Tizen - Samsung's spare Mobile OS*. URL: http://android.mobile-review.com/articles/62308/ Accessed: 01.11.2020

Silberschatz, A.;& Galvin, P. (1994). *OPERATING SYSTEM CONCEPTS.*

Staff, N. (15. January 2006). *The Huawei Way*. URL: https://www.newsweek.com/huawei-way-108201 Accessed: 01.11.2020

StatCounter. (September 2020). *Desktop Operating System Market Share Worldwide.*
  URL: https://gs.statcounter.com/os-market-share/desktop/worldwide Accessed:
  01.11.2020

StatCounter. (2020). *Mobile Operating System Market Share Worldwide.* URL:
  https://gs.statcounter.com/os-market-share/mobile/worldwide/2013 Accessed:
  01.11.2020

StatCounter. (September 2020). *Mobile Operating System Market Share Worldwide.* URL:
  https://gs.statcounter.com/os-market-share/mobile/worldwide Accessed:
  01.11.2020

StatCounter. (2020). *Mobile OS share worldwide 2020.* URL:
  https://gs.statcounter.com/os-market-share/mobile/worldwide Accessed:
  01.11.2020

Statista. (25. July 2013). *Global market share held by Nokia smartphones from 1st quarter
  2007 to 2nd quarter 2013 .* URL:
  https://www.statista.com/statistics/263438/market-share-held-by-nokia-
  smartphones-since-2007/ Accessed: 01.11.2020

Statt, N. (13. August 2020). *Apple just kicked Fortnite off the App Store.* URL:
  https://www.theverge.com/2020/8/13/21366438/apple-fortnite-ios-app-store-
  violations-epic-payments Accessed: 01.11.2020

Sullivan, M. (20. June 2012). *Windows Phone 7 Users Can't Upgrade to WP8.* URL:
  https://www.pcworld.com/article/257991/windows_phone_7_users_cant_upgrade_
  to_wp8.html Accessed: 01.11.2020

Taft, D. K. (9. 11 2010). *Nokia To Take Over Symbian Development.* URL:
  https://www.silicon.co.uk/workspace/nokia-to-take-over-symbian-development-
  13006 Accessed: 01.11.2020

TechAltar. (22. February 2017). *Why are there no new Mobile Operating Systems?* URL:
  https://www.youtube.com/watch?v=-N80hzTpglQ Accessed: 01.11.2020

Terence, E. (10. November 2010). *N8 Fail – Reasons Why the Nokia N8 Sucks.* URL:
  https://shkspr.mobi/blog/2010/10/n8-fail-reasons-why-the-nokia-n8-sucks/
  Accessed: 01.11.2020

Tung, L. (29. July 2019). URL: https://www.zdnet.com/article/here-are-the-real-reasons-
  windows-phone-failed-reveals-ex-nokia-engineer/ Accessed: 01.11.2020

Tung, L. (2013. March 7). *Nokia paying Microsoft €500m for using Windows Phone.* URL:
  https://www.zdnet.com/article/nokia-paying-microsoft-eur500m-for-using-windows-
  phone/ Accessed: 01.11.2020

Viswanathan, P. (24. April 2020). *What Is a Mobile Operating System?* URL:
  https://www.lifewire.com/what-is-a-mobile-operating-system-2373340 Accessed:
  01.11.2020

Walker, A. (17. September 2020). *We asked, you told us: Huawei users would consider ditching EMUI for Harmony OS*. URL: https://www.androidauthority.com/harmony-os-upgrade-poll-results-1159351/ Accessed: 01.11.2020

Warren, T. (6. November 2017). *Samsung returns to mock iPhone X buyers in latest commercial*. URL: https://www.theverge.com/2017/11/6/16611758/samsung-mocks-iphone-x-commercial Accessed: 01.11.2020

Westenberg, J. (20. February 2020). *We asked, you told us: Most of you care what your phone looks like and that's OK*. URL: https://www.androidauthority.com/phone-design-poll-results-1088356/ Accessed: 01.11.2020

White House. (15. May 2020). *Executive Order on Securing the Information and Communications Technology and Services Supply Chain*. URL: https://www.whitehouse.gov/presidential-actions/executive-order-securing-information-communications-technology-services-supply-chain/ Accessed: 01.11.2020

Wright, K. B. (2017). *Researching Internet-Based Populations: Advantages and Disadvantages of Online Survey Research, Online Questionnaire Authoring Software Packages, and Web Survey Services.* Journal of Computer-Mediated Communication, Volume 10, Issue 3, 1 April 2005,.

Zoho Survey. (2020). *Zoho Survey*. URL: https://www.zoho.com/survey/research-panels.html Accessed: 01.11.2020

Appendix

Survey questions:

What is your gender?

a) Male

b) Female

c) Other

d) Prefer not to say

What smartphone are you using at the moment?

a) Android

b) iPhone

c) Other (please specify)

What age group are you belong to?

a) 18-24

b) 25-34

c) 35-44

d) 45-54

e) 55-75

Rate the following aspects of your smartphone by importance: the higher the number, the more influential the feature is (ranking question)

a) Mobile Operating System

b) Design

c) Brand

d) Hardware

e) Camera

f) Battery Life

g) Price

Why Mobile Operating System is essential to you? (Likert scale question)

a) Privacy – I prefer to trust my data to the developers, who care about the privacy of their users more than the competitors

b) Performance – I do not want to use a device which lags, stutters and does not work properly

c) Customisation – I want to be able to customise the user interface, icons, how do I interact with my phone and control all aspects of the user's experience

d) Exclusive features – I believe that Mobile Operating System which I use has exclusive features which still do not have any alternatives and which I consider significant

e) Eco-system – I have other devices which operate on the same Mobile Operating System or collaborate perfectly (tablet, laptop, smartwatch)

f) Brand – I like the products my favourite tech-brand produces, and I buy them

Do you believe that your Mobile Operating System secures your data and keeps it private? (Likert scale question)

a) I feel that my data secured and no one without my consent, even developers of this OS, have access to it

b) I feel that the Mobile Operating System installed on my phone is more secure in comparison to competitor's, but not fully-secured, providing some data to third parties

c) I do not think that the Mobile Operating System which I am using is secure at all, my data is being sent to several companies and organisations for multiple purposes

Is the number of apps which you download through your app distributor (App Store, Google Play) matter to you? (Likert scale question)

a) Yes, I regularly check new apps and games. If there are not enough apps on the Mobile OS, I will not use it.

b) I have a typical pack of mobile apps which I use daily. If those apps are available on the Mobile OS - I am happy.

c) I use pre-installed apps and rarely download something which is not already installed on the phone. Several available apps do not matter to me.

Have you "migrated" from one Mobile OS to another (from Android to IOS, or the other way around)? If yes, what were the reasons behind your choice? (Open-ended question)