

Consumer reactions to market shaping efforts

- a case study of the early stages of 5G mobile network services in Finland

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ABSTRACT OF THE MASTER'S THESIS

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The extensive use of data-hungry devices has heavily increased mobile data traffic. 5G is a solution that can keep up with the increasing data volume. 5G has been on the carpet for almost a decade, and the roll-out has finally begun in several countries. The market shapers must get consumers to adopt 5G so that other companies want to start investing in 5G services. This thesis studied the consumer reactions to market-shaping methods used to improve the current market of mobile networks or develop entirely new technology, depending on one's stance. A cross-sectional electronic questionnaire survey was chosen in this thesis, and the data was collected through Finnish consumers with a sample size of 187. The results indicate that a successful market-shaping strategy results in a more significant adoption rate. The way a consumer views the technology affects their interest in it. Also, the need for a fast-speed internet connection significantly influences the consumers' interest in the technology. Coverage, cheaper subscriptions, innovative applications, improved battery life were important things to develop for consumers who had not adopted the technology. The early adopters of 5G answered coverage, innovative applications, improved battery life, and cheaper subscriptions. A minority of the respondents were concerned about potential health effects, information leaks, and environmental effects.

Keywords: 5G, marketing, consumer

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1. Introduction

This chapter explains what the thesis is all about. The first chapter begins with a thesis presentation, followed by problem areas and information about 5G in Finland. Then comes problem discussion, followed by research questions and purpose. The introductory chapter will end with delimitations and term definitions.

1.1 Thesis background

5G cellular networks has been a topical issue ever since Neelie Kroes, the former Vice-President of the European Commission responsible for the Digital Agenda, gave a powerful speech about 5G in 2013 at the Mobile World Congress in Barcelona. Kroes called on the E.U. industries and other partners to join in a public-private partnership to form an open platform to reach the goal of establishing 5G coherently, directly, and quickly. She added that establishing European 5G is an “unmissable” opportunity to capture a global technological leadership position. Europe has the funds, the will, and the expertise to succeed in this field (Kroes, 2013, p. 3).

If we don't provide the spectrum, the networks, or the most up-to-date technology, then that innovation just won't be possible: we would be blocking off tomorrow's opportunities. And I don't think citizens of any generation, would forgive us that.
(Kroes, 2013, p. 3)

According to Dunnewijk & Hultén (2007, p. 164), in the early 1950s, mobile telephony was introduced in Europe, and ever since, the demand for this service has increased exponentially. The development of mobile telecommunication has advanced in successive generations of technologies, the first of which appeared in the 1950s and is called 1G. GSM technology is the second generation (2G) of mobile telecommunication technologies, and it is used globally as all the later technologies. The third generation (3G) brought the Internet to mobile devices, and 4G enabled increased transmission speeds. Future generations of mobile telecommunication technologies will further increase transmission speeds.

Anasia D'mello (2019) argues that in recent years the extensive use of data-hungry devices by consumers and organizations has heavily increased mobile data traffic and inspired researchers to develop network designs that support speeds of multiple Gbit/s for a 5G network to meet the increasing data demand. Building a comprehensive 5G network is time-consuming. It requires radical changes to the network paradigm to satisfy the future need of the Internet of Things (IoT) and device-to-device communication with high-traffic and low latency requirements. 5G can reach speeds up to 10 Gbit/s, which is approximately 100 times faster than 4G. The speed and bandwidth of 5G could be an effective way to replace the popular Wi-Fi internet connections.

According to James Edmondson (2020), 5G technology can support products and services worth up to €3.8 trillion in industries such as education, entertainment, retail, healthcare, and transportation. Edmondson claims that 80 percent of business leaders, analysts, and technology professionals believe that 5G will drive business growth, increase productivity, efficiency, and accessibility. 5G technology provides fast downloading for its users, and in the future, for example, fully autonomous cars and smarter homes will offer a different reality than today's IoT. Many consumers might be wondering why they should pay for potential future benefits today. They can most likely acquire both the 5G devices and subscriptions less expensively when there are actual IoT products and services in the market that require 5G to function. Some consumers have genuine fears and concerns associated with 5G technology. A minority of consumers believe in various 5G conspiracy theories, and there are petitions to stop the roll-out of the technology. The topic has been extensively discussed in public discourse, albeit also widely debunked. More valid concerns might be information leaks and privacy risks, which have also been a topical issue in the public discourse.

A 5G mobile phone needs a data-intensive 5G signal for heavy tasks and maintains connections to 3G or LTE networks for essential phone functions. Maintaining several connections drains the battery life quickly, and most phones lose half of their battery in a few hours of 5G use (Thomsen, 2020). Half a million 5G users grew tired of the low signals in South Korea and decided to switch back to using 4G. Companies have not yet created 5G applications that would attract consumers to upgrade, and jokes, such as "SpeedTest is the only true 5G app," spread in social media (Zhe, 2020). In

China, enthusiasm is high; almost every second consumer is planning to purchase a 5G phone immediately when the service is available. Only 15-20% of the consumers in Europe and 30% in the U.S. feel the same way (GSMA Intelligence, 2020).

In 2016, most of the wireless telecom industry's significant announcements included strong statements about 5G. Governments, politicians, organizations, and entities worldwide wanted to be associated with 5G because of the future vision it promised. Although the technology has advanced since 2016, skepticism towards 5G has grown (Webb 2019, p. 7).

Although 5G is still in such an early phase, it remains to be seen whether it will be the next important thing or not. Consumers are essential first users of 5G diffusion because companies are more willing to invest in creating 5G services when there are many users. The early-adopting businesses utilizing the technology and creating innovations are essential for the success of 5G. Companies still believe in 5G, and carriers are increasingly investing in 5G stations to expand the coverage area and aggressively market the 5G subscriptions to increase the 5G customer base. They all want to be seen as pioneers, offering the latest technology (Maeng et al. 2020, p. 1).

1.2 Problem discussion

Markets can be simple or complex. Going into a barbershop to buy a haircut in exchange for money is an example of a simple market. In this situation, it is easy and straightforward for both parties to reach an agreement because the seller is also the service provider. The situation is more complicated in more significant trades or when more actors are involved (Pekkarinen & Sutela, 2005, p. 36). In today's world, markets are complicated and developing ecosystems. Market actors should be able to embrace the complexity in order to thrive (Nenonen & Storbacka, 2018, p. 1). Companies want to sell technical innovations to consumers, and they use market-shaping methods to do so, but consumers may be more or less interested in adopting these innovations.

Technology is evolving rapidly, bringing new opportunities to companies and bringing innovations that make consumers' daily lives more comfortable and practical. However, innovations can have their downsides. Companies need to be always on their toes, recognize and react immediately to disruptive innovation or other breakthroughs

that may change an industry's competitive patterns. From a consumer perspective, innovations may be helpful to some and harmful or scary for others. Marketing firms try to reach consumers everywhere, and an average consumer encounters between 6000 to 10000 ads daily, although there are no official figures. Those figures make one question how the human brain copes with the permanent information overload (Carr, 2020).

Sometimes consumers are forced to adopt a technology, and some people think that innovations might produce much change in their daily lives and disorder their routines. They might be afraid of an innovation not being thoroughly examined before the launch and have harmful side effects. These factors can cause innovation resistance in consumers, which might slow down the innovation's takeoff time and result in delayed investment returns. In the worst case, the product is drawn from the market before sales have a chance to grow, resulting in negative payback (Garcia et al., 2007).

The coverage of 5G is improving, but it is still constrained to the central area of bigger cities. The use of 5G is not problem-free either in cities where it has already been implemented. If users want a notably faster connection than what 4G can offer, they should be close to a 5G telecommunication tower without having buildings or other obstacles on the way. The 5G network is still developing, and several 5G mobile devices have not been able to keep up with the network development. Many of the early devices do not support the network that has the best coverage result. Many consumers have already bought one of these devices, which means that they will be left out of most of the 5G expansion if they do not purchase a new device (Conteras, 2020).

It is challenging for a typical person to know what information to trust or not trust because the internet is full of conspiracy theories about 5G. Some believe it is a health hazard, the cause, or an accelerator for COVID-19. Others think it can kill birds and plant life or that the lockdown is a government conspiracy to install 5G antennas en masse (Destiny, 2020). These myths have been widely debunked, but they still circulate in many social media echo chambers.

According to Waterson and Herne (2020), people are trying to make sense of the world after Covid-19 turned everything upside down. The networks have failed to promote scientific evidence about 5G, and the rapid increase of community social media groups

has helped spread several nonsense theories about 5G. Vosoughi et al. (2018, p. 3) studied how false news on Twitter spread compared to factual news. The results indicated that it takes about six times as long for the truth to reach 1500 people than something false. False news is also much more likely to become retweeted and successively passed on.

5G makes it possible for an increasing amount of physical objects to be connected to the internet. These can be devices, such as robot vacuums, rings, and microwaves. Intelligent IoT equipment may significantly improve the life quality of its user. However, the connected devices usually ask end-users to input their age, gender, name, zip code, email address, and other sensitive personal information. An intelligent robot vacuum collects data to identify the walls and furniture in a house to avoid crashing. However, it can also create and share an accurate map of the house to the cloud. Every smartphone has a built-in GPS (global positioning system) to increase convenience and improve users' life quality. However, it could be dangerous if the information gets into the wrong hands.

The digital divide is widening because the 5G network coverage has not been seen as the primary goal. Many of the adopted designs are not perfectly synchronized with the needs of universal mobile coverage. The primary focus with every generation of mobile telecommunication technology has concentrated on the peak data rate, while coverage has been underemphasized. In this early stage of the 5G adoption, it is eminent that nothing has changed. The new technology's performance targets are ambitious, but the coverage goals have been modest (Al-Dulaimi et al., 2018, p. 314). To fill the gap between the urban and the rural coverage to provide universal high-speed internet connection is a significant challenge (Al-Dulaimi et al., 2018. p. 301).

According to the European 5G Observatory (2020), the global 5G race is getting more intense. Since the beginning of 2019, the number of live 5G networks has significantly increased across Europe. Commercial 5G services were deployed already in 14 of the EU-27 plus the UK countries by the end of June 2020. The 5g network has expanded rapidly, but only in densely populated areas. Despite the hype around 5G and its high predicted growth, there are also many concerns, uncertainties, and signs of decreased enthusiasm towards 5G.

Market-shaping companies influence the consumers by building credibility and understanding the customers (Kindström et al., p.44). Companies can then move to improve consumer practices and co-create more use-value for the consumer. It might bring new products, services, extensions, or information forth to the consumer. Consumers can also be influenced by bringing in new actors or new images (Nenonen & Storbacka, 2018, p. 68-69).

According to William Webb (2019, p.7), 5G expectations were enormous in 2016. In most of the wireless telecom industry's significant announcements, the 5G played a considerable part. The future vision that 5G promised led to the fact that governments, politicians, organizations, and entities worldwide wanted to be associated with the technology. Skepticism towards 5G has grown, and there is still a lot to be done, although the technology has advanced since 2016.

In November 2017, Vodafone's chief technology officer (CTO) stated that 5G was overhyped and the key benefit was efficiency gains, while BT's chief executive officer (CEO) said that neither he nor many of the other CEO's he talked to could find a business case for 5G.

(Webb, 2019, p. 7)

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1.3 Research Questions and purpose

This thesis aims to answer the following research questions with its content:

RQ1: How is consumer adoption of technology related to market shaping?

RQ2a: What influences consumers' interest in 5G technology in Finland?

RQ2b: What explains consumers' health concerns related to 5G in Finland?

RQ3: Given the consumers' attitudes to 5G, how should the mobile communication technology vendors shape the 5G market in Finland?

RQ1 will be answered by studying the existing literature on the topic. The gathered empirical data would be analyzed and provide answers to RQ2a and RQ2b. The literature and the data analysis will help give a normative answer for the RQ3. This thesis summarize previously conducted scientific studies on market-shaping, consumer behavior, technology adoption theories. The literature and the conducted

survey help companies on how to tackle consumer innovation resistance towards 5G. This study aims to explore consumer perceptions of 5G in Finland from a market-shaping perspective. The theoretical part of this study examines how companies try to shape the market to fit their purposes. It also examines consumer behavior and the adoption of technological innovations. Consumers are crucial initial users for the technology to be successful, making it essential to understand them and what they indicate with their adoption or non-adoption.

1.4 Delimitations

As the topic reveals, the thesis examines Finnish consumers, and every member of the Finnish society is a consumer either directly or indirectly. Under 18- and over 80-year-old consumers will be left out of this study's empirical part. The decision was made because a researcher should be extra careful when dealing with children, and no one over 80-year-old participated in the study. No further delimitations were made to the population because the writer was interested in getting data from a broad spectrum of different people. A quantitative research method with positivistic philosophy and deductive approach was chosen for this thesis. A survey was used to find answers to the research questions. Because of the consumer perspective and the early stage of 5G, this thesis considered only the mobile communication sphere of operation. Future research could concentrate on how 5G has affected the efficiency of IoT and cloud services.

1.5 Definitions

Innovation = An idea, object, or practice that individuals or other adoption units perceive as new (Rogers, 1995, p. 418). Talukder (2014, p. 9) defines innovation as an idea or a system or a new or significantly improved technology.

Market shaping = Companies often try to adapt themselves to suit the market. However, market-shaping turns this traditional view upside down and shows how a firm can adapt the market to the firm, opening up unexploited value in the process (Nenonen & Storbacka, 2018, p. 1).

Consumer behavior = Khan (2006, p. 4-5) defines consumer behavior as the decision-making process and physical activity, which involves evaluating, acquiring, using, and disposing of goods and services. The buying process starts in the consumer's minds and leads to finding alternatives between products, weighing the different options, and leading to internal and external research. The decision-making process for purchase and using the goods comes next. Finally, post-purchase behavior is also significant for marketers because it clarifies whether consumers like the product or not (Khan, 2006, p.4).

Consumer adoption = When consumers accept and purchase new brands or products. The adoption rate determines whether or not a new product continues to be sold or is withdrawn from the market (Collins Dictionary of Business, 2005).

1.6 Structure of the Thesis

This thesis contains a total of six chapters. The introductory chapter offers a general overview of the thesis, its research area, research questions, and critical concepts and delimitations. The Theoretical Framework in chapter two gives a basic overview of the current research and theory available to us through journals and other literary forms. The focus of this thesis lies on theories that form an underlining foundation for the conducted research. The chapter will focus on market-shaping, different marketing strategies, technology adoption life-cycle, and how a consumer's mind works, and how one can efficiently target it. The hypothesis follows the Theoretical Framework in chapter three. The methodology in chapter four presents how the empirical research was conducted with details of the data collection process and the sample. The chapter also explains details of how the data was cleansed and ultimately analysed. Chapter five presents the empirical findings and data analysis compared to the theoretical framework and empirical data from third-party sources with discussion of the limitations and possibilities for further research, summarizing the thesis. Finally, in chapter six, there is a summary of the thesis in Swedish.

2. Theoretical Framework

The second chapter of the thesis presents the theoretical framework. The chapter presents the company's perspective on innovations and how they are trying to mold the market to suit their company better, and what market-shaping encompasses. The chapter then examines the consumers, what affects their behavior, and discusses the consumer adoption and non-adoption of technologies. The chapter then dives more in-depth into why 5G is needed, the predictions for the technology, conspiracy theories, and legitimate concerns towards 5G.

2.1 Market-shaping

In an environment that is continuously changing, businesses are exploring new ways to innovate, and ambitious companies view markets as something that they are capable of shape or mold. Companies are trying to proactively expand their current business opportunities or create new opportunities by engaging in market-shaping. Market-shaping can be presented by different terms, such as market innovation, market-driving strategies, and proactive market orientation (Nenonen et al., 2020, p. 276). Companies are increasingly engaging in market-shaping strategies to create new business opportunities and not only sense and react to different changes in established markets. The authors mention market formation, market-shaping strategy, niche construction, and effectuation to shape the markets. The authors would describe adaptive and dynamic marketing as market information and knowledge capabilities because this helps gather a deep understanding of the different actors, like customers, channel members, competitors, and the wider business environment, before these genuinely reveal themselves (Nenonen et al., 2019, p. 617).

A configurational view focuses on causal complexity, implying that the outcome of a group of interconnected elements rarely has a single cause (conjunctural causation), there are various pathways to an outcome (equifinality), and an outcome can be connected to both the presence and the absence of attributes (asymmetry). Recent research recognizes markets as systems or ecosystems, suggesting a need to look beyond sellers' and buyers' interactions as part of a more extensive actors system and unveils that nobody can fully predict or control a market system's development. Market systems do not have a central and central control mechanism, nor do they obey

simple cause and effect laws. Instead, a mix of deliberately designed influence and random emergence drives the market to evolve. Market-shaping aims to enhance value creation and value realization for actors within a market system. The key to new value is combining resources in innovative ways, such as creating, accessing, deploying, combining, and exchanging them. Nenonen et al. (2020, p. 277) define market-shaping as a purposive process by focal firms to:

- Identifying the value potential of linking intra- and inter-actor resources in new ways
- Triggering changes in various market components to enable new resource linkages.
- Equip related actors to free up extant resources for new uses.

There is a limited amount of studies that precisely investigate how focal companies can shape the markets. However, they all acknowledge the value proposition's importance. Different studies have conceptualized both value propositions and markets as configurations of factors that are dependent on each other. Business disciplines increasingly employ the configurational perspective, which shows the complexity of the studied phenomenon. The article tries to identify the factors of value proposition characteristics useful for focal companies that engage in market-shaping strategies (Nenonen et al., 2020, p. 277).

Poor, restricted view		Rich, systemic view
Markets defined around industries and/or products.	Definition of markets	Markets defined as complex adaptive systems.
Suppliers and customers in a value chain.	Market structure	A system of market actors (organizations, individuals) with interactions fostering value creation.
Exchange value: the value that is extracted by the supplier when selling a product.	Value focus	Use-value: the value that is created when a product is used in the customer's value creating process.
The market is external to the company. Markets are given and their development is deterministic.	Market versus firm	The market system is an outcome of actions by market actors. Markets are plastic and malleable.
A company's job is to adapt to the market, i.e., opportunities are precursors of strategy.	Market opportunities	A company can influence market development, i.e., opportunities are created by strategy.
Company level competitive strategy – how the company positions itself against competitors.	Role of strategy	System-level value-creating strategy – how the company supports the value creation of customers and other actors in the system.
To find sustainable competitive advantage.	Ultimate goal	Continuous renewal (as competitive advantage is always transient).
Product market share. Shareholder value.	Key measurement of success	Stakeholder/shared value.
Technological and product innovations	Innovation	+ business model innovation, management innovation, and market innovation.

Figure 1. The Poor, Restricted View of Markets versus the Rich, Systemic view (Nenonen & Storbacka, 2018, p. 33)

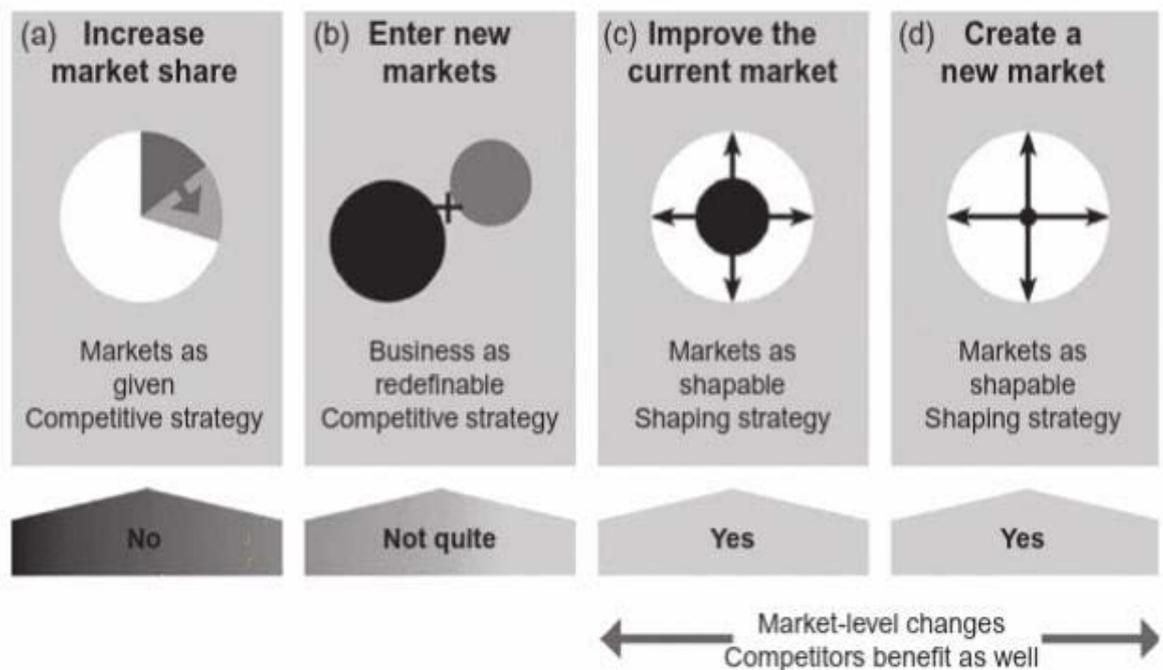


Figure 2. What Counts, or Does Not Count, as Market Shaping (Nenonen & Storbacka, 2018, p. 34)

Consequently, the market-shaping value proposition's role is to explain how focal companies can provide value by equipping actors to improve resource integration. There is a limited amount of studies that precisely investigate how focal companies can shape the markets. However, they all acknowledge the value proposition's importance. Different studies have conceptualized both value propositions and markets as configurations of factors that are dependent on each other. Business disciplines increasingly employ the configurational perspective, which shows the complexity of the studied phenomenon. (Nenonen et al., 2020, p. 277).

