UNIVERSITY OF LJUBLJANA

SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

BUSINESS MODEL DESIGN FOR A FIRM OPERATING IN A SMART HOME MARKET

Ljubljana, August 2021   JAKA KOŠČAK, KARIN MOHAR

AUTHORSHIP STATEMENT

The undersigned Jaka Koščak, a student at the University of Ljubljana, School of Economics and Business, (hereafter: SEB LU), author of this written final work of studies with the title Business model design for a firm operating in a smart home market, prepared under supervision of Associate Professor Matej Černe, PhD.

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LIST OF ABBREVIATIONS

et al. – And others

etc. – Et cetera

e.g. – For example

i.e. – That is

BM – Business model

BMI – Business model innovation

IT – Information technology

AI – Artificial intelligence

5G – fifth generation of cellular networks

SaaS – Software as a service

IoT – Internet of things

ICT – Information communication technology

HR – Human resource

GDP – Gross domestic product

XaaS – Anything as a service

PaaS – Platform as a service

IaaS – Infrastructure as a service

DaaS – Desktop as a service

FIFA – International football organization

UEFA – European football organization

MSP – Multi-sided platform

MOS – Home fair

DOM – Home fair

PC – Personal computer

HAN – Home area network

A/D – Tranformation of data from analog to digital

D/A – Transformation of data from digital to analog

B2B – Business to business channel

B2C – Business to customer channel

EU – European Union

Avg – Average

GE – General Electric company

HBO – streaming service provider

SAP – System Applications and Products

OECD – Organization for Economic Co-operation and Development

CAGR – Compounded annual growth rate

SPSS – Statistical program

St. dev. – Standard deviation

AC – Air conditioning

AAL – Architectural area lighting

B2C – Business to consumer sales channel

B2B – Business to business sales channel

CAGR – Compounded annual growth rate

e-ID – Electronic identification document

PCA – Principal component method

GDPR – General Data Protection Regulation

ECB – European Central Bank

UN – United Nations

PCA – Principal component method

WIPO – World Intellectual Property Organization

INTRODUCTION

Technological advancements over the past 30 years brought a growing interest in building automation and control systems. Energy providers see opportunities in smart energy applications. Telecom, cable and media companies, and hardware and content providers see opportunities for an environment where the home will become an entertainment experience and gaming centre. The growing smart home interest of companies from various industries indicates that the opportunities of the smart home market have not yet been fully seized (Solaimani & Bouwman, 2013). The fast pace of technological developments is forcing smart home companies to rethink their value creation continuously. Cooperation in the smart living domain goes beyond cross-business and industry boundaries. Firms are more and more looking for new opportunities within and beyond their existing business environments and work together with entities from related industries (Casadesus-Masanell & Zhu, 2013)

Over the years, there has been a substantial shift in business strategies brought about by an increasing preference on both businesses and consumers to opt for different kinds of business models. Subscription-based models for a smart living seem to be in demand (Whitler, 2016), sponsored-based models have enabled customers to get products or services free of charge (Casadesus-Masanell & Zhu, 2013), and the number of multisided-platforms has risen in the past decade as they enabled interaction between different customer groups (Hagiu, 2015). Moreover, the circular economy trend pushes companies to reorganise their linear operations and minimise their carbon footprint (Laubscher & Marinelli, 2014). These are but a few business model trends that are reshaping the economy. Microeconomic and macroeconomic environments are continuously evolving along with the competitive arena; as technology evolved, so did business models. While companies make extensive investments for developing new ideas and technologies, they often have little ability to innovate the business models through which these inputs pass (Solaimani & Bouwman, 2013).

The purpose of this master's thesis is to provide insights into opportunities for business model innovation and business model design for firms operating in the smart home market. To accomplish this, the thesis will:

- Define the theoretical background and development of the business model concept, business model innovation process and identify its barriers, enablers, and trends.
- Define the theoretical background and development of the smart home concept.
- Analyse the smart home market and identify its drivers, barriers, trends and other external factors surrounding it.
- Identify consumer preferences and company practices for smart home business models in Slovenia.

The findings gained from investigating the topics mentioned above will be combined and analysed to present opportunities in business model design for firms operating in the smart home market.

The study is partitioned into three main parts (business models, smart homes and empirical research). The chapter about business models initiates by defining the business model concept, followed by a description of its development. It defines the business model innovation process, its enablers, barriers, and management of dual business models and concludes with the effect the business model has on the company. The smart homes chapter defines the smart home concept and the components the technology involves. Then it continues with a presentation of the smart home market and analysis of the external environment (competitive landscape, value chain, PEST analysis, risk matrix, Porter's five forces, drivers, barriers and trends). The third part, the empirical part, consists of quantitative research (survey) and qualitative research (interview) to gather consumer preference and experts' opinions regarding smart home business models. The thesis closes with a summary of the findings, limitations and recommendations for future research.

1   BUSINESS MODELS

This chapter will define the concept around business models and their development through the last few decades. We will discuss the trends that shaped innovation in business model design. Continuing, we will analyse the strengths and weaknesses of different business models that have been adopted globally.

1.1   Defining the business model concept

Authors like Zott and Amit (2001) and Al-Debei, El-Haddadeh and Avison (2008) made extensive research and well-defined that a business model is a conceptual representation of an organisation and all cores interconnected, co-operational and financial arrays developed by an organisation, as well as all core products and services the organisation offers, which are needed to achieve its strategic objectives and goals. In effect, a business model implicitly represents a firm's competitive advantage.

Overall, a business model is comprised of many components: the value stream, revenue stream, interaction mechanism, pricing system, logistic stream, economic control and a network of relationships and coalitions (Osterwalder, 2004). Business models are often studied without an explicit definition of the concept, leading to misinterpretation of results. However, there is a prevalent general acknowledgement that a business model is (1) a new tool of analysis, (2) a holistic and systematic approach to explaining how a company operates and (3) it clarifies value creation as well as value capture and value delivery of a firm (Zott, Amit & Massa, 2011; Al-Debei, El-Haddadeh & Avison, 2008).

1.2   Development of the business model concept

The development of the business model concept was influenced by the introduction of the internet, rapid market growth, bottom-of-the-pyramid issues and increasing industrial dependence on technology. The business environment is turbulent and ever-changing; as technology and end-user expectations evolved, so did business models (Porter, 2001).

Gorey, Dobat and Sweeney (2018) described how the world economy experienced shifting of the economic base several times (see Figure 1). During the agricultural-era, businesses' main value creation was labour and land. The main activities were production, transfer and storage of agricultural produce on a rural level. With the transition to the industrial-era, labour continued to be imperative, but land's input was surpassed by capital in value creation. Business models, at the time, held a competitive advantage based on product excellence, resource management, supply chain management and in-house technology research and development. This standpoint served the businesses well when resources were scarce and costly until the economy entered the digital domain. As we entered the digital domain, the economic base shifted, and the prevailing unit of value became intellect. With that, the world transitioned from industrial-era to knowledge-era economy. In the knowledge-era economy, companies can be active in the long term if they implement new business models that address evolving customer needs and values. Developments in information and communication technologies made new means for businesses to deliver and create value, which allowed new business models and organisational structures to develop. These technological advances changed how businesses take part in economic exchanges, how they are organised and how they interact with suppliers and customers (Zott, Amit & Massa, 2011; Gorey, Dobat & Sweeney, 2018; Porter, 2001).

Figure 1: The shifting of the economic base
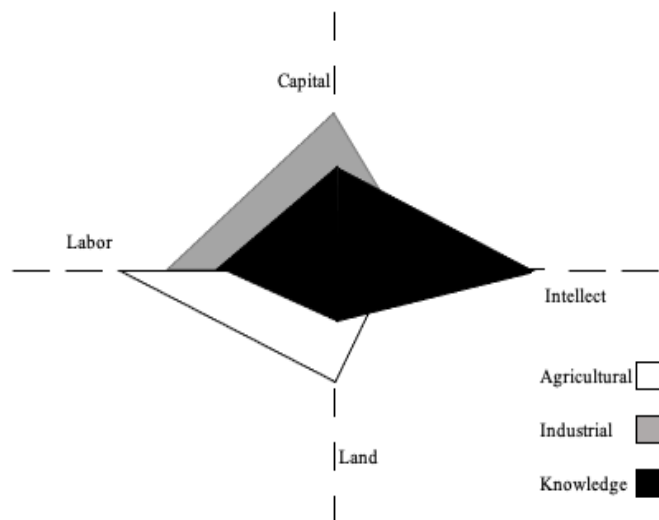
Source: Gorey, Dobat & Sweeney (2018).

According to Al-Debei, El-Haddadeh and Avison (2008), traditional business models operated in moderately stable environments had a low level of competition and had relatively straightforward and static business processes, making it easier to distinguish between a business strategy and business processes. When digital businesses were on the rise, the knowledge-era economy created a gap between a business strategy and business processes. As the business environment became more dynamic, the competition level has risen, and there is greater uncertainty, it has become harder to translate the business strategy into business processes. As a result, the business model concept became a prominent tool of alignment to close the gap created in the digital business domain. It is a theoretical layer that serves as an intermediary between the business strategy and business processes. Due to the appropriate division of the three interrelated yet distinct concepts, managers receive the necessary information to manage better and supervise their firm. Information that is highly aggregated pertains to the business strategy. Information that is operational and highly detailed pertains to business processes. In contrast, the business model contains a tactical level of information (see Figure 2). With that, managers can have a clear view of how their company will be able to adapt its business strategy, business model and business processes to the precipitously changing and turbulent digital environment (Al-Debei, El-Haddadeh & Avison, 2008).

