St. Petersburg State University
Graduate School of Management

Master in Management Program

THE EFFECT OF USER DIGITAL COMPETENCE ON SMARTPHONE PERCEIVED QUALITY IN THE RUSSIAN MARKET

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ЗАЯВЛЕНИЕ О САМОСТОЯТЕЛЬНОМ ХАРАКТЕРЕ ВЫПОЛНЕНИЯ ВЫПУСКНОЙ КВАЛИФИКАЦИОННОЙ РАБОТЫ

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АННОТАЦИЯ

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Образовательная программа	Менеджмент
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Год	2018-2020
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Описание цели, задач и основных результатов	Цель: получение лучшего понимания того, как цифровая компетентность пользователя влияет на восприятие измерений качества на российском рынке смартфонов. Задачи (сформулированы как исследовательские вопросы): − Как индивидуальный уровень цифровой компетенции влияет на оценку измерений воспринимаемого качества смартфона? − Как индивидуальный уровень цифровой компетенции влияет на важность измерений воспринимаемого качества смартфона? Результаты: − Составлена модель цифровой компетентности российских пользователей смартфонов, включающая три элемента – *цифровой инструментарий*, *цифровая эффективность* и *цифровая безопасность*; − Цифровая компетентность пользователя повышает *оценку простоты использования*, *оценку производительности*, *важность производительности* и *важность разнообразия функций* смартфона; − Разработаны рекомендации для производителей смартфонов – например, для достижения лучшего конкурентного положения они могут *адаптировать маркетинговые активности* на российском рынке к разным уровням цифровой грамотности потребителей, а также *повышать цифровую компетентность* пользователей.
Ключевые слова	Цифровая компетентность, смартфоны, воспринимаемое качество

ABSTRACT

Master Student's Name	Labazanov Ruslan Sergeevich
Master Thesis Title	The effect of user digital competence on smartphone perceived quality in the Russian market
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Academic Advisor’s Name	Alkanova Olga Nikolaevna, Candidate of Economic Sciences, Senior lecturer
Description of the goal, tasks and main results	Goal: gaining understanding on how user’s digital competence influences perception of quality dimensions in the Russian smartphone market. Tasks (formulated as research questions): − How does individual digital competence level affect smartphone perceived quality dimensions evaluation by the consumer? − How does individual digital competence level affect smartphone perceived quality dimensions importance for the consumer? Main results: − A model of digital competence of Russian smartphone users has been compiled, which includes three elements – *digital tools*, *digital efficiency*, and *digital safety*; − User’s digital competence increases *evaluation of ease of use*, *evaluation of performance*, *importance of performance* and *importance of versatility* of the smartphone; − Recommendations for smartphone manufacturers have been developed – for example, in order to achieve a better competitive position, they can *adapt marketing activities* in the Russian market to different levels of digital competence of consumers and *enhance the digital competence* of users.
Keywords	Digital competence, smartphones, perceived quality

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INTRODUCTION

Research gap

Digital competence is construct that describes a '*a set of knowledge, skills, and attitudes associated with the use of digital technology in individual's goals fulfillment.*' It is crucial to navigate in the current everchanging digital environment, as well as to choose and use technological solutions appropriately. Various researchers view ICT skills 'as a basic skill needed to function in society', 'as an essential requirement for life', or even as a 'survival skill' (Ferrari, 2012).

At the same time, only 27% of Russian citizens have developed a high level of digital competence (NAFI, 2020). Due to the insufficient level of knowledge and skills in the field of digital technologies, many people and organizations were not ready to work in a remote format in current conditions of self-isolation (NAFI, 2020). Contrary to popular opinion, when it comes to safety and security, as well as the ethical use of the gadgets, even the so-called 'digital natives' often lack important knowledge, attitudes, and skills (Promethean, 2016).

At the moment, there is a lack of clear understanding on how the level of individual digital competence influences consumer perception. Moreover, the concept of consumer digital competence is still not defined in the academic literature, and 'there is still no consensus regarding what constitutes consumer digital competences' (Golovacheva, Smirnova, 2019).

Regarding the concept of digital competence, there is academic research available on the influence of personal innovativeness, digital self-efficacy, or digital savviness (Jin, 2013; Sell et al., 2014; McDonald, Uncles, 2007). However, no research has focused on the relationship between user's digital competence, in all its integrity and complexity, and consumer perception. The *lack of knowledge on relationship between digital competence and consumer perception* represents the wide definition if this master's thesis research gap.

Research problem

User's level of digital competence is expected to affect consumer perception of highly technological goods especially significantly. One of the most appealing product categories for further research are *smartphones*. The number of smartphone users has been increasing significantly because of the growth of the smartphone industry, which develops new operating systems and a proliferation of applications (Martins et al., 2018). The number of Russian active smartphone users is growing and is expected to exceed 93 million in 2022 (Statista, 2020). Russian smartphone market is highly dynamic and has welcomed several new entrants in the last decade, with concentration of top-3 players decreasing from over 80% in 2010 to around 40% in 2019

(Passport GMID, 2020). Smartphones have been influencing the way people communicate with each other, becoming a near necessity in both private and professional lives (Derks et al, 2016). The unprecedented growth of smartphones has attracted academic attention, hoping to determine the motivations that explain smartphone use (Yeh et al., 2016).

The characteristic that can be used to track the effect of individual's digital competence on smartphone perception is *perceived quality*. Quality is a formative concept that plays a particularly important role in the smartphone market, influencing customer satisfaction and customer loyalty (Yeh et al., 2016). At the same time, quality is a multi-dimensional construct and, in its broader definition, can cover almost all characteristics of the product (Molina-Castillo, 2013). The example of such approach is the classical Garvin's eight dimensions of quality that describe various features, including aesthetics of the product (Garvin, 1987). Consequently, the research problem of this master's thesis is gaining understanding on how *user's digital competence influences perception of quality dimensions in the Russian smartphone market*.

Research questions

For quality, it is important to assess not only perceived quality itself, but also assess the *importance* of its dimensions. Consumers perceive some dimensions of quality as more important than others, and it influences their behaviour and decision-making (Brucks et al., 2000). The importance of quality dimensions has been assessed repeatedly during various SERVQUAL model applications (Jones, Shandiz, 2015). According to marketing experts, 'sometimes organisations make assumptions about what is important to the customer. Once they probe, they may discover that what the customer values is quite different' (Wisniewski, 1996). Therefore, it is important to not only understand the consumers' *evaluation* of different quality components, but also understand, which of them are *important*. As a result of such logic, the research questions of the master's thesis are:

RQ1: How does individual digital competence level affect smartphone perceived quality dimensions *evaluation* by the consumer?

RQ2: How does individual digital competence level affect smartphone perceived quality dimensions *importance* for the consumer?

As little research is available on the topic, this master's thesis is of exploratory type, with research conducted in order to initially explore the phenomena of interest. For the same reason, the investigation operates with research propositions and not research hypotheses.

CHAPTER 1. DIGITAL COMPETENCE PHENOMENON

Digital competence is a multidimensional and complex definition that needs to be specified in the context of this master's thesis in order to be applied correctly and appropriately. The chapter starts with the investigation of the concept of digital competence. After that, various models of digital competence are reviewed to create an even better understanding of the construct and initiate the development of the theoretical research framework.

1.1 Definition of digital competence

Evolution of the digital competence concept

Generally, the term 'digital competence' describes the skills, knowledge, and attitudes in regard to information and communication technology (ICT) possessed by and individual. Several terms are used in academic literature to describe this set of skills, knowledge and attitudes: digital competence, digital literacy, information literacy, digital skills, ICT skills, technology skills, information technology skills, 21st century skills, etc. (Ilomäki, 2011). The list of definitions may be continued by 'eLiteracy', 'e-Skills', 'eCompetence', 'basic ICT skills', 'basic computer skills'. In some other academic papers, the terms 'technology literacy' and 'new literacies' can be found (Ferrari, 2012). Some of them are often used as synonyms – especially the most generalized definitions, such as 'digital competence' and 'digital literacy' (Ilomäki, 2011). However, the meaning of these definitions may significantly differ due to the context of research or depending on the researcher's outlook on the very concept of digital competence.

Digital competence is one of the newest definitions aimed at describing an individual's level of practical and theoretical capabilities in the ICT environment (Ilomäki, 2011). In the 20th century and in the beginning of the 21st century, the concept of *digital skills* or *digital literacy* prevailed, focusing on 'technological skills and the ability to use digital tools and software applications' (Morellato, 2014). Such approach may also include individual's 'technological potentials in order to represent and solve problems'.

However, the notion of socio-cultural context started to infuse the definition, enriching it with new perspectives. Consequently, the emphasis was moved towards creation of collaborative knowledge and the use of ICT for interpersonal interaction (Calvani et al., 2009). In the last decade, the focus started to shift to a more ethical behavior and responsible social practices in the digital world, and the more complex concept of *digital competence* was popularized.

According to UNESCO Institute for Statistics, 'there is a general acceptance that competence in digital literacy requires the person to have the necessary knowledge and skills, but views differ regarding attitudes' (Law et al., 2018). General approach to defining competence implies that it is a combination of knowledge, skills and attitudes. Therefore, the inclusion of the attitudinal dimension may be seen as the factor that transforms digital literacy into digital competence (Fielder et al., 2016).

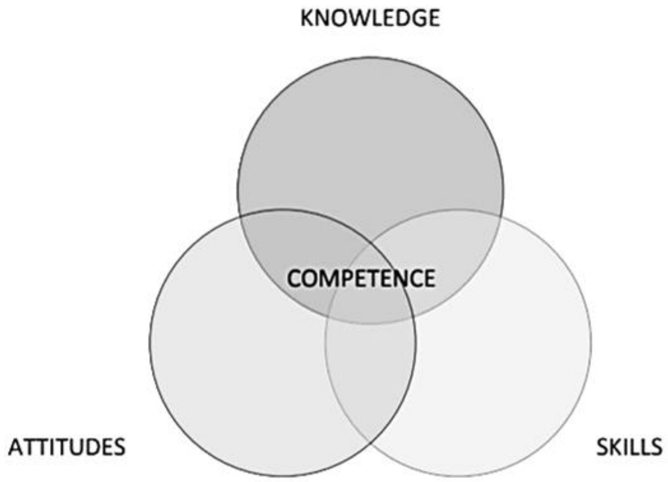

Figure 1. *Competence as a combination of knowledge, attitudes and skills (Source: Fielder et al., 2016)*

As a result of the terminological evolution described above, more sophisticated definitions, set in a socio-cultural environment and focused on a more conscious interaction with ICT, suggest that digital competence consists in 'being able to explore and face new technological situations in a flexible way, to analyze, select and critically evaluate data and information, to exploit technological potentials in order to represent and solve problems and build shared and collaborative knowledge, while fostering awareness of one's own personal responsibilities and the respect of reciprocal rights/obligations' (Calvani et al., 2009). Such definitions argue that digital competence implies a deeper understanding of information technology, meaning a 'critical', 'reflective' and 'responsible' approach to ICT. Consequently, there is an important difference between 'the mere ability to use digital instruments', and the concept of digital competence, which is characterized by a more 'competent and conscious consumption of information technology' (Morellato, 2014).

Following the direction of bringing the definition of digital competence into the socio-cultural environment, digital literacy only implies 'the skills required to use the ICT tools', but does not include 'non-digital skills and processes that might make use of digital tools' (Walker, 2015). According to this perspective, 'digital competence does not automatically follow from the ability to use ICT tools' (Ala-Mutka, 2008), and requires a new set of skills, knowledge and attitudes (Ferrari, 2012). From this point of view, aspects of challenges that are successfully overcome by individuals possessing high levels of digital competence include: privacy and security, ethical and legal use, critical attitude in creating content, critical attitude in using content (Ala-Mutka, 2008).

As mentioned before, at the current state of its evolution, the digital competence concept should be placed into perspective of socio-cultural environment and individual attitudinal characteristics. Indeed, some definitions present a more holistic view on digital competence, describing it as a ‘set of knowledge, skills, and attitudes, strategies and awareness that is needed when using information and communication technology and digital media’ (Ferrari, 2012). An even more inclusive definition of digital competence was developed by the same author, stating that digital competence ‘is the set of knowledge, skills, attitudes, abilities, strategies, and awareness that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, and socializing’ (Ferrari, 2012). This definition is characterized as ‘encompassing’ by its author.

In Russia, the approach taken by ROCIT (Regional public organization ‘Center of Internet technologies’) still focuses on the concept digital literacy, which is characterized as ‘a set of knowledge and skills that are necessary for the safe and effective use of digital technologies and Internet resources’. According to other Russian researchers, ‘digital literacy in its broadest sense is the ability to efficiently use digital tools to achieve your personal goals’ (Boronenko et. al, 2019). Digital competence in Russian research can be understood as ‘continuous mastery of competencies (a system of relevant knowledge, skills, motivations and responsibility) needed for individual’s ability to confidently, efficiently, critically and safely choose and apply information and communication technologies in different spheres of life (information environment, communication, consumption, technosphere), as well as individual’s readiness for such activities’ (Soldatova et al., 2013). Such definition draws parallel with definitions developed by European researchers.

In this master’s thesis, the following definition is used *Digital competence is a set of knowledge, skills, and attitudes associated with the use of digital technology in individual’s goals fulfillment*. It combines the first definition developed by Ferrari with approach taken by Russian researchers to create a simpler and more universally applied explanation of the concept, as different people may need and possess different digital competences according to their personal experiences and aspirations.

Digital competence and consumer digital competence

Concerning the applications of digital competence to specific social groups, most applications and definitions of digital competence focus on educational, healthcare and employment perspectives (Kluzer, Pujol Priego, 2018). During the analysis of digital competence assessment tools, very few were identified that did not target the educational domain – university students, school pupils, schoolteachers, and university professors, etc. (Laanpere, 2019). The practical application of digital competence concept remains underdeveloped, as most of the efforts concentrate on elimination of digital incompetence in socially important areas. For example, initiatives are developed for healthcare sector, including professionals and healthcare students (Evangelinos, Holley, 2014; Terry, et al., 2019).

A separate outlook is emerging for closer investigation of digital competence in regard to consumer perception and behavior. *Consumer digital competence* concerns the challenges presented to modern-day consumers, not citizens in general. Consumer digital competence is not defined appropriately in the academic literature, and 'there is still no consensus regarding what constitutes consumers' digital competences' (Golovacheva, Smirnova, 2019). In a policy report by the Joint Research Center of European Commission, consumer digital competence was defined as 'the competence consumers need to function actively, safely and assertively in the digital marketplace' (Brečko, Ferrari, 2016). It is noticeable that this definition focuses only on digital environment and the process of online purchase. However, consumer behavior relies on multiple and interconnected aspects of consumer knowledge, experience, and perception (Blackwell et al., 2006). This means that consumer digital competence should not only take into consideration digital aspects of customer journey, as perception and behavior online are also influenced by offline factors.

The definition of consumer digital competence should also comply with the general notion of consumer competence – 'the combination of knowledge, skills, and attitudes related to the consumer role' (Grønhøj, 2007), or 'the capability needed by consumers to function effectively and rationally in the marketplace' (Rhee et al., 2007). Therefore, these components – knowledge, skills and attitudes should also be included in the definition. The components were described in a background research for developing a Digital Competence Framework for consumers (Fielder et al., 2016):

- *Consumer digital knowledge (cognitive domain):* information search (online and offline), pre-purchase evaluation, knowledge of legal terms;
- *Consumers digital attitude (affective domain):* consumer beliefs, feelings and behavioral intentions toward digital consumer rights and responsibilities;

– *Consumer skills:* ability to apply and execute knowledge in compliance with the attitude, which refers to traditional consumer skills in general terms, ‘but also to digital goods, content and services purchase and usage skills’, and includes searching, choosing, buying, using, and maintaining the product or service.

From the information above, it can be concluded that *consumer digital competence* and general *digital competence* are vastly different concepts. Consumer digital competence concerns a narrower set of skills and environments, while digital competence in general presents a more holistic approach. It is important to highlight that this research focuses on general digital competence of an individual, not applied to any social group specifically.

1.2 Models of digital competence

In this paragraph, different types of digital competence models are overviewed. Models of digital competence are aimed at describing the phenomena with an exhaustive and comprehensive number of components – their investigation is be helpful for the aims of this research. Firstly, digital competence has to be understood and described with more precision. Secondly, elements of digital competence have to be identified to be later included into the research framework, and further operationalized to measure individual level of digital competence.

1.2.1 Conceptual descriptive models

Walker and White digital competence model

The model presented by Walker and White (2013) primarily focuses on ICT skills. Consequently, the presented set of components rather complies with a less ethical and less cognitive understanding of digital competence.

Figure 2. *Digital competence model (Source: Walker, White, 2013)*

The model consists of four components:

- *Procedural competence*: the ability to perform tasks connected with ICT, meaning more 'technical' skills to use hardware and software. This means the knowledge of the features and functions;
- *Socio-digital competence*: the ability 'to choose and use the appropriate tools (of communication) and language in a given social context' (Walker, 2015);
- *Digital discourse competence*: the ability to choose and apply the appropriate tools for more complex tasks regarding the use of ICT. This may include the resources of information, tools for search and analysis, software or even programming languages. In complex tasks completion, the appropriate combination of ICT tools is also important;
- *Strategic competence*: 'the ability to tackle problems, repair mistakes and compensate for gaps in knowledge' (Walker, 2015).

The author of this master's thesis believes some researchers may claim that the model above rather describes a more profound understanding of digital literacy, and not digital competence. However, a closer look at the ICT skills is also important to understand the basis for further development of digital competence, as in the modern digital society these skills are vital and are acquired to a certain extent by almost every individual.

Digital Literacy: A Conceptual Framework for Survival Skills in the Digital Era

One of the first frameworks viewing digital literacy as a survival skill for modern-day individuals is A Conceptual Framework for Survival Skills in the Digital Era (Eshet, 2004). In the framework, digital literacy incorporates five types of literacy: *photovisual literacy*, *reproduction literacy*, *information literacy*, *branching literacy* and *socio-emotional literacy*.

Table 1. Types of digital literacy (Source: Aviram, Eshet-Alkalai, 2006)

Literacy type	**Definition**
Photovisual literacy	Ability to intuitively and freely 'read' and understand instructions and messages that are displayed in a visual-graphical form
Reproduction literacy	Ability to create new meanings or new interpretations by combining pre-existing shreds of information in any form of media – text, graphic, or sound
Information literacy	Ability of information consumers to make educated and smart information assessments
Branching literacy	Ability to remain oriented and avoid getting lost in hyperspace while navigating through complex knowledge domains, despite the intricate navigation paths
Socio-emotional literacy	Ability not only to share formal knowledge, but also to share emotions by means of digital communication, and to avoid 'Internet traps'

The framework presents a valuable insight into new challenges presented to the individual by the emerging complex digital environments. The focus in the framework narrowed and is placed on cognitive abilities of respondent – the abilities to analyze, understand and create meanings.

Calvani's digital competence framework

A three-dimensional framework of digital competence was developed by Calvani et al. (2009). The model emphasizes not only the three dimensions of digital competence, but also the intersection of them, meaning the interconnected nature of digital competence aspects in the socio-cultural environment. The dimensions in the framework are *technological*, *ethical*, and *cognitive*. Their description is presented in figure on the next page.

In the intersection part of the dimensions an individual can 'take advantage of digital technology in an effective, safe, and ethical way'. Alternatively, to be a fully realized member of a modern digitalized society, 'individuals need to integrate different abilities' (Morellato, 2014). Consequently, being digitally competent 'means to be able to communicate via various media, be aware of the current most suitable digital tools and software, be familiar with security and privacy issues, respect copyrights and current regulations, know how to behave ethically on the Internet and know how to use information gathered on the Web' (IE and ACM, 2013).

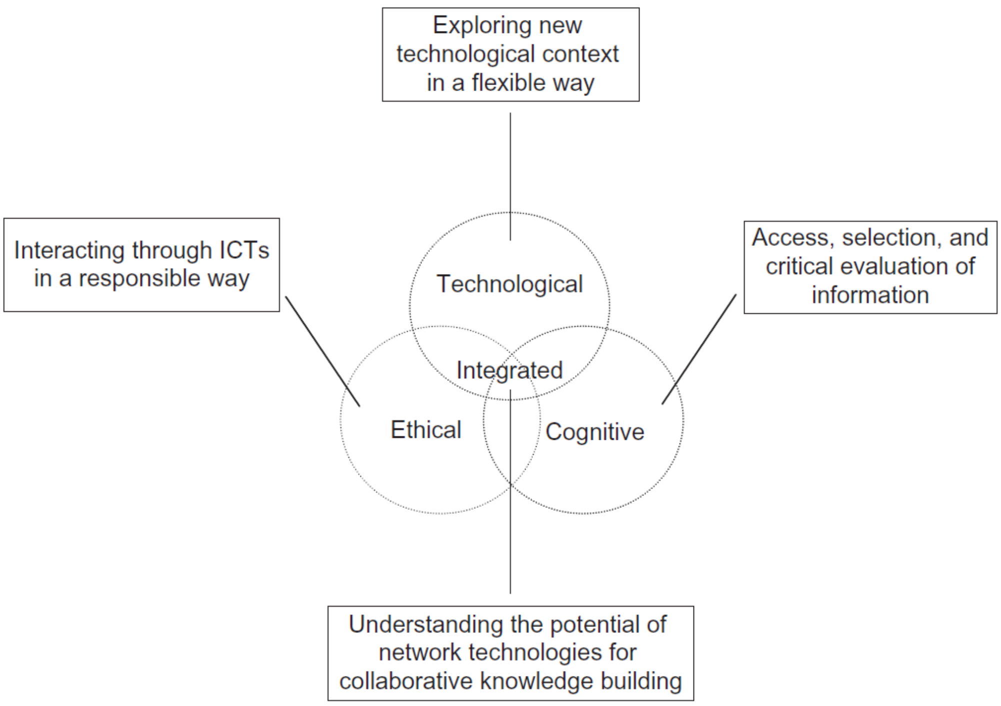

Figure 3. *Digital competence framework (Source: Calvani et al., 2009)*

As can be seen, a more attitudinal (meaning the conscious and critical attitude) and dynamic (meaning the actions of exploration and collaboration) approach is taken in this framework. However, it lacks inclusion of existing skills and knowledge of ICT, and therefore cannot be used as a basic framework in this master's thesis. Nevertheless, the stressing of cognitive and ethical dimensions if this model is especially important for further research.

Digital competence areas by Ferrari

The following framework presents seven main areas of digital competence. With the aim of balancing different outlooks on digital competence, the framework author investigated 15 frameworks of digital competence (Ferrari, 2012). The resulting digital competence aspects are described in the figure below and include: *information management*, *collaboration*, *communication and sharing*, *creation of content and knowledge*, *ethics and responsibility*, *evaluation and problem-solving*, *technical operations*.

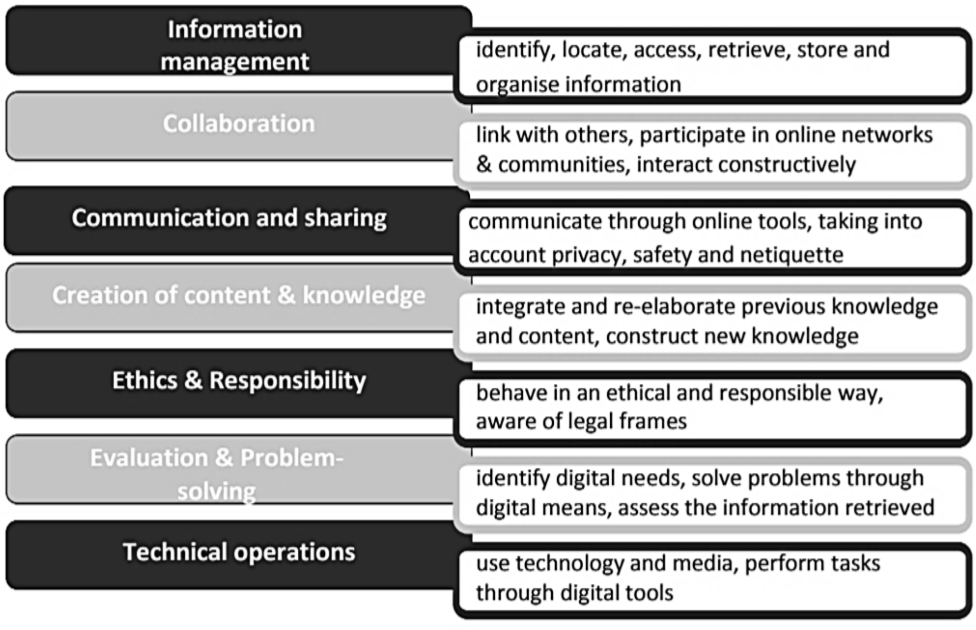

Figure 4. *Digital competence areas (Source: Ferrari, 2012)*

The framework above presents the technical operations perspective, as well as ethical and cognitive perspectives. It is one of the frameworks including the most components and therefore presenting one of the most comprehensive earlier approaches to digital literacy. However, Ferrari's model can be criticized on the lack of a distinguished safety component. This aspect of digital competence has been gaining more and more importance, as 'while younger generations are being labelled as digital natives, when it comes to safety, they are often no more literate than their parents' (Promethean, 2016).

1.2.2 DigComp-based models

DigComp framework

The DigComp framework (Digital Competence for Citizens) framework was developed in 2013 by Joint Research Centre of European Commission and was later revised by authors from the same research organization. The first update (DigComp 2.0) was published in 2016. The latest version of the framework published in 2017 is DigComp 2.1. DigComp models include the scales for assessment of the digital competence and are designed to facilitate the growth of digital competence among citizens. DigComp 2.1 (analogically to the original DigComp model) includes five competence areas as main constituents of digital competence, which are accompanied with more specific digital competences, presented in the table below.