A comprehensive conceptualization of the value proposition concept points out that resource distribution is not moving in a single direction but involves more profound two-sided engagement, expected to result in meaningfully cocreated value propositions. A resource-based view conceptualizes value propositions as signs of market-based and company-based resources. Market-shaping value propositions' core content conveys what kind of enhanced resource integration market actors can expect when a new market is shaped. Nenonen et al. (2020, p. 277). define a market-shaping value proposition as a strategic tool enabling new resource integration possibilities by arranging resource linkages connecting various actors in a market system or equipping actors to join in new resource integration actions.

The conceptual framework is consistent with recent studies using fuzzy-set qualitative comparative analysis (fsQCA). It utilizes a Venn diagram approach and a configurational view to describe the four components of market-shaping value propositions. The framework builds on the emerging literature on market-shaping and novel integrative theoretical insights on value propositions. This framework has two main components. The first one is the core content and design characteristics of the value proposition identified as potentially connected to market-shaping, and the second one is market-shaping outcomes. The authors identify two interrelated overarching consequences of market-shaping on a market system level. These are the change in market system elements and the overall change of a market system itself. Authors identify six market elements that may change due to market-shaping and three crucial forms of the outcome at an overall market system level (Nenonen et al., 2020, p. 277).

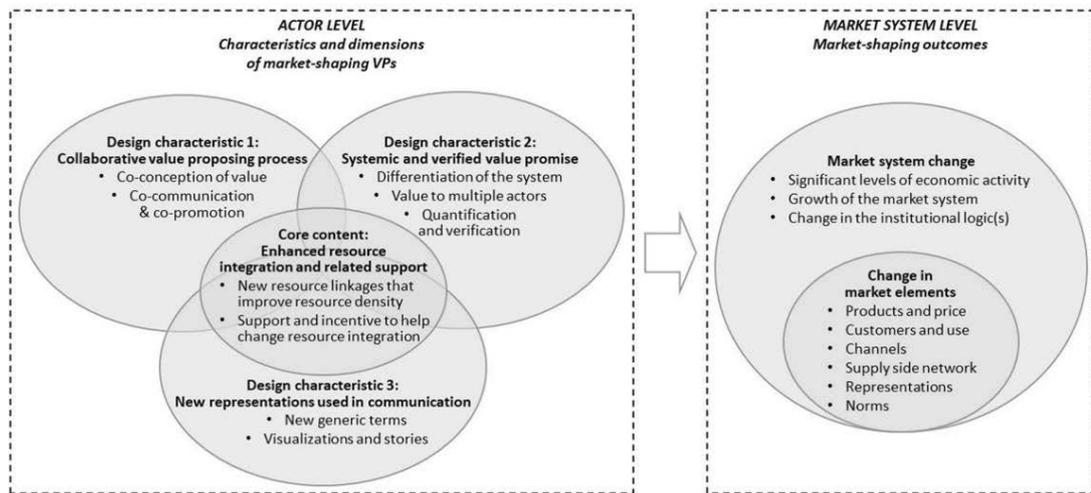


Figure 3. Actor Level to Market System Level (Nenonen et al., 2020, p. 279)

In the first outcome, one or more of the six market components may change:

- products and price
- customers and use
- channels
- supply-side network
- representations
- norms

Applying a systemic view of markets implies that market systems are not reducible to or defined by their components, which means that a change in a market system may occur due to changes in just one or two components (Nenonen et al., 2020, p. 279).

The second outcome is that the overall market systems would change. Successful market-shaping has system-level consequences. Nenonen et al. (2020, p. 280) are using three market-level measures to explore the validity of their model empirically:

- size
- profitability
- value creation of the market.

Three forms of outcomes occur at a market system level:

- presence of significant economic activity
- market system growth
- change in the prevailing institutional logics.

2.2 Consumer perspective

Most innovations diffuse at a slow rate, although many would think that promising innovations would sell themselves. For example, scurvy killed more sailors in long sea voyages than accidents, warfare, and all other causes of death. James Lancaster discovered in his experiments in 1601 that lemon juice prevented scurvy. The British Board of Trade adopted this innovation first in 1865, and scurvy was finally eradicated from the merchant marine (Rogers, 1995, pp. 7-8). The recent advances in universal computing have resulted in an unfathomable number of diverse IoT applications for different environments to improve the end user's life quality. Devices in an intelligent home have an Internet connection that helps monitor and control home appliances and systems. The devices can make autonomous decisions based on sensor information and improve their end users' lifestyles (Akpakwu et al., 2018, pp. 3621-3622).

Social psychology's theories about self-identity represent several perspectives, such as sociology, psychoanalysis, structuralism, and symbolic interactionism. These perspectives highlight that self-identity has a social nature. Interactions and relations with societal institutions, groups, and other individuals shape and influence one's self-identity (Wearing & McDonald, 2013, p. 98). Objects have meaning for people because they act as communicating mechanisms, but these can change over time. Knowledge about the social history of an object is essential for people involved with introducing, developing, and consuming new objects, ideas, and services (Szmigin, 2003, p. 30). From a micro perspective, consumer behavior involves understanding consumers to help a company or organization achieve its goals. From a macro level, consumer behavior research helps forecast where society is heading and how it affects living standards because the consumers heavily influence what companies produce and the resources used (Khan, 2006, p. 5). Marketing and consumer behavior are changing rapidly, which means that the methods used for studying the behavior need to evolve (Hawkins & Motherbaugh, 2010, p. 4).

Traditionally, consumers have been defined as purchasers of economic goods and services and purchasers of products for sale. The new view has broadened up so that one can be a consumer without any monetary change. Initiators, influencers, users, and

buyers are different consumer roles. The initiator determines that there is a need and then purchases a product to fulfill it. An influencer is someone who, either intentionally or unintentionally by actions or words, influences the purchase decision. Usually, one of the parents is acquiring a product or a service for a child. In this case, the parent who makes the purchase transaction is in the buyer's role and the child, who ultimately becomes the consumer, is in a user role (Khan, 2006, p. 4-5).

Consumers may not have many options to choose from when it comes to political parties or public services such as their hospital, the school for their children, and libraries they can use. The situation is very different in the daily consumption of food and goods, with many different grocery store products and brands. In a postmodern world, the nature of our choices has changed, and the changes will continue happening during our lifetime (Szmigin, 2003, p. 13).

2.2.1 Affecting consumer behaviour

One response from different companies to fight the excess of choices in the market has been relationship marketing. Companies engage consumers in long-term partnerships to learn about their customer base to respond to consumer needs in a mutually beneficial way. Suppose a group of consumers is positively involved with a company. In such a case, they are more likely to remain in a relationship with the company and be ready and more welcoming towards the latest offers, product line extensions, and other innovations. Trust is the key to positive involvement. When a company has succeeded in building a customer base, its risk in introducing innovations is mitigated to some degree, as the customers trust the company will meet their needs. Many companies undermine customer awareness and trust, which are critical elements of customer relationships (Szmigin, 2003, p. 13).

Mitigating consumers' perceived risk towards the products or services and increasing trust is essential. Cunningham (1967, as cited in Featherman & Pavlou, 2003, p. 454) identified six perceived risk dimensions: financial, performance, safety, time, social and psychological loss. Jacoby & Kaplan (1973) theorized that consumers weigh the overall perceived risk of products after a risk interchange behavior occurred. Featherman & Pavlov (2003, p. 454) also introduce the privacy risk:

- Privacy risk is the possible loss of control over and misuse of personal information.
- Performance risk is the possible malfunction of a product or of not performing as it was designed.
- Financial risk is the cost of the product, including the maintenance costs.
- Time risk is the time consumers may lose by making a wrong purchasing decision. Consumers would waste time finding information about the product or service when making the purchase. They would also lose time learning how to use the product or service in vain.
- Psychological risk is the risk that the producer's performance or selection harms the consumer's self-perception or peace of mind.
- Social risk means the status loss in a group due to adopting a product or service.
- The overall risk is the general risk perceived by the consumer when all risks are evaluated together.
- Physical risk is the perceived safety risk to human health.

Harker and Egan (2006, p. 225) argue that marketers should focus more on their attention to develop loyalty to their previously and expensively gained customers, not only on acquiring new customers. Marketing activities and actions need to create value for customers. Companies often make the mistake of believing that customer value is in their goods and services delivered to customers in exchange for money. Recent studies clearly show a trend away from the value-in-exchange view and that customers are the ones who create value and not companies. Value is created when customers can use a product to benefit from isolation or co-created in interactions with the company. No customer value exists until that happens, which means that value does not emerge in the producer's space but the customer's space (Grönroos, 2006, p. 399). Companies that want a relationship with their customers and expect loyalty should, in return, be loyal towards the customer (Szmigin, 2003, p. 19).

Customers are those deciding whether a customer relationship exists between them and a company or not. Only after the customers have decided to have a relationship can a company start managing it. The type of company, its product types, or the customer's situation at a specific moment, affects the customer's relationship with a

company. No research exists to demonstrate when a customer recognizes a relationship exists and wants a relationship to exist or shift from a purely transactional state to a relational state. If a company tries to force all its customers into relationships, the marketing activities will become ineffective, inefficient, and inappropriate (Grönroos, 2006, p. 402).

Through outlets such as television, billboards, the Internet, radio, telephone, direct mail, newspapers, magazines, buses, marketers bombard advertising messages to people. A few decades ago, advertisers mainly used TV commercials, billboards, advertisements in newspapers and magazines, and leaflets as their main outlets. Over time, advertisers' pressure to be more creative has meant figuring out new ways of reaching consumers. Technological innovations are one reason for the bombardment through various channels. Nevertheless, a fierce competition is the main reason advertisers have been driven to innovative resourcefulness and why people see advertisements everywhere. A person sees by estimate between 500 and 3000 adverts daily. Advertising is very influential, although many consumers try not to pay attention to it and believe advertisements do not affect them as they do affect others. People cannot pay attention to and fully process every advert encounter. However, when a consumer notices and remembers an advertisement, it may increase the demand for products and services up to 20 times compared to previous demand, although such significant increases are relatively uncommon (Jansson-Boyd, 2010, pp. 96-97). Against this background, we present our first hypothesis related to how market-shaping has affected the consumer adoption of 5G in Finland, as follows:

H1a: Consumers' interest in 5G will be positively related to their awareness of 5G-related advertisements.

2.2.2 Individual-level characteristics influencing consumer adoption of innovations

A person's age, attitude, values, beliefs, perception, self-concept, motivation, personality, social class, social and cultural background, and other internal and external factors determine what, how, where, and when they consume (Khan, 2006, p. 4). Marketers spend hundreds of millions of dollars studying consumer behavior and

billions of dollars trying to influence when, what, and how people consume precisely. Consumers are individuals who have different kinds of buying behaviors. A marketer needs to understand what drives an individual to make a purchase decision. (Hawkins & Mothersbaugh, 2010, p 4).

Psychologists started to study the causes that lead to decision-making and purchases decades before marketers. The theory of Maslow's hierarchy provides information about why consumer behavior differs so much between people. Abraham Maslow published a paper in 1943, where he introduced his needs theory, better known as Maslow's Hierarchy of Needs. A few modifications have been added to the theory, but it is still valid today (Kermally, 1999, p. 25). The theory has four basic premises. The first premise is that every person on earth has similar kinds of biological and psychological needs. The second premise is that some needs or motives are more influential than others. The third one is that to move from one motive to another requires a minimum level of fundamental motivation. Premise number four is that individuals attempt to satisfy the lower-level needs before the higher-level needs emerge (Kumra, 2006, p. 62).

There are five types of hierarchically structured needs with different priorities, which means that an individual's most substantial need determines his behavior at that particular time. First on a person's list is to satisfy his or her basic needs, and when those are filled, they can start moving up to the secondary needs (Khan, 2006, p. 175).

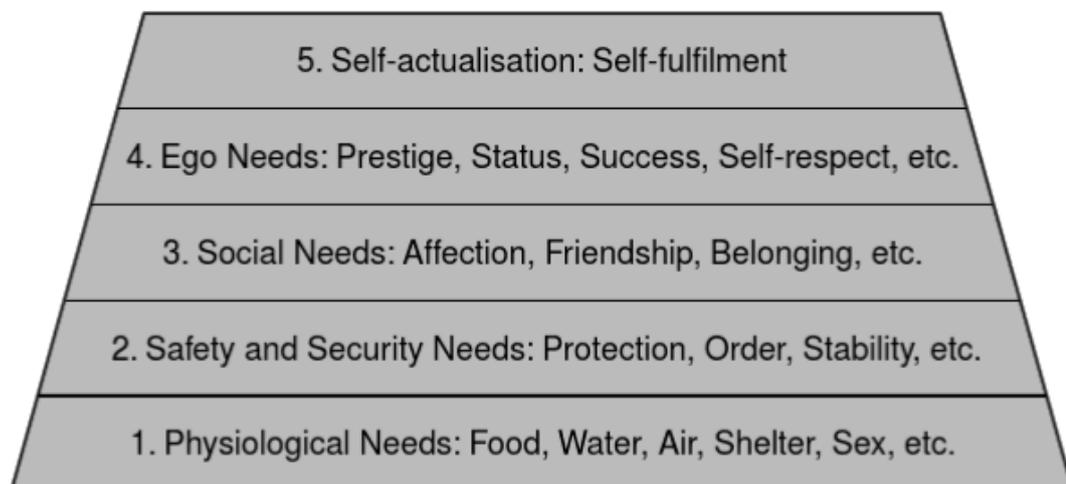


Figure 4. Maslow's hierarchy of needs (Khan, 2006, p. 175)

The figure above demonstrates the hierarchical structure of needs. A dangerously hungry man can think of nothing else than food. A utopia for the man is a place with plenty of food because he cannot stop thinking and dreaming about it. People in this situation tend to think that if they only would have enough food for the rest of their lives, they would be happy and would not ask for anything else, but when a person can eventually satisfy their basic needs, they will get new needs. (Kermally, 1999, p. 26). According to Srivastava et al. (2020, p. 246), low-earning people sometimes try to meet their luxury needs even though their basic needs would not be satisfied. The research is limited but indicates that people at the bottom of the pyramid, earning \$2 to \$8 per day and survive with an annual income of \$3000 or less, aspire for luxury goods and desire to use the same products and brands as society's middle and upper classes. However, they spend approximately 80% of their income to satisfy their basic needs.

Motivational forces govern the purchasing process and behavior. A tension is created in the individual's mind, which leads them to a goal-oriented behavior to satisfy the need. Motivation starts with a need and is a driving force, which affects one's mentality. The process is continuous because when a specific need is satisfied, a new need emerges (Khan, 2006, p. 175). In psychology, this is described as possible or future selves. They are mental representations of what a person either aspire to become or what they do not want to become. Possible selves serve as information organizers, but they are also significant motivational influences to help guide a person to grow to what they aspire to be (Wearing & McDonald, 2013, p. 102). An individual's self-esteem (evaluation of the self) is partly determined by the individual's in-group memberships, which regulate how we feel about ourselves. People favor in-group attitudes, norms, beliefs, and characteristics over out-groups in their pursuit of self-esteem. The group's material status does not matter. Both the most privileged and disadvantaged groups in the community use this internal bias to view themselves favorably. People from more disadvantaged backgrounds may perceive themselves as more authentic, grounded, and genuine. Commonly, they view more privileged groups as superficial and shallow (Wearing & McDonald, 2013, p. 105).

People get exposed to a vast array of information daily, but they recall just a tiny part of it. People will more likely remember information that is important or something that is of interest to them. In families, different members are interested in distinct sorts of

information that they individually retain. The different personalities, attitudes, and motives act as information filters. Selective retention means that only relevant information is kept in our minds while keeping the unnecessary information is kept out (Khan, 2006, p. 28). Marketers segment consumers by their lifestyle, including their activities, interests, opinions, and demographics (Khan, 2006, p. 18). The segmentation can be done with behavioral targeting that follows a consumer's behavior on websites and defines their interests. The consumer then gets ads relating to the interests that have been defined (Washington & Miller, 2009, p.20).

Against this background, we advance to the further hypothesis, as follows:

H1b: Consumers' exposure to 5G-related advertisements is positively related to their interest in 5G.

2.3 Consumer behavior and Diffusion of Innovations

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are concerned with new ideas. communication is a process in which participants create and share information with one another in order to reach a mutual understanding.

(Rogers, 1995, p. 6).

Technology is in constant change, simultaneously creating threats to established business models while offering innovative offers of service. Leading companies often try to shape technological applications' development to their benefit. With the advanced and dynamic growth of technologies, things such as technology availability, convenience, security, and consumers' need influence how fast the consumers adopt these technologies (Lai, 2017, p. 21)

The main elements in the Diffusion of Innovations are:

- Innovation
- Communication channels
- time
- social system

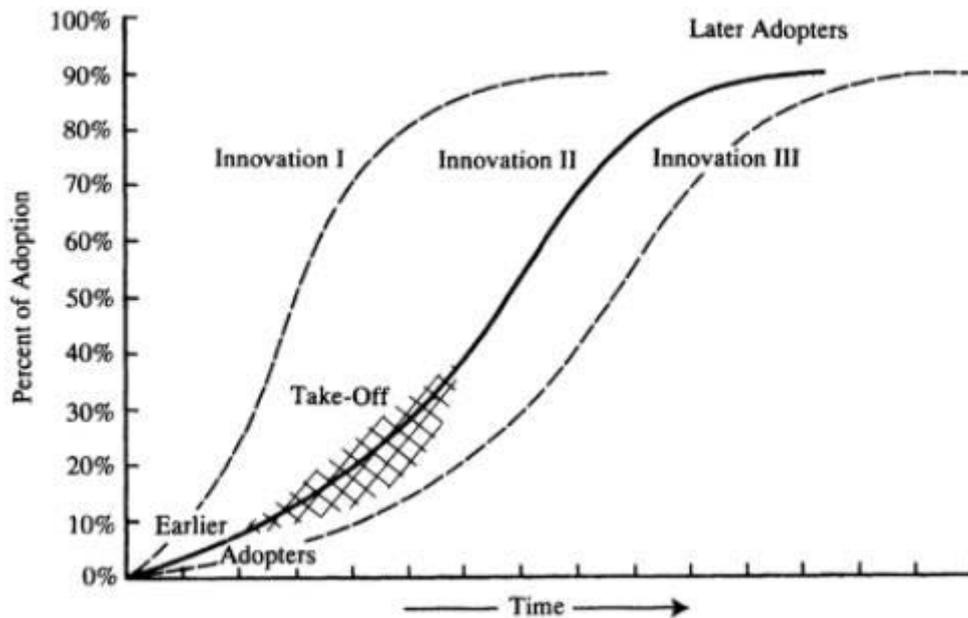


Figure 5. Elements of Diffusion (Rogers, 1995, p. 11)

2.3.1 Conceptualizing consumer adoption of technology

Several theories have proposed to explain consumers' acceptance of new technologies and their intention to use them, starting from the Diffusion of Innovation Theory (DIT) by Everett Rogers in 1960 to Technology Acceptance Model 3 (TAM3) by Venkatesh and Bala in 2008 (Lai, 2017, p.22). This study integrates the diffusion of innovation theory (DIT), the technology acceptance model (TAM), and the model of innovation resistance (MIR) in examining consumer reactions to 5G market-shaping efforts. Diffusion of innovation theory more useful when examining specific innovation characteristics, while TAM acknowledges the fundamental factors affecting the acceptance of innovation (Min et al., 2019, p. 771).

Fred Davis developed TAM to predict individual adoption and use of new Information Technologies (IT). It posits that two beliefs determine individuals' behavioral

intention to use IT. The first belief is the perceived usefulness, which the authors characterize as the extent to which a person thinks that using IT will improve their job performance. The second belief is the perceived ease of use, which the authors characterize as the extent to which a person thinks using IT will be effortless. (Davis & Venkatesh, 1996, p. 20-21). TAM3 is the extension to TAM and TAM2 models and has been used by various researchers to explain technology adoption (Lai, 2017, p. 22). Venkatesh and Bala developed TAM2 and TAM3 by adding external variables to explore the effects of external factors on users' behavioral intention, attitudes, and actual use of technology. TAM2 concentrated on the determinants of TAM's perceived usefulness, while TAM3 concentrated on TAM's perceived ease of use (Lai, 2017, p. 32). Since 5G is an emerging technology, this thesis will consider the respected TAM model with its extensions.

Yoon & Kim (2006, p. 102) acknowledge that the concepts of perceived usefulness and perceived ease of use have been considered significant when determining consumers' acceptance and use of IT during the last few decades. However, the authors claim that new IT acceptance factors may vary depending on the target users, the technological characteristics, and the context. The statement is based on the assumption that omnipresent computing technologies give its users convenience through the intelligence and intercommunication of technologies in our lives' background. The authors made an extended TAM, including perceived convenience as a new factor affecting technology acceptance. The study revealed that perceived convenience is an essential determinant of perceived usefulness, but it did not directly impact the acceptance of omnipresent computing technologies.

TAM is a widely used theory, but many question its ability to explain the adoption of different technology types sufficiently. In order to achieve explanatory power and better understand the fast changes in IT, various studies suggest integrating DIT or other studies with TAM. DIT helps find adoption patterns and understand adoption structure, predicting people's decision-making to adopt an innovation (Min et al., 2019, p. 771-772). DIT provides different tools to assess a particular technology's likely adoption rate and diffusion. There are numerous factors that either facilitate or hinders the adoption process and implementation of new technologies. These factors include the technology's characteristics and, more relevantly, the adopters' characteristics and how they learn and are persuaded to adopt the technology (Molina-

Morales et al. 2018, p. 65). Min et al. (2019, p. 772) present five innovation attributes from DIT that affect the adoption:

1. Relative advantages
2. Complexity
3. Compatibility
4. Observability
5. Trialability

Relative advantage is how people consider a specific innovation to be better than what it replaced and is among the best predictors of innovation adoption. Complexity is the perceived ease of use or degree of difficulty in understanding the innovation. Compatibility refers to the innovation being consistent with the potential customers' needs, existing values, and prior experiences. Observability is how the innovation results are visible to other potential users, and trialability is the ease with which customers can try the innovation (Lee et al., 2011, p. 124).