Figure 2: Digital business layers

Nature of information
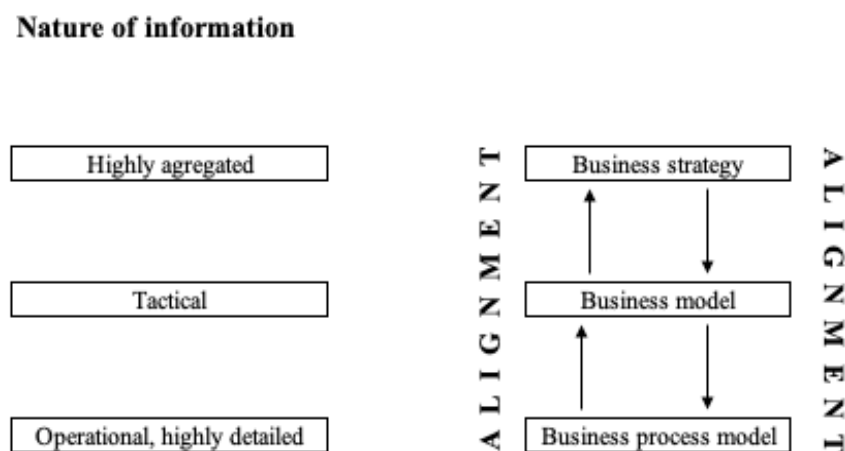
Source: Al-Debei, El-Haddadeh & Avison (2008).

The nine building blocks of a business model proposed by Alexander Osterwalder in 2004 is a pro-active mapping approach that allows firms to simulate various business models and analyse the possibilities before financially committing to an investment (see Figure 3). Osterwalder, along with Pigneur (2010), argued that a business model must deliver the following functions: It must convey the value proposition, identify its customer segment and customer relationship, the revenue flows and distribution channels, define the cost structure and key resources and key activities needed, describe the structure of the value chain and the

value network position linking suppliers and customers (Chesbrough, 2009; Osterwalder & Pigneur, 2010; Osterwalder, 2004).

Figure 3: Osterwalder's 9-point decomposition of a Business Model
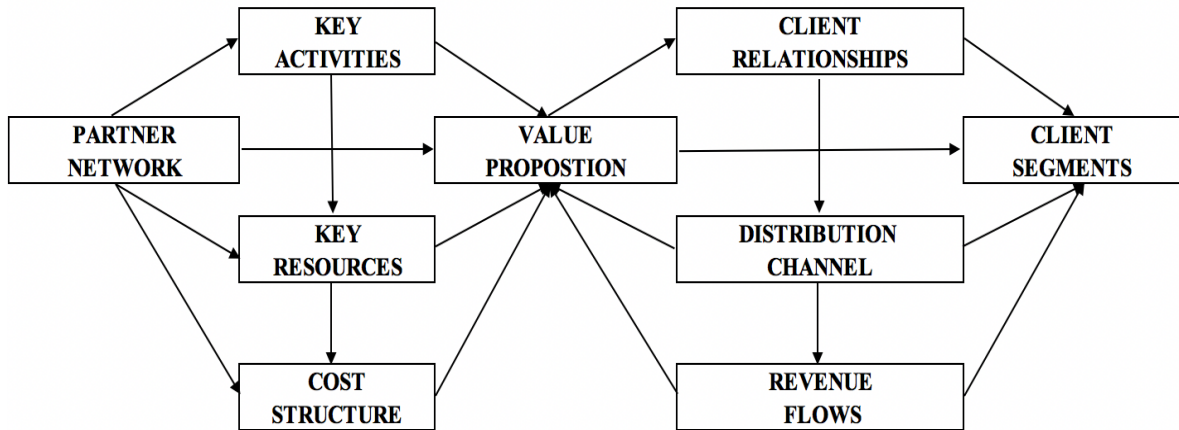
Source: Osterwalder & Pigneur (2010).

The customer segments building block identifies the different groups of people/organisations that the firm plans to reach. The different groups of people/organisations are segmented together based on common needs, behaviour and other attributes. Firms' operations revolve around the customers; they are the heart of any business. A firm can tailor its operations to meet the needs of a mass-market, niche market, or multisided market. Once the customer segments are defined, the business model can then be designed around the customers' needs and values (Osterwalder & Pigneur, 2010).

The value proposition building block articulates the value creation of products or services for customer segments. It represents the reason customers choose one company over the other. The value proposition can be in qualitative terms (ex. price, speed of delivery, cost reduction) or quantitative terms (e.g., customer experience, product design, brand) (Osterwalder & Pigneur, 2010).

The distribution channels building block formulates how a firm communicates with its customer segments to deliver its value proposition. The channels have multiple phases and functions (see Table 1). They are divided into five phases: awareness, evaluation, purchase, delivery and after-sales. We can also differentiate between direct or indirect channels, as well as between owned and partner channels. It is important to develop the right mix of channels to meet the needs and wishes of customers and deliver the value proposition to the market (Osterwalder & Pigneur, 2010).

Table 1: Channel types and phases

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

Source: Osterwalder & Pigneur (2010).

The customer relationships building block explains the types of relationships a firm creates with its customer segments. The relationships can vary; they can be automated or personalised. The goal is to establish a process for customer experience and customer retention to increase average revenue per customer (Osterwalder & Pigneur, 2010).

The revenue streams building block denotes how the firm generates cash from its customer segments. A strategic pricing mechanism must be put in place. In addition, price sensitivity analysis needs to be performed to determine how much is each customer segment prepared to pay for a given value. Osterwalder (2010) distinguished between two pricing systems. On the one hand, there is fixed pricing, when the prices are predetermined on static variables. Oppositely, there is dynamic pricing, when prices fluctuate based on the market circumstances (Osterwalder & Pigneur, 2010).

The key resources building block defines the most significant assets required to make the business model work. The assets can be financial, human, physical, or intellectual. They can be owned, leased, or acquired from business partners. The key activities building block depicts the most important actions a firm must take to make the business model successful. Activities can be production-related, problem-solving, or platform/software related; it depends on the firm's industry. The key partnerships building block represents the network of partners and suppliers needed to make the business model successful. Partnerships can be divided into two kinds: strategic alliances between competitors and strategic alliances between non-competitors. Overall, there are three motivators for creating valuable partnerships: economies of scale and process optimisation, reduced risk, and acquisition of resources or activities (Osterwalder & Pigneur, 2010).

The cost structure building block represents all incurred costs to operate a business model. Although the importance of the cost structure is higher to some companies than to others, some companies have a cost-driven business model, and some companies have a value-driven business model. Furthermore, we can distinguish between four cost structure characteristics: economies of scope, economies of scale, fixed costs and variable costs. The nine-building blocks together form a basis for a useful business tool, known as the business model canvas (see Table 2) (Osterwalder & Pigneur, 2010).

Table 2: Economic business model canvas

Key Partners	Key Activites	Value Proposition	Customer Relationships	Customer Segments
	Key Resources		Channels	
Cost structure			Revenue streams	

Source: Osterwalder & Pigneur (2010).

The triple-layered business model canvas was later developed to respond to the increasing pressure for companies to respond to sustainability issues. The tool was built upon the economic business model canvas and extended to include two more layers: the environmental layer, which considers the lifecycle standpoint and the social layer, which considers the stakeholder standpoint. By looking at all three layers, we gather a holistic view of how a business model captures many types of value (economic, environmental and social) (Joyce & Paquin, 2016; Zott, Amit & Massa, 2011).

The purpose of the environmental business model (see Table 3) is to evaluate how a company can generate more environmental benefits than environmental impacts. The functional value component explains the company's total output of a product or service, expressed in quantitative terms. The materials component is an environmental expansion of the key resources component from the economic business model canvas. It includes all the physical materials that are needed to deliver the functional value. The supplies and outsourcing section encompasses all other activities and materials needed for the functional value. The distribution building block describes the physical means by which a company guarantees access to its functional value. It describes the logistics process of goods or services, distances travelled, and shipment weights (Joyce & Paquin, 2016).

The use phase component concentrates on the customer's involvement in the functional value. It involves customer's energy requirements, material resources, maintenance and repair of products. Due to new business models such as product sharing or co-creation of services, the line between the use and production components can be unclear. The production building block refers to the company's core activities through an environmental lens. The end-of-life component describes when the customer ends the consumption of the functional value. It addresses problems like disassembly, recycling, repurposing, and product disposal. This component pushes companies to think about their environmental responsibility beyond

the functional value that they provide. The environmental impacts building block encompasses all ecological costs of the company's actions, including various biophysical measurements, such as CO2 emissions, water consumption and the overall ecosystem impact. On the contrary, the environmental benefits component describes the company's ecological benefits, extending value creation beyond financial metrics (Joyce & Paquin, 2016).

Table 3: Environmental business model canvas

Supplies and Outsourcing	Production	Functional Value	End-of-Life	Use Phase
	Materials		Distribution	
Environmental Impacts			Environmental Benefits	

Source: Joyce & Paquin (2016).

The social layer of the business model canvas looks at a company from a stakeholder perspective to depict related influences between the company and its stakeholders (see Table 4). The purpose of this layer is to evaluate how a company can produce more social benefits than social impacts. The social value building block describes how a company's value creation creates stakeholder benefits. The employee component focuses on the stakeholder function of employees. This section includes the types and amounts of employees in a company, pay structure and employee demographics. Furthermore, the component describes employee-related programs, such as training, development programs and other support programs (Joyce & Paquin, 2016).