Table 2. Competences in DigComp 2.1 (Source: Carretero, Vuorikari, Punie, 2017)

Competence area	**Competences**
1. Information and data literacy	1.1 Browsing, searching, filtering data, information, and digital content 1.2 Evaluating data, information, and digital content 1.3 Managing data, information, and digital content
2. Communication and collaboration	2.1 Interacting through digital technologies 2.2 Sharing through digital technologies 2.3 Engaging in citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Managing digital identity
3. Digital content creation	3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licenses 3.4 Programming
4. Safety	4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being 4.4 Protecting the environment
5. Problem solving	5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 Creatively using digital technologies 5.4 Identifying digital competence gaps

Each competence area in the DigComp framework is also accompanied with a comprehensive definition (Carretero, Vuorikari, Punie, 2017):

- *Information and data literacy:* ability to identify, locate, retrieve, store, organize and analyze digital information, judging its relevance and purpose;
- *Digital content creation:* ability to create and edit new content (from word processing to images and video), integrate and re-elaborate previous knowledge and content,

produce creative expressions, media outputs and programming and deal with and apply intellectual property rights and licenses;

- *Communication and collaboration:* ability to communicate in digital environments, share resources through online tools, link with others and collaborate through digital tools, interact and participate in communities and networks, cross-cultural awareness;
- *Safety:* ability to personal protection, data protection, digital identity protection, security measures, safe and sustainable use;
- *Problem solving:* ability to identify digital needs and resources, make informed decisions as to which are the most appropriate digital tools according to the purpose or need, solve conceptual problems through digital means, creatively use technologies, solve technical problems and update one's own and others' competences.

The DigComp 2.1 model implies a self-assessment technique. The respondents are asked to identify with one of eight proficiency levels for each competence areas. The proficiency levels are profoundly described in the table on the next page.

Table 3. Proficiency levels in DigComp 2.1 (Source: Carretero, Vuorikari, Punie, 2017)

Proficiency levels		**Complexity of tasks**	**Level of autonomy**	**Cognitive domain**
DC 1.0	**DC 2.1**			
Foundation	1	Simple tasks	With guidance	Remembering
	2	Simple tasks	Autonomy and with guidance where needed	
Intermediate	3	Well-defined and routine tasks, and straightforward problems	Independent	Understanding
	4	Tasks, and well-defined and non-routine problems	Independent according to the needs	
Advanced	5	Different tasks and problems	Guiding others	Applying
	6	Most appropriate tasks	Able to adapt to others in a complex context	Evaluating
Highly specialised	7	Resolve complex problems with limited solutions	Contribute to the professional practice and to guide others	Creating
	8	Resolve complex problems with many interacting factors	Propose new ideas and processes	

DigComp presents a multi-faceted outlook on digital competence expressed in a concise number of components. Although attitudes and skills are represented in the framework, it still does not include individual's knowledge and experience in regard to ICT.

Digital Literacy Global Framework

Digital Literacy Global Framework was developed at UNESCO Institute for Statistics as a response to DigComp framework. One of the main reasons for development was low degree of applicability of the DigComp competence list in less developed geographical areas, as 'a digital literacy framework should include competences needed for basic operations of devices and software, particularly in the context of low-income and developing countries' (Law et al., 2018).

The initial DigComp model was enriched with competences regarding the abilities to use the digital devices, which is perceived as pre-requisite in DigComp framework developed in Europe – a region with relatively more developed digital skills. Consequently, the proposed framework includes an additional competence – *devices and software operations* (physical operations of digital devices and software operations in digital devices).

Other extensions to the initial DigComp model include the addition of Competence 5.5 – 'Computational thinking' and Competence area 6 – 'Career-related competences'. Career-related competences are especially important in developing countries, where lack of basic digital literacy can prevent people from employment.

Table 4. Proposed additions to DigComp model in DLGF (Source: Law et al., 2018)

Competence area	**Competences**
0. Devices and software operations	0.1 Physical operations of digital devices 0.2 Software operations in digital devices
…	
5. Problem solving	5.5 Computational thinking
…	
6. Career-related competences	6.1 Operating specialized digital technologies for a particular field 6.2 Interpreting and manipulating data, information, and digital content for a particular field

The framework proposes a valuable extension to the original DigComp model. At the same time, it is important to mention that DLGF focuses on 'digital technologies for employment, decent jobs and entrepreneurship'. Career-related competences are not a component of universal applicability, although they effectively target the aims of DLGF development.

1.2.3 Models by Russian researchers

Berman's model of digital literacy

Nina Berman, senior lecturer at Pacific State University of Khabarovsk, has developed a three-component model digital literacy. The model is of high interest, at is was adapted for the national initiative called 'Digital Dictation'. The individual result of the dictation is presented according to the three categories developed by Berman – *digital consumption, digital competencies*, and *digital safety*.

In 2020, the all-Russian action ‘Digital Dictation’ became the largest test in Russia in the field of digital literacy. The dictation consists of questions developed considering different age categories: for children (7-13 years old), adolescents (14-17 years old) and adults (18 years old and older) and divided into 4 semantic blocks (3 main and 1 additional). The first block is devoted to the basics of digital consumption, namely, various devices and knowledge of basic programs and applications. The second is for digital competencies (working with the Internet, social networks, online stores, and other online services). The third is digital security, including protecting your personal data and devices. The fourth additional block is for new technologies, including artificial intelligence, the Internet of things and blockchain.

Table 5. Digital literacy model (Source: Berman, 2017)

Competence area	**Competences**
Digital competencies	− Knowledge of Internet search technologies − Ability to critically perceive information and verify its accuracy − Ability to create multimedia content for posting on the Internet − Willingness to use mobile communications − Ability to carry out financial transactions via the Internet, use online services to receive services and goods

Digital consumption	− Level of accessibility of various digital technologies, both hardware and software
	− Level of digital technology use:
	  − availability of broadband and mobile Internet
	  − availability of digital devices
	  − number of online media, online stores in the region
	  − level of provision and use of public services in electronic form

Digital security	− Possession of safe network skills of both technical and socio-psychological nature − Ability to protect personal data, ensure the confidentiality and integrity of information, protect it from computer viruses − Attitude to a pirated media content and software − Level of culture of communication in social networks, compliance with ethical and legal standards when posting digital content on the network

The valuable insight provided by the framework is the effect of digital consumption level on digital literacy. The depth and breadth of digital consumption can be used to indirectly characterize individual’s digital literacy level.

Sharikov's four-component model of digital literacy

Alexander Sharikov, senior professor and researcher at Higher School of Economics, has developed a four-component model of digital literacy. According to the author, the typologies of literacy are, on the one hand, tied to technology, and, on the other hand, unfold in the socio-cultural space. Therefore, at least two substantial poles arise: the 'Technological' and 'Social'. Moreover, the modern technological environment presents both opportunities for individual development and goal fulfillment, as well as threats for an individual. Threats may include Internet addiction, cyberbullying, and ethical violations. Cyberspace is also used by criminal elements to meet potential victims (Sharikov, 2016).

The first quadrant, *Technical and technological opportunities*, has a utilitarian, pragmatic nature of instrumental empowerment of a person. It creates the prerequisites for both expanding the informative and communicative capabilities of an individual, as well as for realizing their creative potential using digital technologies. The component relies on capabilities of using the Internet, abilities to find the necessary information, store and transfer it. The second quadrant, *Informational-communicational opportunities*, includes various methods of communication from interpersonal to mass levels, as well as perception, evaluation, and interpretation of messages. Communicative knowledge and skills, such as communication skills in forums and chats, blogs, and social media, are include into the quadrant. Other capabilities include creation of new informational materials – texts, photographs, videos, audio and video editing.

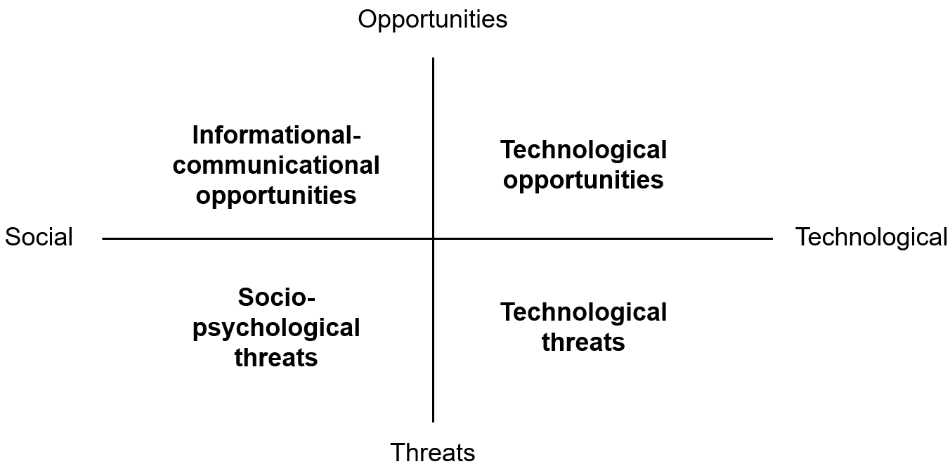

Figure 5. *Four-component model of digital literacy*
(Source: Sharikov, 2016)

The next quadrant, *Technological threats'*, concerns the security of the devices and software used, the formation of knowledge and skills of working with tools that provide such security. Finally, the last quadrant, *Socio-psychological threats*, includes socio-psychological, ethical, and legal aspects of security when working with digital technologies. This field also covers those aspects discussed above – issues of Internet addiction and other types of addiction, cyberbullying, understanding the consequences of, for example, publishing photos and videos on the Internet. On the other hand, this component is connected with the problems of piracy, violation of intellectual property laws.

The framework places emphasis on the complexity of individual's digital experience, by explaining that digital technology can present valuable opportunities combined with various threats. It also highlights the importance of the socio-cultural environment during technology use, making a further step towards the concept of digital competence and not digital literacy.

Digital competence model by Soldatova et al.

A group of researchers from Psychology Faculty of Moscow State University developed a model of digital competence that includes four main components – *information and media competence, communicative competence, technical competence*, and *consumer competence*.

The attitudinal component of digital competence is expressed through 'motivation and responsibility' in the model. Consequently, competence in the model is characterized as 'knowledge, skills, motivation and responsibility'. The notion of safety is included to the 'responsibility' dimension of competence, and therefore is not distinguished separately (Soldatova et al., 2013).

Table 6. Digital competence model (Source: Soldatova et al., 2013)

Competence area	**Competences**
Information and media competence	Search, understanding, organization, archiving, as well as critical reflection on digital information; as well as creating materials using digital resources
Communicative competence	Online communication in a broad sense in different forms and for different purposes
Technical competence	Efficient and safe use of a computer and the corresponding software for solving various problems, including the use of computer networks
Consumer competence	Solve by computer and through the Internet various everyday tasks related to specific life situations involving the satisfaction of various needs

Notably, it also includes 'consumer competence', which relates to 'specific life situations involving the satisfaction of various needs' (Soldatova et al., 2013). The addition of this component is of high interest, as today online-shopping and e-commerce is becoming increasingly popular among all Internet users (PwC, 2018).

1.2.4 Other models

JISC Digital capabilities framework

JISC (Joint Information Systems Committee) aims at development of ‘digital skills and confidence among staff and students’. The *JISC digital capabilities framework* was developed for ‘digital leaders and staff with an overall responsibility for developing digital capability in their organisation’ (JISC, 2019). According to the authors of the framework, it is also appropriate to be used by students in any educational setting.

The framework structure features different layers with the logic following the Maslow’s hierarchy of needs. From the inner levels (implying access to technology and technical skills) to the outer level (implying digital identity and wellbeing) the complexity of individual digital capabilities is increasing:

- *The inner layer – ICT proficiency:* the productivity and functional skills ‘at the base’;
- *Upper middle layer – Specialist practice:* practices that are specific to a subject area of a student or of a professional role;
- *Lower middle layer – Generic practice*: practices that are more universal;
- *The outer layer*: capabilities connected with identity or self-actualisation, ‘the vision of the practitioner or professional that the individual is aspiring to become’.

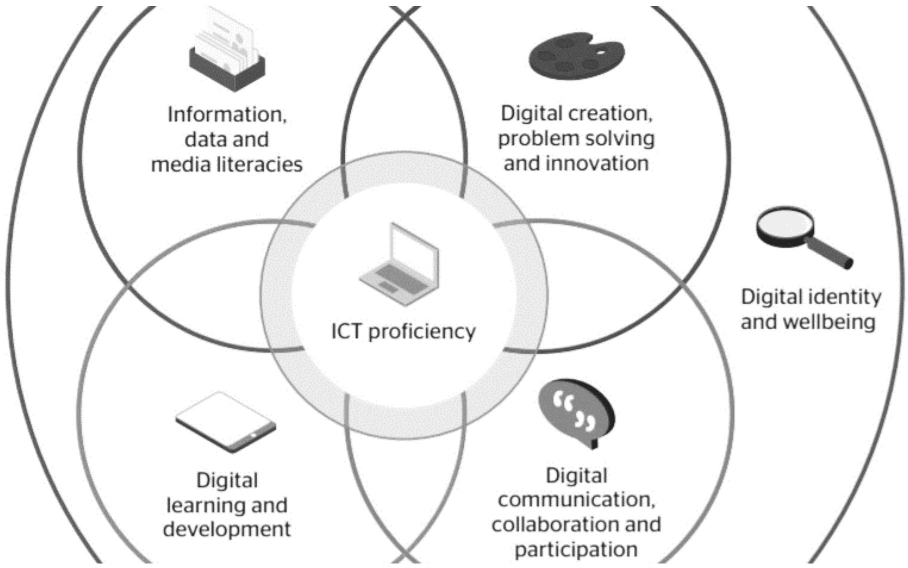

Figure 6. *JISC digital capabilities framework (Source: JISC, 2019)*

Specific digital capabilities and their definitions are also available in the framework. The advantage of the framework is that it also considers individual’s digital productivity, which is crucial in the organisation, where efficiency of operations should be high.

Table 7. Capabilities in JISC digital capabilities framework (Source: JISC, 2019)

Capability area	Capabilities
ICT (digital) proficiency	− Digital proficiency − Digital productivity
Information, data, and media literacies (critical use)	− Information literacy − Data literacy − Media literacy
Digital creation, problem-solving and innovation (creative production)	− Digital creation − Digital research and problem-solving − Digital innovation
Digital communication, collaboration, and participation (participation)	− Digital communication − Digital collaboration − Digital participation
Digital learning and development (development)	− Digital learning − Digital teaching
Digital identity and wellbeing (self-actualising)	− Digital identity management − Digital wellbeing

As mentioned before, the initial target of the framework development was 'to support discussion and build consensus about the capabilities required in a digital organisation', as well as staff development and general education. Therefore, some of important digital competence components (e.g. problem solving and safety) were distributed across other components of digital literacy, and a separate 'Digital learning and development' component was introduced.

Digital Intelligence (DQ) Framework

The Digital Intelligence (DQ) Framework was developed by the Coalition for Digital Intelligence, formed by the Organization for Economic Cooperation and Development (OECD), the IEEE Standards Association, and the DQ Institute in association with World Economic Forum. The framework is focused on being 'all-embracing', encompassing digital literacy, skills, and readiness. The framework features three perspectives of competences:

- *Digital citizenship:* the ability to use digital technology and media in safe, responsible, and ethical ways;
- *Digital creativity:* the ability to become a part of the digital ecosystem, and to create new knowledge, technologies, and content to turn ideas into reality;
- *Digital competitiveness:* the ability to solve global challenges, to innovate, and to create new opportunities in the digital economy by driving entrepreneurship, jobs, growth, and impact.

The framework features 24 competencies – eight competence areas each characterized by the three perspectives mentioned above. For each competence, knowledge, skills, and attitudes (values) are specified.

	Digital Identity	Digital Use	Digital Safety	Digital Security	Digital Emotional Intelligence	Digital Communication	Digital Literacy	Digital Rights
Digital Citizenship	1 Digital Citizen Identity	2 Balanced Use of Technology	3 Behavioural Cyber-Risk Management	4 Personal Cyber Security Management	5 Digital Empathy	6 Digital Footprint Management	7 Media and Information Literacy	8 Privacy Management
Digital Creativity	9 Digital Co-Creator Identity	10 Healthy Use of Technology	11 Content Cyber-Risk Management	12 Network Security Management	13 Self-Awareness and Management	14 Online Communication and Collaboration	15 Content Creation and Computational Literacy	16 Intellectual Property Rights Management
Digital Competitiveness	17 Digital Changemaker Identity	18 Civic Use of Technology	19 Commercial and Community Cyber-Risk Management	20 Organisational Cyber Security Management	21 Relationship Management	22 Public and Mass Communication	23 Data and AI Literacy	24 Participatory Rights Management

Figure 7. *Digital Intelligence Framework (DQ Institute, 2019)*

The DQ Framework features very high-order concepts, as it is developed 'to enable individuals to face the challenges and harness the opportunities of digital life'. The constructs of digital citizenship, digital creativity and digital competitiveness describe rather the desired result of societal evolution and digital competences development. Consequently, it is very appropriate for highlighting global issues related to digital technologies and environments but is less applicable on an individual level.

Summary and conclusions

After analysis of digital competence frameworks, a starting framework for further research was developed. It was called DCR (Digital Competence Research) and is used in this master's thesis to investigate digital competence of Russian smartphone consumers. The digital competence framework used in this research is the Digital Competence Framework for Citizens (DigComp), developed by European Commission's Joint Research Centre, supplemented with the 'Devices and software operations' component from the Digital Literacy Global Framework (DLGF), developed by UNESCO's Institute for Statistics.

The basis of the DCR is DigComp model, which was chosen for three reasons. Firstly, it uses a relatively small number of components to describe all the vastness of different digital competences. Secondly, the DigComp model was implemented in many directions across Europe – for adaptation and specification to different target populations, competence assessment, teacher and trainer preparation, end-user learning and certification (Kluzer, Pujol Priego, 2018).

Consequently, at the current moment it may be the most operationalized and widely used digital competence framework. The DigComp approach has also been applied in Russia by National Agency for Financial Research (NAFI) to measure digital competence level. Finally, the components presented in the model are appropriate for consumer research in the context of this master's thesis – they are comprehensible and widely applicable on individual level.

The initial DigComp model was expanded with one component from DLGF framework – 'Devices and software operations', as the authors of the DLGF model have appropriately emphasized the lack of operational skills, knowledge and attitudes in the original DigComp model.

Figure 8. *DCR (Digital Competence Research) Framework (Source: developed by author)*

According to the research questions of this master's thesis, as well on the basis of the information analyzed in Chapter 1, an initial theoretical framework was developed, which is presented in figure below.

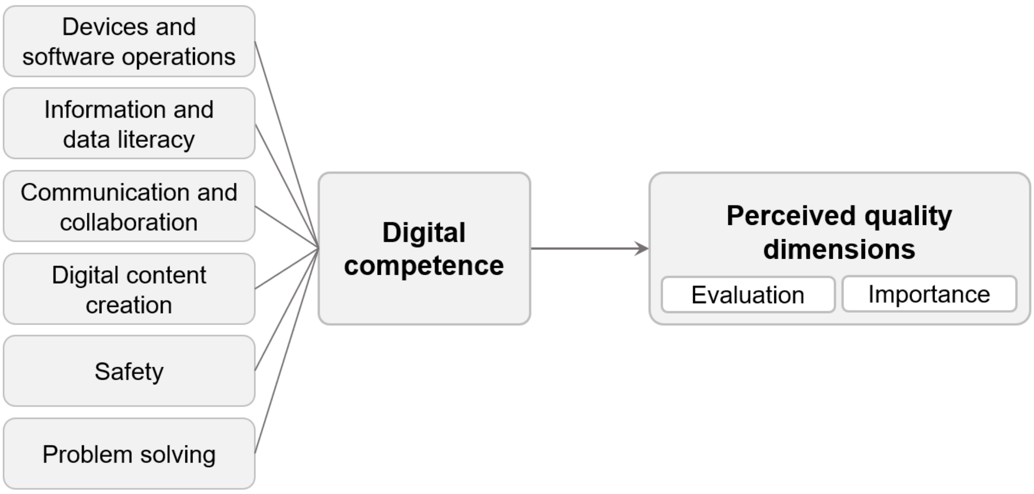

Figure 9. *Initial theoretical framework (Source: developed by author)*

The initial theoretical framework demonstrates the investigated components of digital competence, and the effect of digital competence of perceived quality dimensions, including differentiation between their evaluation by the consumer and importance for the consumer. The initial theoretical framework will further be extended in Chapter 2 of this master's thesis.

CHAPTER 2. DEVELOPMENT OF RESEARCH MODEL

The second Chapter of this master's thesis is aimed at the development of an appropriate research model for assessment of the effect of user digital competence on smartphone perceived quality in the Russian market.

Two main aspects are be concerned in the process of development of the theoretical framework. Firstly, product quality is a complex and multidimensional concept (Molina-Castillo, 2013). As a consequence, smartphone quality has to be defined with different quality constituents for the aims of appropriate measurement and a more precise determination of the studied effects. Secondly, other additional factors may influence the relationship between digital competence and perceived quality of smartphones, which are going to be identified and included into the theoretical framework.

The resulting theoretical framework has to be operationalized through an appropriate research design, which is developed in the second part of the chapter. For that, digital competence assessment technique must be chosen, questionnaire must be developed, and a data collection and analysis approach must be specified.

2.1 Development of the theoretical framework and research propositions

2.1.1 Dimensions of perceived smartphone quality

Smartphone as a durable good

Durable goods or consumer durables is a category of tangible (physical) consumer goods that do not obsolete quickly, and therefore do not have to be purchased frequently. They are known as 'durable goods' because they tend to last for at least three years (Investopedia, 2019). Smartphones and mobile phones are usually marked as consumer durables in academic literature, together with other products in the consumer electronics segment.

If a comparison is made with other durables goods, the technology-based products, including smartphones, are characterized by more distinctively brief lifecycle (Chow et al., 2012). This is connected with the high speed of advancements in technology and fast model renewal, with smartphone producers stimulating faster smartphone replacement for better economic results (Tseng et al., 2011). According to a consumer research conducted in Austria in 2017, the average use time of smartphone is 2.7 years (compared with 4.1 years for laptop). However, the average desirable lifespan of smartphones reported by the customers was 5.2 years (compared with 7 years for laptop) (Tröger, Wieser, Hübner, 2017).

In Russia, the life cycle of using a smartphone is increasing, as new models do not offer significant innovations and buyers use one device longer, the analysts note (Delovoi Peterburg, 2020). In 2019, the smartphone replacement period increased to 2–2.5 years (Vedomosti, 2020). The lifecycle of a smartphone has been increasing globally since 2016 and exceeded two years in 2018 in the USA and 26 months in Europe. The main reasons for the trend is slower technology advancement and market saturation (CNBC, 2019). In Russia, the reason of such trend is also lower buying power of the customers and price growth (Vedomosti, 2020). The flagship smartphone models from the world's top three smartphone companies — Apple, Samsung, and Huawei — saw an average price increase of 52% in three years, which made people less eager to buy new devices (CNBC, 2019).

This trend has also been supported by Apple – based on the availability of operational system updates, the first two iPhone models were relevant for two years, the next two received a life cycle of three years, then two generations received updates and support for a period of four years, and now the company has entered a five-year life cycle (iGuide, 2018). In the case of Android smartphones, the support period is shorter. A significant percentage of Android smartphones could not be updated after only two years (Tröger, Wieser, Hübner, 2017). Consumers who possess Android phones usually receive security updates in the range of 0-3 years depending on the producer and specific model (Carnegie Mellon University Software Engineering Institute, 2019). However, in 2019 Samsung reported its customers using their devices for a longer period over 26 months. The producer is also slowly expanding the support life cycle of its devices (9to5Google, 2020). The average lifespan of Android smartphones was calculated to be 28 months in 2017, but has grown since then (Android police, 2017). Given the growth of the product lifecycle length and the growth of prices, smartphones are slowly returning towards the classical understanding of a consumer durable good. Consequently, it is appropriate to apply the frameworks assessing the quality of durable goods in this research.

Quality dimensions of durable goods

A 'generalizable and comprehensive set of quality dimensions for durable goods' was developed by Brucks et al in 2000. Six dimensions of quality were proposed and later verified through a quantitative study: *ease of use*, *versatility*, *durability*, *serviceability*, *performance*, and *prestige*. Their constituents are specified in table below. The model has been used for quality assessment of different products, including smartphones (Shintaputri, Wuisan, 2017) and cordless phones (Clemenz et al., 2012).

Table 8. Dimensions of durable goods quality (Brucks et al., 2000)

Quality dimensions	Specification
Ease of use	– Clarity and convenience of use – Consumer's ability to start and operate the product
Versatility	– Ability of the product to perform more functions or allow the consumer more flexibility in using the product – Number and complexity of characteristics that distinguish the model or brand from a stripped-down model
Durability	– Length of time the product lasts – Length of time the product works properly (e.g. whether it needs frequent servicing) – How well the product holds up under adverse conditions (e.g. weather, heavy use, or misuse)
Serviceability	– Consumer's ease of obtaining repair service (e.g. access to service centers) – Responsiveness of service personnel – Reliability of service
Performance	– How well the product does ‘what it is supposed to do’ and performs its functions – Consistency of performance (can be referred to as reliability or dependability)
Prestige	– Ability of the product to communicate superiority to the purchaser and relevant social groups of the purchaser – Appearance of the product – Product or brand's image

Before the quantitative validation of quality dimensions, the authors initially compared them with quality dimensions by Garvin. Garvin’s eight dimensions of quality is a universally applied model for quality measurement and assessment, with available applications to smartphone market (Heriyati, Siek, 2011; Chowdhury, 2017; Bayu et al., 2019; Sanusi, Herlina 2019).

Ease of use, not included into Garvin’s list, was discovered to be critical for durable goods, especially given the increasing complexity of durable goods’ functions and settings. On the other hand, *conformance,* as a manager-defined characteristic, does not directly relate to consumers’ perception of quality, and therefore was excluded. In model by Brucks et al., *performance* and *reliability* components have been combined, as consumer data suggested that ‘performance quality cannot be judged independently of reliability’. The dimension of *prestige* targets symbolic needs of the consumer, joining together the *perceived quality (image)* and *aesthetics* originally proposed by Garvin. The correlation between quality dimensions in the two discusses models is demonstrated in table below.

Table 9. Correlation of quality dimensions (Brucks et al., 2000)

Quality dimensions of durable goods	**Quality dimensions by Garvin**
Ease of use	–
–	Conformance
Versatility	Features
Durability	Durability
Serviceability	Serviceability
Performance	Performance, Reliability
Prestige	Perceived quality (image), Aesthetics

At the first stage of the theoretical framework elaboration, the initial theoretical framework was extended with six perceived quality dimensions – perceived smartphone quality is now expressed through six quality dimensions for consumer durables. The individual effect of digital competence on each perceived quality component is investigated in the model, as it allows for a more precise interpretation of the effect.

New research propositions follow the multi-dimensional effect of digital competence on perceived quality. For each proposition, two metrics are included (as *a* and *b* sub-propositions) – the quality dimension *evaluation* and the quality dimension *importance*.