According to Schneir et al. (2019, p. 10), early adopters are usually intensive users and the least price-sensitive and are the most likely to take unlimited data packages that mobile network operators (MNO) have started to offer in recent years. Mainstream users are less intensive users, and they will acquire the service when it grows more established. Laggards are usually the least intensive users and the most price-sensitive. The authors assume that when both mainstream and laggards decide to purchase the service, the subscriptions will not be unlimited but have a capped monthly data allowance. However, some mainstream users may move towards unlimited packages depending on MNO charging structures.

Lee (2012, p. 12) investigated factors affecting consumers' decision-making regarding smart TVs' adoption. The results indicated that innovativeness plays an essential role in affecting the perceived ease of use and perceived usefulness. The findings also imply that particular consumer characteristics, such as personality and motivation, potentially influence consumer opinion concerning innovation characteristics. The study recommends that companies target high-innovativeness groups when introducing new technologies (Lee, 2012, p. 17-18).

Dedehayir et al. (2017, p.14) are on the same lines when proposing that businesses should target consumers with more prior knowledge, possess special technical skills,

and a robust social network when launching new products and services. The people who work in IT fit the description and should be more interested in technology because they find them more comfortable to use. The innovation can improve their job performance. Against this background, we advance to the following hypothesis:

H2a: People working in the IT field are more interested in technological innovations.

When looking at the entire workforce in the IT field, the age distribution does not favor young people because the mean age is 43.1, and the median is 43 years (Teknologiatoollisuus, 2018, p. 2-3). Younger people accept new technology easier than older people, and the difference is more significant in the short term than in the long term. The younger generations have started their technology usage relatively earlier than older generations. The opportunity for older generations to use information technologies before joining the workplace was limited. (Morris & Venkatesh 2000, p. 392). It would suggest that younger people perceive innovations in information technology easy to use. Against this background, we advance the following hypothesis:

H2b: Young people are more interested in technological innovations.

2.3.2 Non-adoption of technology

Lee (2012, p. 13) acknowledges that DIT and TAM present valuable insights on new technology adoption and recommend various essential conceptual elements that affect innovation adoption. He adds, however, that studies based solely on these two theoretical frameworks are often criticized because they have a pro-innovation bias, assuming all innovations are valuable and should be adopted by everyone. Consumers tend to resist innovation because it imposes changes for them, and most people do not want things to change. According to Ram (1987, p. 208-212), it is time to start respecting individuals who resist change. This type of individual is likely more typical and rational than a minority of people who seek change for change's sake and not

because of innovations' fundamental value. The model of innovation resistance (MIR) is a valuable framework to understand non-adaptation and the low rate of diffusion of specific innovations. MIR conceptualizes the consumer's psychological tendencies for innovation resistance (Lee, 2012, p. 13).

Consumers who adopt innovations later than the majority or who have not yet adopted them are called Laggards, which implies they are behind the times and not on the innovative, fashionable, and marketable tides. Marketing needs to understand what makes consumers decide to make a purchase and why they are not making it. There might be many different reasons people decide not to adopt new technologies and hastily denounce all consumers who have not adopted the technology as Laggards. It is essential to examine if time plays a role in the adoption and what consumers indicate with non-adoption. Marketers should be interested in the consumer's choice of not spending their money on new technology at a certain point in time because it is a real consumption choice (Szmigin, 2003, p.85). Better knowledge of consumer behavior can help us consume more wisely (Hawkins & Mothersbaugh, 2010, p. 4).

Innovation resistance is often understood as a determinant that inevitably leads to non-adoption, although it should be seen as another factor in the adoption decision process. Innovation resistance can be categorized into three parts. The first is rejection, which means a strong reluctance to adopt an innovation. Merely a lack of awareness or ignorance is not what drives people who are reluctant towards innovations. The second category is postponement. It is relevant when consumers choose not to adopt an innovation at a particular time. In this category, the consumers find the innovation in question acceptable in principle but decide to wait until circumstances become more suitable for adoption. The third category is opposition. It is the belief that innovation is not suitable and can involve consumer strikes against innovation launch (Lee, 2012, p. 14)

Advertisers want consumers to think that they can find happiness in material goods and services. Psychological research, on the other hand, seems to indicate the contrary. The research increasingly suggests that consumers purchase products and services, hoping that they will substitute for factors that make people truly happy (Jansson-Boyd, 2010, p. 172). There are several products available that can cause misery of some sort to consumers. People still choose to purchase products that can cause misery

because consumers often act in non-rational ways. Products such as alcohol, drugs, and tobacco consumption fall under this category, creating habits that are hard to control. Consumers can feel misery also when purchasing non-harmful products if they become too engaged with several different products (Jansson-Boyd, 2010, p. 175).

Extensive consumer research studies are conducted to recognize the likes and dislikes of a consumer. According to Khan (2006, p. 6), these researches try to determine the following:

- What the customers think about a company's product compared to its competitors?
- How would they improve the product?
- How are they using the product?
- What does the consumer think about the product and its advertising?
- How does the customer's role distribute in the family?

Innovation resistance plays an essential part in the innovation adoption process because it either directly or indirectly counteracts the positive impact of perceived usefulness on the intention to use. It is more likely that people will adopt new technologies if the extent a requirement such as perceived usefulness can be enhanced exceeds the extent to which innovation resistance urges consumers to reject, postpone, or oppose adoption and vice versa. The results imply why the integrated model where has advantages over a single framework. People consider the negative features of innovations just as they do the positive ones (Lee, 2012, p. 18).

2.4 Conspiracy theories about 5G

Conspiracy theorists retrofitted new information about the coronavirus, its effects on human health, its origins, and its suitable treatments into their beliefs, worldviews, and ideologies. Conspiracy theorists have exploited other peoples' fears of how the virus could impact them and the people close to them to advance their narratives. Fact-checked and reliable information debunking conspiracy theories also circulates, but it is less consistent, and it circulates in different networks than the conspiracy theorists' content (Bruns et al., 2020, p. 26). One conspiracy theory falsely claims that 5G infrastructure waves weaken the human immune system. Other theories argue that the

fast spread of Covid-19 in Wuhan is linked to the city's many 5G towers, although in reality, the city's 5G network is in an early phase. In recent months, anti-5G movements have even arisen in multiple countries. Fake headlines concerning 5G are spreading quickly on social media and reinforcing the fears of people who were already suspicious of 5G (Destiny, 2020). Some activists have set cellphone towers on fire in the Netherlands and Canada, with a couple from Quebec accused of setting at least two telecommunications towers on fire. In Europe, the fear of building a 5G network for mobile connections has resulted in the burning of 5G base stations in the UK, the Netherlands, and Sweden. One reason for the vandalism is the belief that the base stations contribute to the coronavirus's spread. In April 2020, a telecom mast was burned in Pedersöre in Ostrobothnia, but the perpetrators have yet to be caught, so there is no certainty about their motive (Hirvonen, 2020).

Räikkä and Ritola (2020, pp. 7–8) suggest prohibition, direct fight, and indirect actions as three approaches to fighting conspiracy theories. The approach of prohibition would ban false conspiracy theories that have a high chance of leading to seriously harmful behavior. Critics of this approach argue that applying prohibitions would be problematic because it is not always apparent which conspiracy theories can be labeled as untrue and unreasonable. The approach of a direct fight would mean that a nation's government actively fights false conspiracy theories without prohibiting their distribution. This could be done through the cognitive infiltration of radical groups, where doubts about the theories are planted, undermining believers' deformed epistemology and introducing valuable cognitive heterogeneity. The direct fight approach would evade the intricacies of restricting free speech. The approach of indirect action would mean that a state uses methods to ensure that people can interpret the media, think critically, and remain aware of the scientific community's views by publicizing them adequately. The state can shed light on diverse views, giving them a platform and publicity within a civic debate, and thus eliminate the echo chambers of specific conspiracy theories. Many issues related to conspiracies' epistemology and ethics have a political dimension, which might partly explain why people have lately seemed to lack the will to understand the opposite side of an issue and do not aspire to sensibly interpret their opponents' arguments.

Although the empirical results indicate that concerns about 5G are low in Finland, there is still a minority who believe in conspiracy theories about the technology. The Finnish government could try to fight conspiracy theories using prohibition, direct fight, or indirect actions, as Ritola and Rääkkä (2020, p. 7–8) suggest. The thesis writer believes that indirect actions would be the most suitable and the least controversial approach. It would also be essential to understand where the conspiracy theory believers come from and have public, civic discussions about differing views, removing the public's desire for forums that function as conspiracy theory echo chambers.

In Finland, concerns about the risks of 5G are reflected in online discussions. There is a lively discussion about the potential dangers of 5G in social media groups, such as the Stop5G Finland group on Facebook, which has more than 2,000 members. Telecom operators are responsible for the safety of mobile networks, and the supervising authority for Finland's safety matters is the Radiation and Nuclear Safety Authority (STUK) (Hirvonen, 2020). In a recent interview with Yleisradio (YLE), Pasi Orreveläinen, the Laboratory Director of STUK's Non-Ionizing Radiation Monitoring Unit, addressed nine claims about 5G. These claims are as follows:

- There are not enough studies about 5G technology safety.
- 5G base stations are much more radiant than 3G or 4G base stations.
- The introduction of 5G will increase the amount of radiofrequency radiation in our environment.
- 5G base stations emit radiation that poses a threat to human health.
- 5G technology is especially harmful to children, the elderly, and pregnant women.
- Radiation from 5G base stations weakens resistance and exposes people to, for example, Covid-19.
- 5G radiation increases the risk of cancer.
- 5G is a threat to nature, including birds and insects.
- STUK does not have sufficient resources to monitor the health threat posed by 5G base stations

According to Orreveläinen, thousands of studies have been conducted on the health effects of radiofrequency radiation used in mobile phone technologies. Based on

current scientific knowledge, all nine of the above claims are baseless. The current level of safety is high and is the result of years of development. Independent decision-making supported by knowledge is how a radiation-safe Finland can be guaranteed (Hirvonen, 2020).

However, many studies have come to opposing conclusions, and some scientists are worried about the potential adverse health effects of 5G and an international agenda to develop this technology. The possible health effects of the rising spread of radiofrequency electromagnetic fields (RF-EMF) are still under investigation. The International Agency for Research on Cancer (IARC), working under the World Health Organisation (WHO), stated that RF-EMF could be carcinogenic to humans. Some of the evidence for this is still controversial. More recent studies imply that RF-EMF affects the metabolic, reproductive, and neurological systems. There is not much data on the millimeter waves (MMW) used in 5G cellphone towers. However, preliminary observations of the MMW indicate several adverse health effects, such as altered gene expression, changes in skin temperature, and effects on metabolic and inflammatory processes (Di Caula, 2018, p. 367). According to Kostoff et al., 2020, p. 38-39), a vast amount of data from epidemiological and laboratory studies shows significant adverse health impacts from every generation of wireless networking technology. A considerable share of the data was collected under conditions that do not reflect real-life. Kostoff claims that the adverse health effects become worse when laying 5G radiation on top of an already profoundly rooted, toxic wireless radiation environment.

According to Grazier & Sloane (2006, p. 21), single parents are the most risk-averse regardless of family structure, but women are more risk-averse than men. People of any sex are more risk-averse if they have children than couples without children. However, married men are less risk-averse than married women. Weststrate & Glück (2017, p. 18) suggest that wisdom is correlated with advanced emotional regulation skills and mental calmness. The authors add that wise people experience less intense emotions, both positive and negative. People who work in IT and people who know more than others about 5G are better aware of the limit values for radiation health effects than other people.

Against the background of the fears associated with 5G technology, which have been extensively discussed in public discourse but have also been widely debunked, we advance the following hypotheses regarding the effect of these fears on consumers:

H3a: People with families will be more concerned about the technology's possible health effects.

H3b: People who work in IT will be less afraid of the technology's possible health effects.

H3c: People who think they know more about 5G than others will be less afraid of the technology's possible health effects.

While fear of possible health effects does not necessarily imply an unwillingness to adopt 5G technology, we do assume a close correlation between these things.

2.5 Consumer adoption of 5G: the current picture

Several companies who led the development of 4G are also developing 5G technology. The prominent companies in 5G technology include Huawei, Ericsson, Nokia, ZTE, Samsung, Intel, and Qualcomm (Virhiä, 2018, p. 10). Some of these companies build base stations, and others build chips that help 5G work. Finland has a great deal of expertise in mobile phone networks, and many companies are involved in the development of 5G. Nokia is one of the most significant actors when it comes to 5G. Finnish operators have also taken advantage of and developed the latest technology quickly (Virhiä, 2018, p. 33).

Nokia, Huawei, and Ericsson are the main actors making 5G network equipment. Huawei has repeatedly been accused of continuous industrial espionage, and the USA is investigating the company of fraud and intellectual property theft. There is still no hard public evidence of significant vulnerabilities in Huawei technology (Kaska et al., 2019, p. 7-8). Several nations impose restrictions on using Chinese technology in their domestic infrastructure. However, attitudes in different countries to the increasing foothold of Chinese technology vary significantly due to differing priorities, differing digital dependency levels, differing security cultures, and existing capabilities (Kaska et al., 2019, p. 15). It is not easy to ignore potential Huawei technology vulnerabilities

that could be exploited in the future. The potential is there whether the flaws would happen intentionally or become exploitable due to some failure. It is also a concern because when digital technology is procured, it often requires a long-term relationship with a supplier and creates a degree of dependence (Kaska et al., 2019, p. 19).

Maeng et al. (2020, p. 1) have conducted a study suggesting thoughtful diffusion approaches for 5G services in the Korean market. The Republic of Korea (South Korea) and Finland have several similarities. They were among the first countries to launch 5G. The first country to launch the first commercial fifth-generation telecoms network can be debated. South Korea was the first, or at least among the first countries to launch 5G (Li & Park, 2019). Several carriers claimed to be the first to launch the commercial fifth-generation telecoms network, Finnish carrier Elisa being one of them (Horwitz, 2018). The citizens of both countries are also highly educated and have a high level of technological competence, which is why we could expect similar patterns in Finland. One of the most significant differences between the countries is population density. South Korea is a small country with a large population, while Finland is a large country with a small population. The population density of South Korea in 2021 is 511.32 people per square kilometer (macrotrends, 2021). The population density of Finland was 18 per square kilometer in 2020 (Worldometers, 2021). The high population density of South Korea makes 5G more cost-effective compared to Finland. According to Maeng et al. (2020, p. 1), as initial users, consumers are essential for 5G diffusion and the creation of 5G services. Consumers prefer faster internet speed, lower subscription fees, and large data offers. Consumers mainly postpone adopting 5G services because of the high subscription cost and lack of need. It is essential to recognize the potential consumers' purchase preferences and behavior to integrate 5G technologies and services successfully. The subscription price was considered the most influential in terms of relative importance.

- Subscription price (33.3%)
- Connected vehicles (28.1%)
- IoT (20.2%)
- speed (10.2%)
- data (8.2%)

(Maeng et al., 2020, p. 1)

5G diffusion should increase if the data offer and transmission rate increase during the subscription price decrease. As for connected vehicles and IoT services, only 31.1% of respondents who plan to purchase a connected vehicle in the future will do it less than a year after being launched. The adoption of connected vehicles is mainly postponed because of the cost burden, distrust, and lack of need. 42.8% are planning to adopt IoT in less than a year after being launched. Impaired functionality, mediocre performance, the belief that 5G is irrelevant for IoT devices, and cost burden are the main reasons why IoT adoption is postponed (Maeng et al. 2020, p. 10). The development of previous generations usually stops when a new generation of technology emerges. However, 5G is partly based on enhanced LTE (4G), so the evolved 4G is likely to be called 5G as a marketing trick even if 4G recaptures popularity in this transition. The even-numbered generations 2G and 4G have been more successful than 3G, and many believe that we will have to wait until 6G to see all of the expectations for 5G fulfilled. 5G will most likely bring in favorable economics and be at least some kind of success, although operators still have many concerns. A cross-industry endorsement is a key to make 5G a tremendous success rather than a moderate success (Onoe, 2018, p. 273-275).

Venture Insights carried out a market survey in late 2018 in New Zealand to better understand the early adoption of 5G services and how consumers feel about the evolving mobile market and platforms. One thousand seven respondents across New Zealand from different age groups participated in the study. The Managing Director of Venture Insight Nick Pugh (2019, p. 92) wrote a paper concentrating on the survey's essential aspects, such as awareness of consumers regarding 5G and race for the early adopter market, and mobile video and streaming services usage of consumers. 30% of respondents knew about the 5G network deployment plans, 6% were willing to upgrade to 5G at launch, and 25% were ready to upgrade within two years from the launch. 11% were ready to pay more for 5G services, and similar results were obtained when asked about the willingness to spend more for 5G hardware. The author claims that their results and strong smartphone usage growth across various applications confirm that consumers care about technology upgrades and are willing to adopt them. In some cases, consumers are willing to pay for a more satisfying mobile experience (Pugh, 2019, p. 94-95).

69% of the respondents answered that they had watched videos on their mobile, and 43% regularly watched video streaming services. From the respondents who watched videos on their mobile phones, 73% answered that they watch more videos now than they did a year ago. 76% watched videos on their mobile, only when using Wi-Fi. The top limiting factors of video viewing were the small size of the screen (30%), mobile data limits (24%), and battery life (17%) (Pugh, 2019, p. 96). The author believes that video viewing will be essential for consumers to adopt 5G because 73% of the respondents who were ready to upgrade to 5G within two years of the launch watched videos on the handset daily, weekly, or monthly. When asked about the crucial factors when considering the next mobile service purchase, 90% answered price, 81% network speed, 68% data allowance, 79% network coverage, 30% wanted a service where a handset is included, and 24% answered that video services are essential (Pugh, 2019, p. 97-98). The average revenue per user has remained chiefly flat, but there has been a descending trend in some cases. Within the last year, the average revenue per user has fallen by 7% in the United States. It will take a long time until we can see the end of the data growth phase, but some early signs suggest that data usage growth could be slowing down. BBC lately announced that teenagers were using their phones slightly less. A similar trend can be seen in many countries, but data growth has lately been incredibly low in Sweden, Japan, and Singapore (Webb, 2019, p. 7-8).

In recent years, Finns have multiplied their use of data and especially mobile data. The use of mobile data increased almost 25-fold in 2011–2017. There has been growth in the use of both consumers and businesses. The growth in data usage has slowed down since 2017 in Finland. Between 2018 and 2019, data use increased by 20 percent annually. The use of mobile data and the fixed network grew equally fast (YLE, 2020).

However, the quarantines worldwide because of Covid-19 have increased internet use to communicate, learn, work, and stay entertained. The use of video streaming services, videoconferencing and -calls, and video gaming has surged to new highs (Kang et al., 2020). The pandemic has put many Finns on telecommuting, which has also been reflected in Telia's statistics. In the autumn, data use rose to a record level. According to Sami Siiki, the Director of Telia Infra Networks, traffic in mobile and fixed network subscriptions grew 30 percent last year. There are several reasons for growth, such as increased streaming services and video content services. Another factor explaining the growth is video conferencing services. Siiki estimates that Teams

and Zoom will register two to three times the data amount than the previous year (Puljujärvi, 2021).

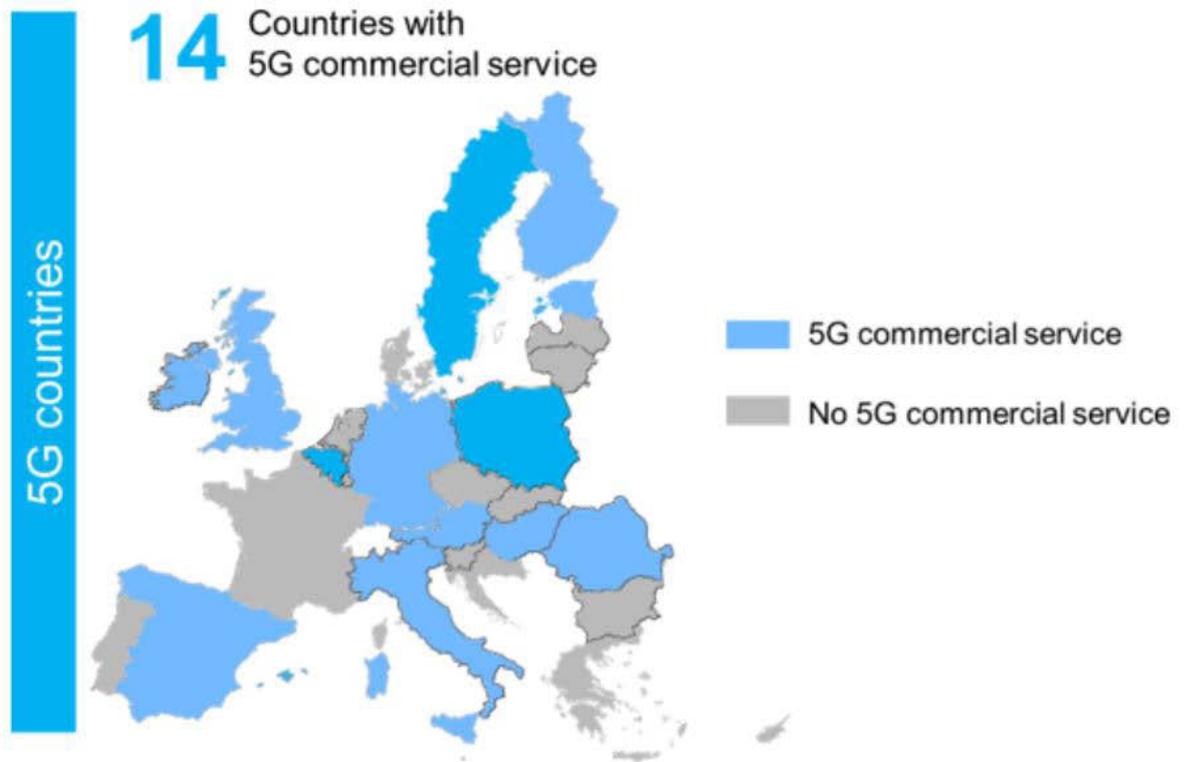


Figure 6. Countries with 5G commercial service – June 2020 (Source: IDATE Digiworld 2020)

In June 2018, Elisa reported that its 5G network provided a 5G phone call between the Estonian minister of Economy and her Finnish colleague in Finland. The tests revealed data speeds of 2.2 Gbps. In autumn 2018, the first 5G licenses were made accessible in the 3.6 GHz band frequencies. In June 2019, Elisa started to offer 5G mobile devices and subscriptions in Helsinki, Turku, Tampere, and Jyväskylä (European 5G Observatory, 2020). South Korea launched the world’s first 5G commercial services in April 2019 (Jahg & Park, 2020, p. 109), so Finland was not far behind. For consumers, Elisa 5G mobile service offering includes subscriptions with unlimited data in Finland, or up to 30 GB per month within the EU with data speed options of 300 Mbps (31.90 € / month), 600 Mbps (36.90 € / month), and 1 Gbps (49.90 € / month). In June 2020, Elisa reported that its 5G network is available in a total of 30 cities and towns across Finland, reaching more than one million people within its service area (European 5G Observatory, 2020).