The governance building block provides space to describe the company's organisational structure, company policies and ownership. Here, it is described whether the company is publicly traded or privately traded or a for-profit or non-profit organisation. The local communities section describes how social relationships are built with local communities and suppliers. If an organisation is located only in one country, it can be considered that it has only one local community. If an organisation is located in multiple countries, each community should be considered a separate stakeholder (Joyce & Paquin, 2016).

Table 4: Social business model canvas

Local Communities	Governance	Social Value	Societal Culture	End-User
	Employees		Scale of Outreach	
Social Impacts			Social Benefits	

Source: Joyce & Paquin (2016).

The societal culture component depicts its potential impact and how its activities positively influence society altogether. The scale of outreach describes the activities through which the company builds its relationship with its stakeholders. The end-users building block focuses on how the value creation meets customer's needs. The social impacts section focuses on addressing the company's social costs. It is an extension of the financial costs and environmental impacts. Although it is difficult to quantify the social costs, the section includes working hours, safety policies, fair working opportunities and cultural heritage. Lastly, the social benefits component focuses on the positive social value that a company creates. The following tool is widely used as a strategic analysis tool and used to make comparisons and analyse different business models. The concept will also be used for the empirical part of the thesis to aid in developing business models for firms operating in the smart home market (Joyce & Paquin, 2016).

1.3   Business model innovation process

Schumpeter (1934) asserted that the only function, which is fundamental for long-term economic development, is innovation, which he defined as a process of industrial change that continuously revolutionises the economic structure from within, continuously destroying the old one, continuously creating a new one. In the theory of economic development, he distinguished between five types of innovation: novelty in products or product quality, a novelty in methods of production or sales process, a novelty in organisational structures/business models, acquiring new sources of supply, exploitation of new markets. Furthermore, he divided the innovation process into four aspects: innovation, invention, imitation and diffusion. Schumpeter's theories seem even more suitable currently, as we are in a knowledge-era economy, and there is an increasing importance of intangible resources, which are harder to manage. Technology innovation is not sufficient to achieve

long-term growth; a firm must innovate its value creation and value capture (Sledzik, 2013; Casadesus-Masanell & Zhu, 2011).

1.3.1 Strategic renewal readiness indicators

Enterprises commercialise their innovative products and services through their business model, so the business model design is treated as innovation. In the years beforehand, we have witnessed how multinational and well-ingrained corporations, such as Nokia, Blackberry and Kodak, were pushed to the edge of bankruptcy by innovative competitors and the changing business environment. Nokia's mobile phones were once the global bestseller; now, the handset business was sold to Microsoft. Blackberry's messaging application was once the trendiest; now, it is financially struggling. Moreover, Kodak used to be the leading company in photographic film, but it failed to digitalise its business properly, which resulted in bankruptcy. These are only a few examples, which verify that firms must continuously renew their strategies to be financially prosperous in the long term (Binns, Harreld, O'Reilly & Tushman, 2015).

Binns, Harreld, O'Reilly and Trushman (2015) argued that four indicators signal whether a firm is ready for strategic renewal. The first indicator is when the firm's profits are dominated by a maturing business (cash cow), and opportunities are scarce. This is seen in the case of Nokia. Nokia used to be the bestselling handset producer, but it failed to comprehend that the new smartphone concept will diminish the existing business entirely if it does not innovate the product and its business model. The second indicator is when there is a direct hazard to the core business advantage and source of profits. For instance, when classified advertisements transitioned to online platforms, profits of traditional newspapers vanished, and they had to reconstruct their business model and source of profit (Binns, Harreld, O'Reilly & Tushman, 2015).

The third indicator is when the firm capabilities are threatened by new monetisation means. Nintendo's gaming system was a revolutionary gaming product that took over the market. Now, people are switching to other gaming platforms, such as smartphones and tablets, which compels Nintendo to rethink its business model. The fourth indicator is when an opportunity is beyond the markets in which the firm operates. One of the reasons for Nokia's failure to compete with its smartphone competitors Apple and Google is that it was difficult to forestall the competition, as they were companies that did not previously operate in the mobile phone industry (Binns, Harreld, O'Reilly & Tushman, 2015).

1.3.2 Stage-gate business model innovation process

Cooper's study regarding the business model innovation process, performed in 1994, acknowledged that a high-quality innovation process was the common denominator of successful innovators. His third-generation stage-gate innovation model (see Figure 4)

depicts the process of product development, seeing that the funnel starts with an idea and ends with successful commercialisation. Correspondingly, Cooper recognised that flexibility within the innovation process is crucial for companies' long-term success; therefore, he emphasised the overlapping stages and gates. He implied that the different stages and gates should not be treated as separate steps but rather as an ongoing unified process. In the earlier generations of the stage-gate model, the phases were separately designed to accumulate the information and prepare for the next step, whereas the third-generation stage-gate model designs the gates as the decision-making points where the entire team assembles and stages as the connecting and overlapping piece of the whole process (Cooper, 1994).

The first stage covers preliminary investigation. At this phase, the project's scope is determined, and assessments regarding the market, business and technicalities are done. The second stage considers a more detailed investigation, depending on the research gathered in the first stage. At this phase, a comprehensive plan with detailed steps is made. The third stage represents the development of the product. At this phase, the new product is modelled and researched, and a comprehensive plan is made, where all departments from the company – from sales and marketing to finance – are included. The fourth stage covers testing and validation. In this phase, the product is examined and tested for the market. Also, marketing, financial and production plans are confirmed in this phase. The fifth stage represents full production and market launch. At this phase, the product is ready to be put on the market. Production and commercialisation are initiated in this phase, and the plan is continuously monitored and adapted to the circumstances at hand (Cooper, 1994).

Figure 4: Cooper's third-generation stage-gate model with overlapping stages and gates
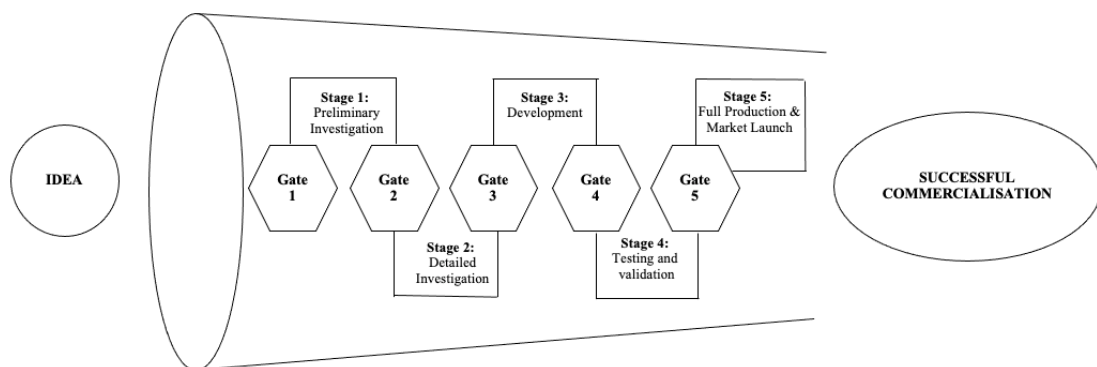
Source: Cooper (1994).

The innovation process is problematic to systematise and specify because creativity is involved, and experimentation plays an important role in developing business models. According to McGrath (2010), the experimentation process takes place throughout the stage-gate process. The business model innovation (BMI) process begins with recognising that change is required (see Figure 5). Here, knowledge about the business model establishment is gathered, and the current business model is analysed. Each idea then goes through the

stage-gate model, and the idea is continuously reviewed at each gate point. Some ideas are discontinued during the process if the potential is too low, and some ideas reach the commercialisation stage. When the BMI process reaches the commercialisation phase, the business model is run as a parallel business model to the already established model, or an integration process starts to integrate the model into the company, and the entire company is reorganised (McGrath, 2010).

Figure 5: BMI process that includes the stage-gate model
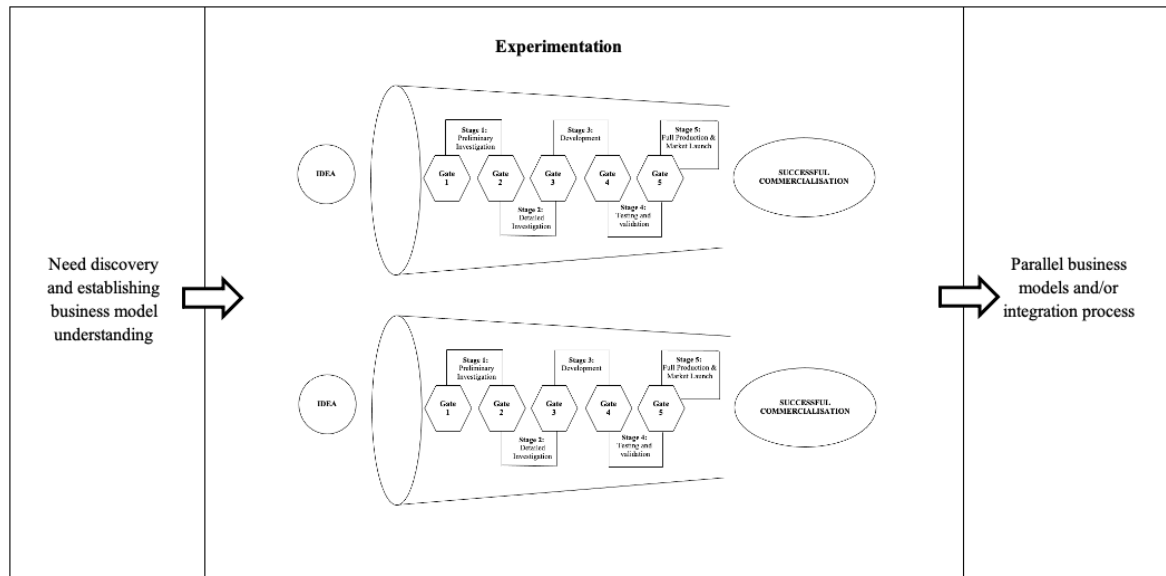
Source: Cooper (1994); McGrath (2010).