According to the authors of the durable goods quality dimensions model applied in the theoretical framework, 'the importance and relevance of each of these dimensions vary across product category. <…> Consumers feel that some dimensions of quality are more important than others, and this differs by consumer segment as well as context. When a consumer evaluates a choice alternative, only those quality dimensions that are relevant for that judgment will be evaluated by the consumer.' (Brucks et al., 2000). Most importantly, as already mentioned before, this logic follows the two research questions stated in the introduction to this master's thesis:

RQ1**:** Does individual digital competence level affect *smartphone* perceived quality *evaluation* by the consumer?

RQ2**:** Does individual digital competence level affect *smartphone* perceived quality *importance* for the consumer?

Ease of use

The ability to easily start and operate the product describes this dimension of quality. For the majority of customers, a user-friendly application of a certain technology is much more important than the technology itself. People tend to introduce new technologies into their lives in order to solve a certain problem or need. Only Innovators and Early adopters focus on technological innovation rather than ready solutions and convenience (Moore, 2014). The constant changing nature of the ICT market is often combined with rather conservative behavior of consumers – 'the market welcomes and asks for new solutions, but very few want to try them out' (Butije, 2012). Consequently, for durable technological goods ease of use is a formative characteristic, influencing the product perception of the majority of consumers.

The study in the Korean smartphone market also confirmed, that ease of use positively influences user satisfaction (Jin et al., 2013). Smartphones that are 'easy to use' can be characterized by 'not requiring a lot of mental effort' and 'not requiring a lot of effort to become skillful at using' (Boakye et al., 2014), easy to handle, easy to use 'at any time' (Jin et al., 2013).

'Perceived ease of use' is among factors influencing the adoption of information systems. Previous usage experience may reduce uncertainty and help obtain information (use, control, management, etc.) on high-tech services. Therefore, previous usage experience has a significant effect on perceived ease of use and product expectation in the smartphone market (Jin et al., 2013). For digitally competent consumers, it may be easier to operate smartphones, which will increase the *evaluation* of ease of use. At the same time, digitally competent consumers may have higher apsiration towards ease of use, as they have more experience, so the *importance* of ease of use will also be higher for them.

P1**:** Digital competence level has positive effect on *ease of use* a) evaluation; b) importance

Performance

Performance is a multidimensional construct. Firstly, it characterizes 'how well the product does what it is supposed to do'. For example, 'for cameras, good performance involves how well the product takes pictures' (Brucks et al., 2000). In the smartphone product category, performance can be ensured by high-quality operating system performance (Bayu et al., 2019). Product features that increase smartphone's perofrmance can include good camera resolution (Bayu et al., 2019), high processing power, high quality screen resolution, good internet capability (Boakye et al., 2014). Battery efficiency also consistently influences the experience of the smartphone users, as it limits their smartphone usage, especially at the end of the day (Ickin, 2015). Long-lasting battery quality is also mentioned as an item of smartphone quality measurement (Bayu et al., 2019). According to the study of Austrian population, the most common fault leading to smartphone replacement was a defective battery (Tröger, Wieser, Hübner, 2017). This means that battery performance can influence both smartphone performance and smartphone durability.

High level of performance dimension is characterized by high level of consistency: the supposed functions must be performed reliably and dependably. For smartphones, high performance is perceived as ‘the ability to function well’ and ‘function well consistently’ (Shintaputri, Wuisan, 2017). Consistent smartphones are described as ‘dependable’, ‘durable’ and ‘reliable’ (Boakye et al., 2014). Analogically for ease of use, digitally competent consumers may have higher aspiration towards smartphone performance, as they may be pursuing more complicated and demanding tasks, so the *importance* of performance, including both general performance and device consistency will be higher for them. It also may be easier to more objectively assess the performance of smartphones, because they have more realistic expectations of device’s abilities. Such consumers are also able to distinguish device-related and device-unrelated problems when they occur. Consequently, digital competence will increase perceived performance *evaluation*.

***P2*:** Digital competence level has positive effect on *performance* a) evaluation; b) importance

Versatility

Versatility involves the number and complexity of characteristics of the product. Perceived versality can be described as having ‘more features than many other smartphone types’ (Boakye et al., 2014), as well as ‘the latest and sophisticated features’ (Bayu et al., 2019). Versatility also allows the product to perform more functions or to be used with more flexibility. Flexibility of use can be characterized by ‘not being rigid and inflexible to interact with’. (Boakye et al., 2014). Digitally competent consumers may have higher aspiration towards smartphone versatility, as they may be pursuing more versatile tasks, so the *importance* of versatility will be higher for them.

The presence of some functions, such as Flash Player, personalized alarm clock, special settings for vibrate-only mode and features for privacy increases quality of experience with a smartphone (Ickin, 2015). Consequently, the *evaluation* of versatility will be higher for digitally competent consumers, as they are able to fully benefit the vastness of today’s smartphones applications and functions.

***P3*:** Digital competence level has positive effect on *versatility* a) evaluation; b) importance

Durability

Durability describes the length of use of the product – total length of use, length of use without servicing. It also describes the ability to function under adverse conditions (weather, heavy use or misuse). Durability of smartphones can be formed by long lifetime usage (Bayu et al., 2019), the ability to 'last in a long time', the ability to function without frequent servicing and the ability to not be 'easily broken because of heavy usage or misuse (Shintaputri, Wuisan, 2017).

Durability is dependent on the phenomenon called functional obsolescence, 'which occurs when the functionality of existing devices is reduced, due to increasing demands on the technology'. This can also occur when the producer stops regular software updates of the device. This phenomenon can be described by consumers as 'the phone could not keep up with my needs', 'restricted functionality' or 'too little capacity' (Tröger, Wieser, Hübner, 2017). More digitally competent consumers may *evaluate* durability of their smartphones as lower, as they are prone to buying new smartphones more frequently. Due to the same reasons, durability will be of lower *importance* for them.

P4**:** Digital competence level has negative effect on *durability* a) evaluation; b) importance

Serviceability

Serviceability of smartphones can be described as speed (shortness of service) and accuracy in services, completeness of spare parts availability, friendly and fast service at the service center, availability of call center that can be contacted at any time (Bayu et al., 2019), easiness of finding a repair service, and the ability to 'fix the problem very well' (Shintaputri, Wuisan, 2017). As, more digitally competent consumers are expected to use their devices more actively, they may *evaluate* serviceability higher and as more *important*.

P5**:** Digital competence level has positive effect on *serviceability* a) evaluation; b) importance

Prestige

Prestige of product allows to communicate superiority to the owner and relevant social groups of the owner. Prestige involves visible characteristics of the product, such as appearance, but also includes a social component that is reflected in the product or brand's image (Brucks et al., 2000). The appearance component of smartphone can be described by unique design, variety of attractive colors (Bayu et al., 2019), being perceived as 'attractive' or being 'an elegant product' (Bayu et al., 2019). The social component of prestige gives the owner the smartphone the feeling of superiority, belonging to a certain social group. Moreover, colors and materials of the smartphones can be perceived as 'prestigious' (Shintaputri, Wuisan, 2017). More digitally competent consumers will possibly buy more prestigious smartphones, as they are usually accompanied with better technical features. This will increase the *evaluation* of prestige for them.

Consumers feel pressured by the social environment to buy new mobile phones, as well as sometimes upgrade their device because the new model 'is more attractive'. People who do not keep up with the trends in technology and fashion can be 'stigmatized as incompetent and old-fashioned'. In fact, many manufacturers therefore offer a range of mobile phones so that the consumers can differentiate themselves, through their phone, from other people (Tröger, Wieser, Hübner, 2017). Digitally competent consumers may feel more pressured to possess a presentable phone to match their level of technological sophistication. Consequently, prestige will be of higher *importance* for them.

***P6*:** Digital competence level has positive effect on *prestige* a) evaluation; b) importance

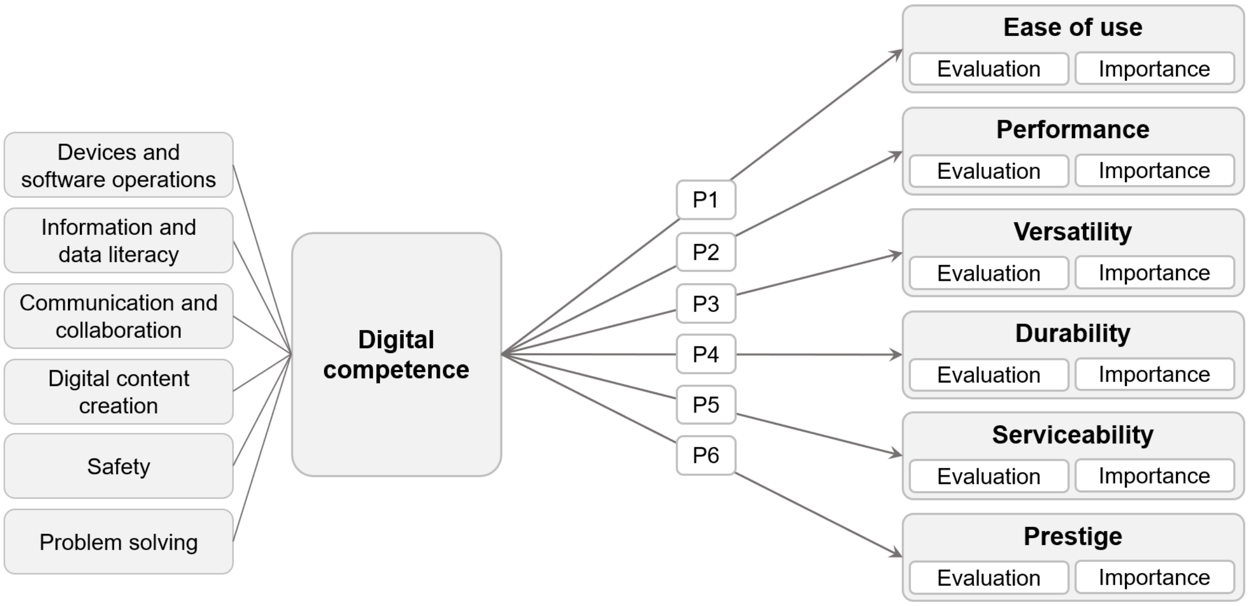

Figure 10. *Theoretical framework with perceived quality dimensions*
(Source: developed by author)

2.1.2 Additional factors influencing perceived smartphone quality

Interactivity as a factor influencing perceived smartphone quality

Smartphone is usually used together with other services that provide its service – operational system, applications, mobile network service. Smartphone users interact with smartphones, mobile providers and services, various content, and applications. Additionally, smartphones are operated by operating systems which manage both hardware and software resources. Such operating systems influence the perceived quality. Consumers are reluctant to use smartphones when they experience frequent delays in response, frequent disconnection, lack of access, or poor security (Shin, 2015).

This complexity of the product use has led to development of *interactivity* perspective. Interactivity in this context is described as a 'factor covering the conceptual dimensions of the service and communication quality' (Kim et al., 2015). Interactivity has five sub-dimensions: *system quality*, *network quality*, *contents quality*, *customer support*, and *compatibility* (Chang et al., 2011). It can be easily seen that these factors include factors not directly connected with the smartphone manufacturer, as, for example, perceived quality of a smartphone 'can be affected by not only the performance of a smartphone but also the performance of a network in which a smartphone is connected' (Kim et al., 2015). The interactivity dimensions are specified below:

- *Network quality*: perception of the ability of a network to offer real-time interaction, such as call quality of the chosen network and high-speed data transmission;
- *System quality:* perception of the characteristics of an interactive smartphone such as speed, high-definition resolution provided by the smartphone and system's stability;
- *Content quality:* perceived utility of digital services added to a given smartphone medium, such as applications;
- *Customer support:* perceived timely feedback interaction between the user and the mobile service provider, regular customer support and technical support that service providers resolve incoming queries;
- *Compatibility:* the interactivity required for the personal tasks and business, the degree to which the innovation or technology fits with the existing values, past experiences, and current needs of potential adopters, e.g. the extent to which smartphone applications fits the way the user works.

The significant effect of these factors on customer satisfaction and continuance intention regarding the smartphone use has been proven in the Korean market (Kim et al., 2015). Another study in the Korean market proved the positive influence of content, service, and system quality on customer satisfaction (Shin, 2015).

The factors that are connected with content quality and system quality also include application interface design and application performance. Operational system is one of key attributes that affect the overall perception of the smartphone for the consumer. The choice of the operating system can be decisive when buying a smartphone, as a set of possible applications and their usability may depend on this parameter. (Zvezdina, Sorokin, 2018). Application interface design involves location of buttons and ease of use of the applications, and low application performance is described by customers as 'freezing', 'sloppy', 'sluggish', 'slow'. For the applications that are available on personal computers the customer expectations tend to be higher, as PC's are equipped with physical keyboards and pointing devices, thus providing a better experience (Ickin, 2015). Among factors influencing the perception of smartphone quality are also the quality of phone accessories and phone accessory price (Oh, 2017).

Consequently, as smartphone is a complex product, closely interconnected with mobile services and providers of applications and operational systems, as described above, different kinds of loyalty can be obtained by the consumer (Oh, 2017):

- *Product loyalty:* loyalty to specific smartphone model under a specific brand or to a specific product line of one brand;
- *Manufacturer loyalty:* loyalty to a specific smartphone manufacturer;
- *Telecommunications carrier loyalty*: loyalty to a specific smartphone manufacturer utilizing the network of a specific telecommunications carrier;
- *Content provider loyalty:* loyalty to the developer or software provider that enables an access to the same set of application contents in use.

As the next step of the final theoretical framework development, this additional factor influencing perceived smartphone quality were introduced. Out of interactivity dimensions, *perceived network quality* was chosen for a separate inclusion into the theoretical framework. Other interactivity dimensions are indirectly included into the measured quality dimensions, which is described in the table below.

Table 10. Correlation of interactivity dimensions with quality dimensions

Interactivity dimensions	**Quality dimensions**
Network quality	–
System quality	Performance, ease of use
Content quality	Performance, ease of use
Customer support	Serviceability
Compatibility	Versatility, ease of use

In some situations, network quality can determine the speed of the smartphone and the consistency of its performance, which correspond with *ease of use* and *performance* quality dimensions. Sometimes the performance of applications is confused with 'underlying network connectivity issues' (Ickin, 2015). At the same time, *perceived network quality* can be influenced by the individual's digital competence level, analogically to the different quality dimensions of smartphone quality. Consumers use different types of network functions depending on their usage style, and their expectations also differ accordingly (Hamka et al., 2013). Consequently, in this research, *perceived network quality* can moderate the relationship between digital competence and two dimensions of perceived quality – ease of use and performance.

According to the relationships described above, additional proposition was developed concerning perceived network quality. The proposition describes only quality evaluation (perception) by the consumer, without assessment of the effect on quality dimension importance.

***P7*: *Perceived network quality* moderates the effect of digital competence on evaluation of a) *ease of use;* b) *performance*.**

Usage experience as a factor influencing perceived smartphone quality

Previous usage experience influences perceived quality of smartphones. It also plays an important role in building continuous usage intentions. After gaining relevant usage experience, consumers develop their own level of expectations, and modify their subsequent perceptions accordingly (Hew et al., 2017).

Consequently, current experience with the smartphone is influenced by previous experience. For example, users may feel less discomfort when using a product similar to one experienced in the past. Previous usage experience may reduce uncertainty and help obtain information on high-tech services. Therefore, previous usage experience has a significant effect on *perceived ease* of use and *product expectations* (Jin et al., 2013).

Smartphone market is often characterized by the presence of a 'cognitive lock-in' effect. This describes a persistence of an existing behavioral pattern, which results from previous repetitive consumption of products and services. Consumers usually apply cognitive efforts 'to learn through use experience to develop certain personal brand-specific knowledge and skills to realize and personalize the functionality and benefits' of a smartphone (Shi, 2018). As a consequence, consumers 'may be cognitively locked in onto the specific ICT brand products because their knowledge, skills, and usage are brand specific and that may not be transferrable to other brands' (Lin, Huang, Hsu, 2015). For example, consumer loyalty to smartphone brands 'may be determined by their cognitive lock-in' and not in a big extent to their trust and commitment towards brands (Shi, 2018). Moreover, users with certain levels of mobile experience tend to have perceptions about smartphones, even if they have never used them (Shin, 2014).

An attitude-based segmentation analysis of mobile phone users among Finnish sample has been conducted by Sell et al. in 2014. The study focused on the respondents' attitudes towards mobile phones and mobile services. However, these attitudes manifest in customer usage patterns and experiences, so segmentation criteria were based on usage experience to a significant extent.

The statements used in the survey were tailored to be market-specific and reflected personal innovativeness with regard to mobile ICTs, respondents' self-efficacy with regard to mobile ICTs, benefits related to using mobile ICTs and social dimensions of using mobile ICTs. Three distinct segments have been identified – *conservative*, *medium,* and *innovative*. The innovative segment tends to be the youngest of three with the highest rate of smartphone usage. They are characterized by higher want of new mobile phone models and are first to try new mobile devices and tend to use more sophisticated features. It is easier for them to obtain the skills needed for mobile phone use, as well as of mobile services. Mobile devices allow them to receive information and perform tasks 'whenever and wherever' and increase their efficiency. Finally, it is important for them that their mobile phone is trendy. The other two segments (conservative and medium) represent people who don't agree with the statements above to the same degree, and tend to use more limited number of function, as well as change the mobile device out of necessity (Sell et al., 2014).

Other authors also introduce behavioral and usage experience indicators into the segmentation criteria. For example, a hierarchical segmentation analysis of characteristics was conducted on the basis of length of smartphone use and a consumption pattern – the number of yearly leisure trips for segmenting the Spanish consumers who use their smartphone for trips planning (Vallespín, Molinillo, Muñoz-Leiva, 2017).

Smartphone usage experience was introduced into the theoretical framework, as it influences the digital competence effect on perceived quality dimensions. Therefore, it was included as a moderator of these relationships. The level of usage experience with smartphones can affect expectations towards smartphone quality, and more experienced users can have higher demands in terms of quality dimensions. Consequently, the higher demands of experienced consumers can make them stricter in evaluating quality. Additionally, having a longer smartphone experience can shift the importance of different factors, as through practical use consumers may understand better, what their personal most important characteristics are. The corresponding proposition was developed to describe the effect of smartphone usage experience in the theoretical model:

P8: *Smartphone usage experience* moderates the effect of digital competence on quality dimensions *a) evaluation b) importance*.

The final research framework, featuring all eight research propositions, as well as all theorised elements of digital competence and perceived smartphone quality, described in the first segment of Chapter 2, is presented on the next page, with moderating relationships shown by dashed lines.

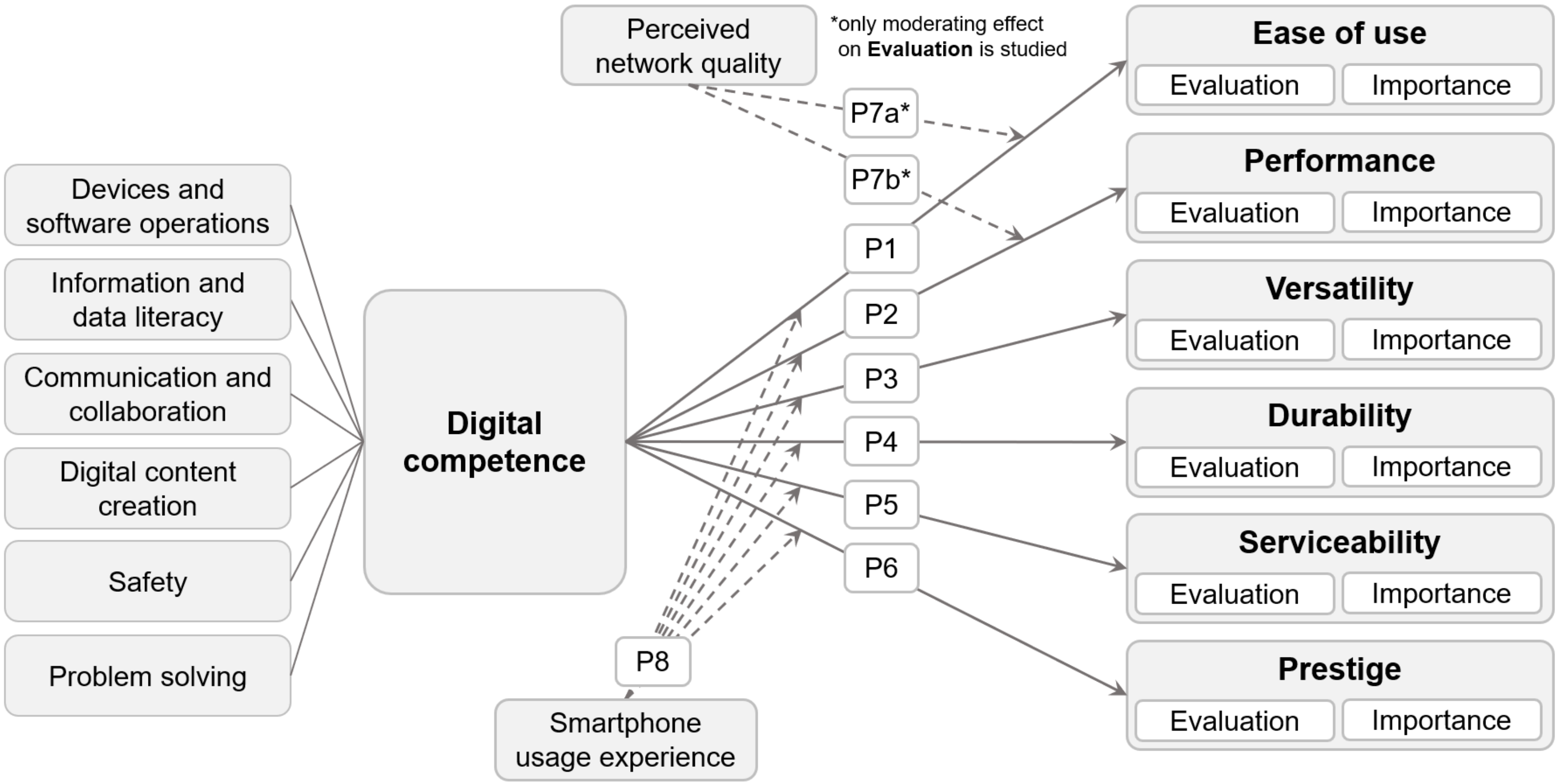

Figure 11. *Final theoretical framework with the moderation effects of perceived network quality and smartphone usage experience (Source: developed by author)*

2.2 Research design development

The research design of this master's thesis is aimed at combining of the previously conducted non-empirical research with empirical research methods. The theoretical framework that and research propositions that were developed through literature and secondary data review have to be explored on empirical evidence to test the stated research propositions

In this master's thesis, *quantitative* research methods are applied to test the research propositions. Qualitative methods allow to use numerical data as a basis for statistical analysis and approval or rejection of statistical hypotheses. This type of study allows to potentially extrapolate the results obtained on a sample to the entire investigated population (if the sample is representative and data quality is high). The two main types of design for such study are survey and observation (Malhotra, Birks, Wills, 2012).

Since the *survey* is a more targeted and convenient way of obtaining quantitative information, it was decided to use this type of data collection method. The advantage of an online over an offline survey is its cost-effectiveness and better potential geographical reach. Therefore, an online survey tool is applied (Malhotra, Birks, Wills, 2012).

2.2.1 Choice of digital competence assessment technique

To further develop research design, a principal decision has to be made regarding the assessment technique for digital competence level measurement. A short description of digital competence assessment techniques is presented further.

Individual's digital competence can be assessed directly, in this master's thesis such approach is called *direct assessment techniques*. Three main types of digital competence assessment techniques based on data collection approach are usually applied in academic research and commercial sector (Kluze, Pujol Priego, 2018; Laanpere, 2019):

- *Self-assessment* – individuals are asked to evaluate their knowledge and skills with questionnaires that range from structured scales to free-form reflection. It is usually performed through declarative questionnaire with statements about one's behaviour in different digital situations;
- *Knowledge-based assessment* – individuals are responding to carefully designed test items that measure both declarative and procedural knowledge. Individuals are presented with realistic problems in a variety of real-life situations;
- *Performance assessment* – individuals are monitored by human observers or software while being engaged in solving authentic, real-life problems by using common software tools (e.g. browser, word processor, spreadsheet) or simulations.

To offer a more complete assessment and resulting profile, a test can integrate other elements, beyond competences (Kluze, Pujol Priego, 2018). 'Secondary' approaches, which here are called *indirect assessment techniques*, can also be used. First of them is providing an *electronic portfolio* (e-portfolio) that contains educational certificates, digital projects and digital creative works, 'and other authentic documentary evidences' (Laanpere, 2019).

Technology use information can also be collected from the respondent. The frequency of various technology use in this case is assumed to deliver indirect evidence of competences. Additionally, 'when an individual uses an application that is considered to be difficult to use (or uses a large variety of applications), this is held to be an indication of a high level of digital skills' (Deursen, 2017).

On the basis of overviews of digital competence assessment techniques (Deursen, 2017; Kluze, Pujol Priego, 2018; Laanpere, 2019) and theory on consumer and market research (Malhotra, Birks, Wills, 2012), a comparison table has been compiled by the author, which is present in the table on the next page. The technique chosen for this research is *self-assessment technique*. Although self-assessment technique tends to be subjective, as it relies on respondent's self-perception, it is the optimal choice given the context of the research and available resources. Several reasons underpin such decision:

- *Timeliness* – this is the least time-consuming technique, which increases the completion rate of the future questionnaire, as well as decreases the cognitive load on respondents to ensure higher quality of answers;
- *Easiness of implementation* – there is no need to develop test questions or special digital interfaces/environments to collect data, technique is available on all digital platforms and is easily scalable, as well as needs no special instruction for respondents;
- *Research applicability* – self-assessment techniques allow to measure attitudinal components of digital literacy.

The subjectivity of self-assessment is be reduced by development of an appropriate questionnaire, with items describing specific knowledge, skills, and attitudes connected with digital competence, in the next paragraph of this chapter.