At the end of 2019, Telia Finland launched its 5G services in seven cities. Besides the regular mobile subscriptions, Telia Finland also offers Fixed Wireless Access for homes. The operator offers its 5G subscriptions with unlimited monthly data in Finland, or up to 25 GB within the EU, varying from 300 Mbps (31.90 € / month) to 1 Gbps (49.90 € / month). In December 2019, DNA launched its “DNA Home 5G”. A month later, the operator started to sell mobile 5G subscriptions. The operator is continuously expanding its 5G networks, and currently, they are providing 5G in over 20 cities and towns across Finland. DNA offers its 5G mobile subscriptions with unlimited data usage in Finland and up to 27 GB within the EU with speeds and prices ranging from 400 Mbps to 1 Gbps and 34.90 € to 44.90 € per month (European 5G Observatory, 2020). The 5G network covers at least partly 40 cities in Finland.

There is some contradicting information about the expansion of 5G networks. The operators believe that a Finland-wide 5G coverage could be possible in 2025. However, Pasi Karjalainen, a professor of Applied Physics at the University of Eastern Finland, believes that the 5G network will never cover Finland entirely. Karjalainen has mapped the possibilities of commercializing 5G in connection with various projects. Jukka Manner, Professor of Telecommunications and Information Networks at Aalto University, agrees with Karjalainen and adds that 5G is not a rural technology because it requires dense base stations to operate a range of one base station is short. Building expensive base stations in remote areas are not commercially viable for operators (Remes, 2020). There is about 1,300 kilometers long, and 60 kilometers wide area from the state border between Finland and Russia to the Finnish side will be left without the most efficient 5G speed because Russia uses the same frequencies used in the Finnish 5G network. The International Radio Regulations restrict Finland’s operations on the same frequencies that Russia needs for its purposes. A United Nations specialized agency, the International Telecommunication Union (ITU), maintains the Radio Regulations. Finland is negotiating with Russia on the possibilities of using 5G. However, for now, it seems Lappeenranta, Imatra, Lieksa, Hamina, Kuusamo, Ilomantsi, and much of Joensuu will not be getting a 5G network (Kivimäki & Sormunen, 2021).

2.6 Summary of conceptual framework

The main characteristics of market-shaping and consumer behavior were discussed in the literature review, and RQ1 (How consumer adoption of technology is related to market-shaping?) will be answered using published literature analysis.

Market shaping is about improving a current market or creating an entirely new one. Random occurrences shape markets, but they can also be shaped and designed deliberately. Companies try to understand the customers' wants and needs and, together with individuals, create, access, deploy, combine, and exchange resources to create shared value for all stakeholders (Nenonen et al., 2020, p. 277). On the market actor level, the changes of market-shaping efforts can be seen in products and price, customers and use, channels, supply-side network, representations, and norms (Nenonen et al., 2020, p. 279). In the example of 5G, the market-shapers are trying to improve the current market by introducing an enhanced mobile technology. The technology adoption and non-adoption models help understand what changes actor level changes are essential for consumer technology adoption. According to TAM, the fundamental factors of consumer technology adoption are usefulness and effortlessness when deciding whether or not to adopt a technology (Davis & Venkatesh, 1996, p. 20-21). According to DIT, a consumer considers a product's relative advantages, complexity, compatibility, observability, and trialability (Lee et al., 2011, p. 124). MIR conceptualizes the consumer's psychological tendencies for innovation resistance (Lee, 2012, p. 13). Perceived risks, such as privacy-, performance-, physical-, and financial risks, can affect technology adoption negatively (Featherman & Pavlov, 2003, p. 454).

The following figure presents the hypothesis based on the literature review. The figure also shows "+" or "-" to indicate the direction of the hypothesized relationship between the independent and dependent variables. The hypotheses are then summarized.

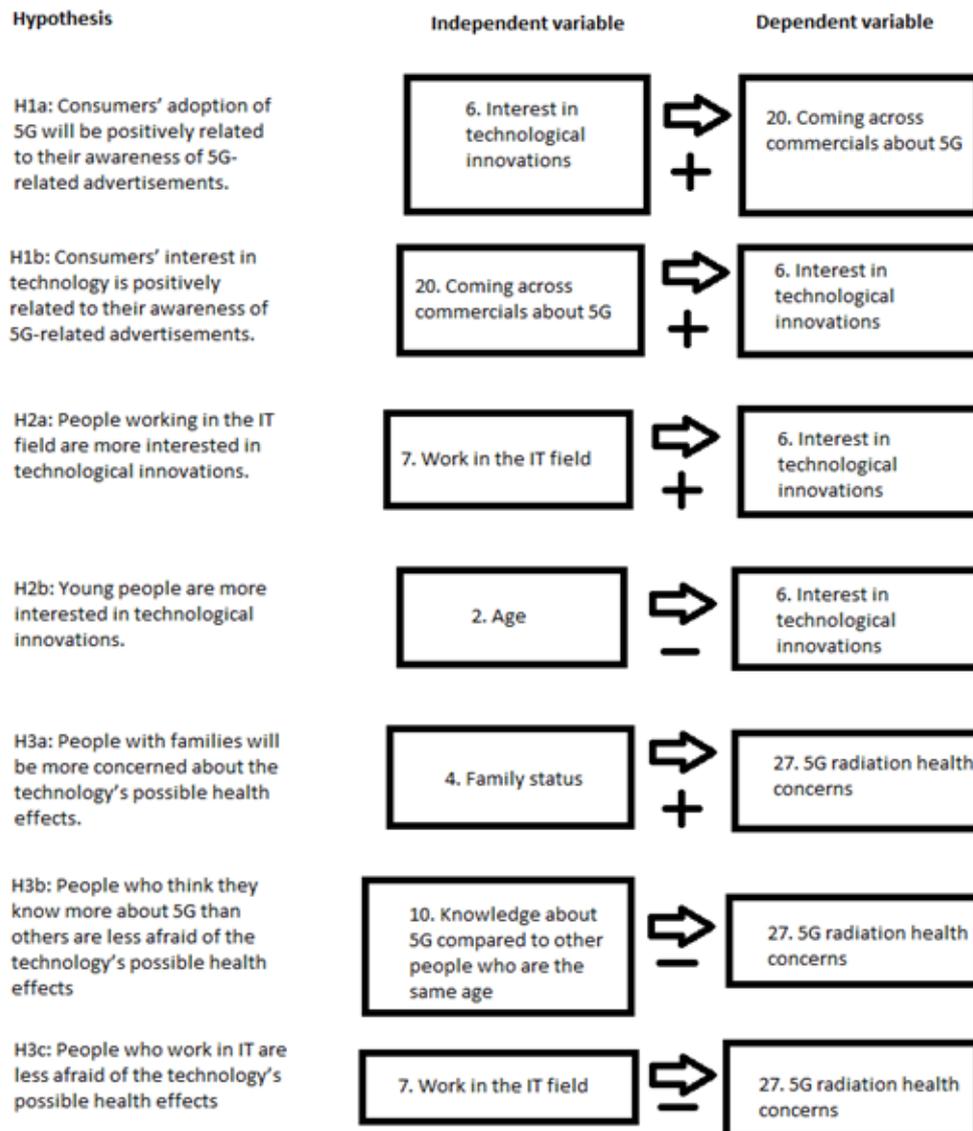


Figure 7. Hypotheses

3. Methodology

This chapter presents the thesis methodology, starting by presenting the theory of research design and the trustworthiness of a study. This chapter will also introduce different research methods and arguments for choosing a quantitative research method for this study. Moreover, this chapter will present the data sources and how the data was collected.

Research method means how research is conducted and executed, while research methodology is all the science and philosophy used in research. The research methodology allows us to understand the stringent restrictions placed upon our notion of knowledge. Furthermore, it helps one understand different knowledge-creation processes. The methodology concepts allow us to face the knowledge that is presented as fact critically and analytically. One must not accept any research work unquestioned because being critical of research knowledge will improve the value it has to society (Adams et al., 2013, p. 5).

3.1 Research design

Quantitative research and Qualitative research are the two main research domains commonly used in the literature. Quantitative research is based on positivism and neo-positivism's methodological principles and adheres to strict research design standards developed before the actual research. Quantitative research applies quantitative measurement, which means that statistical analysis is used. Qualitative research uses several methodological approaches, such as Hermeneutics, Phenomenology, and Social Interactionism. Its data collection methods and analysis are non-quantitative, aiming to examine social relations and describe the respondents' reality (Adams, 2013, p. 6). The quantitative research approach emphasizes quantification when collecting and analyzing the data and involving a deductive approach between research and theory. It includes the norms and practices of positivism and the natural scientific principle and represents an external, objective social reality view. (Bryman, 2012, p. 35-36). The qualitative research approach usually emphasizes words instead of numbers when collecting and analyzing the data. A Qualitative approach mainly highlights an inductive approach between theory and research and has refused the

positivistic and natural scientific norms and practices. It believes that social reality is continually shifting and emerging from individuals (Bryman, 2012, p. 36).

Both quantitative and qualitative researchers have a great set of criticisms towards each other. According to Alan Bryman (2012, p. 178-178), the quantitative approach has received criticism because some consider the social world unfit to be studied through a natural science model. The phenomenologists who criticize the quantitative approach believe it ignores the fact that people interpret the world around them. Objects in the natural sciences (i.e., molecules, atoms, and electrons) do not have a self-reflection capacity. Some believe that there is an artificial and false sense of precision and accuracy in the measurement process. The dependence on managing research tools and procedures to subjects hinders the connection linking research and daily life. It is hard to interpret how a subject has produced an apparent relationship between two or more variables. Thus, the analysis creates a static view of social life independent of people's lives.

Qualitative research receives critique for being too subjective and impressionistic, meaning that the qualitative conclusions rely a lot on what the researcher finds essential and significant. Replication of a study is never a straightforward thing in the social sciences. However, because there are no standard procedures to follow in the qualitative approach, it is almost impossible to conduct an authentic replication. In qualitative research, the populations being observed or interviewed are often small, making it hard to generalize the findings to other settings. It can be not easy to discover what the researcher did and how they came to the conclusions (Bryman, 2012, p. 405-406).

According to Sukamolson (2010, p. 8-9), quantitative research is particularly suited to find an answer to the following six types of research questions:

- When a quantitative answer is sought after, then a qualitative, non-numerical method does not give a numerical answer that is wanted.
- If we study a numerical change, it can only be accurately examined using a quantitative method.
- When conducting audience segmentation, quantitative research helps estimate an audience segment's size as a follow-up step to a qualitative study to

quantify results obtained in a qualitative study and verify data obtained from a qualitative study.

- Quantitative research is often used to quantify opinions, attitudes, and behaviors and determine how the whole population feels about a particular issue.
- A quantitative study suits well when a phenomena need explaining. Several statistical techniques help predict scores on one variable from scores on one or more other variables.
- Quantitative research is excellent for hypothesis testing, to explain whether there is a relationship between two or more variables.

3.2 Research strategy

Research methods are used to find the best guesses to the researcher's questions. The researcher decides what sorts and combinations of research methods serve the study's goals best (Adams et al., 2013, p. 6). The model by Saunders et al. (2009, p. 108) does a great job at demonstrating various research strategies and how they affect the data gathering and data analysis of research. This thesis starts from the outer layer from the more broad and working towards the more specific at the center of the research onion. This thesis uses positivism, deduction, survey, mono method, cross-sectional, and quantitative approaches.

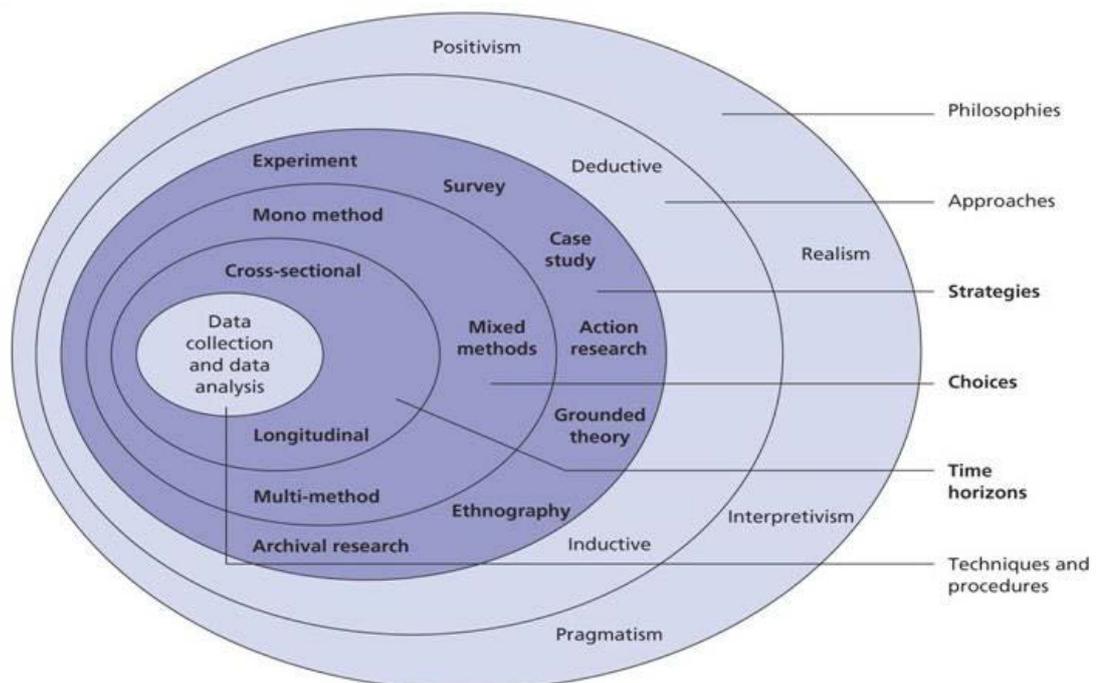


Figure 8. Research Model (Saunders, et al. 2009, p. 108)

A positivistic inquiry provides truth by verifying and replicating observable findings that concern processes or entities that one can easily perceive. The positivistic view considers an objective reality. Positivism utilizes factual statements that match reality's knowable facts, which means that the truth depends on the correspondence of theory to facts existing in our visible reality (Clark, 1998, p. 1243). A few simple assumptions in a good theory can describe an extensive range of events and make specific testable predictions. Researchers with a positivist stance cannot state their findings as absolute truth. They can only explain why their model is sound and state what predictions it makes.

Deductivism uses universal laws as its basis, but the laws are genuinely just hypotheses that also need testing against the laws themselves' predictions. The universal laws persist till one or more of their predictions are proven false, and the theoretical framework used to create them needs examination. In the deductivist method, the researcher is working his way from the broad towards the specific. A broad set of hypotheses correlating to a given phenomenon is narrowed down until the researcher has a single testable hypothesis or a distinct set of testable hypotheses. Hypotheses testing requires applying relevant data, which either confirms or does not confirm the theory's original arguments (Adams, 2013, p. 10). This thesis uses a deductive approach to bring together the two main aspects of the 5G market-shaping actions and the consumer reactions in Finland. The main reasoning for bringing these aspects together is to find out if the consumer market-shaping actions for this innovation have been successful or not, and what should be done for consumers to find 5G more attractive. The deductive process is usually very linear and follows a logical, clear path. The circumstances can change if a new theory or finding is published during the writing process or the data does not fit together with the hypotheses. It can also be the case that only after the data has been collected the relevance of a data set for a theory becomes apparent (Bryman, 2012, p. 24-25).

Two strategies commonly used for a deductive approach are survey and experiment. A survey can be either cross-sectional or longitudinal (Saunders et al., 2009, p?). Surveys enable the collection and standardization of a large amount of data. Data

collection through surveys is used a lot in business and management. The survey method has several approaches to the respondents. Questions can be faced to individuals face-to-face, on the telephone, or through questionnaires. Surveys can vary from small-scale populations to large-scale populations. Census means that an entire population is involved. Answers are appointed to several questions, adaptable to a more quantitative approach regarding data analysis (Adams, 2013, p. 118). A cross-sectional electronic questionnaire survey was chosen in this thesis. A cross-sectional survey focuses on consumer reactions at a specific time, specifically the early phase of 5G.

In a cross-sectional study, the data is gathered at a specific time and classified into more than two categories. Cross-sectional studies help the researcher to find out the relationship of how specific data affects other specific data. This thesis falls under cross-sectional design because the responses are collected at a specific time, and the respondents are classified into different categories (Adams, 2013, p. 69). In this study, respondents are classified based on different generations and their sex and attitude towards 5G.

3.3 Data collection

A researcher's resources are usually insignificant, making sampling a good option because it is both efficient and effective. When carefully choosing the sample and analyzing the data, a smaller sample can be generalized reliably to a larger population. Determining the size of the sample is one of the problems in sampling. The subject is what determines what kind of a sample is needed. A sample of one can be enough when the case study is about a family. However, a sample size of thousands of people might be required to get the needed data in other studies, such as a political telephone survey, to get the needed data. A sample size usually lies between 30 and 400 participants. Sample size depends on various factors, including the study's purpose, the research techniques used, and the population's size. A sample of 30 will be enough for a small study because it usually provides results in a normal distribution. However, the greater the sample size is, the better a population is represented (Guthrie, 2010, p. 53-55).

3.4 Sampling

This thesis used an anonymous questionnaire created with Google Forms to collect the data. The data collection lasted from 28th to 29th December 2020, and during that period, 194 answers were registered. The thesis writer shared the link to the questionnaire on Facebook and LinkedIn, and the link was shared a few times by friends and relatives. Facebook and other social media are used a lot to distribute questionnaires, and it assists in getting a decent sample size promptly. This approach can be flawed if only friends and similar-minded people answer the survey. The respondents may not be representative if they are more or less like-minded (Adams et al., 2013, p. 130). After answering the questionnaire, the participants could participate in a draw, where the thesis writer handed out three gift cards worth 20€ each. The gift cards were intended to attract more people to fill the questionnaire. Approximately only a third of the questionnaire participants participated in the draw, although it would have still kept them anonymous. The thesis was anonymous to get truthful answers from the participants because some of the questions could be considered sensitive.

3.5 Operationalizations

It is essential to operationalizing the applicable theoretical definitions since they have an elemental impact on the validity of the results. A theoretical and operational concept definition is needed to conduct a systematic analysis to answer a research question. The literature review provides the theoretical definitions from legitimate sources. The operational definitions present how a phenomenon is measured (Esaiasson et al., 2012, p. 55).

In H1a and H1b, both the independent and dependent variables (Interest in technological innovations / Coming across commercials about 5G) were measured with a Likert 5-point scale. In H2a, the independent variable (Work in the IT field) was a “Yes/No”-question, while the dependent variable (Interest in technological innovations) was measured with the Likert 5-point scale. The independent variable (age) in H2b was grouped into 8 categories (18-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55 & 56+). The dependent variable (Interest in technological innovations) was measured using the Likert 5-point scale. The independent variable (family status) in H3a was measured by asking how many people live in the respondent’s household (I

live alone – 10+). The dependent variable (5G radiation health concerns) in H3a, H3b, and H3c was measured with a Likert 5-point scale. The independent variable in H3a (Family status) was a “Yes/No”-question, H3b (Knowledge about 5G compared to other people who are the same age) was measured with a Likert 5-point scale, and H3c (Work in the IT field) was a “Yes/No”-question.

3.6 Data analysis

Both descriptive and analytical statistics were used in the statistical analysis. Microsoft Excel for Office 365 MSO 32-bit and Jamovi 1.6.18 were used in every statistical analysis in this thesis. The data was extracted from Google forms to Microsoft excel. In excel, the data was cleansed and processed as a preparation for the analyses. Excel cannot produce in-depth reports for higher-order regression models, but it can be used for analyses up to a certain level (Sahay, 2016, p. 3). Jamovi was used because it is a free and open statistical software, and it can be used for more complex statistical calculations.

Even though this is quantitative research, and most of the data is also quantitative and analyzed using statistical methods, qualitative content was also analyzed. The questionnaire had one optional open question, where the participants could write about their concerns about 5G. The open question gives valuable, more in-depth data about the research question.