Chesbrough (2007) stressed the significance of effectuation. He emphasised that an entrepreneur must not dwell on overanalysing but rather go straight to testing the idea. In the BMI process, he asserted that it is important to test the business model early on and analyse the outcome with the data from the experiment. While McGrath (2010) also affirmed that it is difficult to know which business model will prevail; therefore, it is vital to have a discovery-driven method, as no business model stays unchanged in the long run.

Due to the unpredictable future and importance of experimentation in the BMI process, McGrath proposes real options reasoning (see Figure 6). According to her, an ongoing discovery-driven method is the best way to approach the BMI process. New models should be tested and with as little investment as possible. Because the business environment is changing and adapting ever so quickly, one does not gain any advantage by predicting future outcomes.

The main proposition of real options reasoning is that a company should pursue an options-oriented investment strategy for the BMI process. The idea behind it is that a company should engage in multiple investments to explore many possible business model ventures instead of investing a large amount into one untested business model that might fail (black-

hole investment strategy). By engaging in many options, a company can adapt faster to the ever-changing business environment. As visible on the graph, an options-oriented investment strategy lowers the risks involved, as companies can cancel projects when they think it is appropriate, whether the reasons are financial or other (Chesbrough, 2007; McGrath, 2010).

Figure 6: Black-hole investment strategies versus options oriented strategies
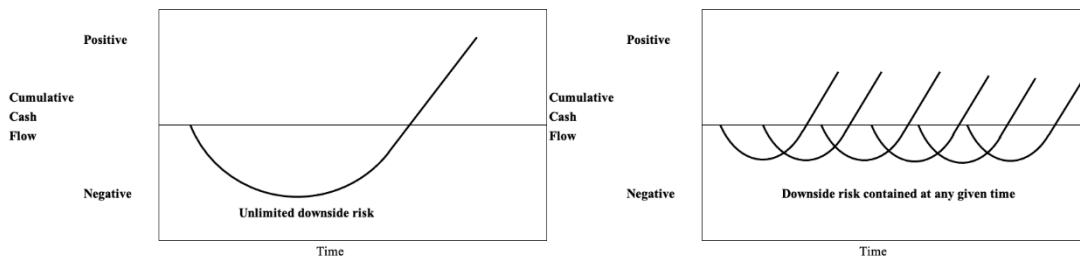
Source: McGrath (2010).

Santos, Spector and Van Der Heyden (2009) say that we must distinguish between the BMI process and business venturing as the two concepts are not equivalent, yet, business venturing may pave the way to BMI. Similarly to McGarther, Osterwalder (2004) thought that given the uncertainty of the future, a company should have a whole portfolio of different business models to be prepared for any possible future outcome. Chesbrough (2007) proposes the same framework. He states that the BMI process requires considerable trial and error, followed by adjustments to the BMI process (Chesbrough, 2007; Santos, Spector & Van Der Heyden, 2009; Osterwalder, 2004).

1.4   Enablers and barriers to business model innovation

The business environment is volatile, so it is difficult to determine the specifics when describing what drives the BMI as it is different for every company. All organisations are affected by internal and external factors. Overall, globalisation has been a fundamental enabler behind innovations in business models (see Table 5). The increasing interconnectedness of countries around the globe helped in the transfer of human capital and knowledge transfer (Chesbrough, 2009).

Technological developments, especially developments in the IT field, helped tremendously towards developments in new business models. Organisations that utilised new technological developments could improve their sales channels by reaching customers directly, revolutionising their supply chain processes by exploiting their assets more efficiently and increasing customer retention by creating tighter customer relationships. Technological developments also opened doors to e-economy, created new communication channels, new payments systems, new cost structures and decreased transaction costs, just

to name a few milestones. Although BMI is not dependent on IT technology, it is merely an enabler (McGrath, 2010; Chesbrough, 2007; Comes & Berniker, 2008).

Innovators noticed how organisational cultures shaped innovations in companies and believe it is an essential enabler of BMI. Creating an organisational structure and work environment that encourages creativity and introducing a process for innovation within a company is of the essence. Autonomy and organisational separation are emphasised, as new BMI must not be constrained by the firm's pre-conceived system (Chesbrough, 2009; Comes & Berniker, 2008; Francisco, 2020).

Innovation-enabling company culture can be achieved only with the support from the top management, as they are the decision-makers. They are the ones responsible for establishing and maintaining the organisational culture that promotes BMI. Chesbrough (2009) conveys the importance of dedicating BMI responsibility to a senior manager. He is then able to cooperate with other departments in the company while overseeing BMI projects. The senior manager's role is to establish a framework that enables idea-sharing and risk acceptance and must continuously participate in any strategic decision. He is also responsible for establishing a reward system that gives incentives to employees for a discovery-driven approach (McGrath, 2010; Comes & Berniker, 2008).

Table 5: Enablers and barriers to business model innovation

Enablers	Barriers
• Globalisation/increasing interconnectedness.	• Competitive imitation.
• Movement of human capital.	• Disruptive technologies.
• Technological developments.	• Long and slow innovation cycles.
• IT (rising information channels).	• Regulation.
• Organisational structure.	• Systemic business models.
• Organisational culture.	• Financial metrics.
• Support from top management.	• Scarcity of resources.

Source: Chesbrough (2009); Weier (2018); Francisco (2020); McGrath (2010); Santos, Spector & Van Der Heyden (2009); Aghion, Bergeaud & Van Reenen (2019); Schroth (2020); Barbier & Homer-Dixon (1999); Vorbach, Wipfler & Schimpf (2017).

On the other hand, new market entrants from a broad range of industries have proven that their innovative business models are successful. However, as products and services can be imitated, so can business models. Incumbents learn from entrants about new business models, as they often respond by imitating the entrant's business model and incorporating it into their own. Competitive replication of business models by incumbents implies that entrants must tactically decide whether to publicly display their business model or hide it under a traditional business model. When establishing a new, innovative business model, an entrant must consider the conditions and circumstances they can benefit from by establishing a new business idea, as the innovation could be imitated by an incumbent (Casadesus-Masanell & Zhu, 2013).

Disruptive technologies have paved the way to new BMI for some companies while obstructing it for other companies. Typically, the gross margins of the emerging technologies are less than those with already established technologies. The fast pace of technological developments causes many technological discontinuities, which pushes organisations to upgrade their digital infrastructure continuously, causing increases in costs (Vorbach, Wipfler & Schimpf, 2017).

Business models are systemic by nature, which entails that if one unit in the organisation is changed, other units need to be reconfigured accordingly, so all units operate uniformly. Lack of communicating the company strategy or vision to all organisation units will result in poor strategy implementation. Because of the extensive changes that need to be made within an organisation to adapt to a new BMI, it represents a barrier to BMI (Weier, 2018; Chesbrough, 2009).

Another impediment for the BMI is long and slow innovation cycles. Top management's innovators might be pressured by top management to execute and implement the new BMI as fast as possible. These rushed decisions might give a false impression that the innovation cycle is moving fast, while they might be setting themselves for a slow BMI execution. When the team makes hasty unsuitable decisions, they must go back and rethink where they went wrong, which leads to cost overruns and product compromises and delays the whole innovation process (Weier, 2018).

Regulation directly impacts innovation processes; it can hinder innovation or support it. For the greater part, in many countries, the regulation still obstructs innovation rather than enable it. For example, the drone market generated 22.5 billion US dollars in 2020, and it is predicted to grow to 42.8 billion US dollars by 2025 worldwide, growing at a compound annual growth rate of 13.8 per cent. Overall, looking at it globally, the industry seems promising. Nevertheless, if we separate the growth by continents, it is noted that Asia is predicted to experience the largest growth, followed by North America and Europe. Asia has and will experience the largest growth in the drone industry as they are at the forefront of innovation regulations. They have structured an innovation enabling regulative framework to boost China's economic development as the number of patents increased substantially during the last decade. According to World Intellectual Property Organization (WIPO), in 2019, China even exceeded the United States in the total number of international patent applications (Aghion, Bergeaud & Van Reenen, 2019; Schroth, 2020).

Financial metrics can be another barrier in the BMI process. According to Comes and Berniker (2008), it is more difficult for publicly held companies to have enough financial freedom to invest in BMI projects than privately held companies, as changes in financial statements affect the stock's price and thus investors' interest. Moreover, the top management of publicly traded companies is paid according to the financial performance, so it is difficult to pursue them to invest and experiment with BMI projects, as some BMI projects might not be lucrative.