Table 11. Comparison of assessment techniques (comprised by author)

Technique		Advantages	Disadvantages	Applicability	Examples of use
Direct assessment	**Self-assessment**	− Most appropriate technique to measure attitudinal components of digital competence − Raises awareness about digital competence and stimulates reflection among respondents	− Low reliability because of subjectivity of self-assessment	The most commonly used method in various contexts	DigComp 2.1 proposed self-assessment technique; Digital Competency wheel (Digital Dannelse, 2019); Consumer Savvy Index (McDonald, Uncles, 2007)
	Knowledge-based	− Measures factual knowledge (knowing specific information) − Measures procedural knowledge (knowing how to perform digital tasks)	− Challenging and time-consuming for respondents	Usually adopted for certification and digital competence level monitoring	ROCIT Digital Dictation; JISC Digital capability discovery tool
	Performance-based	− Provides the most accurate picture of competence seen as 'knowledge in action'	− Very demanding in terms of technical complexity and costs for test providers − Challenging and time-consuming for respondents	Usually adopted for certification, digital competence level monitoring or in academic research to develop theory	PISA (Programme for International Student Assessment); TEL (Technology and Engineering Literacy) Assessment
Indirect	**E-portfolio**	− Provides objective information validated by external institutions	− Increases cost and complexity of assessment − Decreases scalability of assessment	Combined with other techniques	Ikanos Digital Competences Diagnosis Test
	Technology use	− Uses information that is easier to collect and easier to report	− Impossible to attribute directly to digital competence level	Combined with other techniques	ROCIT Digital Literacy Index

2.2.2 Questionnaire development

The survey's questionnaire includes several blocks of questions: digital competence assessment, perceived smartphone quality assessment (including importance of quality characteristics and evaluation of current smartphone in use), questions regarding perceived network quality, individual digital usage, and individual smartphone usage experience. Socio-demographic questions have also been added to the questionnaire. They include gender, age group, city of living, education level, area of employment and income level.

Following screening conditions were introduced. Firstly, only respondents who reported using a mobile phone in their everyday life, and then consequently reported currently using a smartphone are considered. Secondly, only respondents possessing significant experience with their current smartphone (at least 6 months) are considered. This limitation was set to research the customers with experience sufficient enough to establish reliable perceptions and opinions regarding the smartphone in use. The analogical limitation was used in investigation on customer-based brand equity of smartphones in the emerging market (Huang, Shih, 2017). Finally, only respondents who make the final decision when purchasing a smartphone are considered, as they are more involved into process of smartphone evaluation.

Digital competence

The questionnaire items were developed following several principles. First of all, the set of competences follow the list from the DCR framework (based on DigComp and DLGF frameworks). However, to decrease cognitive load on respondents and keep the questionnaire within 15-minute timeframe, only three statements were developed for each competence area measuring different competences. Unfortunately, no ready and suitable solutions were identified through information search and literature review, so a new questionnaire on digital competence had to be developed.

From the initial DigComp framework three competences were selected for inclusion to the questionnaire. The competences were prioritized according to their level of applicability to Russian market. *Programming* was excluded, as it remains the least developed capability in all age groups even in Europe (Khan, 2019). *Protecting the environment* was excluded, as, even though the positive trend is observed in this area, Russian consumers still tend to be less environmentally aware than European (Ipsos, 2018). *Engaging in citizenship through digital technologies* and *managing digital identity* are exceedingly complex concepts, and *creatively using digital technologies* is applicable to a narrow group of respondents, as it means the ability to 'create knowledge and to innovate processes and products' (EU JRC, 2017).

Table 12. DigComp competences included into the questionnaire (Source: developed by author)

Competence area	Included competences	Not included
1. Information and data literacy	1.1 Browsing, searching, filtering data, information and digital content 1.2 Evaluating data, information and digital content 1.3 Managing data, information and digital content	
2. Communication and collaboration	2.1 Interacting through digital technologies 2.2 Sharing through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette	2.3 Engaging in citizenship through digital technologies 2.6 Managing digital identity
3. Digital content creation	3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licenses	3.4 Programming
4. Safety	4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being	4.4 Protecting the environment
5. Problem solving	5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.4 Identifying digital competence gaps	5.3 Creatively using digital technologies

For assessment *devices and software operations* competence, competences regarding such operations were adapted from academic literature on and digital skills (Van Deursen et al., 2014; Van Deursen et al., 2016; Fraillon et al., 2018). As operational competences are multidimensional, and no ready framework is available for their measurement in similar circumstances, an extended, four-item set was introduced for this competence area.

Each competence area must be assessed not only through skills and knowledge items, but also through at least one attitude item, as the competence is a combination of all three components (Fielder et al., 2016). As defined in the previous paragraph of this master's thesis, a self-assessment technique is be used. The list of self-assessed competences is presented in table on the next page.

For each competence, the respondent is suggested to express the level of agreement with a specific statement describing the developed level of a competence. Formulations of statement were adapted from the Digital Competences Self-Assessment Grid (Europass, 2015), with inclusion of adapted statements or their elements from other digital assessment tools – Digital Dictation 2020 and Ikanos Digital Competences Diagnosis. Statements are positively worded and express an 'proficient' digital competence level, so that less digitally competent respondents could vary their level of agreement according to their level of digital competence. Most statements are action- or ability- oriented, even attitudinal items express perception of some actions regarding digital technology.

The assessment is conducted on a 7-point Likert scale. Analogical Likert-scales assessing the level of agreement with positive statements regarding digital competences have already been used to measure ICT self-efficacy (Siddiq, Gochyyev, Wilson, 2017), digital literacy dimensions (Ng, 2012), '21st century competences' (Almerich et al., 2018), digital skills (Van Deursen, 2014) and digital skills (Fleaca, Stanciu, 2019). These scales were of 1 to 5 range or 1 to 6 range. The 7-point Likert scale was applied in the study for development of a self-efficacy scale for digital competences in schools (Norden, 2017). A wider range Likert-scale was chosen to allow for more precise assessment of digital competence level fluctuations among different respondents.

Table 13. Digital competences for self-assessment (Source: developed by author)

Competence area	**Component**	**Competence**	**Scale**
Devices and software operations	Skills, knowledge	Shortcuts and hotkey usage	Likert 7-point *Totally agree* … *Totally disagree*
		Settings personification in software	
		Knowledge of basic device specifications	
	Attitude	Love for installing and trying new software	
Information and data literacy	Skills, knowledge	Search operators and filters usage	
		Smart storage and organization of data	
	Attitude	Critical outlook on online information	
Communication and collaboration	Skills, knowledge	Various communication tools usage	
		Various collaboration tools knowledge	
	Attitude	Respect towards netiquette	
Digital content creation	Skills, knowledge	Simple content for self-expression creation	
		Complex multimedia content creation	
	Attitude	Respect towards intellectual property*	
Safety	Skills, knowledge	Safety settings periodical checks	
		Information encoding and protection skills	
	Attitude	Attention to not share sensitive info online	
Problem solving	Skills, knowledge	Task-appropriate digital tools knowledge	
		Ability to receive help or information	
	Attitude	Love for renewal and increasing of digital competence	

* for verification of this competence assessment, another additional item was introduced – the respondent has to assess the statement 'I consume only licensed content and software' on the 7-point Likert scale from *Never* to *Always*

Perceived smartphone quality and network quality

For this part of the questionnaire, several development steps were taken. Firstly, the characteristics (sub-dimensions) of quality dimensions were adapted from the initial durable goods quality dimensions model (Brucks et al., 2000). Secondly, items describing high quality in these characteristics were adapted from previous academic research (Jin et al., 2013; Boakye et al., 2014; Ickin, 2015; Shintaputri, Wuisan, 2017; Tröger, Wieser, Hübner, 2017; Bayu et al., 2019).

Finally, two items characterizing the desired product features which are important for high performance quality are country specific. They were combined under the new *product features* sub-dimension of *performance*. According to the consumer preferences study in the Russian market, three 'most desired' functions in the smartphone are fast internet browser, quality in-built camera and convenient e-mail client (Zvezdina, Sorokin, 2017). There are possibilities for customization and improvement of internet browsing and e-mailing experience by the customer through installation of additional applications. Operating system developers provide smartphones with ready customizable solutions, making it a part of smartphone's *ease of use* and *general performance level* dimension. However, it is impossible for the customer to change the technical features of the smartphone's camera, so camera quality is initially defined by the manufacturer. Through modelling of consumer preferences in the Russian smartphone market, researches have proven, that there smartphones with higher camera resolution (the higher the resolution, the better quality will photographs and videos be) are perceived as having higher utility be the customers (Zvezdina, Sorokin, 2018). With camera performance being of such significance for the customer, it is hard to attribute camera performance to any other quality dimension. Therefore, a separate item for smartphone camera was developed.

Additionally, a separate item was developed for battery performance, as many authors identified the importance of this characteristic for the perceived quality (Ickin, 2015; Bayu et al., 2019). At the same time, a quality battery is especially important for the Russian smartphone market, as in Russia (and other countries where winter takes place at temperatures below 0°C), the gadget can be discharged at any time because of the low temperatures effect (Mail.ru High-tech, 2017). The finalized list of characteristics describing perceived smartphone quality is presented in table on the next page.

For each perceived quality characteristic, the respondent is suggested to share two assessments: the importance of the characteristic, and its evaluation for the current smartphone in use. Statements, again, are positively worded and describe a high level of smartphone quality, so that respondents can vary their level of agreement according to individual perception of their smartphone's quality. 7-point Likert scales for agreement measurement have already been used in academic research which included measurement of smartphone quality and functional value (Kim, 2011; Boakye, 2014; Yeh, Wang, Yieh, 2016; Hew, 2017; Huang, Shih, 2017; Noh, Lee, 2016; FIlieri, Lin, 2016). Likert scale for assessment of quality importance in the smartphone market has also been applied (Wollenberg, Thuong, 2014; Chen, Ann, 2014; Chen, Murphy, Knecht, 2016).

Table 14. Smartphone characteristics in the questionnaire (Source: developed by author)

<table>
<tr><th colspan="2">Quality dimensions and sub-dimensions</th><th>Smartphone characteristics</th><th>Scale</th></tr>
<tr><td colspan="2" rowspan="2">Ease of use</td><td>Easy and convenient to use</td><td rowspan="20">Likert 7-point

1) Not at all important
… Very important

2) Totally agree
… Totally disagree</td></tr>
<tr><td>Easy to just turn on and start using</td></tr>
<tr><td colspan="2" rowspan="2">Versatility</td><td>Lots of various functions</td></tr>
<tr><td>Possible to use for different purposes</td></tr>
<tr><td rowspan="4">Durability</td><td rowspan="2">Longevity</td><td>Long total life cycle</td></tr>
<tr><td>Ability to work long time without service</td></tr>
<tr><td rowspan="2">Endurance</td><td>No need for careful/cautious use</td></tr>
<tr><td>Ability to work even in unfavorable conditions (temperature, humidity, etc.)</td></tr>
<tr><td colspan="2" rowspan="2">Serviceability</td><td>Accessibility of quality service (repair, etc.)</td></tr>
<tr><td>Accessibility of quality customer support</td></tr>
<tr><td rowspan="6">Performance</td><td rowspan="2">General performance level</td><td>High technical characteristics (processing power, screen, memory, etc.)</td></tr>
<tr><td>Fast speed of work</td></tr>
<tr><td rowspan="2">Product features</td><td>Ability to make good photographs</td></tr>
<tr><td>Ability to work for a sufficient time without charging</td></tr>
<tr><td rowspan="2">Consistency (reliability)</td><td>Ability to work even during active use</td></tr>
<tr><td>Ability to work reliably and correctly</td></tr>
<tr><td colspan="2" rowspan="2">Prestige</td><td>Attractive appearance</td></tr>
<tr><td>Ability to demonstrate social status</td></tr>
</table>

Perceived network quality is measured through two questions on two main domains of the mobile service – phone and SMS quality (more conventional use), and Internet and data transfer quality (modern functions).

Table 15. Perceived network quality characteristics in the questionnaire (Source: developed by author)

Characteristic	Scale
Phone call and SMS quality	Likert 7-point *Very low … Very high*
Internet and data transfer quality	

A 7-point Likert scale is used, ranging from *very low* to *very high*. Analogical scales were used to measure consumer durables quality (Brucks et al., 2000). The change of the scale descriptors was also proposed to facilitate more variability of questionnaire for the respondents.

Digital usage and smartphone usage experience

The level of individual's *digital usage* is assessed through one question for the questionnaire conciseness. The respondent is asked to choose all the statements that characterize the way of using digital technology. After the analysis of digital competence assessment instruments, the following list of usage areas was introduced:

- Basic functions of digital devices (calls and SMS, e-mail, file storage, etc.);
- Personal purposes (talking with friends, searching for information, shopping, etc.);
- Entertainment purposes (viewing online content, games, etc.);
- Study/work use as an auxiliary tool (the use of "office" and Internet applications, etc.);
- Study/work use as the main tool (professional creation of complex digital content, programming, etc.).

The level of individual's *smartphone usage experience* is assessed through two questions. Initially, the respondent is asked to provide the total length smartphone usage (in years).

After that, the they are asked to choose all the smartphone brands that they have ever used for at least half a year. Brands of Samsung, Apple, Huawei, Xiaomi/Mi, Sony, Nokia and ZTE were included as initial options as market share leaders (Statcounter, 2020). From the list of smartphone brands used by the respondent, conclusions on the experience with different operational systems is going to be made. At the moment, two major operating systems represent around 98-99% of operating systems used in the Russian market (Statista, 2019; Statcounter, 2020) – iOS and Android. iOS is an operating system developed by Apple and used only for products of this company. Android is an operating system developed by Google, used for installation on products of a wide range of companies: Samsung, Xiaomi, Huawei, and many others.

2.2.3 Data collection and analysis

General population

The general population of the research are Moscow and Saint Petersburg citizens 15-44 years of age who use a smartphone in their daily life. The age of 15-44 years is the 'typical' age of a smartphone user in Russia. In its research on consumer behavior in the Russian market, PwC identified that smartphones are 'promoted by consumers aged 25-44 years'. In 2017, the share of consumers using smartphones within this age group increased significantly. Younger buyers, who are 18-24 years old, continue to 'set the tone' by extensively using smartphones (PwC, 2018). According to the research conducted by Beeline in 2018, the largest percentage of all iPhone users was 25-44 years old – more than 61% (iGuides, 2018). In the research on consumption of the Internet, Mediascope identified that in the 12-24 age group 93% of Russian respondents surfed the Internet on their smartphone; the analogical percentage was 89% for the 25-34 age group and 79% for the 35-44 age group. For the next age group of 45-54 years, the number decreased dramatically to 60% of respondents (Mediascope, 2019).

The studied general population is also narrowed down to consumers living in Moscow and Saint Petersburg. That is due to the fact that consumers in these cities are faster to adopt new trends and technologies. For example, consumers from Moscow and Saint Petersburg shop online (PwC, 2018), use non-cash payment for their mobile phone balance replenishment (EG-online, 2015). According to the Federal State Statistics Service, over 5.1 million people of 14-45 years currently live in Moscow, and over 2.2 million people of the same age group live in Saint Petersburg (FSSS, 2019). This means that the total general population of over 7.3 million people could be potentially investigated in this research.

The number also has to be corrected according to the smartphone usage rate, because only consumers who have practical experience with smartphones are be able to provide valuable insights for the research. Smartphone ownership rate in Russia is 59%. This could be compared with the average rate of 45% for emerging economy countries and the average rate of 76% for advanced economies (Statista, 2020). Consequently, the general population size is around 4.4 million people.

Sampling method and sample size

Restrictions on the level of income, educational level and other characteristics of the respondent are not set. However, to ensure sample representativeness, it is necessary to set quotas on the main demographic characteristics of respondents, which in this research include age group and gender. Quotas are used to guarantee that representatives of both genders (male, female) and all age sub-groups (15-24, 25-34, 35-44 years) are presented in the collected numerical data. Consequently, in this research, a *non-probability quota sampling* is used.

After the quotas for quota sampling is specified, sampling selection is usually done through purposive or convenience sampling (Semiz, 2016). For the simplification of data collection process, the data is collected through convenience and snowball sampling methods. This means that initially the respondents are attracted from a group of people easy to contact or to reach (convenience sampling), but they are also stimulated to recruit other participants for to take part in the survey (snowball sampling).

The size of each quota was set at 40 respondents. The quota size was chosen to exceed the 'small sample' size, which is usually set at 30 observations (Sergeant, Bock, 2002). Moreover, academic researches use samples starting from 40 and even 30 observations for PLS data analysis (Goodhue, Lewis, Thompson, 2012), the same type of analysis that is going to be used in this research design. Equal quotas were set, and the sample structure is not aimed at replication of the demographic structure of the general population. This done is for a wider applicability of the study results.

Table 16. Minimal quotas for the research (Source: developed by author)

		Gender		
		Male	**Female**	**Total**
Age group	**15-24**	40	40	80
	25-34	40	40	80
	35-44	40	40	80
	Total	120	120	240

The total sample size is 240 respondents, which has to comply with the minimum for the chosen statistical methods of analysis. The appropriate data analysis method for this type of research is PLS-SEM (the choice of data analysis method is specified in the following paragraph). The statistically determined minimum sample size for PLS-SEM is 160. Additionally, a '10-times rule-of-thumb' is widely used, which implies that the 'sample size should be greater than 10 times the maximum number of inner or outer model links pointing at any latent variable in the model' (Kock, 2018). The maximum number of links connected to the *digital competence* variable in the theoretical model is 15, therefore, according to the '10-times rule' the minimum sample size should be 150.

The sample size should also correspond with the chosen research objectives. table below shows typical sample sizes required for various tasks (Malhotra, Birks, Wills, 2012). The aims of this master's thesis can be described as 'problem or phenomenon exploration'. Consequently, the minimum sample size for this type of research is 200 respondents.

Table 17. Typical and minimum sample sizes for various types of research (Source: Malhotra, Birks, Wills, 2012)

Research aims	Minimum sample size	Typical sample size
Problem or phenomenon identification	500	1000-2500
Problem or phenomenon exploration and solving	200	300-500
Product, concept testing	200	300-500
Communication testing	150	200-300

Data collection method and survey distribution

Since the study population (especially with quotas application) may be difficult to access, it was decided to conduct an *online survey*. The advantage of an online survey is its cost effectiveness, combined with the possibility of general population analysist through collection of a sample of an appropriate size (Malhotra, Birks, Wills, 2012).

The survey was distributed through social network Vkontakte. Vkontakte is the 5th popular website in Russia, and the most popular Russian social network. It has average monthly reach of 21.4 million users, with all demographic groups present (Mediascope, 2020). The initial distribution was conducted through convenience sampling, however, the respondents were stimulated to further share the questionnaire. For that purpose, a prize lottery was held among respondents.

Data analysis methods

The first major method of data analysis is *exploratory factor analysis* aimed at composing the final list of factors comprising digital competence and the new list of smartphone quality dimensions. The objective of the exploratory factor analysis is to ensure that the items adequately capture the domain of interest, which in some cases includes complex multidimensional concepts. The need for exploratory factor analysis in this research is justified by two reasons. First of all, some of the questionnaire items were developed by the author and have not yet been validated. Exploratory factor analysis is a popular tool for validation for questionnaire items and constructs that are comprised from them. Secondly, the original models of digital competence and model perceived quality dimensions, which are included into the theoretical framework of this master's thesis, have components that may internally overlap. For example, in the original DigComp model, the 'Communication and collaboration' competence area includes the competence 'Collaborating through digital technologies', which is described as a process of co-construction or co-creation. Consequently, it can also be partly attributed to 'Digital content creation' competence area. The statistical analysis enables the redistribution of the initial items to the new, data-based categories.

Researchers have already applied exploratory factor analysis in studies concerning smartphone quality (Boakye, 2014; Filieri, Lin, 2016), as well as studies measuring Internet skills (Van Deursen, 2014), digital skills (Van Deursen, 2016) and 'digital empowerment' (Kong, Wang, Lai, 2019).

The next major method of data analysis applied is *PLS-SEM* (partial least squares structural equation modeling). Structural equation modeling is statistical analysis technique used to analyze structural relationships. This technique is the combination of factor analysis and regression analysis, and it is used to analyze the structural relationship between measured variables and latent constructs (Statistics Solutions, 2020). The appropriate application of SEM allows to understand relationships between the studied constructs – digital competence and perceived quality. There are two major SEM techniques – covariance-based (CB-SEM) and variance-based (PLS-SEM). The second one is more appropriate in the context of this master's thesis. PLS-based SEM can be used in an exploratory study, where the theoretical knowledge is relatively limited (Chin, 2010). This type of analysis is distribution-free and able to handle data from non-normal or unknown distributions. PLS-SEM can also process small sample size without harm to its ability to deliver higher level of statistical power (Hew, 2017). PLS-SEM aims to test predictive relationships between constructs by looking at whether there is a relationship or influence between the constructs. PLS-SEM modelling can be performed without a strong theoretical basis, and PLS-SEM is very suitable for use in research that aims to develop theory. The accuracy parameters of predictive models can be seen from the R-square (Sanusi, Herlina, 2019; Bayu et al., 2019). PLS-SEM has already been used in studies concerning smartphone quality (Boakye, 2014; Filieri, Lin, 2016; Hew, 2017; Sanusi, Herlina, 2018 Bayu et al., 2019), as well as studies examining digital literacy (Muthupoltotage, Gardner, 2018; Seufert, Guggemos, Tarantini, 2019).

Summary and conclusions

The final theoretical framework can be observed in Figure 11. It includes digital competence and digital usage components derived from previous chapter, as well as proposed smartphone perceived quality dimensions. They are *ease of use*, *performance*, *versatility*, *durability*, *serviceability*, and *prestige*. The dimensions are adapted from the model of durable goods quality dimensions (Brucks et. al, 2000). Each effect is investigated individually for more precise results and interpretations.

Two additional factors moderating the effect of digital competence on the perceived quality of smartphones were also introduced – *perceived network quality* and *smartphone usage experience*. Perceived network quality derives from the notion of interactivity, which means that smartphone is used together with network services, and their quality can influence smartphone quality perception. In the research propositions, perceived network quality moderates the effect on evaluation of *ease of use* and *performance*, while smartphone usage moderates all construct relationships between quality dimensions and digital competence.

Table 18. Research propositions of master's thesis and corresponding concepts

№	Formulation	Concept
P1	DC level has positive effect on **ease of use** a) evaluation; b) importance	Perceived quality dimensions
P2	DC level has positive effect on **performance** a) evaluation; b) importance	
P3	DC level has positive effect on **versatility** a) evaluation; b) importance	
P4	DC level has negative effect on **durability** a) evaluation; b) importance	
P5	DC level has positive effect on **serviceability** a) evaluation; b) importance	
P6	DC level has positive effect on **prestige** a) evaluation; b) importance	
P7	**Perceived network quality** moderates the effect of digital competence on evaluation of a) ease of use; b) performance.	Additional factors
P8	**Smartphone usage experience** moderates the effect of digital competence on quality dimensions a) evaluation b) importance.	

A research design was developed to facilitate the appropriate testing of the proposition in the research model. A quantitative empirical approach was taken, with the quantitative survey as data collection method. Self-assessment technique was chosen for measurement of individual digital competence, because of its timeliness, ease of implementation and wider research applicability. Subjectivity of self-assessment is reduced by the appropriate item design of the questionnaire.

The questionnaire applied for data collection can be found in Appendix 1. For the most parts it features positively expressed statements on digital competence and smartphone quality which describe high level of digital competence or smartphone quality. The agreement with the statements is assessed on a 7-point Likert scale with descriptors from 'Totally agree' to 'Totally disagree'. Snowball and convenience sampling are applied, with *quotas* based on age group and gender, with each quota amounting to 40 respondents and total sample of 240 respondents.

For data analysis, *exploratory factor analysis* and *partial least squares structural equation modelling* is applied. This first procedure is needed to understand how the proposed DCR model and the developed questionnaire items perform in practical application to the target group, it will also allow for dimension redesign and reduction. The second method applied to investigate the relationships between studied constructs and test the research propositions.

CHAPTER 3. DATA ANALYSIS AND PRACTICAL IMPLICATIONS

The chapter presents the results of obtained data analysis. First of all, an exploratory factor analysis will be performed in SPSS software, either validating the initially proposed factors, or adapting the initial factor structure if the obtained data will demonstrate different evidence.

Then, with modified investigated factors, the research proposals will be tested on the basis of statistical hypotheses testing. Modelling will be performed in WarpPLS 7.0 software, and statistical checks will be performed on the basis of its comprehensive user guide, that summarizes all the necessary statistical information for PLS-SEM method (Kock, 2020).

The discussion of the results presents the most important part of the study. First, new data-based models will be developed if the initial research model is not approved. Finally, the chapter concludes with theoretical and practical implications made on the quantitative research results.

3.1 Data analysis

3.1.1 Obtained sample

In total 507 responses to the questionnaire were obtained. The total amount of views on different posts containing the link to the questionnaire is close to 13.500, which allows to calculate the approximate response rate of 3.8%. Out of all responses, more than half were filtered out according to the initially set criteria, and several duplicates were deleted.

Table 19. Criteria for responses selection (Source: developed by author)

Criteria	**Target value**
Geography	Moscow, Saint Petersburg
Age	15-45
Device usage	‘Mobile phone’ selected among options
Currently own/use a smartphone	Yes
Total smartphone usage length	At least 6 months
Current smartphone usage length	At least 6 months

After data filtering, 323 responses were selected for further quota sampling. In some demographic groups the number of responses exceeded minimum quotas – in this case random selection was applied. In one demographic group (Male, 35-44) the minimum quota was not reached. However, the total number of respondents in the target group was compensated through addition of female respondents in the same age group. Out of 240 respondents, 14% reside in Moscow, while 86% live in Saint Petersburg.

Table 20. Final obtained sample (Source: collected data)

		Gender		
		Male	**Female**	**Total**
Age group	**15-24**	40	40	80
	25-34	40	40	80
	35-44	32	48	80
	Total	112	128	240

We can conclude that the sample on average has a significant experience of smartphone use: 60% of respondent have been using smartphones for at least 8 years. On average, respondents have used 2.86 different smartphone brands throughout their smartphone usage experience, and around 38% of them have used both Android and iOS-based smartphones. All major brands in the Russian smartphone market are also represented in the sample.