Descriptive statistics are numbers that provide a summary of the data. It shows where the middle of the distribution is and how the observations are spread around that middle. Descriptive statistics help check for errors in data entry and other data flaws, such as extreme outliers. (Berkman & Reise, p. 5.)

The data were analyzed with correlation analysis and linear multiple regression analysis to get the correlations between the independent and dependent variables. Correlation and regression analysis the most widely used tools to investigate the relationship between two or more variables. Correlation analysis reveals how strong or weak the relationship (expressed with r) between the two variables is (Sahay, 2016, p. 2). Multiple regression allows a more advanced exploration of the

interrelationship within a set of variables compared to correlation. It is one of the various techniques used to examine the relationship between one continuous, dependent variable and a set of independent variables. The exploration of the interrelationship within a set of variables makes Multiple regression an ideal tool for investigating complex real-life research questions instead of laboratory-based research questions (Pallant, 2020, p. 153). Multiple regression reveals the degree that the independent variables explain the dependent variable variance. It also shows the relative contribution of every independent variable. Tests allow determining the results' statistical significance concerning both the individual independent variables and the model itself (Pallant, 2020, p. 158).

Multiple regression can be used to address research questions, such as:

- *How well a set of variables is able to predict a particular outcome.*
- *Which variable in a set of variables is the best predictor of an outcome.*
- *Whether a predictor variable is still able to predict an outcome when the effects of another variable are controlled for (e.g. socially desirable responding).*

(Pallant, 2020, p. 154)

The coefficient of determination (expressed with r^2) indicates how good the independent variable is to predict the dependent variable and judges the regression model's adequacy. The r^2 -value is always between 0% and 100% ($0 \leq r^2 \leq 1$). The r^2 value indicates the amount of variation in the data explained by the regression model, and theoretically, an r^2 -value of 1 (or 100%) would explain all variation in the data. (Sahay, 2016, p. 36). R^2 values are usually lower in fields that attempt to predict human behavior (r^2 -values typically $< 50\%$). It is more challenging to predict human behavior than predict things, such as physical processes. Although the r^2 -value is lower in the humanities, the statistically meaningful predictors help draw meaningful outcomes about how changes in the independent variable values are correlated with the response value changes. Nevertheless, significant coefficients represent the mean variation in the response for one unit of change in the independent variable while holding other independent variables in the model constant (Minitab, 2013).

Multicollinearity measures the relationship between the independent variables in a regression model. When two or more independent variables in a regression model are correlated, it means that multicollinearity exists. It is common to see correlations among the independent variables. However, serious multicollinearity may cause problems because it increases the regression coefficients' variance and makes them unsteady and difficult to understand. The regression results may be misleading if multicollinearity is present (Sahay, 2016, p. 114). Variance inflation factor (VIF) values more significant than ten indicate that multicollinearity excessively influences the regression results. Multicollinearity can be reduced by excluding insignificant independent variables from the model. We determine whether multicollinearity exists by calculating the correlation between every independent variable in the model. The figure below shows what the thresholds for extreme, moderate, and low multicollinearity are.

Values of VIF	Predictors are...
VIF =1	Not correlated
$1 < \text{VIF} < 5$	Moderately correlated
VIF = 5 -10 (or greater)	Highly correlated

Table 1. Detecting correlation using VIF values (Sahay, 2016, p. 116)

3.7 Ethical considerations

Most people share the opinion that research that is likely to harm participants is unacceptable. Harm can involve several aspects, such as physical harm, stress, self-esteem loss, harming participants' development, and provoking participants to conduct reprehensible acts (Bryman, 2012, p. 135). In many respects, informed consent is the area within social research ethics that is the most passionately debated. According to this principle, people should be given enough information to decide whether they want to join a study. However, the discussion tends to focus on what people varyingly call either disguised or covert observation. Disguised or covert observation can involve secretly observing a participant, but it can also mean contrived or straightforward observation, in which the researcher conceals his or her true identity. Covert observation disobeys the principle of informed consent because participants cannot refuse to join (Bryman, 2012, p. 138). The ethical concern of invasion of privacy deals

with the degree of invasion that can be approved. Many hold the right to privacy essential, and it is not acceptable to violate that right in the name of research. Invasion of privacy and the principle of informed consent are connected. When a participant gives informed consent based on a thorough comprehension of the causes for their involvement, they surrender their privacy right concerning the used research method (Bryman, 2012, p. 142). Deception happens when a researcher represents his or her work as something that it is not. Researchers in social psychology experiments often need the participants to respond naturally, and thus they frequently use deception to limit the participants' belief of what the research is all about. From an ethical point of view, deception is not a nice thing to do, and a question of professional self-interest arises. If many researchers are deceiving people for professional progression, future researchers might face difficulties in gaining financial support and research participants (Bryman, 2012, p. 143).

Conducting research using the Internet as a data collection method raises specific ethical issues. Netiquette is the code of politeness or determinations of acceptable behavior recognized by online communities and service providers' acceptable use policies and data protection laws that governs Internet users' behavior. Using the Internet for data collection is multiplying and creating over-researched populations who suffer from respondent fatigue. All of the researchers using the Internet for data collection do not follow ethical principles, resulting in suspicion and creating difficult circumstances for future Internet researchers (Bryman, 2012, p. 679).

The participants' welfare was considered during the collection and when using the collected data. Throughout the data collection period, the thesis writer has strived to provide an accurate reflection of the research subject. The questionnaire itself was made entirely anonymous to protect the privacy of the participants. Only the e-mail addresses for those who wanted to participate in the gift card draw were collected, but the addresses could not be connected to the questionnaire. The researcher informed the participants about who has access to the data. Participants gave their consent to collect and analyze the data for the thesis's designated purpose by participating in the study.

3.8 Trustworthiness of the Study

This master's thesis's trustworthiness can be divided into reliability and validity. Primary data was collected for this study because primary data's validity is more significant than secondary data. Primary data means that it has been collected directly from the information source, and it has not been published. Primary data is more authentic, reliable, and objective than secondary data because it has not been altered or changed by anyone (Kabir, 2016). Reliability evaluates the measurement's consistency. Consistency essentially means that the outcome remains the same when a tool is used to measure something the same way, with the same subjects, under similar conditions. A measurement instrument is reliable if something is measured many times and the result is always the same. Reliability is a necessary precondition for validity, but reliability is not a sufficient qualification on its own for a valid measurement instrument. An instrument may be mismeasuring a variable all the time, but it is reliable as long as the outcome is consistent (Adams, 2013, p. 245).

The researcher thoroughly reviewed and selected literature and the research methods. The primary data results were carefully organized and analyzed to ensure the study's validity. It is essential to mention that this thesis researcher probably knows at least some of those who participated in the quantitative research from before. There is a chance that the people who know the researcher might want to help, which could lead to biased answers. The questionnaire's link was shared on social media, which might decrease the reliability because everyone does not use the platform. It is harder for the more underprivileged society members to participate in the questionnaire. There is a chance that the participants' demographics were too similar, although the research reached a wide array of potential respondents with different backgrounds. It is still plausible that the results of a reconducted study under the same circumstances would be consistent with this one.

4. Empirical Findings and Data Analysis

This chapter will present and analyze the empirical results from the survey. The chapter starts by describing the respondents' demographics and moving to hypotheses testing and the analysis of the collected data. After that, the validity and reliability of the results were evaluated. At the end of this chapter, the results of the data analysis are presented.

The empirical part of this study will answer the second research question, which has been divided into two parts:

- a. *What influences consumers' interest in 5G technology?*
- b. *What explains consumers' health concerns related to 5G?*

The data from following survey questions will help to answer the research question 2a:

- Gender
- Age
- How interested are you usually in technological innovations?
- Do you work in the IT field?
- Do you play video games with a PC or a console?
- How has your interest in 5G changed over time?
- Do you think 5G has been a success thus far?
- What should be improved to get you more interested in 5G?

2b:

- Gender
- Age
- How many people live in your household?
- How interested are you usually in technological innovations?
- Do you work in the IT field?
- Do you play video games with a PC or a console?
- How much do you think you know about 5G when compared to other people who are the same age as you?
- How concerned are you with the 5G radiation on your or your family members' health?
- Do you believe 5G radiation affects the birds' or insects' sense of direction?
- Do you believe 5G mobile phone signals transmit the coronavirus?

- Do you believe 5G mobile phone signals reduce the human body's resistance to the coronavirus?
- Do you believe 5G mobile phone signals reduce the human body's resistance to the coronavirus?
- Do you have any other concerns regarding 5G? (Qualitative?)

This thesis's learnings will be used to answer the last research question: *Given consumers' attitudes to 5G, how should the mobile communication technology vendors shape the 5G market?*

4.1 Demographic Data

The gender distribution was 58 (31.0%) females, 127 (67.9% males), and two (1.1%) did not want to answer the question.

	Frequency	Percentage
Gender		
Females	58	31.02%
Males	127	67.91%
Others	2	1.07%
Age		
18-25	13	6.95%
26-30	82	43.85%
31-35	33	17.65%
36-40	26	13.90%
41-45	10	5.35%
46-50	5	2.67%
51-55	11	5.88%
56-60	1	0.53%
61-65	4	2.14%
71-75	1	0.53%
76-80	1	0.53%
City		
Helsinki	54	28.88%
Kokkola	20	10.70%

Turku	41	21.93%
Vaasa	14	7.49%
Other (<10)	58	31.02%

Table 2. Descriptive overview of the sample collected

4.2 Data Extraction and Cleansing

Out of the population of 194, seven answers were considered not valid and thus removed. Six of the seven answers were removed because the participant lived abroad. One answer from a 20-26-year-old male from Turku was a duplicate and thus removed. The filled surveys were successively received and had all the same answers, including the same sentence in the comment section, which would be too big of a coincidence. The total quantity of the revised population is 187. The two participants who did not reveal their gender will be included in the sample but will not be considered when analyzing the two sexes. There was only one participant from each of the age groups 56-60, 66-70, 71-75, and 76-80, and only four participants from the age group 61-65, which is why these were combined as one group with ages ranging from 56-80. A large share of the population came from four cities, Helsinki 54 (28.88%), Turku 41 (21.93%), Kokkola 20 (10.70%), and Vaasa 14 (7.49%). Two of the city names were translated from Swedish to English. The participants were divided into small and big cities. Tilastokeskus (2021) was used to get information about the Finnish cities' populations from December 2020. In this thesis, a big city has at least 100 000 citizens and thus includes the following Finnish cities:

- Helsinki (657 674 inhabitants)
- Espoo (292 913 inhabitants)
- Tampere (241 391 inhabitants)
- Vantaa (237 231 inhabitants)
- Oulu (207 424 inhabitants)
- Turku (194 488 inhabitants)
- Jyväskylä (143 485 inhabitants)
- Kuopio (120 246 inhabitants)
- Lahti (120 039 inhabitants)

Participant's living in any of the other Finnish cities were considered to live in a "small city." The line between the big cities and small cities was drawn here, and the biggest of the small cities where a participant joined was Kouvola with 81 216 citizens.

12 No-answers were removed from the free comment section about additional concerns regarding 5G because an empty field represents no answer. Questions 3-31 were adjusted from a question to a statement. Question number 4. (How many people live in your household?) was adjusted to Family. The participants who answered 1 or 2 in question number 4, were considered not to have any children of their own. However, those who answered something between 3 and 10+ were considered to have at least one child and be a family. The answers for question number 5. Problems with internet connectivity were adjusted to Often (= 0) and Seldom (= 1). In this thesis, Daily and Weekly internet problems are considered Often, while monthly, a few times a year, and I never have problems with internet connectivity are considered Seldom. All answers, except 25. Things to improve for higher interest in 5G and 31. Other concerns regarding 5G were adjusted from a word to a number, as shown below. The questionnaire was only available in English. Six qualitative answers for the last question were translated from Finnish to English.

4.3 Descriptive statistics

Question	Mean	St.Dev.
1. Gender (Male = 0 / Female = 1 / (Other = 2))	0.33	0.49
2. Age (18-25 = 1 / 26-30 = 2 / 31-35 = 3 / 36-40 = 4 / 41-45 = 5 / 46-50 = 6 / 51-55 = 7 / 56-80 = 8)	0.49	0.5
3. City (Small = 0 / Big = 1)	0.65	0.48
4. Family status (No family = 0 / Family = 1)	0.36	0.48
5. Problems with internet connectivity (Often = 0 / Seldom = 1)	0.59	0.49
6. Interest in technological innovations (scale 1-5)	3.99	0.93
7. Work in the IT field (No = 0 / Yes = 1)	0.25	0.43
8. Play video games (No = 0 / A few times a year = 1 / A few times a month = 2 / Once a week = 3 / A few times a week = 4 / Daily = 5)	2.83	1.9
9. Knows what 5G is (No = 0 / Yes = 1)	0.97	0.18

10. Knowledge about 5G compared to other people who are the same age (scale 1-5)	3.44	0.9
11. 5G network covers the place where participant lives (No = 0 / I do not know = 1 / Yes = 2)	1.08	0.87
12. Owns a 5G supported device (No = 0 / I do not know = 1 / Yes = 2)	0.75	0.9
13. Owns a 5G subscription (No = 0 / I do not know = 1 / Yes = 2)	0.39	0.74
14. Able to spend on technology compared to others who are the same age (scale 1-5)	3.4	0.92
15. Plans to upgrade to 5G (Not sure when & I have no plans for upgrading = 0 / When my contract period ends = 1 / I already upgraded = 2)	0.45	0.73
16. 5g makes Wi-Fi obsolete in the near future (No = 0 / I do not know = 1 / Yes = 2)	0.75	0.72
17. The importance of a fast-speed Internet connection (scale 1-5)	4.37	0.76
18. The importance of a low latency (scale 1-5)	4.35	0.8
19. First time when heard about 5G (I have not heard of 5G = 0 / 2020 = 1 / 2017-2019 = 2 / 2016 or earlier = 3)	2.24	0.53
20. Coming across commercials about 5G (I have not noticed any commercials = 0 / Monthly = 1 / A few times a month = 2 / Once a week = 3 / A few times a week = 4 / Daily = 5)	4.06	1.51
21. Change in interest in 5G over time (scale 1-5)	3.53	0.86
22. 5G has been a success thus far (scale 1-5)	2.97	0.93
23. The price of 5G subscriptions (scale 1-5)	3.4	0.74
24. Concerned the that 5G will drain the phone battery fast (scale 1-5)	3.43	1.06
25. Things to improve for higher interested in 5G	-	-
26. Information leak concerns with 5G technology (scale 1-5)	2.33	1.06
27. 5G radiation health concerns (scale 1-5)	1.85	1.09
28. 5G radiation affects the birds' or insects' sense of direction (scale 1-5)	2.02	1.01

29. 5G mobile phone signals transmit the coronavirus (scale 1-5)	1.06	0.32
30. 5G reduces the human body's resistance to the coronavirus (scale 1-5)	1.14	0.59
31. Other concerns regarding 5G	-	-

Table 3. Survey questions

Independent variable	Dependent variable	Hypothesis
6. Interest in technological innovations	20. Coming across commercials about 5G	H1a: Consumers' interest in 5G will be positively related to their awareness of 5G-related advertisements.
20. Coming across commercials about 5G	6. Interest in technological innovations	H1b: Consumers' exposure to 5G-related advertisements is positively related to their interest in 5G.
7. Work in the IT field	6. Interest in technological innovations	H2a: People working in the IT field are more interested in technological innovations.
2. Age	6. Interest in technological innovations	H2b: Young people are more interested in technological innovations.
4. Family status	27. 5G radiation health concerns	H3a: People with families will be more concerned about the technology's possible health effects.
10. Knowledge about 5G compared to other people who are the same age	27. 5G radiation health concerns	H3b: People who think they know more about 5G than others are less afraid of the technology's possible health effects.
7. Work in the IT field	27. 5G radiation health concerns	H3c: People who work in IT are less afraid of the technology's possible health effects.

Table 5. Hypothesis

H1a: Consumers' interest in 5G will be positively related to their awareness of 5G-related advertisements.

&

H1b: Consumers' exposure to 5G-related advertisements is positively related to their interest in 5G.

Model Fit Measures

Model	R	R ²
1	0.280	0.0781

Table 6. H1a correlation & variance

Model Coefficients - Coming across commercials about 5G

Predictor	Estimate	SE	t	p
Intercept	1.246	0.470	2.65	0.009
Interest in technological innovations	0.454	0.115	3.96	<.001

Table 7. H1a Coefficients - Coming across commercials about 5G

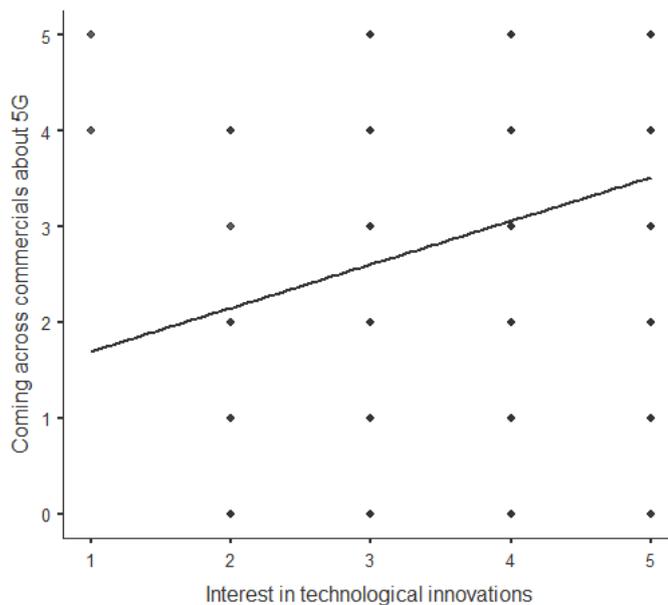


Figure 9: Scatterplot Illustrating the test of H1a

Only one test was needed for the hypotheses H1a and H1b. The result is the same, even if the independent and dependent variables would change places. Both hypotheses were made because we wanted to show that exposure to many advertisements can influence a consumer's interest in technology, but also the consumer's interest in technology can influence how many adverts they encounter.

Linear regression was used to answer the hypotheses H1a and H1b. The results show a correlation (R) of 0.28 and R² of 0.08 for both H1a and H1b. There is a correlation between the two variables, but it is not significant and does not entirely explain the model. The p-value is smaller than 0.001 in H1a. If the unit of *Interest in technology* is increased by 1, there will be an increase of 0.45 in the coefficient *Coming across commercials about 5G*. The significance of H1b is also high because the coefficient 0.17 comes with a p-value smaller than 0.001. These values are in line with the literature, which is why we fail to reject the hypotheses.

H2a: People working in the IT field are more interested in technological innovations.

Model Fit Measures

Model	R	R ²
1	0.338	0.114

Table 8. H2a correlation & variance

Model Coefficients - Interest in technological innovations

Predictor	Estimate	SE	t	p
Intercept	3.816	0.0739	51.60	<.001
Work in the IT field	0.728	0.1491	4.88	<.001

Table 9. Coefficients - Interest in technological innovations

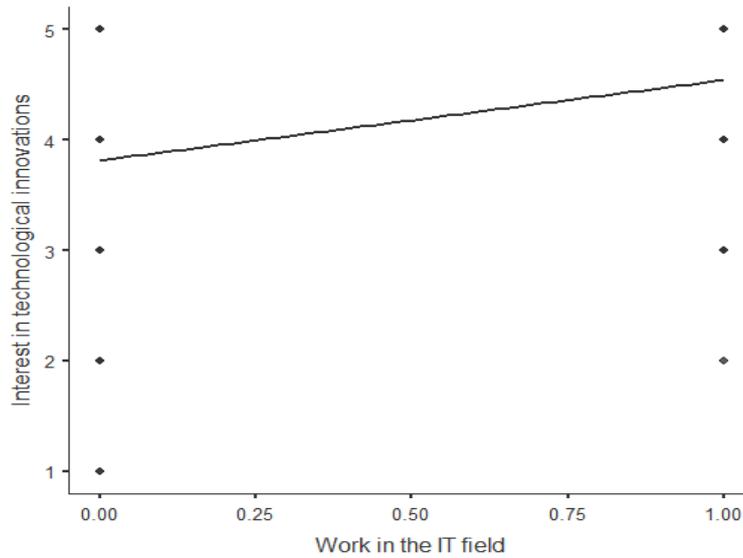


Figure 10. Scatterplot Illustrating the test of H2a

In the H2a, the R is 0.34, the R² is 0.11, and the p-value is smaller than 0.001. Going from 0 to 1 (from not working to working), we have an increase of 0.73 in the interest in technology. The results support our hypothesis, which is why we fail to reject it. The slope in the scatter plot is not steeper because also those who do not work in the IT field are very interested in technological innovations.

H2b: Young people are more interested in technological innovations.