Lastly, scarcity of resources is the fundamental economic challenge, and it challenges innovation likewise. In poorer or underdeveloped countries, where scarcity of resources is high, societies experience more difficulties in innovation. Lack of resources can bring about various social struggles and institutional challenges that hinder the innovation policy framework. Scarcity of resources does not explicitly limit a country's economic growth, but it unequivocally affects innovation (Barbier & Homer-Dixon, 1999; Comes & Berniker, 2008).

1.5   Management of dual business models

One might find themselves facing many challenges when taking part in the BMI process. One might face challenges like financial calculations, resource scarcity, or uncertainty in the company's strategy. Berniker, Comes and Chesbrough (2007) believe that financial contemplations typically only obstruct the development of business models, as the BMI project's performance is measured alongside the company's core business. Therefore, they propose that new BMI projects should be measured separately from other BMI projects and the company's core business to avoid perceiving that the BMI projects take away resources from its core business (Comes & Berniker, 2008; Chesbrough, 2007; Markides & Charitou, 2004). When managing dual business models, Markides and Charitou (2004) recommended a framework of strategies (see Figure 7).

Figure 7: Different strategies for managing dual business models

Source: Markides & Charitou (2004).

The strategies are arranged on two dimensions; the similarities between the already established business model and the BMI and the nature of conflicts between the established business model and the BMI. These two dimensions distinguish whether the company would benefit from a separation strategy or integration strategy. A separation strategy is ideal when

conflicts between the BMI and core business model are serious and there is low strategic relatedness between the two. In contrast, an integration strategy is ideal when there are low conflicts between the BMI and core business model, and they operate in very similar markets. While a phased separation strategy is ideal when there are minor conflicts between the two business models and operate in different markets. On the other hand, a phased integration strategy is best for the company when there are serious conflicts between the business models and they operate in similar markets. Typically, the fewer the conflicts and the higher the market similarity between the two business models, the better positioned a company is with a dual business model (Markides & Charitou, 2004).

1.6   The effect of the business model on company performance

The connection between business model designs and firm performance can be examined by analysing the full potential of the firm's business model value creation and the firm's ability to capture the value created. Casadesus-Masanell and Zhu (2013) affirmed that because business model innovation denotes how a business is organised and refers to new means to create and capture stakeholder value, it affects the whole company accordingly. Research recognises that business models that accentuate novelty and are combined with cost leadership or differentiation strategy positively impact a company's performance. Similarly, they recognise that business models, which emphasise novelty coupled with early market entry, also positively affect a company's performance (Zott, Amit & Massa, 2011; Casadesus-Masanell & Zhu, 2013).

In addition, by conducting widespread interviews with corporate managers, consultants at IBM have analysed that firms, which put business model innovation at the forefront financially outperformed other firms, which did not give precedence to business model innovation. A business model is a firm's competitive advantage. It is more of a strategy than a product market positioning and should be thought of as complements rather than substitutes. Although traditional classification emphasises strategy to focus more on competition and value capture, the business model is more concentrated on cooperation and value creation (Zott, Amit & Massa, 2011; Casadesus-Masanell & Zhu, 2013).

1.7   Trends in business model design

The way we work is constantly changing. The way businesses are operated and managed is constantly changing. What occurs in the business environment affects the market; consequently, it affects the companies, affecting their business models (Kuepper & Cheng, 2020). Thus, we will identify the trends in the business environment that indirectly/directly affect business models and then continue with business models trends.

Many trends are continuously reshaping microeconomic and macroeconomic environments. The world economy experienced great globalisation and increasing interconnectedness for

the past decades. It has benefited the economy by making the markets more open and efficient. The foreign direct investment helped in knowledge transfer and exploitation of economies of scale, as it was easier to expand to other markets. On the other hand, experience has shown us that globalisation is a double-edged sword. It can cause too much interdependence on other countries and uneven equity distribution. It also made it hard for local small businesses to compete with such large multinational corporations. As a result, globalisation intensified competition, which is continuously reshaping the competitive arena. The increased movement of human capital also assisted in the intensification of competition (Kuepper & Cheng, 2020)

The next trend that influences the market is the changing workforce demographics. With increasing numbers of older workers and minorities, global labour force demographics are more diverse than ever. The workforce today is comprised of five generations: Generation Z, Millennials, Generation X, Baby Boomers and Traditionalists. They range from recent college graduates to people in their 70s. It is predicted that by the year 2025, Millennials will represent three-quarters of the global workforce. Asia will largely feel the impact of India's changing labour force demographics, as the increase of the country's ageing population will account for more than half of the total increase in Asia. In contrast, China and Japan are experiencing an overall shrinkage in the numbers of their workforce in the last few years. Currently, in the European Union (EU), there are fewer Generation Z and Millennials in the active labour force than there are Boomers. The EU's retirement-age population is predicted to surpass the working-age population in the following decades slowly. Whereas in the United States, Millennials sum up to a third of the total workforce, and Generation Z represents five per cent of the total workforce. As time progresses, the generations that comprise a market change and, with that, the market demand changes as new generations have different demands and needs (Catalyst, 2019).

Companies must adapt their business and innovate their business models to cater to the new consumer expectations. Several trends pertain to consumer expectations. There is an increasing demand for personalisation and information aggregation. Consumers expect technology to make the whole experience easier and that it is immediate and intuitive. Examples of businesses that cater to such demand are TripAdvisor, Google and Apple. They make use of technologies such as geolocation services and provide personalised information. The next trend that shapes consumer expectations is the demand for always faster service. A large provider of such services is Amazon. They have strategically placed their warehouses all over the world to arrange the fastest delivery possible. Value-based purchasing is also evolving. For the most part, the trend is noticeable in the healthcare industry (Solomon, 2017).

Technological advancements reshaped the world, unlike any other business trend. However, no other technological breakthrough would be possible if it were not for the discovery of electricity. It is the foundation on which the economy is built. Over the decades, technology

made its way into almost any sector. It is used in healthcare, manufacturing, consumer electronics, banking and many more. The development of the internet has a historical impact as it became the global information and communication infrastructure. The discovery of semiconductor chips subsequently allowed the evolution of the laptop and smartphone. We can expect the next big leap forward will be in quantum computing. These were but a few technological milestones that reshaped the world as we know it today. It opened new possibilities of development and growth, which reshaped the businesses across all sectors and evolved its business models. Innovation in robotics and artificial intelligence (AI) have reshaped many business models and operational processes across the globe as well (ROBO Global, 2019). For industrial automation and smart manufacturing, computer vision will play an important role forthcoming. We will witness further developments in industrial processes to improve product traceability and quality control. Trends in machine vision are 3D imaging, deep learning and embedded vision, and are used in autonomous and self-driving vehicles. While embedded vision is currently mainly utilised in the consumer sector, it is predicted to be used in the industrial sector soon (Richter, 2015; Frater, 2007; Hammond, 2020; Boutin, 2004).

Similarly, the Internet of Things (IoT) sector has witnessed significant growth over the last decades. The technology penetrated cities, homes, and many industries. It changed how we interact. Some of the technological trends that follow the IoT technology are security, 5G connectivity, edge computing, Software as a Service, and data analytics. At the same time, industry trends that follow the IoT relate to smart cities, industrial IoT, smart homes, and healthcare. McKinsey analysed the potential economic impact of various technological trends. They concluded that IoT and automation of knowledge work, followed by mobile internet, have the most potential to make an economic impact (Ajaykumar, 2019; Horwitz, 2019; Macarrone, 2019; Boutin, 2004).

1.7.1 Franchising model

A franchise is a license that is acquired by a company (franchisee). It provides the franchisee proprietary knowledge and trademarks to permit selling their product or service under the franchisor's brand. The franchisor might choose to sell the license to reduce his financial risk and gain market share (Hayes, 2019).

The main reason for franchise attractiveness is that the franchisee has access to the brand's name and its purchasing power. It has an already well-established brand awareness, brand reputation and access to the know-how, which reduces the learning costs. Some other factors that have boosted the popularity of the franchising business model are the desire to expand the business, lack of capital, and the need to overcome long distances (FranCity, 2019).

There are several different types of franchises (see Table 6). Each type of franchise provides a different area of business integration between franchisor and franchisee. A job franchise is

a type of franchise where a person runs a small business by himself. For this type, a low investment is required, and the franchise can be a home-based business. Examples of such franchises are van businesses, plumbing or cleaning services and shipping services. In a product/distribution franchise, the franchisee distributes the franchisor's products, but the franchisor does not make their entire operating system available. Examples of such franchises are car dealers (FranCity, 2019).

Table 6: Types of franchises

Type of franchise	Description	Examples
Job franchise	- A person runs a small business by himself. - Low investment is required. - It can be a home-based business.	Van businesses, plumbing services, cleaning services, travel agencies, shipping services
Product/distribution franchise	- The franchisee distributes the franchisor's products. - The franchisor does not make available their entire operating system.	Car dealers, Apple
Business format franchise	- Franchisor provides the complete operational system. - The most widespread type of franchises.	Fast food restaurant chains (McDonald's, Kentucky Fried Chicken, Burger King, Subway)
Manufacturing franchise	The franchisee produces and sells the products under the franchisor's brand name and trademark.	Coca-Cola, Pepsi, Singer
Investment franchise	- Large capital investment is needed. - The franchisee can involve the franchisor's management unit or their own. - The purpose is to yield a return on investment and capital gain.	Hotels (Hampton by Hilton), restaurants
Conversion franchise	- Transforms independent businesses within the same industry to franchising units. - Adoption of marketing and advertisement systems, trademarks, training programs and client standards. - Procurement costs are lower. - It can have high growth per unit. - Proceeds are royalty-free.	Real-estate brokers, firms for professional services, plumbing services, electricians and other home-services

Source: FranCity (2019).