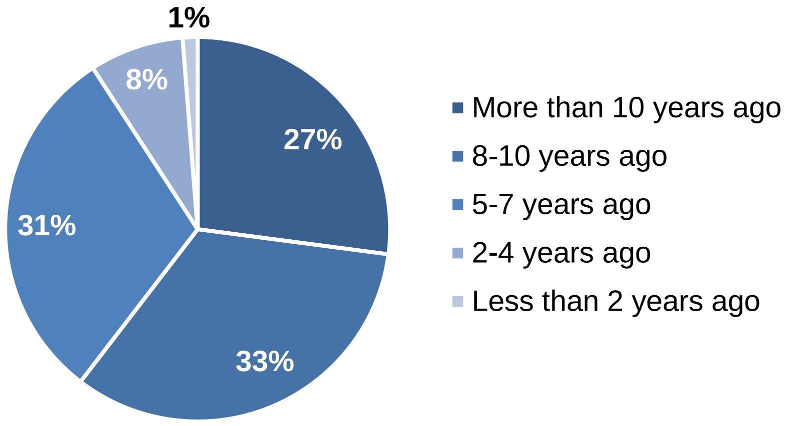

Figure 12. *Respondents' total length of smartphone use (Source: collected data)*

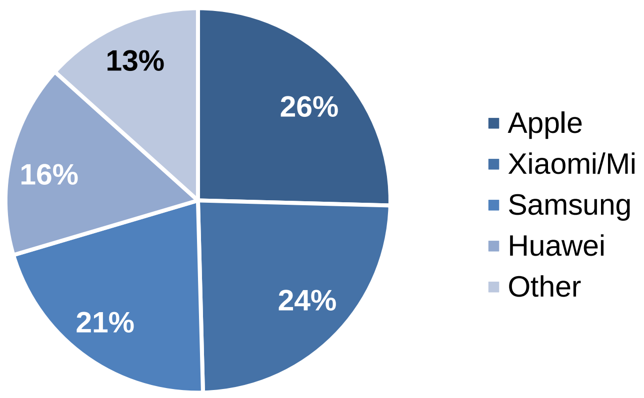

Figure 13. *Current smartphone brand in use (Source: collected data)*

3.1.2 Exploratory factor analysis

Digital competence characteristics

After the analysis of the correlation matrix, analysis of means and initial exploratory factor analysis of different DCR items, some items were excluded from the initial exploratory factor analysis.

Table 21. Excluded items (Source: developed by author)

Competences (items)	Statistical performance	Possible explanation
Usage of various online communication tools; Knowledge and application of netiquette (Communication and collaboration)	– Low correlation with other items – Highest average (>6.2/7) among all digital competence items – Low performance during EFA (low factor loadings, low 'face value' of resulting factors)	Most respondents comply with the statements, as nowadays metropolis inhabitants use various digital tools for communication and try to comply with communication rules; consequently, the items did not reflect the difference in digital competence levels
Critical attitude towards information online (Information and data literacy)	– Low correlation with other items – Low communality (<0.4) in the initial EFA – Low performance during EFA (low factor loadings, low 'face value' of resulting factors)	The items showed inconsistency that may be attributed to personal characteristics of the respondent rather than digital competence level (e.g. individual level of suspiciousness, aspiration towards self-expression, attitude towards intellectual property, price perception)
Simple content creation (Digital content Creation)	– Low correlation with other items – Low performance during EFA (low factor loadings, low 'face value' of resulting factors)	
Respect towards licenses and intellectual property (Digital Content creation)	– Low correlation with other items – Low performance during EFA (low factor loadings, low 'face value' of resulting factors) – Combination with check-item 'Consumption of only licensed content' did not improve consequent factor performance	

Without the items described above, an exploratory factor analysis with high face value and statistical value was accomplished. The KMO measure of 0.912 was reached, with communalities above 0.4 and significant Bartlett's test of sphericity. Three factors were extracted out of remaining 14 factors. The only index that may need further improvement is the cumulative percentage of explained variance – 59,76%.

Table 22. Resulting factors (Source: developed by author)

Factor	**Competences (items)**	**Initial competence areas**
Digital toolbox: individual level of application of digital technology – vastness of possessed digital tools, and the willingness to acquire a wider set of digital tools	– Knowledge how to get help or needed info – Task-appropriate digital tools knowledge – Love for renewal and increasing of digital competence	Problem solving
	– Information encoding and protection skills	Safety
	– Collaboration tools knowledge	Communication and collaboration
	– Complex multimedia content creation	Digital content creation
	– Love for installing and trying new software – Knowledge of basic device specifications	Devices and software operations
Digital efficiency: the ability of an individual to make the technology use convenient for them, making it less time consuming and effort consuming	– Settings personalization in software – Shortcuts and hotkeys usage	
	– Search operators and filters usage – Smart storage and organization of data	Information and data literacy
Digital safety: actions that provide safety of personal accounts, files, and devices	– Attention to not share sensitive information online – Periodical checks of safety settings and passwords	Safety

The factor structure was confirmed to be of high quality through various checks. Item loadings all exceed 0.7 (minimum value is 0.5), with all loadings being significant (p-value <0.001), which proves convergent validity. Composite reliability is showed through CR indicators of all four factors exceeding 0.8 (minimum value is 0.7). Cronbach’s alfa exceeds 0.7 (in all cases except for Digital Safety, where it equals 0.66), thus proving internal consistency of factors. All VIFs are below 2.3 (maximum value is 3.3), all AVEs are above 0.5 (minimum value is 0.5). The resulting factors can be characterized by high ‘face value’ comprising individual digital competence are described below.

The resulting latent variable comprised from three digital competence components (toolbox, efficiency, safety) was proven to be of high quality, as Cronbach’s Alfa (0.862 >

minimum of 0.7), Composite Reliability (0.756 > minimum of 0.7), AVE (0.678 > minimum of 0.5) and VIF (1.215 < maximum of 3.3) all comply with needed reference values. All factor loadings are significant and exceed 0.5 (starting from 0.691).

Smartphone quality dimensions evaluation and importance

Exploratory factor analysis was also performed for smartphone's perceived quality evaluation and performance. For both quality evaluation and importance, it was targeted at creating an analogical pair-wise structure to facilitate future analysis of the dimensions. This means that the quality evaluation factors should match the quality importance factors. Luckily, most of the constructs in the collected data proved high quality of the initial proposed quality dimensions. However, some amendments were made in order to increase the statistical power and validity of the factors. First of all, three items were deleted (total of six for both quality evaluation and quality importance).

Table 23. Excluded items (Source: developed by author)

Characteristics (items)	**Statistical performance**	**Possible explanation**
Ability to work for a long time without charging; **Ability to make good photographs** (Performance – Features)	– Low performance during EFA (low factor loadings, low 'face value' of resulting factors) – Cronbach's Alfa was increasing after items exclusion	Specific product features evaluation and importance may depend on individual style/regime of use
Easy to just turn on and start using (Easy to use)	– Low performance during EFA (low factor loadings, low 'face value' of resulting factors) – Low Cronbach's Alfa (<0.6) of the initial 'Ease of use' factor	Incorrect item formulation or its low accordance with the notion of 'Ease of use'

After exploratory factor analysis, factor structure underwent slight changes. Instead of 6 initial factors, 7 were formed. After deletion of one of the two 'Ease of use' items, this factor was left represented with just one item. This situation is unfavorable, but still possible for exploratory research. Durability factor split into two factors in accordance to its subdimensions – *Longevity* and *Endurance*. This change follows the original subdimensions in the theoretical model, and therefore makes sense. Other factors were left unchanged. Notably, 'Performance' factor did not split into *General performance level* and *Consistency (reliability)*, although such outcome could be expected – all four items combined into one formative 'Performance' factor.

Table 24. New smartphone quality dimensions (Source: developed by author)

Resulting factors	Smartphone characteristics	Initial quality dimensions and sub-dimensions	
Ease of use	Easy and convenient to use	Ease of use	
Excluded	Easy to just turn on and start using		
Versatility	Lots of various functions	Versatility	
	Possible to use for different purposes		
Longevity	Long total life cycle	Durability	Longevity
	Ability to work long time without service		
Endurance	No need for careful/cautious use		Endurance
	Ability to work even in unfavorable conditions (temperature, humidity, etc.)		
Serviceability	Accessibility of quality service (repair, etc.)	Serviceability	
	Accessibility of quality customer support		
Performance	High technical characteristics (processing power, screen, memory, etc.)	Performance	General performance level
	Fast speed of work		
	Ability to work even during active use		Consistency (reliability)
	Ability to work reliably and correctly		
Excluded	Ability to make good photographs		Product features
	Ability to work for a sufficient time without charging		
Prestige	Attractive appearance	Prestige	
	Ability to demonstrate social status		

The statistical quality of factors was proven to be acceptable. The description of main statistical indicators is presented in the table below with recommended values (Kock, 2017). As the result, the initially proposed factor structure was proven to be suitable both for smartphone quality dimensions *evaluation* and smartphone quality dimensions *importance*. It was validated for future analysis, although small changes were made to it.

Table 25. Main statistical indicators for new factors (Source: obtained data)

Characteristics	Importance factors	Evaluation factors	Recommended values
CA	Three >0.74, Three >0.64 (acceptable)	Four >0.76, Two >0.68 (acceptable)	>0.7
CR	All >0.85	All >0.83	>0.7
AVEs	All >0.65	All 0.71	>0.5
VIFs	All <2.0	Five <2.5 One =3.6 (acceptable)	<3.3
Convergent validity	All >0.78, all significant	All >0.84, all significant	Factor loadings >0.5 with p-value <0.05

3.1.3 Research model and hypotheses testing

Below is the renewed theoretical model with applied changes concerning prior exploratory factor analysis. The number of quality dimensions has grown from six to seven, while the number of digital competence constituents decreased from six to three.

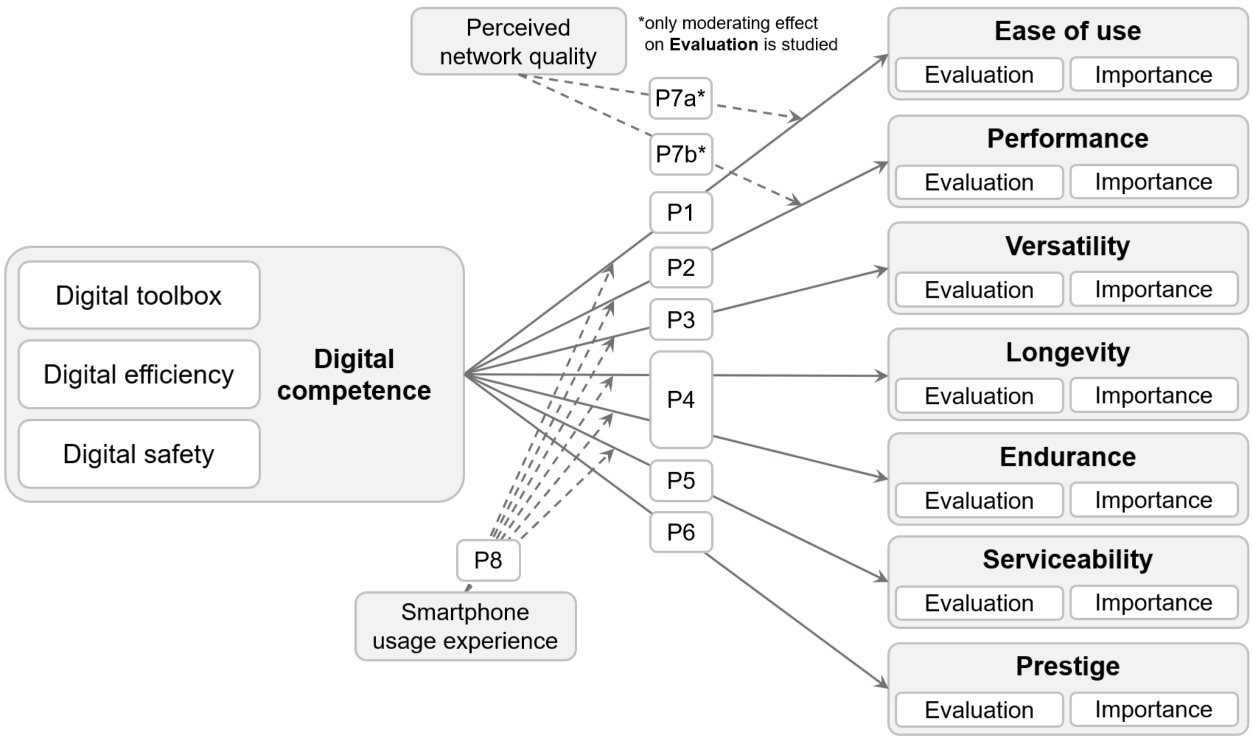

Figure 14. *Renewed research framework after factor analysis (Source: developed by author)*

This theoretical research model was operationalized into two models (evaluation and importance) and run in the WarpPLS 7.0 software. General model fit and quality indices were calculated, with all indices reaching the necessary values to prove quality. However, for both models the Average R-squared and Average adjusted R-squared were lower than 0.1, which can be interpreted as a low overall predictive and explanatory quality of the model. As a result, both models were modified during further modelling process.

On the basis of two modelling sessions (for perceived quality evaluation and importance), conclusions were made on the initial research propositions. Statistical hypotheses regarding each research proposition were formed, and the relationships between investigated variables were calculated by the applied software. Three indicators in regard to path coefficients of the model were taken into consideration when testing the hypotheses – the significance of path coefficients, effect sizes of path coefficients, and the value of path coefficients (for comparative purposes). All size coefficients must be significant. Paths coefficients 'should be at least 0.20 in order to be considered meaningful' (Chin, 1998). Valid effect sizes start from 0.10. The significant small effect size in PLS-SEM method usually starts at the value of 0.02 (Cohen, 1988), but such threshold is considered too low by the author to be applied in this research and make substantiated conclusions.

Most of the proposed variable relationships were characterized by significant path coefficients, but the effect sizes appeared to be too low in most cases to provide reasonable conclusions and support the initial research propositions. However, all path coefficients and effect sizes of the relationships between digital competence and different quality dimensions were positive. This can also possibly be caused by higher overall pleasure of digitally competent consumers when using smartphones, and not only by the influence of digital competence itself.

The results of research hypotheses testing are presented below – out of eight research propositions, one was confirmed, and three were partially confirmed, while four were rejected. Further qualitative research is needed to better explain the consumer insights that lead to such quantitative findings. Possible explanations for the confirmed research propositions are described further in the text.

Table 26. Tested research propositions (Source: developed by author)

№	Formulation	Status
P1	DC level has positive effect on ease of use:	**Partially confirmed**
	a) evaluation;	Confirmed
	b) importance	Rejected
P2	DC level has positive effect on performance: a) evaluation; b) importance	**Confirmed**
P3	DC level has positive effect on versatility:	**Partially confirmed**
	a) evaluation;	Rejected
	b) importance	Confirmed
P4	DC level has negative effect on durability: a) evaluation; b) importance	**Rejected**
P5	DC level has positive effect on serviceability: a) evaluation; b) importance	**Rejected**
P6	DC level has positive effect on prestige: a) evaluation; b) importance	**Rejected**
P7	Perceived network quality moderates the effect of DC on evaluation of:	**Partially confirmed**
	a) ease of use;	Confirmed
	b) performance	Rejected
P8	Smartphone usage experience moderates the effect of DC on quality dimensions: a) evaluation b) importance.	**Rejected**

***P1$_a$:** Digital competence has positive effect on **ease of use** evaluation*

Individuals with higher level of digital competence tend to evaluate the ease of use of their smartphones more positively. This may possibly be explained by the fact that digitally competent individuals have better knowledge of interfaces and applications, and therefore it is easier for them to use a digital device. Because of higher digital competence, it is also easier to adapt and get used to new smartphones, and, as a consequence make one's experience more convenient. This complies with the notion of the 'digital efficiency' factor in the resulting digital competence factor model.

***P2$_{(ab)}$:** Digital competence has positive effect on **performance** a) evaluation; b) importance*

Individuals with higher level of digital competence tend to *evaluate* the performance of their smartphones more positively. First of all, digitally competent individuals have better knowledge of various and technical characteristics and functions, as well as the 'behavior patterns' of smartphones in different environments. Because of that, their expectations are the closest to reality, and thus the possibility of dissatisfaction in smartphone performance is lower. Secondly, such smartphone users also avoid making mistakes during use, obtaining overall a more consistent and unerring experience, and, consequently, perceiving the smartphone as more consistent in terms of performance. Performance is also more *important* for digitally competent smartphone users. As these individuals tend to possess a richer digital toolbox and are able to benefit from it, they have more points of contact with smartphone's performance level, and it affects them to a larger extent.

***P3$_b$:** Digital competence has positive effect on **versatility** importance*

Digital competence increases the importance of smartphone's versatility for the consumer. If an individual possesses a higher level of digital competence, more instruments and functions are accessible to them. Consequently, it is important for the smartphone to contain them and be able so solve various tasks.

***P7$_a$:** Perceived network quality moderates the effect of digital competence on **ease of use** evaluation*

Network quality influences the relationship between digital competence and perceived ease of use – higher network quality *decreases* the effect of digital competence on perceived ease of use. This means that if the network quality is high, digital competence has less effect on evaluation ease of use, as consumer's don't have to differentiate between network- and device-related issues, and therefore don't need a higher level of digital competence needed for successful troubleshooting during connectivity issues.

3.2. Discussion of the results

3.2.1 Data-based models and their interpretation

The modification of the two initial models based on the collected data kept three main aims as the focal point. The first aim is to produce models with better R-squared values, and thus with a higher predictive and explanatory quality. The second aim is to only include relationships between variables that possess higher path coefficient indices (significant path coefficients with higher effect sizes). Thirdly, model elaboration allowed to review the relationships of the latent variables and even reassess their inclusion to the model. On the basis of model modification and the information discussed previously, practical interpretations are made.

Data-based model on perceived quality evaluation

The new model has successfully passed all of the model fit and quality indices checks while also possessing an Average R-squared of 0.35 and Average adjusted R-squared of 0.34, which is considered moderate (Chin, 1998) or even substantial for exploratory research (Cohen, 1988). *Serviceability* was excluded from the model due to low R-squared and low path coefficients and effect sizes with all other analyzed variables. All the effects are positive, meaning that in the resulting model all the constructs cause an increase of the constructs they influence.

The only exception is the negative moderating effect of perceived network quality on the relationship between digital competence and ease of use. As already mentioned, it means that higher network quality *decreases* the effect of digital competence on perceived ease of use. Smartphone manufacturers can develop initiatives on raising knowledge among consumers that will help distinguish between product-related incidents and network-related incidents.

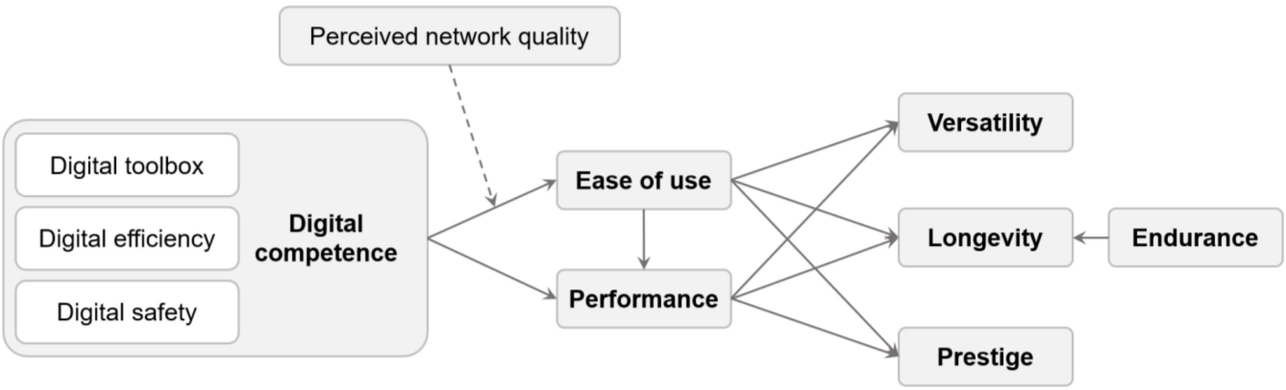

Figure 15. *Data-based model on smartphone perceived quality evaluation*

(Source: developed by author)

It was discovered that *ease of use* and *performance* act as mediators between digital competence and other perceived quality dimensions. Therefore, in accordance with initial research propositions, digital competence, indeed, can influence other quality dimensions, but through mediators. It means that the level of individual digital competence has positive effect on evaluation of ease of use and performance of the smartphone. These two characteristics, in turn, positively influence perceptions of *versatility, longevity* and *prestige*. As the same time, perceived ease of use increases perceived performance – we can assume that convenient devices are perceived as more consistent, more powerful, and fast. Consequently

If the smartphone is perceived as easy-to-use and of high-performance, it can be applied to solve a variety of tasks (versatility). This also leads to a longer perceived product lifecycle, which can possibly be explained by the fact that easy-to-use and high-performance devices become obsolete slower, as their performance stays competitive longer (longevity). Another possible explanation of higher longevity is higher build quality of more expensive smartphones.

Easy-to-use and high-performance devices are perceived as more prestigious. This might be attributed to the principles of smartphone model lineups – smartphones with better hardware are also meant to look and feel more presentable and visually appealing. Longevity is also positively influenced by *endurance*, which is logical – the more the smartphone is robust even in unfavorable conditions, the longer its total length of use is going to be. So, endurance was discovered to be a factor increasing perceived longevity, but less connected with other constructs in the model.

Perceived network quality is still moderating the effect of digital competence on ease of use. This effect has been described previously – when there are no connectivity issues, no digital competences have to be involved for convenient user experience, and no understanding of digital ‘black box’ is needed. Consequently, high perceived network quality decreases the effect of digital competence on ease of use.

Data-based model on perceived quality importance

The new model has successfully passed all of the model fit and quality indices checks while also possessing an Average R-squared of 0.30 and Average adjusted R-squared of 0.29. This is still a relatively low value, but it represents a significant growth in comparison with initial modelling results and is substantial for exploratory research (Cohen, 1988). In stricter approach, the model quality can be seen as moderate – the minimum requirement for R-squared is 0.33 (Chin, 1998). *Longevity* was excluded from the model due to low R-squared and low path coefficients and effect sizes with all other variables. Again, all the effects describing the relationships are positive.

As mentioned during statistical hypotheses testing, digital competence has positive effect on importance of *performance* and importance of *versatility* of a smartphone. However, digital competence is not the only construct from the initial model that increases these two quality dimensions. First of all, importance of *ease of use* increases the importance of *performance*. The more convenience is valuable for the consumer, the higher technical specifications and consistency of the smartphone should be. Due to the same reason, *versatility* importance also increases, as only a truly versatile device can guarantee a seamless user experience.

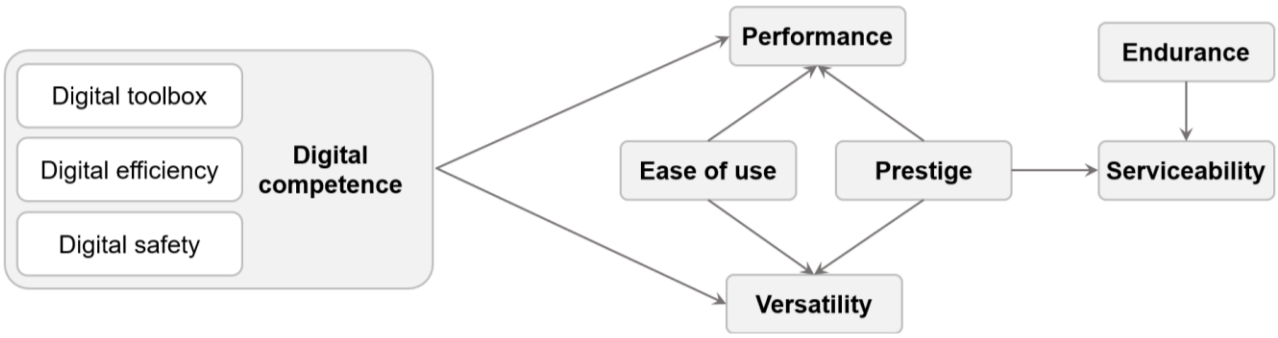

Figure 16. *Data-based model on smartphone perceived quality importance*
(Source: developed by author)

Higher importance *prestige* has positive effect on both performance and versatility. If it is important for consumer to demonstrate status by the smartphone, it has to be fast, reliable, and versatile. Otherwise the elegant or respectable appearance of the devise will contrast with its low functional benefits and may create unfavorable situations in the desirable social groups of the consumer. Prestige also increases the importance of *serviceability* – we can assume that consumers who prefer high-end smartphones expect quality service accompanying the product. The importance of serviceability also grows under influence of *endurance.* If it is important for a person to be able to use smartphone in unfavorable conditions and without a ‘special’ or ‘careful’ attitude, then the repairment services become of higher value. Exposed to more intense use, devices need services more frequently, so the importance of serviceability dimension increases.

3.2.2 Further practical implications

Data-based digital competence framework

One of the important contributions of the master's thesis is the development of a digital competence framework of Russian smartphone users. This framework can be applied both by researchers in the field of digital competence and market practitioners to measure or increase to increase digital competence level of a certain target group depending on the aims.

The framework is especially interesting with the inclusion of the 'digital efficiency' component which characterizes the way the consumer makes technology use more convenient and less time-consuming for their personal preferences and goals. Out of eleven digital competence models analyzed in the first chapter, no model featured a distinctive 'efficiency' component. It can be noted that the first component, 'Digital Toolbox', explains, *what* instruments and tasks are available to the individual, while the other two, characterize *how* these tasks are performed (level of efficiency and safety).

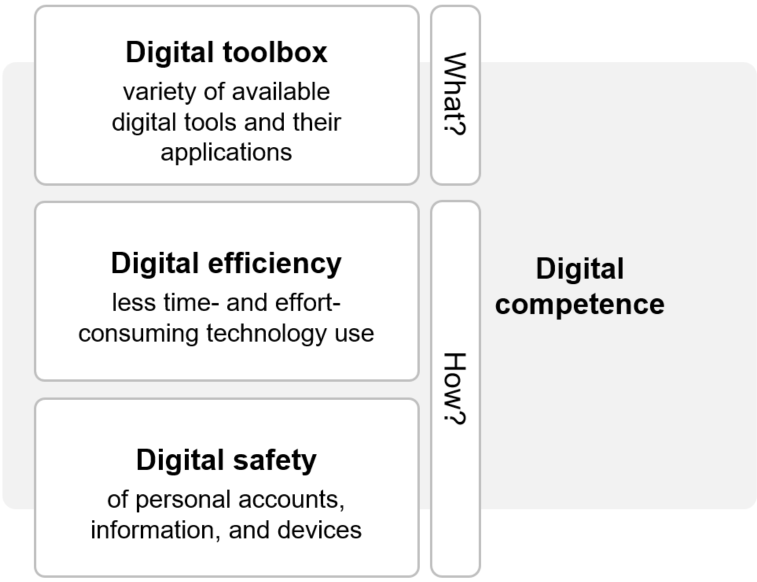

Figure 17. *Data-based digital competence framework (Source: developed by author)*

Digital toolbox: the factor describes the individual level of application of digital technology. It includes the vastness of digital tools accessible to the respondent, as well as characterizes the willingness to acquire a wider set of skills and knowledge. The 'digital toolbox' can be partly associated with 'Devices and software operations' component in Digital Literacy Global Framework (UNESCO Institute for Statistics, 2018) and 'Digital proficiency' in the JISC Digital Capabilities Framework (JISC, 2019).