Model Fit Measures

Model	R	R ²
1	0.0135	1.83e-4

Table 10. H2b correlation & variance

Model Coefficients - Interest in technological innovations

Predictor	Estimate	SE	t	p
Intercept	3.97225	0.1395	28.468	<.001
Age	0.00706	0.0384	0.184	0.854

Table 11. H2b Coefficients - Interest in technological innovations

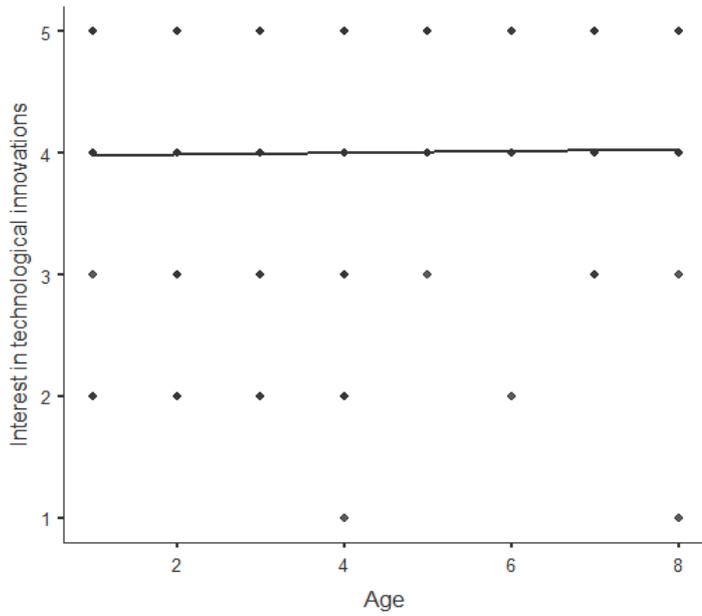


Figure 11. Scatterplot Illustrating the test of H2b

In H2b, the R is 0.014, R² is 1.83e-4, and the p-value is 0.85. It means that there is no correlation between the variables, and age is not suited to predict the degree of interest in technology. It is not what our hypothesis nor the literature suggested, which is why we will reject this hypothesis.

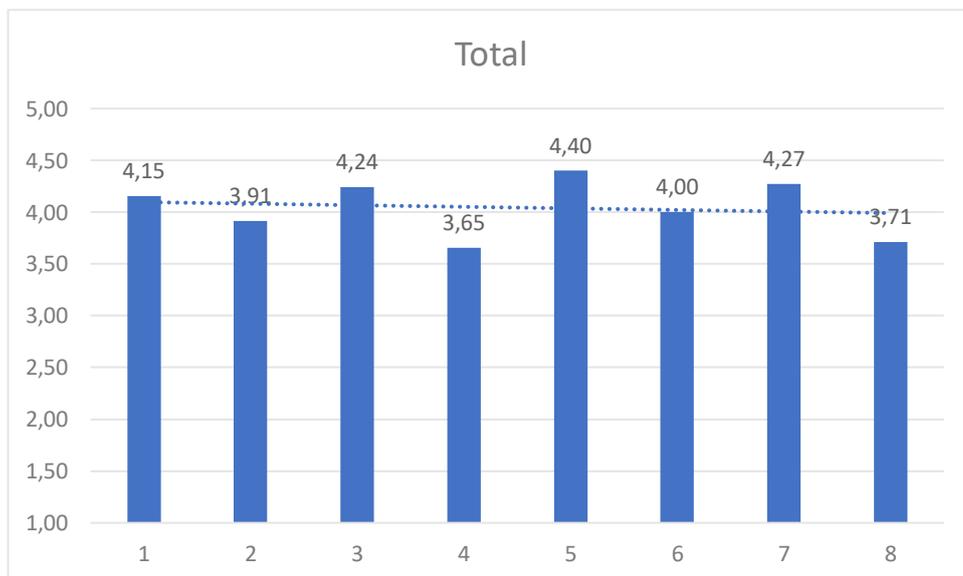


Figure 12. Average interest in technological innovations by age groups

There might be several reasons for this. Potential reasons are that the respondents who wanted to participate in the questionnaire found the subject interesting. The survey was also distributed on social media, and the data collection lasted only one day. According to Tilastokeskus (2019), internet use starts to decrease from the age group 45-54 upwards, which increases the chance that an older participant is also more interested in technology or social media than the mean of their age group. The online data collection method to collect the data through social media can be flawed if only friends and similar-minded people answer the survey (Adams et al., 2013, p. 130). It could have caused why the data in this thesis does not follow the same pattern as in the general population.

Age	Uses the internet	Uses the internet several times a day
16-24	100	97
25-34	100	96
35-44	100	97
45-54	98	90
55-64	96	82
65-74	80	57
75-89	41	23

Table 12. Own illustration of Internet usage and age. Tilastokeskus (2021)

H3a: People with families are more concerned about the technology’s possible health effects.

H3b: People who think they know more about 5G than others are less afraid of the technology’s possible health effects.

H3c: People who work in IT are less afraid of the technology’s possible health effects.

5G radiation
health
concerns

5G radiation health concerns	Pearson's r	—
	p-value	—
Family status	Pearson's r	0.083
	p-value	0.261

Knowledge about 5G compared to other people who are the same age	Pearson's r	-0.230**
	p-value	0.002
Work in the IT field	Pearson's r	-0.276***
	p-value	< .001

Table 13. H3abc correlations

Model Fit Measures

Model	R	R ²
1	0.311	0.0967

Table 14. H3abc Linear regression - correlation & variance

Model Coefficients - 5G radiation health concerns

Predictor	Estimate	SE	t	p
Intercept	2.510	0.3189	7.87	< .001
Family status	0.188	0.1608	1.17	0.244
Knowledge about 5G compared to other people who are the same age	-0.175	0.0964	-1.81	0.072
Work in the IT field	-0.516	0.2001	-2.58	0.011

Table 15. H3abc Coefficients - 5G radiation health concerns

Collinearity Statistics

	VIF	Tolerance
Family status	1.02	0.976
Knowledge about 5G compared to other people who are the same age	1.29	0.777
Work in the IT field	1.28	0.781

Table 16. H3abc collinearity test

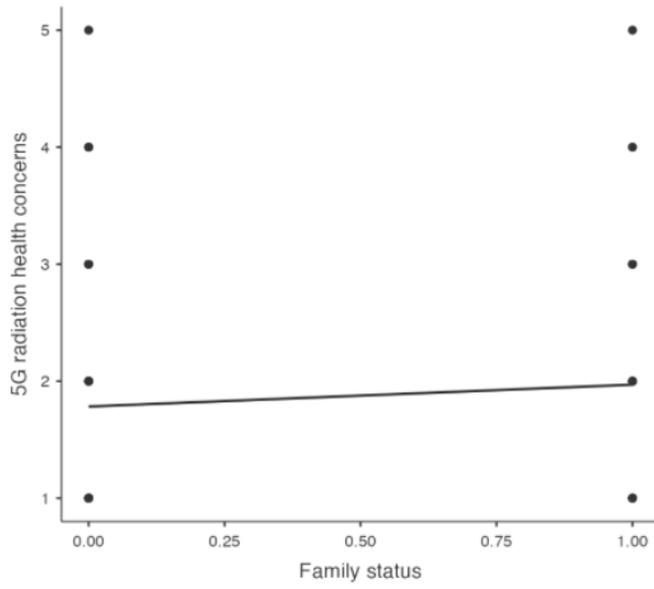


Figure 13. Scatterplot Illustrating the test of H3a

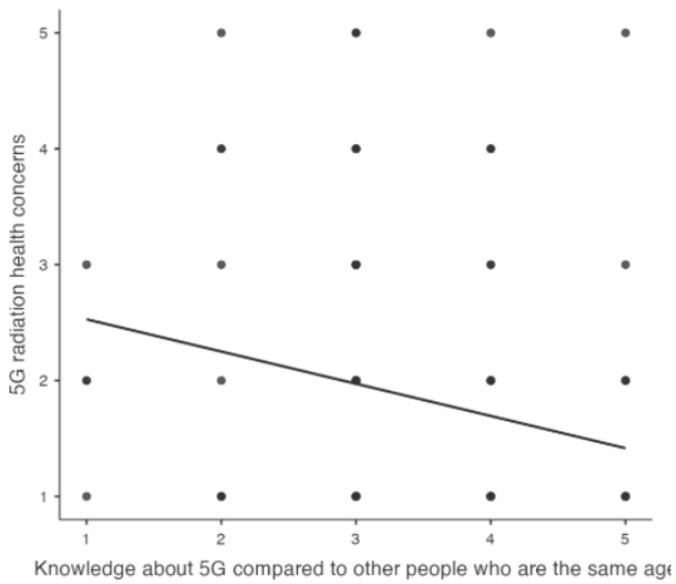


Figure 14. Scatterplot Illustrating the test of H3b

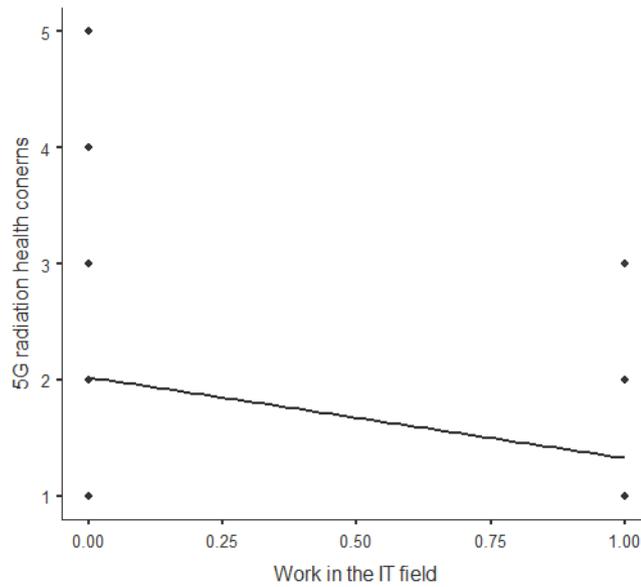


Figure 15. Scatterplot Illustrating the test of H3c

Linear regression was used to conduct the hypotheses test for 3a, 3b, and 3c because all three hypotheses have the same dependent variable. 5G radiation concerns have weak negative correlations with knowledge about 5G ($R = -0.23$ and $p\text{-value} = 0.002$) and work in the IT field ($R = -0.28$ & $p\text{-value} < 0.001$) but not with the family status ($R = 0.08$ & $p\text{-value} = 0.26$). Hypothesis 3a was rejected, but the H3b and H3c are accepted. The linear multiple regression model shows that the model improves when the covariates *Work in the IT field* and *Knowledge about 5G compared to other people the same age* are put together, but the second coefficient is not significant because the two coefficients are correlated with each other. We will consider the variable *Knowledge about 5G compared to other people the same age* redundant and remove it. Instead, we looked at how gender affected 5G radiation concerns because the literature suggested that females are more risk-averse than men, and our correlation matrix-supported this claim. We tested only males and females and found a significant positive correlation with 5G radiation concerns and Gender ($R = 0.29$ & $p\text{-value} = < 0.001$). Gender was also negatively related to the *Knowledge about 5G compared to other people the same age*. Gender was added in the linear multiple regression, and it improved the model. The covariates *Work in the IT field* and Gender are together more correlated to 5G radiation concerns ($R = 0.37$, $R^2 = 0.14$ & $p\text{-value} < 0.001$).

4.5 Empirical findings

RQ2a: What influences consumers' interest in 5G technology?

We started by making a correlation matrix with *Change in interest in 5G over time* as the independent variable and all other questions as dependent variables and removed all p-values higher than 0.05.

		Change in interest in 5G over time
Change in interest in 5G over time	Pearson's r	—
	p-value	—
Interest in technological innovations	Pearson's r	0.294***
	p-value	< .001
Knowledge about 5G compared to other people who are the same age	Pearson's r	0.27***
	p-value	< .001
Able to spend on technology compared to others who are the same age	Pearson's r	0.158*
	p-value	0.031
Plans to upgrade to 5G	Pearson's r	0.231**
	p-value	0.001
The importance of a fast-speed Internet connection	Pearson's r	0.403***
	p-value	< .001
The importance of a low latency	Pearson's r	0.178*
	p-value	0.015
First time when heard about 5G	Pearson's r	0.163*
	p-value	0.026
5G has been a success thus far	Pearson's r	0.551***
	p-value	< .001
Information leak concerns with 5G technology	Pearson's r	-0.147*
	p-value	0.044
5G radiation health concerns	Pearson's r	-0.313***
	p-value	< .001
5G radiation affects the birds' or insects' sense of direction	Pearson's r	-0.255***
	p-value	< .001
5G reduces the human body's resistance to the coronavirus	Pearson's r	-0.258***
	p-value	< .001

***: $p < 0.001$ (Significant at 99.9% confidence level)

** : $p < 0.01$ (Significant at 99% confidence level)

*: $p < 0.05$ (Significant at 95% confidence level)

Table 17. RQ2a - Significant correlations with question “change in interest in 5G over time”

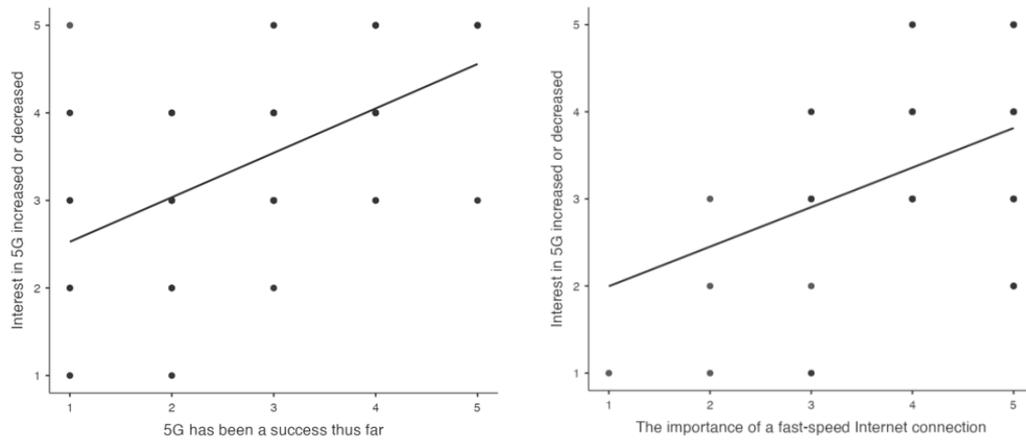


Figure 16. RQ2a - Scatterplot illustrating the highest correlations

The results show that the following factors have the highest correlation with the consumer's interest in 5G positively and negatively.

Increased interest:

1. *5G has been a success thus far* (0.55)
2. *The importance of a fast-speed Internet connection* (0.4)
3. *Interest in technological innovations* (0.29)
4. *Knowledge about 5G compared to other people who are the same age* (0.27)

Decreased interest:

1. *5G radiation health concerns* (-0.31)
2. *5G reduces the human body's resistance to the coronavirus* (-0.26)
3. *5G radiation affects the birds' or insects' sense of direction* (-0.26)

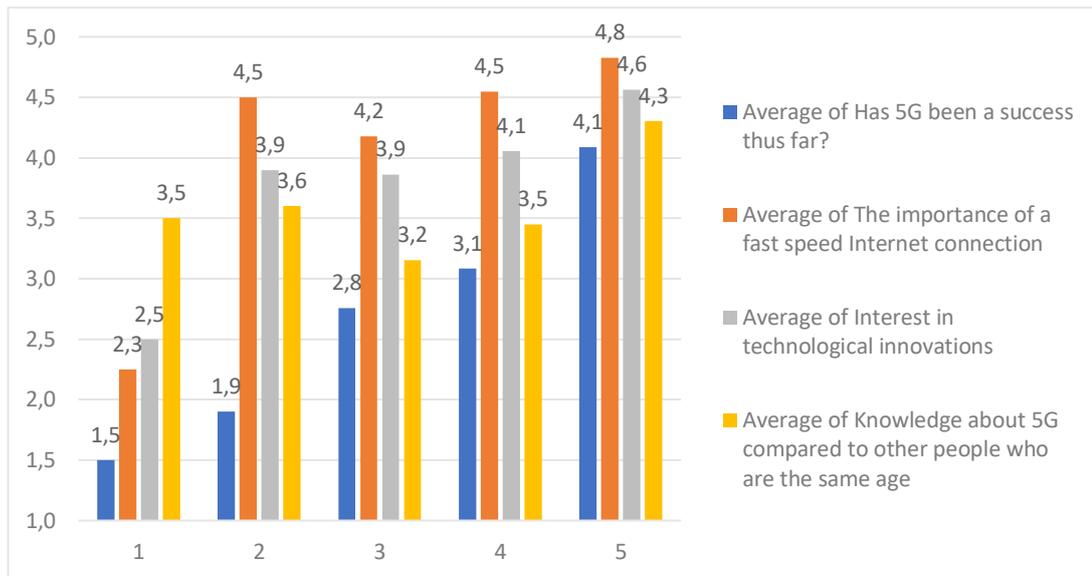


Figure 17. RQ2a - Interest in 5G increased over time (1= decreased a lot & 5= Increased a lot)

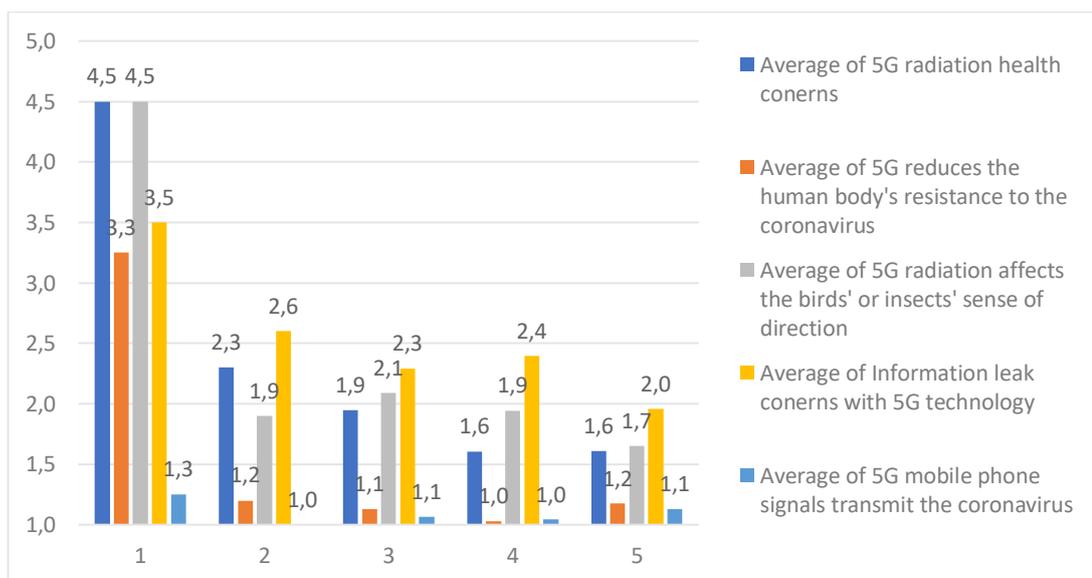


Figure 18. RQ2a - Interest in 5G decreased over time (1= decreased a lot & 5= Increased a lot)

Change in interest in 5G over time had the highest correlation with *5G has been a success thus far*. The two questions are pretty similar, so it is not surprising that those are highly correlated. It still offers valuable information to the RQ2a, and it is plausible that people who view the technology as a success are also more interested in it. The moderate correlation with *The importance of a fast-speed Internet connection* is not surprising either because a fast Internet connection is one of 5G's essential missions.

The interest of and knowledge about 5G were also positively correlated. The concerns about the technology affect the interest negatively. These will be discussed more in the analysis of research question 2b.

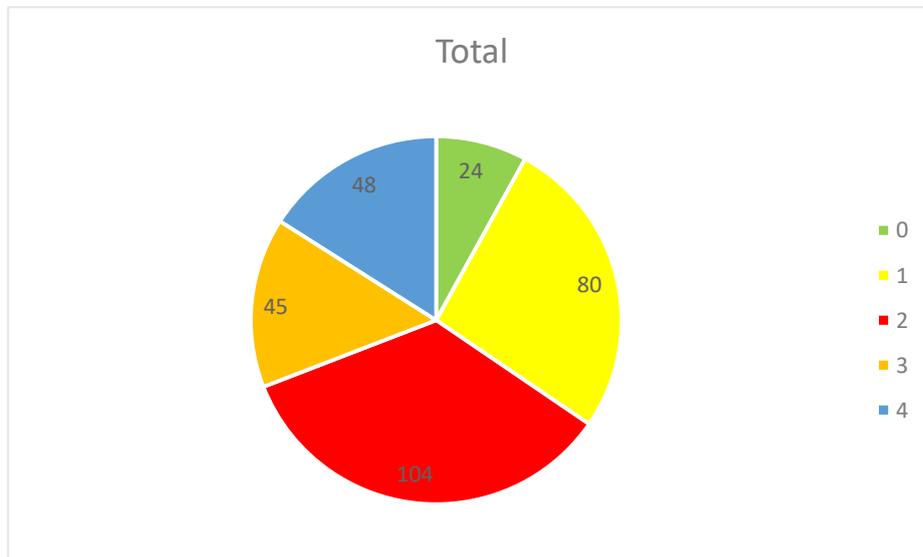


Figure 19. RQ2a - What would make the participants more interested in 5G

0. Nothing	(24 / 181)
1. Cheaper subscriptions	(80 / 181)
2. Larger network coverage	(104 / 181)
3. Battery life	(45 / 181)
4. New applications that require 5G to work	(48 / 181)

104 (57.5 %) participants thought they would be more interested in 5G if the network coverage would be more extensive. It was seen as the most important thing to improve to get consumers more interested in 5G. Cheaper subscriptions with 80 (44.2 %) votes were seen as the second most impactful factor to increase the technology's interest. New applications that require 5G to work came third with 48 votes (26.5%), and only 45 (24.9%) participants thought a better battery-life for the mobile devices would make them more interested. 24 (13.3 %) participants did not think any of these would make them more interested in 5G. Six answers were excluded because of no knowledge of what 5G is.