In a business format franchise, the franchisor provides the complete operating system so that the franchisee can manage and market the products or services. It is the most widespread

type of franchise. Examples of such franchises are fast food restaurants like McDonald's, Burger King and Kentucky Fried Chicken. In a manufacturing franchise, the franchisor permits the franchisee to produce and sell the products under their brand name and trademark. Coca-Cola and Pepsi are the most known global enterprises of such franchise. In an investment franchise, the franchisee can involve the franchisor's management unit or their own. The purpose of this type of franchise is to yield a return on investment and capital gain. Large capital investment is needed when taking on such a franchise. The purpose is to yield a return on investment and capital gain. The Hampton by Hilton hotel chain is an example of such type of franchise. Conversion franchise transforms independent businesses within the same industry into franchising units. This type takes on marketing and advertisement systems, trademarks, training programs and client standards. These types of franchises generally have lower procurement costs, high growth per unit and royalty-free proceeds. Examples of such franchises are real-estate brokers, firms for professional services, plumbing services, electricians and other home services (FranCity, 2019).

As everything has its advantages and disadvantages, so does the franchising business model (see Table 7). To start with, one of its advantages is that it is a well-established business model. When taking on a franchise, its further advantages are that the franchisee adopts an established brand awareness, loyal customer base, selling power of the well-known brand and franchisor's collective buying power. The franchisee is part of a network of peers (other franchisees) and franchisee associations, which provides continuous support. Depending on the franchise brand, some brands have annual conferences, where franchisees can learn about the latest trends and practices of the franchise brand in which they are involved. A franchisee receives assistance with securing funds and gets initial training from the franchisor to reduce the learning curve, and with that, they get clear directions on how to operate the franchise. This reduces the costs for the franchisee and shortens the time to opening. The franchisor also provides the advertisement and everything related to branding. It can be regional, national, or international advertisement, depending on where the brand operates. The purpose of such practice is that the brand perception is uniform in all regions or countries (Goldberg, n.d.; Hayes, 2019).

On the other hand, it also has several inconveniences. Some of the disadvantages are lack of independence in product development, brand image and brand reputation. Space for creativity and innovation is limited. Another shortcoming is that the franchisor can make mandatory global promotions that might not work in the market franchisee operates due to cultural differences. No influence in management change is another drawback, which can bring the brand in an undesired direction. Franchises also demand a high initial investment to establish the business. The funds can be hard to raise, and financing options from the franchisor are scarce. Furthermore, there is little financial privacy as reports need to be shared with corporate, and there are continuous royalty charges (Goldberg, n.d.; Hayes, 2019).

Table 7: Advantages and disadvantages of franchises

Advantages	Disadvantages
• Well-established business model. • Established brand awareness (higher chance of success). • Loyal customer base. • Shorter time to opening. • Initial training and continuous support. • The selling power of the well-known brand. • Low suppliers' cost (franchisor's collective buying power). • National/regional advertisements. • Network of peers (other franchisees). • Annual conferences. • Franchisee associations. • Assistance with securing funding. • Franchisors offer financial assistance.	• Lack of independence (product development, brand image and reputation). • Global mandatory promotions that might not work in a certain market (cultural differences). • Possibility of change in management that bring the brand to the undesired direction • Ongoing royalty costs. • High start-up costs (initial investment is high). • Limited creativity. • Scarce financing options from the franchisor. • Little financial privacy (reports need to be shared with corporate).

Source: Goldberg (n.d.); Hayes (2019).

1.7.2 Subscription-based model

In the world that is digitalising worldwide, the concept of a subscription-based business model is increasingly growing. More and more businesses are considering changing from a selling relationship to a service relationship. A subscription-based or subscription revenue model is a business model that charges customers a reoccurring fee to gain access to their services or products for the time that the fee is paid. Usually, the fee is charged monthly or yearly (Wang, Zhang, Ye & Nguyen, 2005).

Numerous factors influence the willingness of a consumer to pay for a subscription. The value perceived by the consumer is gathered not only from the products/services sold but also from the process of obtaining the products/services (Keeney, 1999). Convenience is one of several components that influences the perceived value of a customer. Studies showed that convenience is highly regarded as sometimes customers are willing to pay a higher price for given online services/products, thus contributes to the explanation to the increasing growth in online subscription businesses. Essentiality is suggested to contribute to the perceived value if it satisfies the customer's immediate needs (Wang, Zhang, Ye & Nguyen, 2005).

An Online Publishers Association research conducted in 2005 showed that business, entertainment/lifestyle, and personals/dating categories summed up 67% of all subscription-based online content sold worldwide. The three other largest subscription categories that

follow are research, general news and games. From this research conducted, we can observe what the most common immediate needs of consumers are. Likewise, frequency of product/service usage, perceived fairness and security also influence the perceived value of a business model. Consumers sense value through their rationally perceived cost/benefit analysis, yet some subscription-based businesses can be habit-forming and thus influence consumers' satisfaction and future choice of activities (Wang, Zhang, Ye & Nguyen, 2005).

There are several ways a company can price their subscriptions (see Table 8). In its simplest of forms, a company can charge a fixed rate to the customer. It is a price paid upfront for each pre-agreed upon period. Food services and surprise food boxes have this kind of pricing system. The tiered pricing model is a pricing model where multiple packages are offered at different prices and have different offers. Examples of such businesses are TV providers like HBO and streaming services such as TIDAL, Amazon Prime and Netflix. The two-tier pricing model consists of one-time payment (installation costs) and reoccurring revenue (monitoring revenue). Such pricing models have various smart security businesses, where they charge customers an installation price for installing the security equipment and a monthly or yearly subscription fee for maintenance (Moira, 2018; Patrick, 2020; Warrillow, 2015).

Per unit or per user model offers different packages depending on how many users can use the subscription package. Numerous business portals use this pricing model. The usage model is a pricing model where users are charged based on how much of the product or service they consume. Telecommunication companies are well-known to use this pricing system. Lately, it can be noted that Hilti, a company that manufactures and sells products for construction, embarked on this pricing arrangement. They used to sell their products merely; now, they rent them out based on how much a customer will use them. The Freemium model offers some content for free, but it restricts access to premium content. Numerous news media platforms like Bloomberg or Businessweek use this pricing scheme. Bloomberg offers ten free articles per month, and for the rest of the articles, the user needs to pay a subscription fee (Moira, 2018; Patrick, 2020; Warrillow, 2015).

The promotional strategy is a pricing arrangement that offers a free trial for a month or more; then, it automatically charges the user a fee when they finish the free trial. It is a useful strategy for customer procurement, as customers get to see the benefits of using said products or services fully. Streaming services such as Netflix, Amazon Prime and Apple Music use this promotional strategy, as do news media platforms like Financial Times. Pay as you go is unlike other pricing models as this pricing model is charging the fee at the end of the month based on customer's usage. Various food services and delivery services use this subscription model. The overage model is comprised of a base price and price for the extra usage. Examples of such pricing models are car rental companies. A customer pays a flat fee for renting the car and a fee for the extra kilometres or days they rent out the car (Moira, 2018; Patrick, 2020; Warrillow, 2015).

Table 8: Types of subscription pricing models

Subscription pricing models	Description	Examples
Fixed-rate model	The fixed price paid up front.	Food services, surprise food boxes
Tiered pricing model	Multiple packages offered at different prices and offers.	TV providers (HBO) and streaming services (TIDAL, Amazon Prime, Netflix)
Two-tier pricing model	(Installation revenue) one-time payment + (monitoring revenue) reoccurring revenue.	Smart security businesses
Per unit/user model	Offering different packages depending on how many users (or posts) can use the package.	Buffer, business portals
Usage model	Users are charged based on how much product/service they consume.	Telecommunication companies, product rentals (Hilti)
Freemium model	Offering some content for free but restricting access to premium content.	News media (Bloomberg, Business week)
Promotional strategy model	Offering one month for free/free trial.	Streaming services (Netflix, Amazon Prime, Spotify, TIDAL, HBO, Apple Music), News media (Financial Times)
Pay as you go model	Paying the fee at the end of the month not upfront.	Food services, delivery services
Overage model	Base price + price for extra usage.	Car rentals

Source: Moira (2018); Patrick (2020); Warrillow (2015).

One of the main advantages (see Table 9) of a subscription-based business model is predictable income, leading to a higher company value due to revenue predictability. Costs for customer retention can be lowered, and a bigger budget is available for customer procurement. With a subscription model, a company can create good customer relationships and receive better feedback. Another main advantage of a subscription model is the data collected on customers or subscribers. Many well-known and well-established corporations are monetising data collection. Examples of such are Google, Microsoft and Amazon (Dodd, 2017; Charlton, 2015).

Table 9: Advantages and disadvantages of the subscription-based model

Advantages	Disadvantages
• Predictable income. • Good customer relationship. • Convenience for customers. • Higher budget for customer procurement. • Lower budget for customer retention. • Better feedback. • Higher company value due to predictability of revenue. • Data collected on customers/subscribers.	• Risk of high cancellations. • Discouragement against contracts. • Difficulty at maintaining value. • Dullness of singular products. • The difficulty of retrieving product/hardware.

Source: Dodd (2017); Charlton (2015).