Digital efficiency: the word ‘efficiency’ describes ‘the level of performance that uses the least amount of inputs to achieve the highest amount of output’. This means that individual with high digital efficiency makes the technology use convenient for them, making it less time consuming and effort consuming. The concept of digital efficiency is included into the ‘Digital productivity’ component of the JISC digital capabilities framework (JISC, 2019), and is also mentioned in the ‘Technical competence’ component of digital competence model by MSU researchers (Soldatova et al., 2013).

Digital safety: the factor is mainly associated with confidentiality of data in digital environments, achieved through safety of personal accounts, files and devices. Digital safety is one of the core dimensions on digital literacy in Russia (Sharikov, 2016; Berman, 2017; ROCIT, 2020) and is inherited from the original DigComp framework (European Commission’s Joint Research Centre, 2017).

Importance-performance analysis

Importance-performance analysis (IPA) is a widely popular technique for product management, which helps understand consumer preferences better. The technique implies measurement of performance levels of different product characteristics, as well as measurement of their importance. After that, a comprehensive matrix is built, proposing appropriate strategies for each of the four quadrants (Martilla, James, 1977). The IPA has already been applied before in the smartphone market (Chen, Ann, 2014).

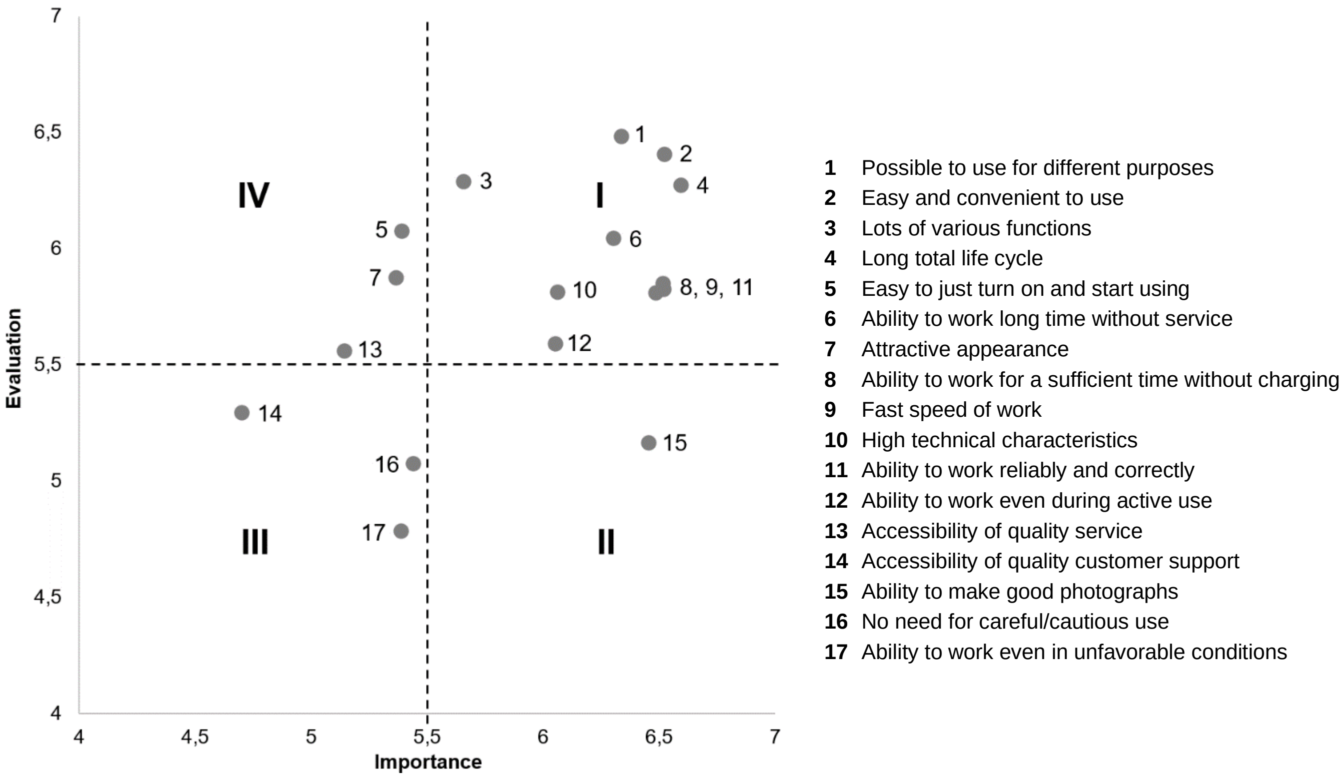

Figure 18. *Data-based importance-performance matrix*

Average marks on evaluation of current smartphone in use and importance of various smartphone characteristics were taken from the collected data to form the IPA matrix. As the assessments were skewed toward higher scores, the scales in the resulting matrix start from 4. The ‘ability to demonstrate social status’ was excluded from the matrix, as it had the lowest (3,071) score for importance.

I – Keep up the good work (high importance, high evaluation): The most important features for the consumers are *long total life cycle (4)*, *easy and convenient use (2)*. Both these features received highest scores for evaluation, so we can conclude that market players are performing well, understanding what characteristics generate the most value. However, some of the smartphone characteristics that also proved to be especially important, could be improved even further – *ability to work reliably and correctly (11), ability to work for a sufficient time without charging (8)* and *fast speed of work (9)*. The possibility to *use the device for different purposes* received the highest evaluation score, which shows the highly developed functionality of modern smartphones. The *ability to work during even active use* could be improved, as it was evaluated the lowest in the first quadrant.

II – Concentrate here (high importance, low evaluation): The only feature that was distributed to this quadrant is the *ability to make good photographs*. Currently smartphone manufacturers apply a lot of effort in this direction, introducing multi-camera smartphones and improving the automatic post-processing. If this trend continues, and the new models penetrate the Russian market, the evaluation of smartphone cameras can probably increase in the nearest future.

III – Low priority (low importance, low evaluation): *Accessibility of quality customer support* was found to be a low-priority characteristic – this may be due to the fact that users prefer to research for solutions online. *Ability to work even in unfavorable conditions* and *No need for careful/cautious use,* both items characterizing smartphone’s endurance, have also been placed in this category. It can be possibly explained by the fact that consumers are used to the general fragility of their devices and do not expect them to endure heavy use. Finally, *Ability to demonstrate social status* on average was the least important characteristic, however, it is still highly relevant for premium customers.

IV – Possible overkill (low importance, high evaluation): *Attractive appearance* and *accessibility of quality service* in the matrix are also characterized as something smartphone manufacturers should not focus on to such an extent. Again, these features are still of significant importance for some consumer segments, even if on average they demonstrate low importance level. The *Easy to just turn on and start using* attribute may have lost importance for consumers in the recent years, as such basic level of use has become available to more people due to improvement in user interfaces and general increase in device operation skills.

Targeting based on digital competence level

First of all, market players should modify targeting based on consumers digital competence level. This policy is already applied by some of the smartphone brands but is most vividly applied by Apple. The company has two distinctive lineups for people with different competence levels – the basic lineup and the Pro lineup. Positioning and marketing communications of the Pro models align with the findings of research – performance and ease of use characteristics are highlighted, as well as versatility of applications.

One of the approaches taken is demonstration of smartphone's application by professional content creators. Advanced content creation was included into the 'digital toolbox' factor of digital competence, so this strategy is also consistent with research findings. At the same time, the marketing communications of the basic model, targeted at less digitally competent consumers, focus on other product features – entertainment abilities, bright-colored design, device endurance in case of misuse (e.g. water or beverage spill onto the device).

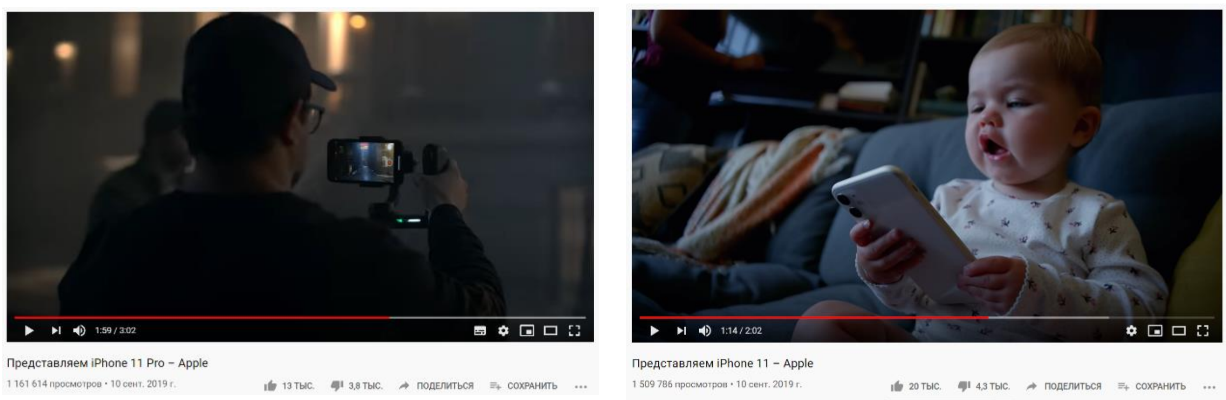

Figure 19. *iPhone 11 Pro advertisement targeted at professional content creators and iPhone 11 advertisement targeted at less digitally competent consumers (Source: Apple Russia YouTube channel)*

The advertising videos show that iPhone Pro models combine high performance with convenient use. The high performance and exquisite technical specifications are further highlighted through collaborations with music artists, where the marketed devices act as a substitute for professional cameras. This also highlights the versatility of Apple smartphones – various applications from daily life to commercial use are demonstrated.

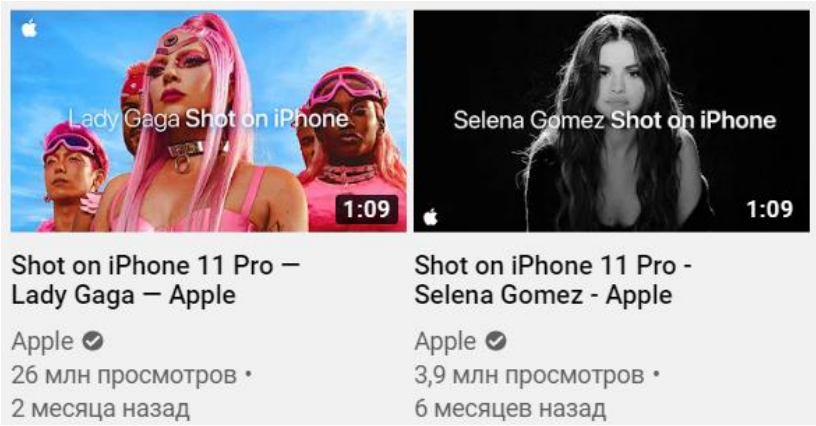

Figure 20. *iPhone 11 Pro integrations targeted at professional content creators (Source: Apple Russia YouTube channel)*

Consumer education on digital competence

Another strategy recommended for market players is education of consumers with the aim of image creation and extraction of additional benefits. As proven in the research, more digitally competent consumers will value and assess some of the smartphone characteristics higher, so stimulating the increase of digital knowledge, skills and attitudes may elevate the image of the brand. Consumer education can 'offer benefits to business' – increased customers satisfaction and sales, more realistic expectations of products and services (Knapp, 1991). 'Operational competence and problem-solving orientation' of consumers stimulated by the company increases brand's trustworthiness (Alhabeeb, 2007).

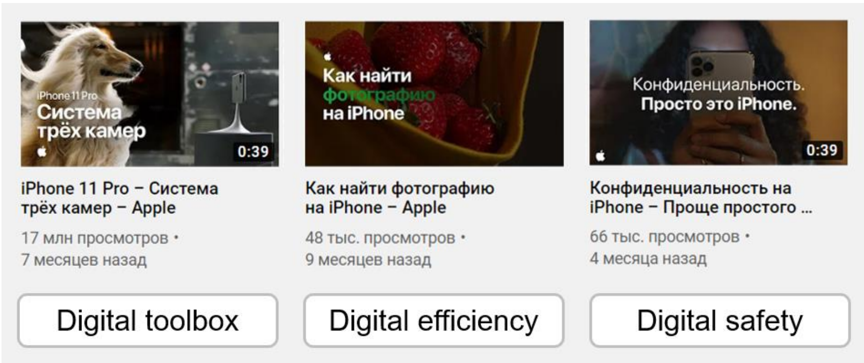

Figure 21. *Content produced by Apple targeting digital competence components (Source: Apple Russia YouTube channel)*

This direction is also pursued by Apple – the company creates and promotes educational materials matching all three discovered factors of digital competence, which also convey the product's advantages. Videos on the company's official YouTube channel target 'digital toolbox' (e.g. explanation of devices technical features and possible applications), 'digital efficiency' (e.g. instructions on how to perform certain tasks easier and faster) and 'digital safety' (e.g. information on confidentiality solutions in the devices).

3.2.3 Limitations and further research

The research has several limitations described further. Most of limitations are connected with the chosen sampling technique. The study's sample consists only of Saint Petersburg and Moscow citizens – although it matches the general population chosen for the research, it reduces potential applicability of the model in other regions of Russia, where smartphone market and digital competences of consumers may be less developed. Another important limitation is connected with the choice of self-assessment technique for measurement of individual's digital competence. Self-assessment technique choice was substantiated in Chapter 2, but it still introduces subjectivity into the data. Even though the identical quota sizes allowed to make model more generalizable, they do not match the actual demographic structure of the Russian population, so conclusions generalized to the Russian population should be made carefully. Quota sampling allowed to include representatives of all demographic groups of interest into the sample, however, sampling method still remained of convenience and snowball nature, which may introduce bias to the data. Finally, the sample size is 240 observations, which complies with all minimum requirements, but could still possibly harm the representativeness of the sample. The questionnaire was distributed through social networks and messengers, which means that respondents were digitally competent enough to use these digital mediums. Moreover, 98.2% of the initial sample were smartphone users, when in reality, the average smartphone ownership rate in Russia is 60% (Statista, 2020). This introduces the bias to the data with respondents being more digitally competent than the general population. Other statistical limitations are connected with Average R-squared indices of the resulting models, fluctuating around 0.3. Although this number is acceptable (Cohen, 1988; Chin, 1998), it is too low to prove the high predictive quality of the models.

Further research connected with the results of this master's thesis should include qualitative techniques of research aimed at providing insights into consumer perception and behavior. Qualitative techniques are often applied to 'support quantitative, descriptive or causal research designs' and for explanation of statistical findings (Malhotra, Birks, Wills, 2012). For example, the identified relationships between variables can be explored through in-depth interviews with smartphone customers. This will allow to obtain understanding of the causes and consumer motivations for such effects.

CONCLUSIONS

For the aims of research, digital competence concept evolution was tracked, and eleven digital competence frameworks were reviewed. On their basis, a research digital competence model was developed. A model of quality dimensions was chosen for application in the Russian smartphone market, and additional factors influencing the effect of digital competence on smartphone perceived quality were identified. A questionnaire for digital competence level assessment and smartphone quality assessment was comprised and practically tested.

The research proposes several theoretical findings. After statistical analysis of the obtained data, smartphone quality dimensions applied to Russian market were proposed – *ease of use*, *versatility*, *longevity*, *endurance*, *serviceability*, *performance,* and *prestige*. This presents a difference from the initial quality dimensions model applied in the research design: the original component of 'durability' has split into two – 'longevity' (characterizing the total length of product's life cycle) and 'endurance' (characterizing the ability of the device to work in unfavorable circumstances).

Another, both theoretical and practical contribution, is the result of digital competence factor analysis. The resulting three-component digital competence framework for Russian smartphone users was formed. A separate component of *digital efficiency* was discovered, which is not explicitly covered by current digital competence models. The other two, more conventional components of data-based digital competence framework, are 'digital toolbox' and 'digital safety'.

The research propositions that were substantiated imply that user's digital competence in the Russian smartphone market has positive effect on *ease of use evaluation*, *performance evaluation*, *performance importance*, and *versatility importance*. Therefore, user digital competence, directly affects smartphone perceived quality in the Russian market through these four relationships. These relationships describe the answer to the research questions stated in the beginning of the research. Moreover, *perceived network quality* moderates the effect of digital competence on smartphone's ease of use, decreasing the effect of digital competence on perceived ease of use.

Master's thesis also draws several practical recommendations for market players based on the analyzed data. Two models have been built, describing relationships between digital competence and smartphone quality dimensions, as well as between some of those quality dimensions. These patterns can be used by smartphone manufacturers to modify consumers' perception of their devices. For example, more digitally competent consumers will demand higher performance and higher versatility from their smartphones, so these characteristics must be up to par with their requirements. When prestige of the smartphone is of high importance for the user, the expectations of performance and versatility will also grow, as well as expectations to receive quality service. Digitally competent consumers tend to assess smartphone’s ease of use and performance higher, likely because they are able to benefit from more functions and interface solutions provided by the device. The increase of evaluation of these two characteristics (ease of use and performance) will lead to increase of versatility, longevity, and prestige evaluation. Consequently, users with higher digital competence are able to evaluate almost all smartphone quality dimensions higher, even though sometimes through mediating constructs.

Perceived network quality moderates the effect of digital competence on smartphone’s ease of use. This means that smartphone manufacturers can develop initiatives on development of knowledge among consumers, that will help distinguish between product-related incidents and network-related incidents.

Additional managerial implications are also developed. Firstly, it is important to *target consumers based on their digital competence level*. With this approach, marketers should differentiate the product characteristics emphasized in marketing communications, with *performance, ease of use* and *versatility* components of smartphone quality taking central place for digitally competent audience. Secondly, smartphone producers should *pursue consumer education* with the aim of creating more positive perception of products and brands. The increase in digital competence will lead to higher evaluation and importance of product characteristics. This, in turn, may also increase brand loyalty.

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APPENDICES

Appendix 1. Questionnaire

Исследование цифровой компетентности

Добрый день!

Спасибо за Ваше согласие заполнить анкету, посвященную Вашему опыту в сфере информационных технологий и Вашим потребительским предпочтениям. Все ответы полностью анонимны, собранные данные будут рассматриваться лишь в агрегированном виде.

Время заполнения — около 10 минут.

В конце анкеты Вам будет предложено оставить свои контакты для участия в розыгрыше призов! Описание условий розыгрыша доступно по ссылке: vk.com/wall10579763_4233

Ваш уровень цифровой компетентности (часть 1)

Что такое цифровая компетентность:

Цифровая компетентность (в России её часто также называют «цифровая грамотность») — набор знаний, навыков и установок, которые необходимы человеку для эффективного и безопасного использования информационных (цифровых) технологий в своих целях.

Я оцениваю свой уровень цифровой компетентности как...

Очень низкий						*Очень высокий*
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Какими современными цифровыми устройствами Вы пользуетесь?

- Персональный компьютер
- Ноутбук
- Планшет
- Мобильный телефон
- Электронная книга
- Цифровой фотоаппарат
- Цифровой плеер
- Умные часы
- Фитнес-трекер
- Другое: ______________________________

Как Вы используете цифровые технологии и устройства?

- Использую базовые функции цифровых устройств (звонки и SMS, электронная почта, хранение файлов и т.д.)
- Использую в личных целях (общение с друзьями, поиск информации, покупки и т.д.)
- Использую в развлекательных целях (просмотр онлайн-контента, игры и т.д.)
- Использую для учёбы/работы в качестве вспомогательного инструмента (применение «офисных» и интернет-приложений и т.д.)
- Использую для учёбы/работы в качестве основного инструмента (профессиональное создание сложного цифрового контента, программирование и т.д.)
- Другое: ______________________________

Ваш уровень цифровой компетентности (часть 2)

Что такое цифровой контент:

Цифровой контент — это информационные и развлекательные материалы, которые распространяются в электронном виде и используются на цифровых устройствах: компьютерах, планшетах, смартфонах, электронных книгах и т.д.

Оцените, насколько Вы согласны со следующими утверждениями:

Полностью не согласен						*Полностью согласен*
1	2	3	4	5	6	7
○	○	○	○	○	○	○

- Я применяю разнообразные быстрые сочетания клавиш (также называются «горячие клавиши» и hot keys) в программах, которые я использую на персональном компьютере/ноутбуке.
- Я всегда изменяю настройки своих цифровых устройств и приложений, чтобы адаптировать их под себя.
- Я знаю мощность, объем памяти и размер хранилища, разрешение экрана и другие общие технические характеристики моих устройств.
- Мне нравится устанавливать и пробовать новые приложения и программное обеспечение на моих устройствах.
- Я умею использовать поисковые фильтры и различные поисковые операторы, чтобы найти нужную мне информацию.
- Я использую различные методы для хранения и организации данных (физические и облачные хранилища, классификация по папкам и т. д.).
- Я критически воспринимаю информацию в Интернете и предпочитаю перепроверять достоверность получаемых данных и их источников.
- Я активно использую широкий спектр цифровых инструментов (электронную почту, чаты, SMS, социальные сети, блоги и т. д.) для общения.
- Я владею инструментами совместной работы в Интернете (общие календари, системы управления проектами, видеоконференции, приложения по управлению задачами, файлы с общим доступом и т. д.).

- Я соблюдаю правила понятного и уважительного общения онлайн (также называют «сетевой этикет»).

- Я создаю простой цифровой контент с целью самовыражения (фотографии, видео, записи в социальных сетях и т. д.).

- Я умею создавать сложный контент из разных мультимедийных материалов (текст, фотографии, видео, музыка и т. д.) в разных цифровых форматах.

- Я стараюсь уважать цифровую интеллектуальную собственность, авторские права и лицензии.

- Я пользуюсь только лицензионным контентом и программным обеспечением.

- Я периодически проверяю настройки безопасности на своих устройствах, в приложениях и в социальных сетях, а также меняю пароли моих личных профилей и устройств.

- Я знаю различные способы шифрования или защиты информации при ее передаче.

- Я внимательно отношусь к тому, чтобы не передавать и не распространять свои конфиденциальные данные в Интернете.

- Я всегда понимаю, какой цифровой инструмент лучше всего подходит для моих потребностей и целей в каждом конкретном случае.

- Когда при использовании цифровых технологий возникает проблема или вопрос (не связанные с техническими неполадками), я всегда знаю, куда обратиться за помощью и где найти необходимую информацию.

- Я люблю приобретать новые знания и навыки в сфере информационных технологий, а также искать возможности для повышения своей цифровой компетентности.

Ваш опыт использования смартфонов (часть 1)

Что такое смартфон:

Смартфон — мобильный телефон, как правило, с большим сенсорным экраном, дополненный частью функций персонального компьютера (возможность установки приложений и игр, собственная операционная система, разнообразные технологии для использования сети Интернет и работы с цифровым контентом).

Пользуетесь ли Вы смартфоном в повседневной жизни?

- Да
- Нет

Ваш опыт использования смартфонов (часть 2)

Как давно Вы начали пользоваться смартфонами?

- Менее 6 месяцев назад
- Менее 2 лет назад
- 2-4 года назад
- 5-7 лет назад
- 8-10 лет назад
- Более 10 лет назад
- Другое: ____

Назовите, если помните, модель Вашего первого смартфона:

____

Смартфонами каких из перечисленных брендов Вы когда-либо пользовались на протяжении не менее 6 месяцев?

- Samsung
- Apple
- Huawei
- Xiaomi/Mi
- Sony
- Nokia
- ZTE
- Lenovo
- Asus
- LG
- HTC
- Motorola
- Sony Ericsson
- Другое: ____

Смартфоном какого бренда Вы пользуетесь сейчас?

Если Вы пользуетесь более чем одним смартфоном, укажите основной или наиболее часто используемый.

- Samsung
- Apple
- Huawei
- Xiaomi/Mi
- Sony
- Nokia
- ZTE
- Другое: ________________________________

Как долго Вы пользуетесь этим смартфоном?

- Менее 6 месяцев
- Менее 1 года
- 1-2 года
- 3-4 года
- 5-6 лет
- Более 6 лет

Когда я выбираю смартфон, я…

(выберите продолжение фразы, наилучшим образом соответствующее Вам)

- Опираюсь на собственное мнение и выбираю сам
- Изучаю отзывы и рекомендации, но выбираю сам
- Советуюсь с теми, чьему мнению доверяю, но выбираю сам
- Ориентируюсь на рекомендации продавца в магазине
- Доверяю выбор другому человеку
- Другое: ________________________________

Ваше отношение к смартфонам

Оцените, насколько для Вас важно, чтобы Ваш смартфон соответствовал следующим характеристикам:

Совсем не важно 1	2	3	4	5	6	*Очень важно* 7
○	○	○	○	○	○	○

- Легко и удобно использовать
- Можно просто включить и начать им пользоваться сразу после покупки
- Наличие большого количества разнообразных функций
- Возможность использовать смартфон в разных целях и для решения разных задач
- Способность долгое время работать без ремонта и сервисного обслуживания
- Продолжительный общий срок службы
- Отсутствие необходимости в «особенном» (бережном) обращении
- Способность смартфона работать даже в неблагоприятных условиях (температура, влажность и т.д.)
- Легкая доступность ремонтных и сервисных работ
- Доступность качественной службы поддержки
- Возможность делать качественные фотоснимки
- Способность смартфона эффективно работать даже при очень активном использовании
- Способность работать без подзарядки в течение достаточного времени
- Высокая скорость работы
- Высокие технические характеристики (вычислительная мощность, параметры экрана, память и т.д.)
- Способность смартфона работать надежно и безошибочно
- Привлекательный внешний вид
- Возможность с помощью смартфона продемонстрировать свой статус

Ваш текущий смартфон

Если Вы пользуетесь более чем одним смартфоном, оцените основной или наиболее часто используемый. Оцените, насколько Вы согласны со следующими утверждениями о Вашем текущем смартфоне:

Полностью не согласен 1	2	3	4	5	6	*Полностью согласен* 7
◯	◯	◯	◯	◯	◯	◯

- Мой смартфон легко и удобно использовать.
- Мой смартфон можно просто включить и начать им пользоваться сразу после покупки.
- Мой смартфон предлагает большое количество разнообразных функций.
- Мой смартфон можно использовать в разных целях и для решения разных задач.
- Мой смартфон может долгое время работать без ремонта и сервисного обслуживания.
- У моего смартфона продолжительный общий срок службы.
- Мой смартфон не требует «особенного» (бережного) обращения.
- Мой смартфон может работать даже в неблагоприятных условиях (температура, влажность и т.д.).
- Для моего смартфона легко доступны ремонтные и сервисные работы.
- Пользователям моего смартфона доступна качественная служба поддержки.
- Мой смартфон позволяет делать качественные фотоснимки.
- Мой смартфон может эффективно работать даже при очень активном использовании.
- Мой смартфон способен работать без подзарядки в течение достаточного времени.
- Мой смартфон обладает высокой скоростью работы.
- Мой смартфон обладает высокими техническими характеристиками (вычислительная мощность, параметры экрана, память и т.д.).
- Мой смартфон работает надежно и безошибочно.
- Мой смартфон выглядит привлекательно.
- Мой смартфон позволяет мне продемонстрировать свой статус.