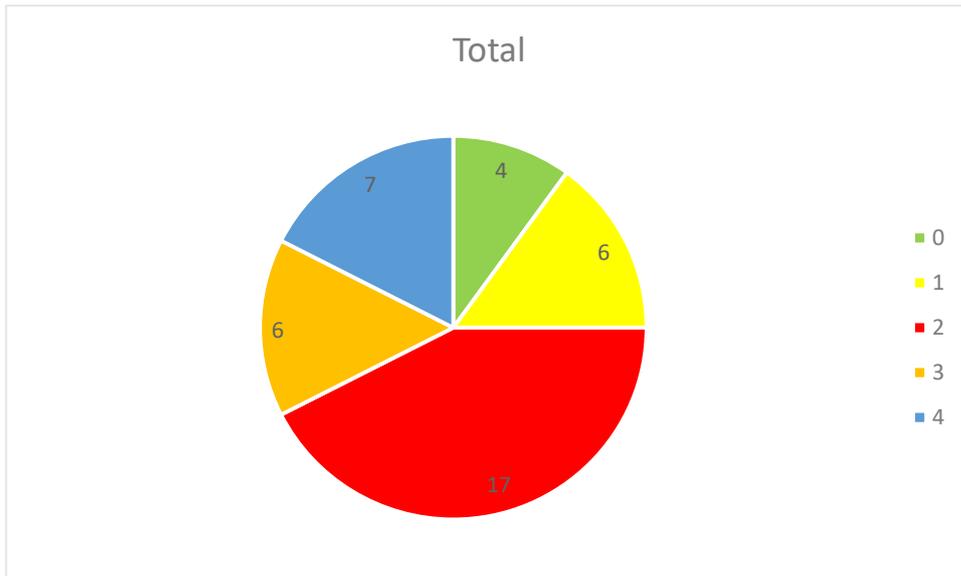


Figure 20. RQ2a - Participants who have adopted the technology

0. Nothing	(4 / 25)
1. Cheaper subscriptions	(6 / 25)
2. Larger network coverage	(17 / 25)
3. Battery life	(6 / 25)
4. New applications that require 5G to work	(7 / 25)

When looking at people who already have experience of 5G, the shares are pretty similar, with the exception of *Cheaper subscriptions* and *Larger network coverage*. Out of 25 people who own a 5G mobile device and a 5G subscription, 17 (68.0%) participants think a more extensive network coverage would make them more interested. New applications that require 5G to work came second with 7 (28.0%) votes. Cheaper subscriptions and Battery life for mobile devices shared the last place with 6 (24.0%) votes each. A much smaller share of the participants who already use 5G does not think the subscriptions are too expensive, and the share of those who would want it to be cheaper fell from 44% to 24%.

RQ2b: What explains consumers' health concerns related to 5G?

We started by making a correlation matrix with *5G radiation health concerns* as the independent variable and all other questions as dependent variables. We then removed

all p-values with a p-value lower than 0.05. Gender correlated with the 5G radiation health concerns, so the two participants who answered “other” were removed from the equation.

		5G radiation health concerns
5G radiation health concerns	Pearson's r	—
	p-value	—
Gender	Pearson's r	0.274***
	p-value	< .001
Interest in technological innovations	Pearson's r	-0.501***
	p-value	< .001
Work in the IT field	Pearson's r	-0.273***
	p-value	< .001
Play video games	Pearson's r	-0.258***
	p-value	< .001
Knowledge about 5G compared to other people who are the same age	Pearson's r	-0.243**
	p-value	< .001
Able to spend on technology compared to others who are the same age	Pearson's r	-0.173*
	p-value	0.019
Plans to upgrade to 5G	Pearson's r	-0.240***
	p-value	< .001
The importance of a fast-speed Internet connection	Pearson's r	-0.353***
	p-value	< .001
The importance of a low latency	Pearson's r	-0.161*
	p-value	0.029
First time when heard about 5G	Pearson's r	-0.191**
	p-value	0.009
Change in interest in 5G over time	Pearson's r	-0.314***
	p-value	< .001
5G has been a success thus far	Pearson's r	-0.229**
	p-value	0.002
The price of 5G subscriptions	Pearson's r	0.190*
	p-value	0.010
Concerned about 5G draining the phone battery fast	Pearson's r	-0.175*
	p-value	0.018
Information leak concerns with 5G technology	Pearson's r	0.516***
	p-value	< .001
5G radiation affects the birds' or insects' sense of direction	Pearson's r	0.674***
	p-value	< .001
5G mobile phone signals transmit the coronavirus	Pearson's r	0.279***
	p-value	< .001
5G reduces the human body's resistance to the coronavirus	Pearson's r	0.426***
	p-value	< .001

***: $p < 0.001$ (Significant at 99.9% confidence level)
 **: $p < 0.01$ (Significant at 99% confidence level)
 *: $p < 0.05$ (Significant at 95% confidence level)

Table 18. RQ2b - Significant correlations with question “5G radiation health concerns”

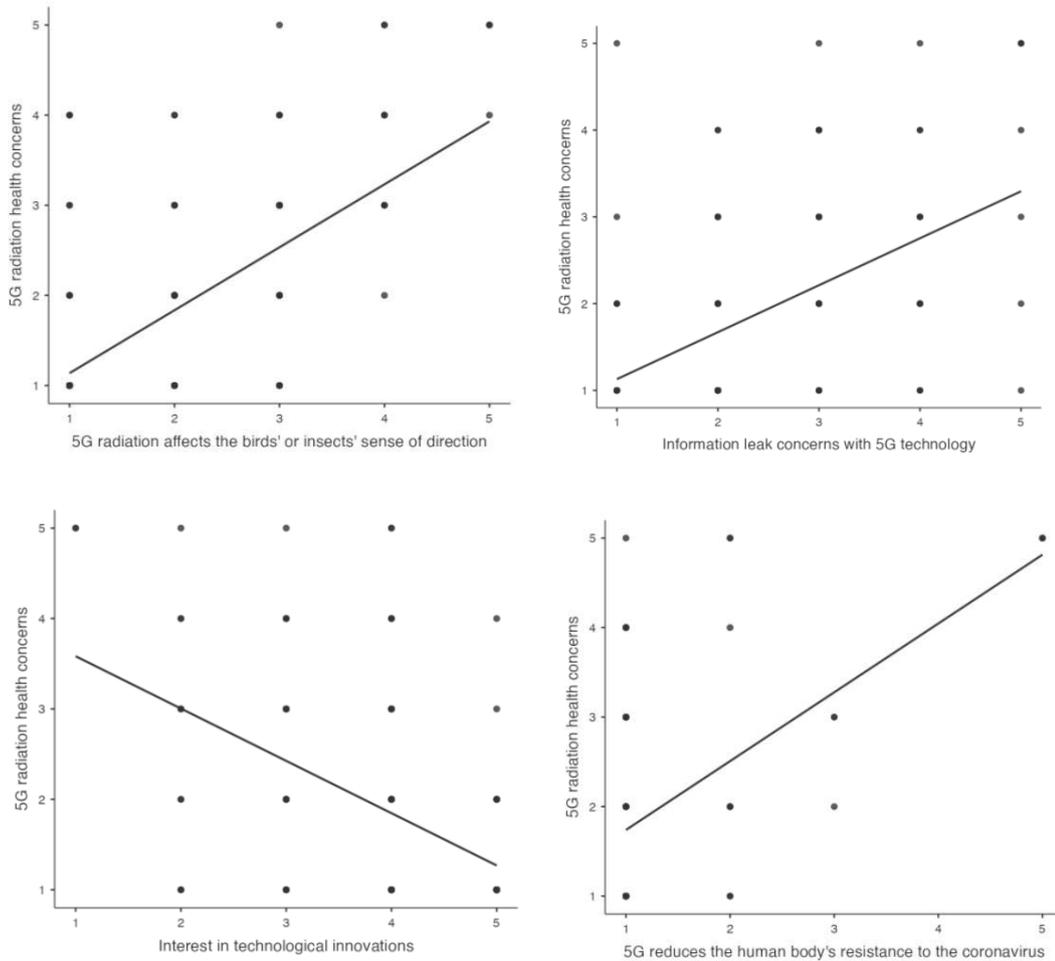


Figure 21. RQ2b - Scatterplot illustrating the highest correlations

The correlation matrix revealed that the following things are related to 5G health concerns:

Increase concerns:

1. *5G radiation affects the birds' or insects' sense of direction* (0.67)
2. *Information leak concerns with 5G technology* (0.52)
3. *5G reduces the human body's resistance to the coronavirus* (0.43)
4. *5G mobile phone signals transmit the coronavirus* (0.28)
5. *Gender (Female)* (0.27)

All 5G concerns except “*Concerned the that 5G will drain the phone battery fast*” significantly correlate with each other. It means that when a participant was concerned about one aspect (health, environmental, or information security), they were more likely to be also concerned about the other factors.

Correlation Matrix

		Information leak concerns with 5G technology	5G radiation health concerns	5G radiation affects the birds' or insects' sense of direction	5G mobile phone signals transmit the coronavirus	5G reduces the human body's resistance to the coronavirus
Information leak concerns with 5G technology	Pearson's r	—				
	p-value	—				
5G radiation health concerns	Pearson's r	0.526***	—			
	p-value	< .001	—			
5G radiation affects the birds' or insects' sense of direction	Pearson's r	0.467***	0.649***	—		
	p-value	< .001	< .001	—		
5G mobile phone signals transmit the coronavirus	Pearson's r	0.222**	0.274***	0.310***	—	
	p-value	0.002	< .001	< .001	—	
5G reduces the human body's resistance to the coronavirus	Pearson's r	0.198**	0.418***	0.444***	0.545***	—
	p-value	0.007	< .001	< .001	< .001	—

Note. * p < .05, ** p < .01, *** p < .001

Table 19. RQ2b - Concerns correlation matrix

Decrease concerns:

1. *Interest in technological innovations (-0.5)*
2. *The importance of a fast-speed Internet connection (-0.35)*
3. *Change in interest in 5G over time (-0.31)*
4. *Work in the IT field (-0.27)*
5. *Play video games (-0.26)*
6. *Knowledge about 5G compared to other people who are the same age (0.24)*

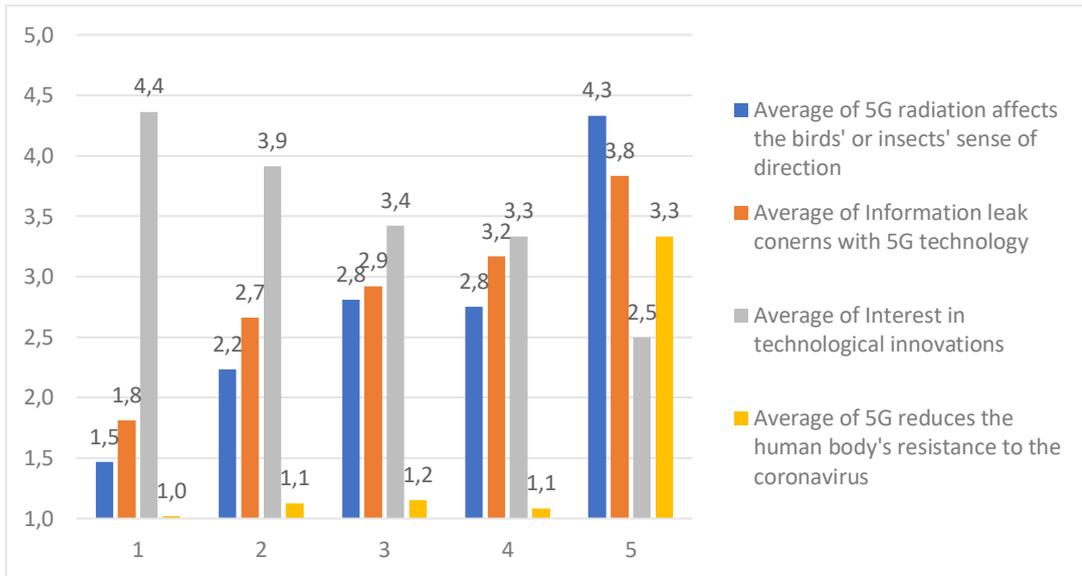


Figure 22. RQ2b - 5G radiation health concerns (1= Not at all concerned & 5= Very concerned)

The graph above illustrates the four most significant correlations with the 5G health concerns. The graph is very linear and shows how the decrease in interest in technological innovations increases the concerns towards 5G.

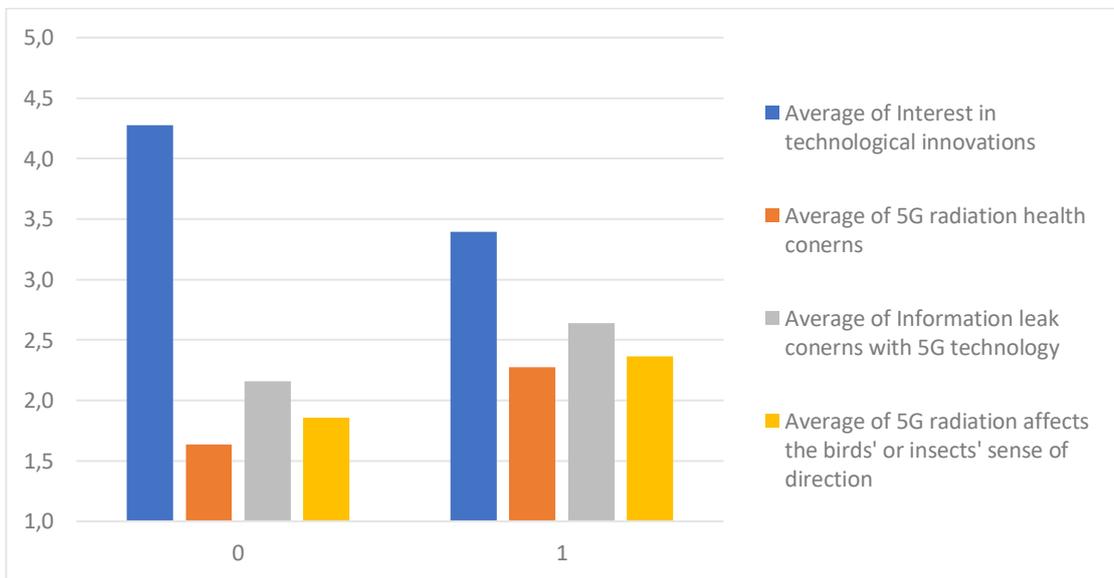


Figure 23 – RQ2b - Gender differences

Females are more concerned about 5G compared to males. The empirical data would indicate that it has to do with women having a lesser interest in technological innovations. However, the literature suggests it has something to do with women being

more risk-averse than men. It is plausible that several other factors also influence these results. This thesis will not further elaborate on the causes of differences in technological interest between genders.

4.6 Qualitative insights

Although this thesis uses a quantitative research method to study consumer reactions towards 5G in Finland, the study participants were given the possibility to add a comment about other concerns about the technology in an optional text field at the end of the survey. After excluding the 12 “no/nope”-answers, 26 participants out of all 187 chose to write valuable comments. The comments touched upon several themes.

Seven central themes were identified from the qualitative comments:

1. Coverage concerns
2. Costs of 5G (roll-out and subscriptions)
3. Privacy concerns
4. Performance concerns
5. Concerns towards people who do not understand the technology
6. Consumer 5G is a useless technology
7. Health concerns

Six of the participants mentioned that the 5G coverage is an issue. There were doubts about 5G replacing WiFi because the 5G signals are poor at penetrating objects between the base station and a 5G device.

Teleoperators have been talking about 5G for such a long time without even having a product or solution to sell. This has diluted the population's belief towards the concept. The roll-out has been super slow and favors major cities. This will cause a division between rural and urban folks. Idiotic conspiracies have an outstanding impact on generating fears about the technology, as the technology companies themselves are very bad at explaining how the networks operate and that they're safe. MAKE IT SIMPLE, MAKE IT ACCESSIBLE.

Five of the participants were concerned about the costs of the 5G roll-out and how it affects the subscription prices. Some believe the subscriptions will become cheaper once the technology becomes mainstream.

It requires huge investments from ISP's (Internet service providers) to their network to provide people 5G effectively. The money has to come from somewhere... Lay-offs? Consumers might not need it just yet, but it is good to offer 5G to businesses as it might drop costs compared to fiber connections. Also, are the ISP's too pressured or worried about providing the connections, and it might impact how well they are backed up? E.g., if a crucial node goes down, are there enough backup devices? (Using 4g instead of 5g in case of possible problems).

Four participants who commented on the last question had some privacy concerns about the 5G technology, such as information leaks and the large companies knowing their location and gathering information about their behavior. The Chinese multinational technology company Huawei Technologies Co., Ltd was mentioned as an example.

I've read about contradicting opinions on the matter. These regard radiation from 5G, which I've read may affect our health, but I haven't dug deeper on the matter. I also have a feeling large companies have a better possibility to watch us and the "big brother" syndrome will grow even bigger. Personally, I do not think 5G is necessary in my own life, but I've understood it will help mostly industries and factories. My opinion on 5G is not at least on the positive side.

Performance concerns and concerns towards people who do not understand the technology both received three comments. Three participants also wrote that the technology is still basically useless. The comments about performance concerns and the comments about the technology being useless for consumers were partially overlapping.

Performance:

We still miss standalone networks & lower latency and faster upload speeds. Currently 5G is just bit better than 4G and coverage is quite poor.

Useless technology:

In my opinion it's part of the tech-utopian narrative and besides being a valid technology, it lacks actually useful applications for the good of humanity.

People who do not understand the technology:

I'm concerned about what people do when they believe different kinds of stories about 5G being harmful. People have no idea what kind of frequencies consumer-used 5G uses (compared to WiFi or Bluetooth) yet still burn down 5G transmitters.

Two participants wrote about their health concerns about 5G. One participant stood out with her comment, indicating that she has read some alternative facts about 5G.

5G will cause increased health problems, e.g., cancers and infertility. It will also destroy nature and its animals. The 5G project should be suspended immediately.

5. Conclusions

The previous chapter results are interpreted, and a general conclusion is formed in this chapter, followed by a discussion including the opportunities and challenges of 5G in Finland. The theoretical and practical implications are then presented, and the chapter concludes with a discussion of the limitations of the thesis and suggestions for further research.

5.1 General Conclusion

This section reviews the research questions and their answers and then uses this insight to explain how the thesis's aim has been fulfilled.

The existing literature was used to answer research question 1: How is consumer adoption of technology related to market shaping?

Market shaping is intended to improve a current market or create an entirely new one. Random occurrences shape markets, but markets can also be shaped and designed deliberately. Companies try to understand their customers' wants and needs to create, access, deploy, combine, and exchange resources to create shared value for all stakeholders (Nenonen et al., 2020, p. 277). On the market actor level, changes in market-shaping efforts can be seen in products and prices, customers and product use, channels, supply-side networks, and representations and norms in the society (Nenonen et al., 2020, p. 279). In the case of 5G, market-shapers are trying to improve the current market by introducing enhanced mobile technology. Technology adoption and non-adoption models help understand what actor-level changes are essential for consumer technology adoption. According to TAM, the fundamental factors of consumer technology adoption are the perceived usefulness and effortlessness of use (Davis & Venkatesh, 1996, pp. 20–21). According to DIT, a consumer considers a product's relative advantages, complexity, compatibility, observability, and trialability (Lee et al., 2011, p. 124). MIR conceptualizes the consumer's psychological tendencies for innovation resistance (Lee, 2012, p. 13). Perceived risks, such as privacy risks, performance risks, physical risks, and financial risks, can negatively affect technology adoption (Featherman & Pavlov, 2003, p. 454).

The analysis of the empirical data for research question 2a (What influences consumers' interest in 5G technology?) resulted in various findings, some of which are exciting and unexpected. First, the data show that the way a consumer views the technology affects their interest in it. Also, a consumer's need for a high-speed Internet connection significantly influences consumers' interest in the technology. Surprisingly, low latency, which is another essential feature of the technology, was barely correlated with interest in 5G. Low latency may become a more significant factor when other technologies that require low latency, such as autonomous driving, become more prevalent. Interest in technological innovations and knowledge about 5G were also positively correlated with the 5G interest. This correlation would be in line with Dedehayir et al.'s proposition that businesses should target consumers with more prior knowledge, special technical skills, and a robust social network when launching new products and services (2017, p.14). Another noteworthy finding is that there was no correlation between age and interest in technological innovations or 5G. This finding contradicts the common belief that younger consumers would be more interested. Several concerns were negatively correlated with interest in 5G. A minority of the participants of this study are sincerely concerned about several matters, including conspiracy theories that 5G reduces the human body's resistance against Covid-19. We dug deeper into the concerns included in research question 2b: What explains consumers' health concerns related to 5G?

In the multiple-choice question of this study, almost 60% of the participants thought they would be more interested in 5G if the network coverage were more extensive, followed by 45% if they had access to less expensive subscriptions. Other less important aspects were the existence of innovative applications that require 5G to work (26.5%) and better battery life for mobile devices (24.9%). Of the participants, 13.3% did not think any of these changes would make them more interested in 5G. This distribution is similar to that of people who already have experience with 5G, except for the incentives of less expensive subscriptions and more extensive network coverage. The most significant change by far was the more extensive network coverage, with 68% of participants choosing this option. Other less important factors were the development of new applications that require 5G (28.0%). Less expensive subscriptions and battery life for mobile devices were seen as the least important factors (24.0% each). Participants who already use 5G are less price-sensitive than

those who have not adopted the technology, with the share of those wanting the technology to be less expensive falling from 44% to 24%. This finding is in line with Schneir et al.'s proposition that early adopters are intensive users who are the least price-sensitive and the most likely to use the unlimited data packages that mobile network operators (MNO) have started to offer in recent years (2019, p. 10).

Our analysis of RQ2b suggests that the most significant correlations with 5G health concerns were environmental concerns and information leak concerns. The concern with the 5G radiation affecting birds' or insects' sense of direction was significantly correlated with health concerns. Sufficient real-life studies about the effects of radiation on the environment are still limited in this early stage. The long-term environmental effects of 5G, as a novel technology, are still unknown. However, we know that the technology will have at least some adverse environmental impacts because of the plenitude of new devices and new infrastructure required and the extensive amount of energy required to support and maintain the development. Various recent studies have suggested that consumers are becoming more conscious about the environment and pushing for sustainable solutions, so 5G might not fit this vision well.