Contrariwise, the disadvantages are a high risk of subscription cancellations, discouragement against contracts and difficulty maintaining value for the customer. Singular products can seem dull with time to the customer, so constant value capturing is necessary, which is challenging and demanding to achieve. Another disadvantage of such a pricing model is the difficulty of retrieving products or hardware in case of cancelled subscription; therefore, this kind of model fits better for companies with products that are easy to disassemble (Dodd, 2017; Charlton, 2015).

1.7.3   Circular business model

Transferring from a linear business model to a circular business model started to appeal to many large corporations and smaller businesses in recent years no matter in which industry they operate, as once underappreciated possibilities are now noticed. A circular and zero-waste business model benefits are apparent to increasingly more companies (Laubscher & Marinelli, 2014).

Various approaches and ideas touching on clean production, waste minimisation and recycling methods have been created to tackle environmental issues, as sustainable production and consumption have become of international matter. A notion to dematerialise the economy has made further developments in product-service business models. It refers to the integrated combination of offering products and services, where the focus is not on selling the product itself but selling the use of the product. This concept has evolved as a possibility to provide maximum utility to consumers with services while, on the other hand, minimises materialisation (Mont, 2002; Pergande, et al. 2012).

However, the full transition to it is far from simple. The European Commission also embraced the idea of a circular economy and has adopted legislation to review waste consumption, recycle materials, and set long-term targets to propel Europe towards a zero-waste economy. When it comes to these types of business models, customers are thought of

as users rather than consumers and making transactions is seen as establishing relationships rather than a one-time deal. The circular business model encompasses downstream and upstream integration, where the aim is to establish a closed-loop supply chain (Laubscher & Marinelli, 2014; European Commission, 2021a).

According to Laubscher and Marinelli (2014), circular business models can be integrated to only some areas of the company or all areas (see Table 10). Integration within the area of sales or revenue model means conversion from selling products to selling services. It means leasing the products to customers instead of selling them to them. This way, a company can retract the products after its product lifespan is over, and with that, a company can recycle the materials and reuse them. Recycling products in such a way aids in the creation of a supply loop. Supply loops are an area of circular integration where return logistics and recovery of its assets are incorporated in the business to reuse and recycle effectively. Product design or material composition is another area of circular business integration. Here the products are built so that the reuse of its materials and components is maximised by using recyclable product materials (Laubscher & Marinelli, 2014).

Table 10: Integration areas of circular business models

Area of integration	Description
Sales/revenue model	• Conversion from selling products to selling services. • Leasing the products instead of selling them.
Product design/ material composition	• Use of recyclable materials. • Reuse of its materials and components is maximised.
IT/data management	• All products are traceable. • Resources are optimised.
Supply loops	• Return logistics and recovery of its assets are incorporated in the business.
Strategic sourcing for own operations	• Building long-term partnerships with suppliers and customers. • Co-creation with suppliers and customers.
HR/incentives	• Appropriate culture adaptation. • Development of new capabilities through training programs and rewards.

Source: Laubscher & Marinelli (2014).

Information Technology (IT) or data management is where all products, including their components and material data, are traceable to optimise the resources. Material composition and usage information aids in better sorting of materials and determine their residual value. Strategic sourcing for own operations involves the co-creation and building of long-term partnerships with suppliers and customers: human resources and incentives. Appropriate culture adaptation and incentives that promote a circular economy will stimulate employees to purposefully reuse, recycle and overall strive to a zero-waste economy. Continuous development of new capabilities through training programs and rewards will further keep employees motivated (Laubscher & Marinelli, 2014).

Slowly, we are seeing the circular business model being adopted by more and more companies. Nevertheless, many drawbacks are obstructing companies from adopting such a business model (see Table 11). Costly transition and challenges with measuring performance are but a couple of significant obstacles. The British government estimated that a full transition from a linear economy to a circular economy on only European grounds would amount roughly to around 108 billion €. Due to the circular transformation, a company might experience reduced sales as they might experience insufficient demand for such products or services. The quality of reusable and recyclable products might be challenging to achieve. New skills and more human resources might be needed, which prolongs the circular transition and with that, again costs increase (Hannon, Magnin-Mallez & Vanthournout, 2016; Velis, 2018).

Furthermore, it is more demanding to manage the supply chain loop and the traceability of the materials and their components in circular business models. There are also institutional barriers that hinder the adoption of a circular model because our current economy is still inclined to demand a linear economy. For example, the GDP index does not reflect environmental and social externalities; therefore, the effect of a circular economy cannot be measured. Regulation can obstruct innovation in a circular economy because laws might not be adapted yet for entrepreneurs in a circular economy (Hannon, Magnin-Mallez & Vanthournout, 2016; Velis, 2018).

Table 11: Advantages and disadvantages of a circular business model

Advantages	Disadvantages
- Environmental benefits. - Attending to consumer preferences. - Resource efficiency. - Cost efficiency. - Subsidies. - Government's incentives.	- Reduced sales. - Costly transition. - Insufficient demand. - Quality of products. - New skills and human resources needed. - Challenging to measure performance. - Challenging supply chain management. - Institutional barriers.

Source: Hannon, Magnin-Mallez & Vanthournout (2016); Velis (2018).

While many hindrances obstruct the adoption of the circular business model, government bodies across the world, especially in the European Union, are, in recent years, coming up with new fiscal policies to promote the circular economy and penalise waste production. Adopting the circular business model has its advantages as well. If the strategy for the circular economy is executed and maintained properly, we could see new opportunities for the economic renewal to flourish, as resources will be fully utilised, consumed and recycled. It also has immense environmental benefits as there are fewer negative externalities because the circular model focuses on monetising positive externalities. Resource and cost efficiency is maximised, and the company can attend to consumer preferences as the demand for zero-waste consumption is slowly but surely increasing (Hannon, Magnin-Mallez & Vanthournout, 2016).

1.7.4 Everything-as-a-service model

Libraries and DVD rental companies have long ago implemented a product-as-a-service business model, as they rented out the products they offered. However, it was not until recent years that the trends in the IT field leaned more towards developments in everything-as-a-service or anything-as-a-service (XaaS) business models. The trend of XaaS business models has reflected the state of social and economic development in the past. If the economy was growing, so were XaaS models and vice versa (Duan et al. 2015). Cloud computing, though the development of the IoT and edge computing, further assisted in its expansion. XaaS, overall, classifies a category of services related to cloud computing and remote access. There are fundamentally two types of public clouds over which the XaaS models are offered to its customers. The first type serves individuals for personal use, and the second type provides services to businesses (Foote, 2017).

In recent years, increasingly more companies are moving to cloud platforms to modernise their IT infrastructure, and companies have started to offer their technological capabilities through different revenue channels. Which XaaS model fits a company the most depends on the organisation itself and its goals. Cloud computing is exhibited in a wide assortment of services. There are four dominant business models in this regard (ESDS, 2015).

Software-as-a-service (SaaS) is carried out through the internet and is predominantly constructed for the end-user. Typically, it is offered through a subscription model. Due to its user-friendliness and convenience, the usage of the business model is predicted to increase. A company may benefit from the SaaS model because the software service is easily accessible anywhere where there is the internet. It is easily managed as it is governed from a central location, and users do not need to upgrade the Software. Its downturn is that this model is not best for companies restricted by law or restricted from sharing their data, as data security issues continue to persist. Some of the biggest players in this category are Microsoft, Amazon and IBM, alongside Salesforce, Google and Oracle. Netflix, Airbnb and Uber also belong within this category of services (see Table 12) (ESDS, 2015; Bhattacharya, 2020).

Platform-as-a-service (PaaS) is quite similar to SaaS except for the one fundamental difference. Instead of offering software, the PaaS model offers a platform for creating software supplied over the internet. PaaS permits software multitenancy in which software runs on a server and serves multiple users. It aids in data load balancing through inbuilt scalability. It is a suitable model for companies that require multiple developers working on the same project. PaaS allows them to test the environment, host and manage applications in numerous phases of development. The largest providers of PaaS are, again, Microsoft, Amazon and IBM. Companies like SAP, Salesforce and Google have also established themselves well in this category (see Table 12) (ESDS, 2015; Shim, 2020a).

Table 12: Types of cloud computing as-a-service model

Type of model	Description	Example
Software as a service (SaaS)	• It is offered over the internet. • It is primarily designed for the end-user. • Commercial software accessible on the internet. • Managed from a central location. • No requirements for software upgrades.	Netflix, Microsoft, Salesforce, Adobe, SAP, Oracle, Google, IBM, Amazon Prime Video, Uber, Slack, Spotify, Airbnb
Platforms as a service (PaaS)	• Offers a platform for the creation of software. • It is provided over the internet. • It allows software multitenancy. • It aids in data load balancing.	SAP Cloud, Microsoft Azure, Heroku (Salesforce), AWS Lambda (Amazon), Google App Engine, IBM Cloud Foundry, Oracle Cloud Platform
Infrastructure as a service (IaaS)	• Provides cloud computing infrastructure. • Users have access to servers, network tools and data storage. • It allows scaling. • Costs vary.	Microsoft Azure, Amazon Web Services, Google Cloud Infrastructure, IBM Cloud, Alibaba Cloud
Desktop as a service (DaaS)	• It provides all back-end services. • Relocation to another platform is simple. • Accessible from anywhere. • It is multi-tenant. • It is highly customisable.	Amazon Workspaces, Citrix Managed Desktops, Microsoft Windows Virtual Desktop, VMware Horizon Cloud, Workspace ONE, IBM Cloud

Source: ESDS (2015); Bhattacharya (2020); Shim (2020a); Shim (2020b); Posey, Botelho & Steel, (2020).