Ваш мобильный оператор

Если вы пользуетесь более чем одним мобильным оператором, оцените основного или наиболее часто используемого.

Выберите своего основного мобильного оператора: *

- МегаФон
- МТС
- Билайн
- Tele2
- Yota
- Другое: ____

Оцените качество телефонных звонков и передачи SMS-сообщений:

Очень низкое 1	2	3	4	5	6	*Очень высокое* 7
◯	◯	◯	◯	◯	◯	◯

Оцените качество Интернет-соединения и передачи данных:

Очень низкое 1	2	3	4	5	6	*Очень высокое* 7
◯	◯	◯	◯	◯	◯	◯

Немного о Вас

Укажите свой пол:

- Мужской
- Женский

Укажите свой возраст:

- Младше 15
- 15-19
- 20-24
- 25-29
- 30-34
- 35-39
- 40-44
- 45-49
- 50-54
- 55-59
- 60-64
- 65 и старше

Где Вы сейчас проживаете?

- Санкт-Петербург
- Москва
- Другое: ___________________________

Отметьте свой уровень образования:

- Незаконченное среднее образование
- Полное среднее (11 классов)
- Среднее специальное (техникум, колледж и т.д.)
- Высшее: Бакалавриат/специалитет (неоконченное или получен диплом)
- Высшее: Магистратура (неоконченное или получен диплом)
- Высшее: Докторантура и аспирантура (неоконченная или присвоена степень)
- Другое: ___________________________

Выберите свою сферу занятости:

- Безработный/безработная, домохозяин/домохозяйка
- Студент/студентка
- Рабочий или сотрудник обслуживающего персонала (в компании)
- Специалист (в компании)
- Руководитель среднего звена (в компании)
- Руководитель высшего звена (в компании), управляющий компании
- Фрилансер, самозанятый
- Собственный бизнес (собственная компания)
- Пенсионер/пенсионерка
- Другое: ________________________

Какое утверждение лучше всего описывает Ваш уровень дохода?

- Денег не хватает даже на приобретение продуктов питания
- Денег хватает только на приобретение продуктов питания
- Денег достаточно для приобретения необходимых продуктов питания и одежды, но на более крупные покупки приходится откладывать
- Покупка большинства товаров длительного пользования (холодильник, телевизор) не вызывает трудностей, однако приобрести автомобиль или квартиру мы не можем
- Мы можем позволить себе приобрести автомобиль или квартиру
- Денег достаточно, чтобы вообще ни в чем себе не отказывать

Пожалуйста, оставьте свой контакт, если хотите поучаствовать в розыгрыше призов среди участников исследования:

Это может быть электронный адрес, мобильный телефон или ссылка на профиль в социальной сети.

____

Если у Вас остались вопросы или комментарии касательно этого опроса, Вы можете поделиться ими ниже:

____

Appendix 2. Exploratory factor analysis

Digital competence

Table 27. Descriptive statistics

Item	Variable name	Mean	Std. Deviation	N
Shortcuts and hotkey usage	dc_oper_hotkeys	5,125	1,6746	240
Settings personification in software	dc_oper_settings	5,358	1,5405	240
Knowledge of basic device specifications	dc_oper_specs	5,146	1,7307	240
Love for installing and trying new software	dc_oper_apps	4,933	1,6929	240
Search operators and filters usage	dc_info_search	5,821	1,3182	240
Smart storage and organization of data	dc_info_storage	5,629	1,4722	240
Critical outlook on online information	dc_info_critical	5,633	1,4256	240
Various communication tools usage	dc_comm_tools	6,229	1,0558	240
Various collaboration tools knowledge	dc_comm_collab	5,254	1,6203	240
Respect towards netiquette	dc_comm_netiquette	6,283	1,0525	240
Simple content for self-expression creation	dc_content_simple	5,063	1,8591	240
Complex multimedia content creation	dc_content_advanced	4,404	1,8678	240
Respect towards intellectual property*	dc_content_license	5,038	1,7098	240
Respect towards intellectual property*	dc_content_license_check	4,104	1,5955	240
Safety settings periodical checks	dc_safety_settings	4,900	1,6788	240
Information encoding and protection skills	dc_safety_encrypt	3,800	1,8996	240
Attention to not share sensitive info online	dc_safety_sensitive_data	5,308	1,4567	240
Task-appropriate digital tools knowledge	dc_problem_tools	5,146	1,3628	240
Ability to receive help or information	dc_problem_help	5,346	1,4555	240
Love for renewal and increasing of digital competence	dc_problem_new_skills	5,233	1,5265	240

Table 28. Correlations

	dc_oper_hotkeys	dc_oper_settings	dc_oper_specs	dc_oper_apps	dc_info_search	dc_info_storage	dc_info_critical	dc_comm_tools	dc_comm_collab	dc_comm_netiquette	dc_content_simple	dc_content_advanced	dc_content_license	dc_content_license_check	dc_safety_settings	dc_safety_encrypt	dc_safety_sensitive_data	dc_problem_tools	dc_problem_help	dc_problem_new_skills
dc_oper_hotkeys	1	,433**	,303**	,372**	,359**	,436**	,216**	,291**	,442**	,129*	,116	,357**	-,064	,034	,183**	,351**	,156*	,399**	,346**	,311**
dc_oper_settings	,433**	1	,440**	,460**	,399**	,422**	,254**	,207**	,292**	,141*	,023	,325**	,019	,058	,376**	,356**	,279**	,372**	,320**	,393**
dc_oper_specs	,303**	,440**	1	,560**	,417**	,476**	,271**	,167**	,421**	,090	,047	,414**	-,040	,025	,312**	,512**	,249**	,449**	,480**	,440**
dc_oper_apps	,372**	,460**	,560**	1	,473**	,529**	,283**	,261**	,459**	,175**	,117	,433**	,079	,130*	,292**	,529**	,207**	,425**	,478**	,618**
dc_info_search	,359**	,399**	,417**	,473**	1	,433**	,154*	,222**	,398**	,145*	,090	,293**	,038	,122	,238**	,330**	,208**	,296**	,399**	,430**
dc_info_storage	,436**	,422**	,476**	,529**	,433**	1	,376**	,281**	,583**	,160*	,157*	,456**	,034	,145*	,308**	,407**	,188**	,423**	,449**	,499**
dc_info_critical	,216**	,254**	,271**	,283**	,154*	,376**	1	,181**	,285**	,136*	,013	,224**	,007	,017	,196**	,265**	,165*	,215**	,313**	,297**
dc_comm_tools	,291**	,207**	,167**	,261**	,222**	,281**	,181**	1	,438**	,352**	,285**	,331**	,213**	,122	,199**	,138*	,006	,227**	,171**	,283**
dc_coom_collab	,442**	,292**	,421**	,459**	,398**	,583**	,285**	,438**	1	,151*	,146*	,471**	,098	,202**	,205**	,491**	,130*	,447**	,403**	,438**
dc_comm_netiquette	,129*	,141*	,090	,175**	,145*	,160*	,136*	,352**	,151*	1	,262**	,188**	,320**	,194**	,158*	,058	,038	,164*	,217**	,177**
dc_content_simple	,116	,023	,047	,117	,090	,157*	,013	,285**	,146*	,262**	1	,425**	,344**	,198**	,178**	,089	,008	,171**	,159*	,123
dc_content_advanced	,357**	,325**	,414**	,433**	,293**	,456**	,224**	,331**	,471**	,188**	,425**	1	,149*	,136*	,320**	,447**	,088	,407**	,410**	,394**
dc_content_license	-,064	,019	-,040	,079	,038	,034	,007	,213**	,098	,320**	,344**	,149*	1	,606**	,261**	,060	,210**	,093	,154*	,122
dc_content_license_check	,034	,058	,025	,130*	,122	,145*	,017	,122	,202**	,194**	,198**	,136*	,606**	1	,279**	,228**	,278**	,199**	,165*	,096
dc_safety_settings	,183**	,376**	,312**	,292**	,238**	,308**	,196**	,199**	,205**	,158*	,178**	,320**	,261**	,279**	1	,436**	,493**	,345**	,288**	,261**
dc_safety_encrypt	,351**	,356**	,512**	,529**	,330**	,407**	,265**	,138*	,491**	,058	,089	,447**	,060	,228**	,436**	1	,370**	,556**	,522**	,485**
dc_safety_sensitive_data	,156*	,279**	,249**	,207**	,208**	,188**	,165*	,006	,130*	,038	,008	,088	,210**	,278**	,493**	,370**	1	,363**	,255**	,255**
dc_problem_tools	,399**	,372**	,449**	,425**	,296**	,423**	,215**	,227**	,447**	,164*	,171**	,407**	,093	,199**	,345**	,556**	,363**	1	,576**	,521**
dc_problem_help	,346**	,320**	,480**	,478**	,399**	,449**	,313**	,171**	,403**	,217**	,159*	,410**	,154*	,165*	,288**	,522**	,255**	,576**	1	,585**
dc_problem_new_skills	,311**	,393**	,440**	,618**	,430**	,499**	,297**	,283**	,438**	,177**	,123	,394**	,122	,096	,261**	,485**	,255**	,521**	,585**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 29. Communalities, KMO and Bartlett's Test of Sphericity, component loadings

Communalities

	Initial	Extraction
dc_oper_hotkeys	1,000	,521
dc_oper_settings	1,000	,683
dc_oper_specs	1,000	,506
dc_oper_apps	1,000	,594
dc_info_search	1,000	,519
dc_info_storage	1,000	,599
dc_coom_collab	1,000	,578
dc_content_advanced	1,000	,462
dc_safety_settings	1,000	,664
dc_safety_encrypt	1,000	,655
dc_safety_sensitive_data	1,000	,737
dc_problem_tools	1,000	,626
dc_problem_help	1,000	,635
dc_problem_new_skills	1,000	,588

Extraction Method: Principal Component Analysis.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,912
Bartlett's Test of Sphericity	Approx. Chi-Square	1387,458
	df	91
	Sig.	,000

Rotated Component Matrix[a]

	Component		
	1	2	3
dc_problem_help	,789		
dc_problem_new_skills	,727		
dc_problem_tools	,701		
dc_safety_encrypt	,682		
dc_oper_apps	,603		
dc_content_advanced	,570		
dc_oper_specs	,564		
dc_oper_settings		,737	
dc_oper_hotkeys		,690	
dc_info_search		,657	
dc_info_storage		,591	
dc_safety_sensitive_data			,854
dc_safety_settings			,776

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Table 30. Variance explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6,153	43,952	43,952	6,153	43,952	43,952	3,858	27,554	27,554
2	1,297	9,266	53,218	1,297	9,266	53,218	2,672	19,086	46,640
3	,916	6,541	59,760	,916	6,541	59,760	1,837	13,120	59,760
4	,831	5,939	65,699						
5	,738	5,271	70,969						
6	,645	4,608	75,577						
7	,566	4,041	79,619						
8	,545	3,891	83,509						
9	,494	3,528	87,037						
10	,426	3,043	90,080						
11	,421	3,006	93,086						
12	,356	2,545	95,631						
13	,318	2,274	97,906						
14	,293	2,094	100,000						

Extraction Method: Principal Component Analysis.

Table 31. Convergent validity

	dcf_efcy	dcf_safe	dcf_tlbx	dcf_lcns	Type (as defined)	SE	P value
dc_oper_settin	(0.754)	0.249	-0.179	-0.089	Reflective	0.057	<0.001
dc_oper_hotkey	(0.744)	-0.088	-0.088	-0.040	Reflective	0.057	<0.001
dc_info_storag	(0.771)	-0.110	0.280	0.061	Reflective	0.056	<0.001
dc_info_search	(0.726)	-0.052	-0.021	0.070	Reflective	0.057	<0.001
dc_safety_sens	-0.053	(0.864)	-0.028	-0.031	Reflective	0.055	<0.001
dc_safety_sett	0.053	(0.864)	0.028	0.031	Reflective	0.055	<0.001
dc_oper_specs	0.036	0.112	(0.724)	-0.218	Reflective	0.057	<0.001
dc_oper_apps	0.199	-0.079	(0.768)	0.003	Reflective	0.056	<0.001
dc_comm_collab	0.287	-0.281	(0.693)	0.171	Reflective	0.057	<0.001
dc_content_adv	0.056	-0.150	(0.663)	0.110	Reflective	0.057	<0.001
dc_safety_encr	-0.239	0.257	(0.774)	-0.068	Reflective	0.056	<0.001
dc_problem_too	-0.150	0.176	(0.745)	-0.027	Reflective	0.057	<0.001
dc_problem_hel	-0.140	-0.022	(0.760)	0.049	Reflective	0.056	<0.001
dc_problem_new	-0.015	-0.052	(0.765)	0.000	Reflective	0.056	<0.001
dc_content_lic	-0.060	-0.018	0.008	(0.896)	Reflective	0.055	<0.001
dc_content_lic	0.060	0.018	-0.008	(0.896)	Reflective	0.055	<0.001

Notes: Loadings are unrotated and cross-loadings are oblique-rotated. SEs and P values are for loadings. P values < 0.05 are desirable for reflective indicators.

Table 32. CR, CA, AVE and VIF

	dcf_efcy	dcf_safe	dcf_tlbx	dcf_lcns
R-squared				
Adj. R-squared				
Composite reliab.	0.836	0.855	0.905	0.891
Cronbach's alpha	0.738	0.661	0.880	0.755
Avg. var. extrac.	0.561	0.747	0.544	0.803
Full collin. VIF	2.122	1.364	2.239	1.141
Q-squared				
Min	-3.814	-3.055	-2.815	-2.403
Max	1.339	1.396	1.712	1.653
Median	0.210	0.017	0.027	0.254
Mode	1.339	1.396	1.712	-0.725
Skewness	-0.801	-0.483	-0.261	-0.278
Exc. kurtosis	0.410	-0.267	-0.558	-0.725
Unimodal-RS	Yes	Yes	Yes	Yes
Unimodal-KMV	Yes	Yes	Yes	Yes
Normal-JB	No	No	Yes	No
Normal-RJB	No	No	Yes	No
Histogram	View	View	View	View

Notes: Unimodal-RS = Rohatgi-Szŭkely test of unimodality; Unimodal-KMV = Klaassen-Mokveld-van Es test of unimodality; Normal-JB = Jarque-Bera test of normality; Normal-RJB = robust Jarque-Bera test of normality; click on "View" cell to see corresponding histogram.

Evaluation of quality dimensions

Table 33. Descriptive statistics

Item	Variable name	Mean	Std. Deviation	N
Easy and convenient to use	q_eva_easy_convenience	6,404	,8429	240
Easy to just turn on and start using	q_eva_easy_use_right_away	6,075	1,2420	240
Lots of various functions	q_eva_vers_functions	6,288	,9265	240
Possible to use for different purposes	q_eva_vers_tasks	6,483	,7814	240
Long total life cycle	q_eva_dur_long_between_service	6,271	,9840	240
Ability to work long time without service	q_eva_dur_long_total	6,042	1,1121	240
No need for careful/cautious use	q_eva_dur_endur_careful	5,075	1,5452	240
Ability to work even in unfavorable conditions (temperature, humidity, etc.)	q_eva_dur_endur_environment	4,783	1,5801	240
Accessibility of quality service (repair, etc.)	q_eva_serv_service	5,558	1,4992	240
Accessibility of quality customer support	q_eva_serv_support	5,292	1,5109	240
High technical characteristics (processing power, screen, memory, etc.)	q_eva_perf_features_camera	5,813	1,2519	240
Fast speed of work	q_eva_perf_consistency_active_use	5,825	1,3012	240
Ability to make good photographs	q_eva_perf_features_battery	5,163	1,7098	240
Ability to work for a sufficient time without charging	q_eva_perf_general_speed	5,850	1,2452	240
Ability to work even during active use	q_eva_perf_general_specs	5,588	1,3815	240
Ability to work reliably and correctly	q_eva_perf_consistency_reliable	5,808	1,1300	240
Attractive appearance	q_eva_prestige_look	5,875	1,3102	240
Ability to demonstrate social status	q_eva_prestige_status	4,042	1,8965	240

Table 34. Correlations

	q_eva_easy_convenience	q_eva_easy_use_right_away	q_eva_vers_functions	q_eva_vers_tasks	q_eva_dur_long_between_service	q_eva_dur_long_total	q_eva_dur_endur_careful	q_eva_dur_endur_environment	q_eva_serv_service	q_eva_serv_support	q_eva_perf_features_camera	q_eva_perf_consistency_active_use	q_eva_perf_features_battery	q_eva_perf_general_speed	q_eva_perf_general_specs	q_eva_perf_consistency_reliable	q_eva_prestige_look	q_eva_prestige_status
q_eva_easy_convenience	1	,399**	,595**	,553**	,407**	,357**	,169**	,286**	,261**	,282**	,437**	,423**	,230**	,449**	,381**	,503**	,387**	,259**
q_eva_easy_use_right_away	,399**	1	,330**	,208**	,175**	,155*	,128*	,230**	,270**	,305**	,171**	,138*	,166*	,194**	,174**	,279**	,124	,134*
q_eva_vers_functions	,595**	,330**	1	,732**	,369**	,350**	,084	,266**	,267**	,331**	,566**	,535**	,361**	,592**	,623**	,576**	,305**	,357**
q_eva_vers_tasks	,553**	,208**	,732**	1	,395**	,376**	,043	,214**	,290**	,334**	,516**	,540**	,326**	,565**	,527**	,489**	,419**	,252**
q_eva_dur_long_between_service	,407**	,175**	,369**	,395**	1	,617**	,267**	,323**	,283**	,206**	,252**	,433**	,387**	,378**	,329**	,461**	,276**	,169**
q_eva_dur_long_total	,357**	,155*	,350**	,376**	,617**	1	,303**	,329**	,327**	,314**	,336**	,393**	,331**	,421**	,376**	,492**	,274**	,245**
q_eva_dur_endur_careful	,169**	,128*	,084	,043	,267**	,303**	1	,421**	,199**	,039	,109	,217**	,231**	,167**	,138*	,231**	,021	,042
q_eva_dur_endur_environment	,286**	,230**	,266**	,214**	,323**	,329**	,421**	1	,258**	,318**	,333**	,372**	,348**	,283**	,354**	,354**	,106	,219**
q_eva_serv_service	,261**	,270**	,267**	,290**	,283**	,327**	,199**	,258**	1	,639**	,270**	,267**	,211**	,271**	,334**	,365**	,240**	,211**
q_eva_serv_support	,282**	,305**	,331**	,334**	,206**	,314**	,039	,318**	,639**	1	,423**	,258**	,169**	,324**	,431**	,410**	,317**	,327**
q_eva_perf_features_camera	,437**	,171**	,566**	,516**	,252**	,336**	,109	,333**	,270**	,423**	1	,517**	,378**	,607**	,654**	,539**	,486**	,484**
q_eva_perf_consistency_active_use	,423**	,138*	,535**	,540**	,433**	,393**	,217**	,372**	,267**	,258**	,517**	1	,602**	,727**	,677**	,606**	,294**	,347**
q_eva_perf_features_battery	,230**	,166*	,361**	,326**	,387**	,331**	,231**	,348**	,211**	,169**	,378**	,602**	1	,538**	,530**	,443**	,325**	,386**
q_eva_perf_general_speed	,449**	,194**	,592**	,565**	,378**	,421**	,167**	,283**	,271**	,324**	,607**	,727**	,538**	1	,759**	,693**	,406**	,392**
q_eva_perf_general_specs	,381**	,174**	,623**	,527**	,329**	,376**	,138*	,354**	,334**	,431**	,654**	,677**	,530**	,759**	1	,673**	,376**	,535**
q_eva_perf_consistency_reliable	,503**	,279**	,576**	,489**	,461**	,492**	,231**	,354**	,365**	,410**	,539**	,606**	,443**	,693**	,673**	1	,413**	,396**
q_eva_prestige_look	,387**	,124	,305**	,419**	,276**	,274**	,021	,106	,240**	,317**	,486**	,294**	,325**	,406**	,376**	,413**	1	,519**
q_eva_prestige_status	,259**	,134*	,357**	,252**	,169**	,245**	,042	,219**	,211**	,327**	,484**	,347**	,386**	,392**	,535**	,396**	,519**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 35. Communalities, KMO and Bartlett's Test of Sphericity, component loadings

Communalities

	Initial	Extraction
q_eva_vers_functions	1,000	,823
q_eva_vers_tasks	1,000	,891
q_eva_dur_long_between_service	1,000	,795
q_eva_dur_long_total	1,000	,769
q_eva_dur_endur_careful	1,000	,739
q_eva_dur_endur_environment	1,000	,772
q_eva_serv_service	1,000	,815
q_eva_serv_support	1,000	,842
q_eva_perf_consistency_active_use	1,000	,762
q_eva_perf_general_speed	1,000	,829
q_eva_perf_general_specs	1,000	,837
q_eva_perf_consistency_reliable	1,000	,722
q_eva_prestige_look	1,000	,818
q_eva_prestige_status	1,000	,808

Extraction Method: Principal Component Analysis.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,853
Bartlett's Test of Sphericity	Approx. Chi-Square	1687,712
	df	91
	Sig.	,000

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
q_eva_perf_general_speed	,830					
q_eva_perf_general_specs	,806					
q_eva_perf_consistency_active_use	,787					
q_eva_perf_consistency_reliable	,683					
q_eva_serv_support		,860				
q_eva_serv_service		,858				
q_eva_dur_long_between_service			,821			
q_eva_dur_long_total			,784			
q_eva_vers_tasks				,834		
q_eva_vers_functions				,741		
q_eva_prestige_look					,819	
q_eva_prestige_status					,803	
q_eva_dur_endur_environment						,809
q_eva_dur_endur_careful						,806

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Table 36. Total variance explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,369	31,204	31,204	4,369	31,204	31,204	2,645	18,890	18,890
2	1,921	13,719	44,923	1,921	13,719	44,923	2,066	14,757	33,647
3	1,446	10,330	55,253	1,446	10,330	55,253	1,621	11,581	45,228
4	1,199	8,564	63,817	1,199	8,564	63,817	1,607	11,479	56,707
5	1,007	7,196	71,014	1,007	7,196	71,014	1,504	10,743	67,449
6	,703	5,019	76,032	,703	5,019	76,032	1,202	8,583	76,032
7	,580	4,146	80,178						
8	,524	3,740	83,917						
9	,497	3,552	87,469						
10	,473	3,379	90,848						
11	,449	3,210	94,058						
12	,333	2,378	96,435						
13	,273	1,951	98,387						
14	,226	1,613	100,000						

Extraction Method: Principal Component Analysis.

Table 37. Convergent validity

	eva_vers	eva_long	eva_endu	eva_serv	eva_perf	eva_pres
q_eva_vers_fun	(0.931)	-0.066	0.024	-0.017	0.119	-0.036
q_eva_vers_tas	(0.931)	0.066	-0.024	0.017	-0.119	0.036
q_eva_dur_long	0.046	(0.899)	0.000	-0.088	-0.062	0.003
q_eva_dur_long	-0.046	(0.899)	0.000	0.088	0.062	-0.003
q_eva_dur_endu	-0.019	0.038	(0.843)	-0.076	0.026	0.021
q_eva_dur_endu	0.019	-0.038	(0.843)	0.076	-0.026	-0.021
q_eva_serv_ser	0.016	0.065	0.067	(0.905)	-0.019	-0.085
q_eva_serv_sup	-0.016	-0.065	-0.067	(0.905)	0.019	0.085
q_eva_perf_con	0.036	0.052	0.069	-0.111	(0.858)	-0.191
q_eva_perf_con	-0.170	0.103	0.002	0.084	(0.845)	0.217
q_eva_perf_gen	0.023	0.000	-0.083	-0.045	(0.911)	-0.019
q_eva_perf_gen	0.104	-0.147	0.017	0.074	(0.889)	-0.003
q_eva_prestige	0.114	0.128	-0.051	0.002	-0.208	(0.872)
q_eva_prestige	-0.114	-0.128	0.051	-0.002	0.208	(0.872)

Notes: Loadings are unrotated and cross-loadings are oblique-rotated. SEs and P values are for loadings. P values < 0.05 are desirable for reflective indicators.