This study has shown that information leaks related to 5G are a valid concern due to the abnormal increase in services and devices. Security solutions are needed for the various threats and vulnerabilities brought by the new technology. Surprisingly, the perception that 5G reduces the human body's resistance to Covid-19 was only moderately correlated with health concerns. This is purely a conspiracy theorist's proposition with no scientific proof, but the empirical data of this study confirms the existence of a minority in Finland who believe it. Women were more concerned about the technology's health effects, supporting Grazier's & Sloane's proposition that women are more risk-averse than men (2006, p. 21).

The factors negatively correlated with 5G health concerns were interest in technological innovations, regarding high-speed Internet connection as important, change in interest in 5G over time, work in the field of IT, playing video games, and knowledge about the technology. It can be presumed that consumers who know more about 5G technology score higher in the variables mentioned above due to their perceived usefulness of 5G, which is in line with Lee's studies on the factors affecting

consumers' decision-making regarding the adoption of smart TVs (2012, p. 12). The results indicate that a person's attitude toward innovations plays an essential role in affecting the perceived ease of use and perceived usefulness of a new product.

RQ3: Given consumers' attitudes to 5G, how should actors shape the 5G market? Several actors are shaping 5G markets, including Ericsson, Nokia, and Huawei, the leading companies producing 5G network equipment, such as base stations. These three companies (and others with a smaller market share) are trying to win deals with operators worldwide. Some operators can freely choose which equipment supplier to use, but Chinese suppliers, such as Huawei, are prohibited in many countries. Huawei and the Chinese government could be a part of the reason for information leak concerns. Governments may be trying to decrease this perceived risk by imposing restrictions on the use of Chinese technology in their domestic infrastructure. Several other significant actors are shaping the market, such as companies building chips that help 5G work, content creators, and device manufacturers. The literature identified seven perceived risk dimensions that might affect technology adoption: financial, performance, safety, time, social, and psychological loss (Cunningham, 1967, as cited in Featherman & Pavlou, 2003, p. 454), as well as privacy risk (Featherman & Pavlov, 2003, p. 454). The empirical data from this thesis indicate that consumers perceive several risks of these risks with 5G, including privacy, financial, performance, and physical risks. Market actors must mitigate these risks to increase trust in 5G products and services.

The empirical results of this thesis indicate that more extensive network coverage is the most critical factor for consumers who have not yet adopted the technology and that it is even more important to consumers who have already adopted the technology. Finland needs an extensive 5G network for the technology to reach its full potential. However, it is costly to do so in a relatively large country by area with a small and dispersed population. The price of a 5G subscription is the second most crucial factor for those who have yet to adopt the technology, which might be troublesome for operators trying to get returns on their huge investments in 5G. The existence of new applications that require 5G to work and better battery life for 5G devices were also important factors for consumers who had already adopted and those who had yet to adopt the technology.

5.2 Managerial implications

Some recommendations and managerial implications can be formed based on an evaluation of previous research results and the empirical findings of this study. The results may not be statistically generalizable to the entire Finnish population. However, the sample population of 187 provides extensive insight into the experiences and opinions of the early stages of 5G in Finland. There was no correlation between the participants' age and their interest in technological innovations or 5G in particular. This finding is exciting and noteworthy because it implies that older consumers can be very interested in technology and thus should not be overlooked by companies trying to engage in market shaping.

5G is a breakthrough that could unleash various disruptions within the massive 5G IoT ecosystem. 5G could transform nearly every industry imaginable. The benefits for consumers include improved video live streaming, augmented reality, autonomous cars, and gaming experience, to name a few. Still, in the eyes of many, 5G has been simply an additional feature on flagship mobile devices thus far. Trying to justify higher prices to consumers today for the potential future benefits of this technology is challenging. Consumers will most likely pay less for both devices and subscriptions in the future when 5G supported services and applications are a reality. It seems that actors are moving in the right direction because the 5G phones are getting less expensive, coverage is getting better, and speeds are expected to get faster.

Prohibition, direct fight, and indirect actions are three approaches suggested to fight conspiracy theories about 5G. Indirect actions mean that a state would ensure that people can interpret media and think critically and that the scientific community's views get enough publicity (Räikkä & Ritola, 2020, pp. 7–8). 5G actors could engage governments, and together, they could build a scientific platform on which people with diverse views can have public debates, thus reducing the appeal of conspiracy theory echo chambers online.

5.3 Limitations

The results of the study have certain limitations that need to be addressed. The population of the study is too small to be credibly generalized to the entire Finnish

society. The snowball sampling method is not optimal because at least some participants do not represent a random sample, which may produce biased results. The participants' geographic scope could have been greater because nearly 70% of the participants lived in four Finnish cities. Most of the participants were 18 to 55 years old, and only seven of the participants were between 56 and 80 years old, which is not enough to enable credible generalization. With the limited amount of time available for the sampling process, the results could also have been affected by society's operations, such as the Christmas holidays during the sampling period. Finally, the quantitative statistical models used in this research determine only correlation and do not consider causation.

5.4 Suggestions for further Research

Due to time constraints, we could not obtain accurate data on long-term consumer reactions to 5G market shaping. We did ask how consumers' views of 5G today compare to their views when they first heard about the technology. 5G is still in its early stages, and the roll-out will continue for years to come, so it would be interesting to measure participants' opinions at a later date. Another consideration for future research is narrowing down the age groups' spread or studying only consumers in specific age groups.

The qualitative insights of this study provided valuable and interesting data, but the information and knowledge that can be extracted from that data are still minimal, so qualitative research into a similar theme would be interesting to read. This thesis covered only the consumer perspective. 5G can transform several industries, so it would be valuable to study how companies have adopted the technology and what kind of impact they believe it will have. Because this thesis studied the consumer perspective, and because 5G is in the early stages, only the mobile communication sphere of operation was considered. Future research could concentrate on 5G's effect on the efficiency of IoT and cloud services.

6. Summary in Swedish – Svensk sammanfattning

Konsumenternas reaktioner på marknadsutformning

- en fallstudie av de tidiga skeden av 5G-mobilnätstjänster i Finland

Introduktion

Den omfattande användningen av datakrävande mobila enheter har kraftigt ökat datatrafiken och inspirerat forskarna att utveckla 5G-nätverksdesign som stöder flera Gbps-hastigheter för att hålla med den ökande efterfrågan på data. 5G erbjuder snabb uppkoppling med låg latens (Anasia D'mello, 2019). 5G har redan fått mycket publicitet i flera år, och över tiden tror många att teknologin är en banbrytare som kommer att förändra människors liv och hur man använder sakernas internet. Det finns ändå några tecken på minskad entusiasm gentemot 5G hos en del av konsumenter.

Syfte och forskningsfrågor

Avhandlingen är en fallstudie som studerar konsumenternas reaktioner på 5G-marknadsutformning i Finland i detta tidiga skede. Finska operatörer var bland de första i världen som introducerade en kommersiell 5G-uppkoppling för sina kunder. Syftet med avhandlingen är att ge en djupare förståelse av hur finska konsumenter uppfattar 5G och hurdana skäl till oro de känner gentemot teknologin. Avhandlingen ger viktig information för olika 5G-aktörer hur 5G-kommunikation tas emot och hurudan kommunikation de borde satsa på för att förhöja adopteringsgraden för teknologin, samt minska oron gentemot 5G. Tillverkare av telekommunikationsutrustning, operatörer och den finska staten är exempel på organisationer som kan ha nytta av denna slutarbeten. Jag har identifierat tre forskningsfrågor med utgångspunkt i syftet som besvaras genom denna avhandling:

- Forskningsfråga 1: Hur är konsumenternas adoption av teknik relaterad till marknadsutformningen?
- Forskningsfråga 2a: Vad påverkar konsumenternas intresse för 5G-teknik i Finland?

- Forskningsfråga 2b: Vad förklarar konsumenternas hälsorelaterade oro för 5G i Finland?
- Forskningsfråga 3: Med tanke på konsumenternas attityder till 5G, hur borde 5G-aktörerna utforma 5G-marknaden i Finland?

Teoretisk referensram och hypoteser

Med hjälp av olika teorier och tidigare studier i teoretiska referensramen, formulerades hypoteser som beskriver hurdana resultat som kan förväntas av denna vetenskapliga undersökning. Enligt Jansson-Boyd (2010, s. 96-97) är annonsering mycket inflytelserik, även om man försöker ignorera den. Konsumenter kan inte observera eller tillägna sig alla reklammöten, men när de anammar en annons, kan det höja efterfrågan på produkter och tjänster upp till 20 gånger.

Mot denna bakgrund presenteras den första hypotesen om hur marknadsutformning har påverkat konsumentintroduktionen av 5G i Finland enligt följande:

H1a: Konsumenternas adoption av 5G kommer att vara positivt relaterad till deras medvetenhet om 5G-relaterade annonser.

Individernas olika personligheter, attityder och motiv filtrerar viss information. Endast information som är relevant för oss anammar vi, medan den onödiga informationen filtreras (Khan, 2006, s. 28). Detta leder vidare till nästa hypotes:

H1b: Konsumenternas intresse för teknik är positivt relaterat till deras medvetenhet om 5G-relaterade annonser.

Enligt DedeHayir et al. (2017, s.14) gynnas företag av att koncentrera sig på konsumenter med förkunskaper, speciella tekniska färdigheter och ett robust socialt nätverk när de lanserar nya produkter och tjänster. Människor som arbetar inom IT passar beskrivningen eftersom de är bekvämare med att använda tekniska innovationer som även kan förbättra deras jobbprestanda. Mot denna bakgrund följer nästa hypotes:

H2a: Människor som arbetar inom IT-området är mer intresserade av tekniska innovationer.

Yngre människor accepterar ny teknik lättare jämfört med äldre människor, och skillnaden är mer betydelsefull på kort sikt än på lång sikt (Morris & Venkatesh 2000, p. 392). Följande hypotes bygger på detta:

H2b: Ungdomar är mer intresserade av tekniska innovationer.

Mot bakgrund av den oro som är förknippad med 5G-tekniken, och som i stor utsträckning diskuterats i den offentliga diskussionen (även om en stor del har blivit avslöjat som myter), följer tre hypoteser om dess effekt på konsumenter:

H3a: Människor med familjer känner mera oro över teknikens möjliga negativa hälsoeffekter.

H3b: Människor som arbetar inom it känner mindre oro över teknikens möjliga negativa hälsoeffekter

H3c: Människor som vet mera om 5G känner mindre oro för teknikens möjliga negativa hälsoeffekter.

Metod, datainsamling och analys av data

Eftersom avhandlingen undersöker konsumenters uppfattningar om 5G-marknadsutformning i Finland valdes en kvantitativ forskningsmetod. Denna avhandling faller under tvärsnittsdesign eftersom svaren samlades in vid en viss tidpunkt och respondenterna klassificerades i olika kategorier (Adams, 2013, s.69). I denna studie klassificerades respondenterna baserat på olika generationer och deras kön och attityd gentemot 5G. Litteraturen och forskningsmetoder granskades grundligt innan urvalet. De primära dataresultaten organiserades noggrant och analyserades för att säkerställa studiens giltighet. Datainsamlingen gjordes genom ett anonymt frågeformulär som skapades med Google Forms för att samla in data. Frågeformuläret var anonymt för att deltagarna inte skulle vara rädda att svara sanningsenligt, eftersom vissa av frågorna kunde betraktas som känsliga. Microsoft Excel för Office 365 MSO 32-bit och Jamovi 1.6.18 användes i varje statistisk analys i denna avhandling. Uppgifterna extraherades från Google-formuläret till Microsoft Excel. I Excel rensades och bearbetades data som en förberedelse för analyserna. Totalt deltog 194 respondenter i studien. Svaren av 7 respondenter utelämnades på grund av att de var ogiltiga. Av de 7 respondenternas svar togs 6 bort eftersom deltagaren bodde

utomlands och den sista svar var en kopia och den togs därmed bort. Det totala bearbetade samplet var 187. De två deltagarna som inte avslöjade sitt kön ingår i samplet, men kommer inte att beaktas när de två könen analyseras. Hypoteserna 2b och 3a avvisades, medan de andra hypoteserna passade antagandena och var godkända.

Resultat

Analysen av forskningsfråga 2a antyder att företagen använder marknadsutformning för att påverka marknadsutvecklingen och för att orsaka en beteendeförändring hos konsumenterna genom att ifrågasätta deras föreställningar. Inom 5G-området försöker företagen förbättra den nuvarande marknaden genom att utveckla en förbättrad teknik. Syftet är att skapa en marknad för tekniken och få potentiella kunder att använda tekniken. En framgångsrik marknadsutformningsstrategi leder till en högre adoptionsgrad av teknik hos konsumenterna, vilket är hur de två termerna är relaterade.

Analysen av forskningsfråga 2b antyder att de viktigaste korrelationerna med hälsoeffekter av 5G-mikrovågsstrålning är teknologins miljöeffekter och oron över informationssäkerheten. Oron över 5G-mikrovågstrålningens hot mot insekter och fåglar korrelerade signifikant med den potentiella negativa hälsoeffekten. Studier om hälsoeffekterna är begränsade i detta tidiga skede och de långsiktiga miljöeffekterna är okända. Tekniken kommer definitivt ha viss negativ miljöpåverkan på grund av produktionen av de enorma antalet nya enheter och den omfattande mängd energi som krävs för att stödja och upprätthålla utvecklingen.

Forskningsfråga 3: Hur borde 5G-aktörerna forma 5G-marknaden med tanke på konsumenternas attityder till 5G? Flera aktörer formar 5G-marknaderna. Ericsson, Nokia och Huawei är de dominerande företagen inom produktion av 5G-nätverksutrustning. Dessa tre företag (och andra företag med en mindre marknadsandel) försöker vinna över affärer med operatörer över hela världen. Vissa operatörer kan fritt välja vilken utrustningsleverantör de vill använda, medan i många länder är Huawei och andra kinesiska leverantörer förbjudna.

De empiriska resultaten indikerar att ett omfattande mobilnätverk är den viktigaste faktorn för konsumenter som inte ännu tagit i bruk 5G och är ännu viktigare för konsumenter som redan tillägnat sig teknologin. Man borde utveckla ett omfattande 5G-nätverk, även om det är dyrt att bygga 5G i Finland, som är ett relativt stort land med en liten och decentraliserad befolkning. Priset på ett 5G-abonnemang är den näst

viktigaste faktorn för dem som ännu inte använder teknologin, vilket kan vara besvärligt för operatörerna som försöker få in avkastning på deras stora investeringar i 5G. Nya applikationer som skulle kräva 5G för att fungera och en bättre batteritid (hur länge en enhet fungerar innan den måste laddas) för 5G-enheter var också viktiga faktorer för alla konsumenterna.

Diskussion och avslutning

5G är ett tekniskt genombrott som kan möjliggöra en stor mängd av omstörtande innovationer inom det enorma ekosystemet av sakernas internet och omvandla nästan alla tänkbara branscher. Konsumenternas upplevelser t.ex. av direktsändningar, förstärkt verklighet, autonoma bilar och spelupplevelse kan nå en ny nivå. Många har hittills ändå inte upplevt 5G som något annat än en ytterligare egenskap på mobiltelefonernas flaggskeppsmodeller. Det är svårt att motivera varför konsumenterna borde betala extra för en teknik idag för potentiella framtida fördelar. Både mobila enheter och abonnemangen kommer troligtvis vara billigare i framtiden när flera tjänster och applikationer som konsumenterna vill använda bara fungerar med 5G-tekniken. Riktningen är ändå rätt eftersom 5G-telefonerna hela tiden blir billigare, operatörerna satsar mycket på att utöka 5G-mobilnätets täckning och mobilnätets hastigheter blir snabbare.

Förbud, direkta och indirekta motåtgärder är tre metoder som föreslås för att bekämpa konspirationsteorier. Indirekta åtgärder innebär att en stat använder metoder för att säkerställa att människor kan tolka media, tänka kritiskt och att vetenskapssamhällets åsikter får tillräckligt med publicitet (Räikkä & Ritola, 2020, s. 7-8). 5G-aktörerna kunde försöka engagera sig och arbeta tillsammans med staten. Tillsammans kunde de bygga en vetenskaplig plattform där människor med olika åsikter kan ha offentliga debatter och därmed ersätta ekokamrarna i sociala medier som sprider konspirationsteorier om teknologin.

Deltagarnas ålder spelade ingen roll för deras intresse för teknologiska innovationer eller intresse för 5G. Det är spännande och anmärkningsvärt eftersom det innebär att äldre konsumenterna kan vara väldigt intresserade av teknologiska innovationer och därför inte bör negligeras av företag som utför marknadsutformning. Man kan ifrågasätta om avhandlingens statistiska resultat kan generaliseras för hela

befolkningen i Finland eller inte, men ett urvalssampel på 187 ger åtminstone en omfattande inblick i finska konsumenters erfarenheter och åsikter om 5G.

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Appendix

Survey questionnaire

1/11/2021

5G questionnaire

5G questionnaire

* Required

1. Gender *

Mark only one oval.

- Male
- Female
- Other / Prefer not to answer

2. Age *

Mark only one oval.

- 18-25
- 26-30
- 31-35
- 36-40
- 41-45
- 46-50
- 51-55
- 56-60
- 61-65
- 66-70
- 71-75
- 76-80
- 81-85
- 86-90

3. City *

https://docs.google.com/forms/d/16sXphb6FB7m6ElzVLIuta6cD8DmtPaWrq_d2mU6Le0/edit

1/9

4. How many people live in your household? *

Mark only one oval.

- I live alone
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10+

5. How often do you face problems with internet connectivity? *

Mark only one oval.

- Daily
- Weekly
- Monthly
- A few times a year
- I never have problems with internet connectivity

6. How interested are you usually in technological innovations? *

Mark only one oval.

- 1 2 3 4 5
-
- Not interested Very interested

4. How many people live in your household? *

Mark only one oval.

- 1 live alone
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10+

5. How often do you face problems with internet connectivity? *

Mark only one oval.

- Daily
- Weekly
- Monthly
- A few times a year
- I never have problems with internet connectivity

6. How interested are you usually in technological innovations? *

Mark only one oval.

- 1 2 3 4 5
-
- Not interested Very interested
-

7. Do you work in the IT field? *

Mark only one oval.

Yes

No

8. Do you play video games with a PC or a console? *

Mark only one oval.

Daily

A few times a week

Once a week

A few times a month

A few times a year

I do not play video games

9. Do you know what 5G is? *

Mark only one oval.

Yes

No

10. How much do you think you know about 5G when compared to other people who are the same age as you? *

Mark only one oval.

1 2 3 4 5

Much less Much more

11. Does the 5G network cover your household? *

Mark only one oval.

- Yes
 No
 I do not know

12. Do you own a 5G supported device? *

Mark only one oval.

- Yes
 No
 I do not know

13. Do you have a 5G subscription? *

Mark only one oval.

- Yes
 No
 I do not know

14. How much money do you think you are able to spend on technology when compared to other people who are the same age as you? *

Mark only one oval.

	1	2	3	4	5	
Much less	<input type="radio"/>	Much more				

15. When do you plan to upgrade to 5G? *

Mark only one oval.

- I already upgraded
- As soon as the network covers the place where I live
- When my contract period ends
- Not sure when
- I have no plans for upgrading

16. Do you believe 5g makes Wi-Fi obsolete in the near future? *

Mark only one oval.

- Yes
- No
- I do not know

17. How important do you find a fast speed Internet connection? *

Mark only one oval.

	1	2	3	4	5	
Not important	<input type="radio"/>	Very important				

18. How important do you find a low latency? (Latency=delay (or time) it takes when you e.g click something until the page opens) *

Mark only one oval.

	1	2	3	4	5	
Not important	<input type="radio"/>	Very important				

19. When did you first hear about 5G? *

Mark only one oval.

- 2016 or earlier
 2017-2019
 2020
 I have not heard of it

20. How often have you come across a commercial about 5g? *

Mark only one oval.

- Daily
 A few times a week
 Once a week
 A few times a month
 Monthly
 I have not noticed any commercials

21. Has your interest in 5G increased or decreased over the years? *

Mark only one oval.

	1	2	3	4	5	
Decreased significantly	<input type="radio"/>	Increased significantly				

22. Do you think 5G has been a success thus far? *

Mark only one oval.

	1	2	3	4	5	
Not at all successful	<input type="radio"/>	Very successful				

23. Are the 5G subscriptions expensive in your opinion? *

Mark only one oval.

	1	2	3	4	5	
Very cheap	<input type="radio"/>	Very expensive				

24. Are you concerned the 5G will drain the phone battery fast? *

Mark only one oval.

	1	2	3	4	5	
Very concerned	<input type="radio"/>	Not concerned at all				

25. What should be improved to get you more interested in 5G? *

Check all that apply.

- New applications that require 5G to work
- Larger network coverage
- Cheaper subscriptions
- Battery life of mobile devices
- None of the above

26. How concerned are you about information leaks in 5G technology? *

Mark only one oval.

	1	2	3	4	5	
Not at all concerned	<input type="radio"/>	Very concerned				

27. How concerned are you with the 5G radiation on your or your family members' health? *

Mark only one oval.

1	2	3	4	5	
Not at all concerned	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very concerned

28. Do you believe 5G radiation affects the birds' or insects' sense of direction? *

Mark only one oval.

1	2	3	4	5	
I am certain it has no effect	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I am certain it has an effect

29. Do you believe 5G mobile phone signals transmit the coronavirus? *

Mark only one oval.

1	2	3	4	5	
I am sure they do not	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I am sure they do

30. Do you believe 5G mobile phone signals reduce the human body's resistance to the coronavirus? *

Mark only one oval.

1	2	3	4	5	
I am sure they do not	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I am sure they do

31. Do you have any other concerns regarding 5G?

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