	Type (as defined)	SE	P value
q_eva_vers_fun	Reflective	0.055	<0.001
q_eva_vers_tas	Reflective	0.055	<0.001
q_eva_dur_long	Reflective	0.055	<0.001
q_eva_dur_long	Reflective	0.055	<0.001
q_eva_dur_endu	Reflective	0.056	<0.001
q_eva_dur_endu	Reflective	0.056	<0.001
q_eva_serv_ser	Reflective	0.055	<0.001
q_eva_serv_sup	Reflective	0.055	<0.001
q_eva_perf_con	Reflective	0.056	<0.001
q_eva_perf_con	Reflective	0.056	<0.001
q_eva_perf_gen	Reflective	0.055	<0.001
q_eva_perf_gen	Reflective	0.055	<0.001
q_eva_prestige	Reflective	0.055	<0.001
q_eva_prestige	Reflective	0.055	<0.001

Notes: Loadings are unrotated and cross-loadings are oblique-rotated. SEs and P values are for loadings. P values < 0.05 are desirable for reflective indicators

Table 38. CR, CA, AVE and VIF

	eva_vers	eva_long	eva_endu	eva_serv	eva_perf	eva_pres
R-squared						
Adj. R-squared						
Composite reliab.	0.928	0.894	0.831	0.901	0.930	0.863
Cronbach's alpha	0.845	0.763	0.693	0.780	0.899	0.683
Avg. var. extrac.	0.866	0.808	0.711	0.819	0.767	0.760
Full collin. VIF	2.518	1.653	1.571	1.680	3.600	1.979
Q-squared						
Min	-4.882	-3.370	-2.233	-3.248	-3.418	-3.055
Max	0.768	0.891	1.571	1.156	1.113	1.388
Median	0.768	0.326	0.053	0.056	0.206	0.042
Mode	0.768	0.891	1.571	1.156	1.113	1.388
Skewness	-1.388	-0.916	-0.317	-0.663	-1.083	-0.578
Exc. kurtosis	2.090	0.031	-0.571	-0.075	0.942	-0.018
Unimodal-RS	Yes	Yes	Yes	Yes	Yes	Yes
Unimodal-KMV	Yes	Yes	Yes	Yes	Yes	Yes
Normal-JB	No	No	No	No	No	No
Normal-RJB	No	No	Yes	No	No	No
Histogram	View	View	View	View	View	View

Notes: Unimodal-RS = Rohatgi-Szŭkely test of unimodality; Unimodal-KMV = Klaassen-Mokveld-van Es test of unimodality; Normal-JB = Jarque-Bera test of normality; Normal-RJB = robust Jarque-Bera test of normality; click on "View" cell to see corresponding histogram.

Importance of quality dimensions

Table 39. Descriptive statistics

Item	Variable name	Mean	Std. Deviation	N
Easy and convenient to use	q_imp_easy_convenience	6,525	,8127	240
Easy to just turn on and start using	q_imp_easy_use_right_away	5,392	1,6981	240
Lots of various functions	q_imp_vers_functions	5,658	1,2476	240
Possible to use for different purposes	q_imp_vers_tasks	6,338	,9366	240
Long total life cycle	q_imp_dur_long_between_service	6,596	,8074	240
Ability to work long time without service	q_imp_dur_long_total	6,304	,9912	240
No need for careful/cautious use	q_imp_dur_endur_careful	5,442	1,4795	240
Ability to work even in unfavorable conditions (temperature, humidity, etc.)	q_imp_dur_endur_environment	5,388	1,5618	240
Accessibility of quality service (repair, etc.)	q_imp_serv_service	5,146	1,6465	240
Accessibility of quality customer support	q_imp_serv_support	4,704	1,9057	240
High technical characteristics (processing power, screen, memory, etc.)	q_imp_perf_features_camera	6,063	1,3569	240
Fast speed of work	q_imp_perf_consistency_active_use	6,521	,7651	240
Ability to make good photographs	q_imp_perf_features_battery	6,458	,9409	240
Ability to work for a sufficient time without charging	q_imp_perf_general_speed	6,517	,7867	240
Ability to work even during active use	q_imp_perf_general_specs	6,054	1,1209	240
Ability to work reliably and correctly	q_imp_perf_consistency_reliable	6,488	,7921	240
Attractive appearance	q_imp_prestige_look	5,367	1,6103	240
Ability to demonstrate social status	q_imp_prestige_status	3,071	1,9618	240

Table 40. Correlations

	q_imp_ easy_ convenience	q_imp_ easy_use_ right_away	q_imp_ vers_ functions	q_imp_ vers_ tasks	q_imp_ dur_long_ between_ service	q_imp_ dur_long_ total	q_imp_ dur_ endur_ careful	q_imp_ dur_ endur_ environment	q_imp_ serv_ service	q_imp_ serv_ support	q_imp_ perf_ features_ camera	q_imp_ perf_ consistency_ active_ use	q_imp_ perf_ features_ battery	q_imp_ perf_ general_ speed	q_imp_ perf_ general_ specs	q_imp_ perf_ consistency_ reliable	q_imp_ prestige_ look	q_imp_ prestige_ status
q_imp_easy_ convenience	1	,405**	,318**	,266**	,389**	,232**	,196**	,215**	,218**	,203**	,232**	,184**	,155*	,137*	,047	,088	,313**	,061
q_imp_easy_use_ right_away	,405**	1	,304**	,103	,278**	,332**	,196**	,443**	,494**	,441**	,242**	,174**	,207**	,120	,154*	,203**	,423**	,257**
q_imp_vers_ functions	,318**	,304**	1	,593**	,203**	,128*	,105	,311**	,261**	,158*	,299**	,271**	,130*	,308**	,399**	,279**	,321**	,246**
q_imp_vers_tasks	,266**	,103	,593**	1	,148*	,114	,058	,108	,057	,002	,224**	,297**	,094	,200**	,218**	,296**	,223**	,140*
q_imp_dur_ long_between_ service	,389**	,278**	,203**	,148*	1	,505**	,224**	,350**	,274**	,286**	,210**	,322**	,223**	,244**	,126	,250**	,134*	,021
q_imp_dur_long_ total	,232**	,332**	,128*	,114	,505**	1	,222**	,259**	,273**	,234**	,120	,287**	,258**	,205**	,083	,274**	,095	,025
q_imp_dur_endur_ careful	,196**	,196**	,105	,058	,224**	,222**	1	,476**	,413**	,288**	,128*	,169**	,076	,076	,061	,151*	-,009	,064
q_imp_dur_ endur_environment	,215**	,443**	,311**	,108	,350**	,259**	,476**	1	,617**	,441**	,322**	,275**	,192**	,184**	,234**	,209**	,171**	,211**
q_imp_serv_service	,218**	,494**	,261**	,057	,274**	,273**	,413**	,617**	1	,679**	,264**	,189**	,159*	,171**	,202**	,237**	,198**	,168**
q_imp_serv_support	,203**	,441**	,158*	,002	,286**	,234**	,288**	,441**	,679**	1	,281**	,252**	,246**	,273**	,274**	,221**	,262**	,300**
q_imp_perf_feature_ camera	,232**	,242**	,299**	,224**	,210**	,120	,128*	,322**	,264**	,281**	1	,335**	,131*	,338**	,300**	,283**	,413**	,222**
q_imp_perf_ consistency_ active_use	,184**	,174**	,271**	,297**	,322**	,287**	,169**	,275**	,189**	,252**	,335**	1	,394**	,524**	,509**	,511**	,187**	,140*
q_imp_perf_ features_battery	,155*	,207**	,130*	,094	,223**	,258**	,076	,192**	,159*	,246**	,131*	,394**	1	,431**	,254**	,333**	,159*	,037
q_imp_perf_ general_speed	,137*	,120	,308**	,200**	,244**	,205**	,076	,184**	,171**	,273**	,338**	,524**	,431**	1	,642**	,487**	,210**	,185**
q_imp_perf_ general_specs	,047	,154*	,399**	,218**	,126	,083	,061	,234**	,202**	,274**	,300**	,509**	,254**	,642**	1	,559**	,216**	,259**
q_imp_perf_ consistency_reliable	,088	,203**	,279**	,296**	,250**	,274**	,151*	,209**	,237**	,221**	,283**	,511**	,333**	,487**	,559**	1	,187**	,137*
q_imp_prestige_look	,313**	,423**	,321**	,223**	,134*	,095	-,009	,171**	,198**	,262**	,413**	,187**	,159*	,210**	,216**	,187**	1	,474**
q_imp_prestige_ status	,061	,257**	,246**	,140*	,021	,025	,064	,211**	,168**	,300**	,222**	,140*	,037	,185**	,259**	,137*	,474**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 41. Communalities, KMO and Bartlett's Test of Sphericity, component loadings

Communalities

	Initial	Extraction
q_imp_vers_functions	1,000	,818
q_imp_vers_tasks	1,000	,815
q_imp_dur_long_between_service	1,000	,725
q_imp_dur_long_total	1,000	,748
q_imp_dur_endur_careful	1,000	,882
q_imp_dur_endur_environment	1,000	,694
q_imp_serv_service	1,000	,846
q_imp_serv_support	1,000	,793
q_imp_perf_consistency_active_use	1,000	,654
q_imp_perf_general_speed	1,000	,709
q_imp_perf_general_specs	1,000	,791
q_imp_perf_consistency_reliable	1,000	,626
q_imp_prestige_look	1,000	,737
q_imp_prestige_status	1,000	,806

Extraction Method: Principal Component Analysis.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,776
Bartlett's Test of Sphericity	Approx. Chi-Square	1165,576
	df	91
	Sig.	,000

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
q_imp_perf_general_specs	,835					
q_imp_perf_general_speed	,813					
q_imp_perf_consistency_reliable	,741					
q_imp_perf_consistency_active_use	,724					
q_imp_serv_service		,873				
q_imp_serv_support		,821				
q_imp_dur_endur_environment		,608				
q_imp_vers_tasks			,867			
q_imp_vers_functions			,832			
q_imp_dur_long_total				,840		
q_imp_dur_long_between_service				,803		
q_imp_prestige_status					,866	
q_imp_prestige_look					,794	
q_imp_dur_endur_careful						,899

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Table 42. Total variance explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,369	31,204	31,204	4,369	31,204	31,204	2,645	18,890	18,890
2	1,921	13,719	44,923	1,921	13,719	44,923	2,066	14,757	33,647
3	1,446	10,330	55,253	1,446	10,330	55,253	1,621	11,581	45,228
4	1,199	8,564	63,817	1,199	8,564	63,817	1,607	11,479	56,707
5	1,007	7,196	71,014	1,007	7,196	71,014	1,504	10,743	67,449
6	,703	5,019	76,032	,703	5,019	76,032	1,202	8,583	76,032
7	,580	4,146	80,178						
8	,524	3,740	83,917						
9	,497	3,552	87,469						
10	,473	3,379	90,848						
11	,449	3,210	94,058						
12	,333	2,378	96,435						
13	,273	1,951	98,387						
14	,226	1,613	100,000						

Extraction Method: Principal Component Analysis.

Table 43. Convergent validity

	imp_vers	imp_long	imp_endu	imp_serv	imp_perf	imp_pres
q_imp_vers_fun	(0.893)	-0.053	0.007	0.079	0.064	0.074
q_imp_vers_tas	(0.893)	0.053	-0.007	-0.079	-0.064	-0.074
q_imp_dur_long	0.030	(0.867)	0.016	0.020	0.028	-0.025
q_imp_dur_long	-0.030	(0.867)	-0.016	-0.020	-0.028	0.025
q_imp_dur_endu	-0.074	-0.026	(0.859)	-0.137	0.033	-0.012
q_imp_dur_endu	0.074	0.026	(0.859)	0.137	-0.033	0.012
q_imp_serv_ser	0.102	-0.024	0.116	(0.916)	-0.035	-0.076
q_imp_serv_sup	-0.102	0.024	-0.116	(0.916)	0.035	0.076
q_imp_perf_con	-0.008	0.100	0.191	-0.147	(0.781)	-0.171
q_imp_perf_gen	-0.021	0.002	-0.168	0.051	(0.824)	0.047
q_imp_perf_gen	0.029	-0.188	-0.092	0.129	(0.844)	0.151
q_imp_perf_con	-0.001	0.101	0.086	-0.045	(0.786)	-0.042
q_imp_prestige	0.034	-0.038	-0.095	-0.104	-0.066	(0.858)
q_imp_prestige	-0.034	0.038	0.095	0.104	0.066	(0.858)

Notes: Loadings are unrotated and cross-loadings are oblique-rotated. SEs and P values are for loadings. P values < 0.05 are desirable for reflective indicators.

	Type (as defined)	SE	P value
q_imp_vers_fun	Reflective	0.055	<0.001
q_imp_vers_tas	Reflective	0.055	<0.001
q_imp_dur_long	Reflective	0.055	<0.001
q_imp_dur_long	Reflective	0.055	<0.001
q_imp_dur_endu	Reflective	0.056	<0.001
q_imp_dur_endu	Reflective	0.056	<0.001
q_imp_serv_ser	Reflective	0.055	<0.001
q_imp_serv_sup	Reflective	0.055	<0.001
q_imp_perf_con	Reflective	0.056	<0.001
q_imp_perf_gen	Reflective	0.056	<0.001
q_imp_perf_gen	Reflective	0.056	<0.001
q_imp_perf_con	Reflective	0.056	<0.001
q_imp_prestige	Reflective	0.056	<0.001
q_imp_prestige	Reflective	0.056	<0.001

Notes: Loadings are unrotated and cross-loadings are oblique-rotated. SEs and P values are for loadings. P values < 0.05 are desirable for reflective indicators

Table 44. CR, CA, AVE and VIF

	imp_vers	imp_long	imp_endu	imp_serv	imp_perf	imp_pres
R-squared						
Adj. R-squared						
Composite reliab.	0.887	0.859	0.849	0.913	0.883	0.849
Cronbach's alpha	0.745	0.671	0.645	0.809	0.824	0.643
Avg. var. extrac.	0.797	0.752	0.738	0.840	0.655	0.737
Full collin. VIF	1.468	1.437	1.816	2.006	1.820	1.767
Q-squared						
Min	-4.088	-4.040	-2.637	-2.435	-3.985	-2.194
Max	0.999	0.693	1.214	1.272	0.846	1.757
Median	0.101	0.693	0.075	0.036	0.271	-0.024
Mode	0.999	0.693	1.214	1.272	0.846	-0.747
Skewness	-1.120	-1.640	-0.693	-0.525	-1.648	-0.172
Exc. kurtosis	1.161	2.465	-0.191	-0.466	2.737	-0.425
Unimodal-RS	Yes	Yes	Yes	Yes	Yes	Yes
Unimodal-KMV	Yes	Yes	Yes	Yes	Yes	Yes
Normal-JB	No	No	No	No	No	Yes
Normal-RJB	No	No	No	No	No	Yes
Histogram	View	View	View	View	View	View

Notes: Unimodal-RS = Rohatgi-Szŭkely test of unimodality; Unimodal-KMV = Klaassen-Mokveld-van Es test of unimodality; Normal-JB = Jarque-Bera test of normality; Normal-RJB = robust Jarque-Bera test of normality; click on "View" cell to see corresponding histogram.

Appendix 3. Data-based models

Evaluation of quality dimensions

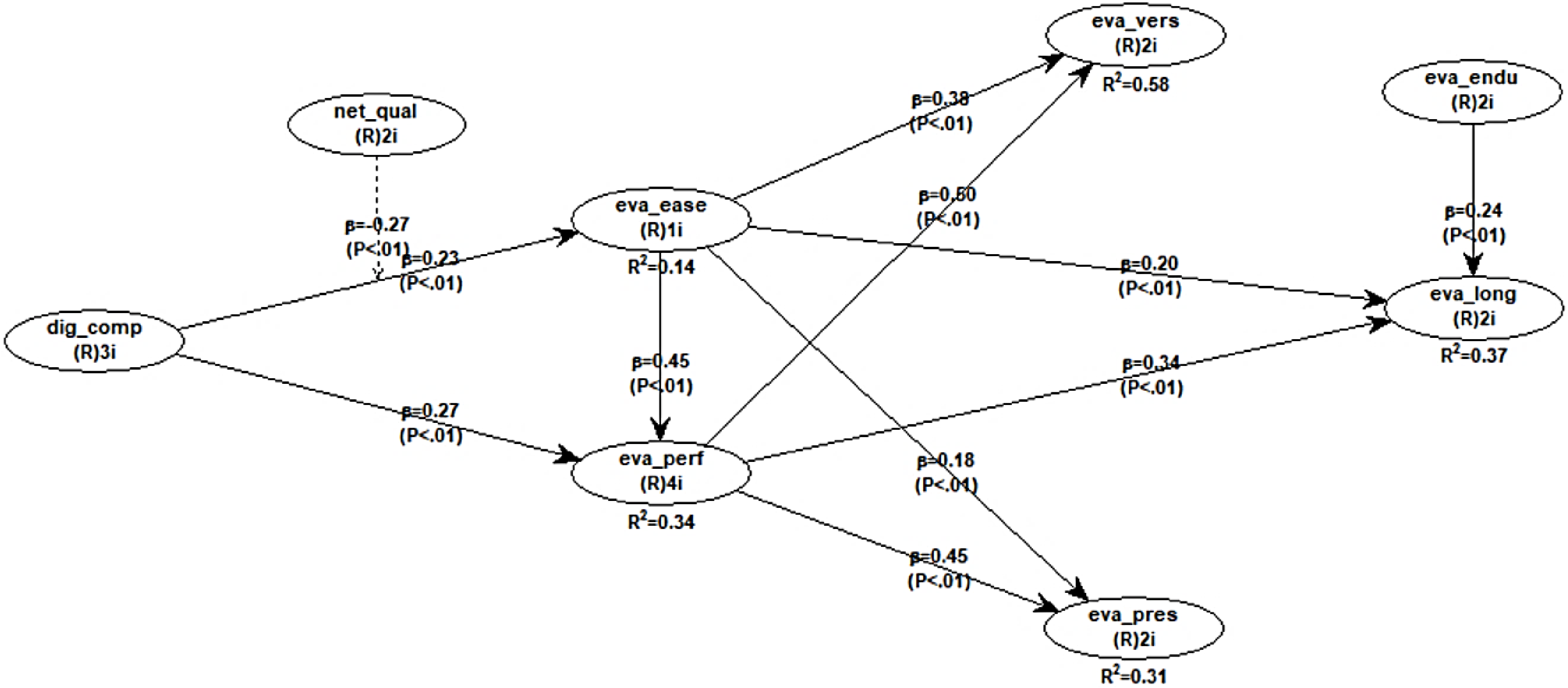

Figure 22. *Smartphone quality evaluation model*

Model fit and quality indices

Average path coefficient (APC)=0.320, P<0.001
Average R-squared (ARS)=0.348, P<0.001
Average adjusted R-squared (AARS)=0.342, P<0.001
Average block VIF (AVIF)=1.202, acceptable if <= 5, ideally <= 3.3
Average full collinearity VIF (AFVIF)=1.678, acceptable if <= 5, ideally <= 3.3
Tenenhaus GoF (GoF)=0.534, small >= 0.1, medium >= 0.25, large >= 0.36
Sympson's paradox ratio (SPR)=1.000, acceptable if >= 0.7, ideally = 1
R-squared contribution ratio (RSCR)=1.000, acceptable if >= 0.9, ideally = 1
Statistical suppression ratio (SSR)=1.000, acceptable if >= 0.7
Nonlinear bivariate causality direction ratio (NLBCDR)=1.000, acceptable if >= 0.7

Figure 23. *Smartphone quality evaluation model fit*

Table 45. Path coefficients and P-values

Path coefficients

	dig_comp	net_qual	eva_vers	eva_long	eva_endu	eva_pres	eva_perf	eva_ease	net_qual*dig_comp
dig_comp									
net_qual									
eva_vers							0.500	0.380	
eva_long					0.237		0.341	0.203	
eva_endu									
eva_pres							0.452	0.178	
eva_perf	0.275							0.454	
eva_ease	0.225								-0.271
net_qual*dig_comp									

P values

	dig_comp	net_qual	eva_vers	eva_long	eva_endu	eva_pres	eva_perf	eva_ease	net_qual*dig_comp
dig_comp									
net_qual									
eva_vers							<0.001	<0.001	
eva_long					<0.001		<0.001	<0.001	
eva_endu									
eva_pres							<0.001	0.002	
eva_perf	<0.001							<0.001	
eva_ease	<0.001								<0.001
net_qual*dig_comp									

Table 46. Standard errors and effect sizes

Standard errors for path coefficients

	dig_comp	net_qual	eva_vers	eva_long	eva_endu	eva_pres	eva_perf	eva_ease	net_qual*dig_comp
dig_comp									
net_qual									
eva_vers							0.059	0.060	
eva_long					0.062		0.061	0.062	
eva_endu									
eva_pres							0.060	0.063	
eva_perf	0.062							0.060	
eva_ease	0.062								0.062
net_qual*dig_comp									

Effect sizes for path coefficients

	dig_comp	net_qual	eva_vers	eva_long	eva_endu	eva_pres	eva_perf	eva_ease	net_qual*dig_comp
dig_comp									
net_qual									
eva_vers							0.344	0.238	
eva_long					0.098		0.179	0.088	
eva_endu									
eva_pres							0.240	0.067	
eva_perf	0.105							0.236	
eva_ease	0.101								0.083
net_qual*dig_comp									

Importance of quality dimensions

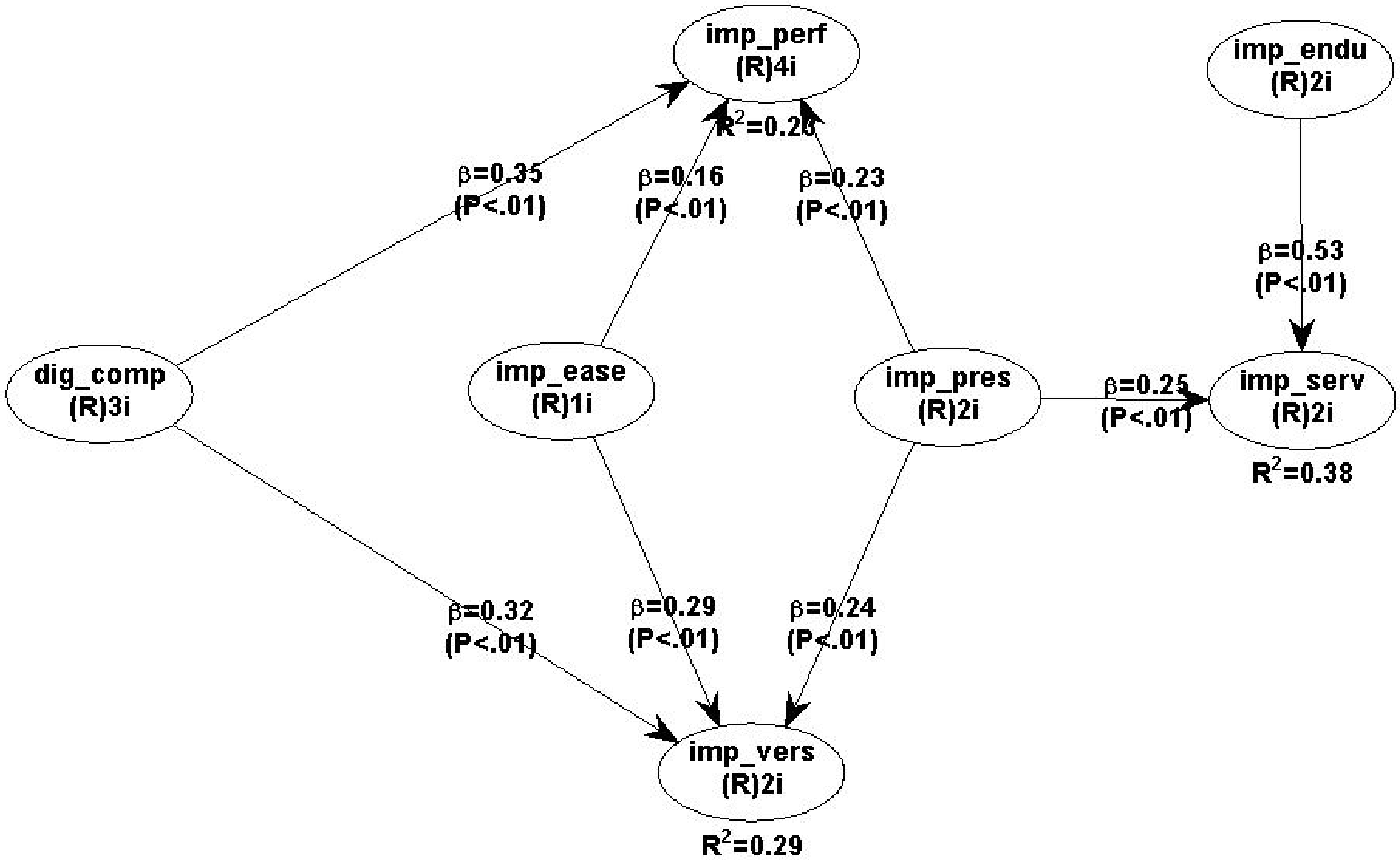

Figure 24. *Smartphone quality importance model*

Model fit and quality indices

Average path coefficient (APC)=0.296, P<0.001
Average R-squared (ARS)=0.297, P<0.001
Average adjusted R-squared (AARS)=0.289, P<0.001
Average block VIF (AVIF)=1.025, acceptable if <= 5, ideally <= 3.3
Average full collinearity VIF (AFVIF)=1.377, acceptable if <= 5, ideally <= 3.3
Tenenhaus GoF (GoF)=0.481, small >= 0.1, medium >= 0.25, large >= 0.36
Sympson's paradox ratio (SPR)=1.000, acceptable if >= 0.7, ideally = 1
R-squared contribution ratio (RSCR)=1.000, acceptable if >= 0.9, ideally = 1
Statistical suppression ratio (SSR)=1.000, acceptable if >= 0.7
Nonlinear bivariate causality direction ratio (NLBCDR)=1.000, acceptable if >= 0.7

Figure 25. *Smartphone quality importance model fit*

Table 47. Path coefficients and P-values

Path coefficients

	dig_comp	imp_vers	imp_endu	imp_pres	imp_perf	imp_ease	imp_serv
dig_comp							
imp_vers	0.323			0.240		0.289	
imp_endu							
imp_pres							
imp_perf	0.353			0.232		0.158	
imp_ease							
imp_serv			0.527	0.245			

P values

	dig_comp	imp_vers	imp_endu	imp_pres	imp_perf	imp_ease	imp_serv
dig_comp							
imp_vers	<0.001			<0.001		<0.001	
imp_endu							
imp_pres							
imp_perf	<0.001			<0.001		0.006	
imp_ease							
imp_serv			<0.001	<0.001			

Figure 26.

Table 48. Standard errors and effect sizes

Standard errors for path coefficients

	dig_comp	imp_vers	imp_endu	imp_pres	imp_perf	imp_ease	imp_serv
dig_comp							
imp_vers	0.061			0.062		0.061	
imp_endu							
imp_pres							
imp_perf	0.061			0.062		0.063	
imp_ease							
imp_serv			0.059	0.062			

Effect sizes for path coefficients

	dig_comp	imp_vers	imp_endu	imp_pres	imp_perf	imp_ease	imp_serv
dig_comp							
imp_vers	0.110			0.073		0.103	
imp_endu							
imp_pres							
imp_perf	0.132			0.065		0.032	
imp_ease							
imp_serv			0.298	0.080			