Infrastructure-as-a-service (IaaS) provides cloud computing infrastructure and its resources in the form of service. This model gives users access to servers, network tools and data storage. The advantage of such a model is its flexibility as it allows scaling. In contrast, the cost of such a model depends on the use of its infrastructure. IaaS model is suitable for companies with a greater requirement for a cloud computing infrastructure, yet they do not have the funds for hardware. Unless there are issues with regulatory compliance regarding data security, it is more beneficial to establish a private cloud and have greater control over the cloud computing infrastructure. Some of the largest corporations that have expanded into the IaaS field are Microsoft, Salesforce, Amazon, SAP and Google (see Table 12) (ESDS, 2015; Shim, 2020b).

Desktop-as-a-service (DaaS) model delivers a virtual desktop to its users, which can be accessed from anywhere. It is a multi-tenant model. It makes available all back-end services that would have typically been offered by application software. Relocation to another platform is unproblematic, and it is user-friendly relative to other models. It is highly customisable, giving the clients ability to personalise it as they see fit. The DaaS model is ideal for small businesses with limited funds yet recognise that a cloud computing

infrastructure is needed for their company. Microsoft's, IBM's, and Amazon's names come up no matter which category we touch upon; they have offered something in every category mentioned above. They are a great example of how a business can evolve to keep long-term profitability, as it has extended its internal e-commerce services to customers outside the company for them to use in their businesses (Deloitte, 2017). Although, in this category, some of the biggest players are Citrix Managed Desktops, Workspace ONE and VMware Horizon Cloud (see Table 12) (ESDS, 2015; Posey, Botelho & Steele, 2020).

Reasons behind why a company should consider XaaS business models are plentiful (see Table 13). The consumer data that companies can gather have only increased in value in recent years. The advantage is that data helps companies to understand their customers better and meet their demands. Companies like IBM, Google and Salesforce collect data to analyse consumer behaviour and even try to predict their behaviours to meet their needs before they might even realise they need it. Deloitte made a study in 2018 to see whether companies with a greater proportion of XaaS are more likely to be cost-efficient. 55 per cent of surveyed companies, which use XaaS for more than three years, stated that they have mostly or fully achieved cost savings, compared to the 44 per cent of companies, which use XaaS for less than three years. This shows that cost reductions are an advantage when adopting a XaaS model. Given the increased communication with customers and flow of information about consumers' preferences, companies can thus improve their relationships with customers, and with that, productivity increases (Le Merle, 2012; Crossan, Hupfer, Loucks & Srinivasan, 2018).

Table 13: Advantages and disadvantages of an as-a-service model

Advantages	Disadvantages
• Data collection. • Extend and diversify service. • Improved customer relationships. • Increase in productivity due to convenience. • Better communication flows. • Cost efficiency.	• Data and cybersecurity issues. • Internet dependency. • Performance issues when there are too many users. • Costly and complex to continuously update technology. • XaaS provider discontinues the service.

Source: Le Merle (2012); Crossan, Hupfer, Loucks & Srinivasan (2018).

These types of business models also have their disadvantages. First and foremost, there is the issue of cybersecurity. The issue does not only pertain to this kind of business model but many others that are technology-based as well. Nowadays, although the internet reaches many corners of the world, there can still be glitches that impede a company to run its activities smoothly. Adopting a XaaS model implies a full dependency on the internet, which might present itself as a disadvantage if the internet connection fails during critical activities. Complications can also arise when there are too many users, so the system crashes and obstructs day to day operations. The time it takes to repair these issues is another disadvantage because technical problems can occur during mission-critical processes, slowing down all company processes. Furthermore, it can be costly and complex to continuously update and upgrade the technology, as there is the danger that the XaaS provider discontinues the service (Le Merle, 2012; Crossan, Hupfer, Loucks & Srinivasan, 2018).

1.7.5 Sponsor-based model

The sponsor-based business model monetises through sponsorship rather than charging a price to its customers. Adopting such models has experienced slow growth because it is not always obvious from whom a company receives the revenues. Sponsorships are a type of advertisement that is not as apparent to its users or customers as regular advertisements. Usually, sponsors represent a longer-term agreement with the company compared to a classical advertisement. The term monetisation intensity refers to the amount charged to customers in return for the free product. In other words, the stronger the monetisation intensity, the more revenue a company is earning from its sponsors rather than from its customer base (Casadesus-Masanell & Zhu, 2011).

Sonderman and Tran (2013b) distinguished four types of sponsor-based business models (see Table 14), which are differentiated by the degree of independence the sponsor has in creating its sponsored content on the company's platform. In the underwriting model, the sponsor's brand is affiliated with the company's usual content. This model conserves the company's objectivity and individuality the most, as the sponsor's brand is merely paying the company to be associated with its content. Well, known examples of such models are various pornography websites and news websites. In the agency model, the company hires employees to help create content that aligns with the sponsor's partnership. Social media influencers and airline companies, such as Ryanair are an example of such model (Sonderman & Tran, 2013b; Casadesus-Masanell & Zhu, 2013).

In a platform model, the company provides a dedicated space for sponsors to post their content on their behalf. In this model, the brands are connected, but it is clear which content is from the sponsor and which is from the company. Most recognisable corporations that apply such a sponsor-based business model, alongside other business models, operate in the sports industry. Corporations like Coca-Cola, Samsung, Visa and Alibaba associated their brands with Olympic games, and corporations like Adidas, Hyundai and McDonalds associated their brands with FIFA World Cup. In the aggregated or repurposed model, a company offers sponsors the right to utilise archived content and provide new content of interest to the sponsor. When a company embarks on a sponsor-based business model, many factors must be considered: its revenue potential, resources and sponsors' needs, and ethical principles. Out of the mentioned models, this model allows the most independence for sponsors. Known examples of such models are SpeakEasy and The Dallas Morning News (Sonderman & Tran, 2013a; FIFA, 2020; The Tokyo Organizing Committee of the Olympic and Paralympic Games, 2020; Casadesus-Masanell & Zhu, 2013).

Table 14: Types of sponsor-based business model

Type of model	Description	Example
Underwriting model	• The sponsor's brand is affiliated with the company's usual content. • This model preserves the company's individuality the most.	News websites, pornography websites
Agency model	• The company employs people to help create content that is in line with the sponsor's partnership.	Influencers, Ryanair airline
Platform model	• The company provides a dedicated space for sponsors to publish their content in their names. • Brands are affiliated, yet it is clear which content is from the sponsor and the company.	Sports organisations (FIFA, UEFA, Olympic games)
Aggregated/ repurposed model	• Sponsors can utilise archived content and provide new content that is of their interest. • This model provides the most independence for sponsors.	SpeakEasy, The Dallas Morning News

Source: Sonderman & Tran (2013b); Casadesus-Masanell & Zhu (2013).

The remarkable growth of sponsor-based models was due to their many advantages (see Table 15). This model has not only been adopted worldwide by many companies but also the intensity of sponsorships increased within each organisation that practices a sponsor-based model. This model is not burdensome to its customer base, as they are not charged any associated sponsorship costs. This allows companies to take on as many sponsorships as they can attain. Typically, sponsorships provide a positive brand association of the companies involved because companies do extensive brand research when choosing sponsors, so they make sure that the sponsors are a good fit for the company. If the right brands are chosen for sponsors, then the sponsor's brand credibility is another advantage that can be exploited. Because such a marketing strategy can be very lucrative, many companies have made it the main revenue model and marketing strategy. A sponsor-based model allows companies to build relationships with their sponsors as well as with their customer base. This enables companies to vastly increase their brand awareness (Sonderman & Tran, 2013a; Farrelly & Quester, 2004).

As a sponsor's brand credibility can be advantageous to exploit, it can also be a disadvantage if the brand perception is negatively perceived. A brand positioning strategy must be performed in detail. If sponsors content does not match companies' customer bases or organisational cultures, customers will notice it, and the whole sponsorship backfires. Therefore, sponsor's cultural fit with the company it also important to consider. Another shortcoming to the sponsor-based model is the instability. Sponsors can decide not to endorse a brand anymore when they see that the sponsorship does not benefit them. The most notorious case is the cyclist Lance Armstrong. In 2012, Armstrong was confirmed to take performance-enhancing drugs. He lost eight sponsors overnight, which were all together making him around 75 million US dollars. Furthermore, as with any marketing strategy,

sponsor-based models have no guarantee for a positive return on investment. It is vital to make a contract where both parties have clearly defined activities and responsibilities regarding the sponsorships, so both parties' interests are protected (Farrelly & Quester, 2004; Sonderman & Tran, 2013a; Rotunno, 2012).

Table 15: Advantages and disadvantages of a sponsor-based model

Advantages	Disadvantages
• No charge to customers/not burdensome to customers. • Positive brand association. • Building relationships. • Sponsor's positive brand credibility.	• Sponsor's negative brand credibility. • Sponsor's cultural fit. • Instability. • No guaranteed return on investment.

Source: Sonderman & Tran (2013a); Farrelly & Quester (2004).

1.7.6   Multisided platform model

Multisided platforms (MSP) are business models that essentially enable interaction between two or more customer groups. These kinds of business models have seen fast growth in the past decade, predominantly because these business models effectively create value by cutting search and transaction costs for the customer groups involved. Its principal value proposition is that it identifies the needs of two or more customer groups and connects them to enable a faster and smoother transaction. There are various aspects, strategic decisions and trade-offs that distinct the MSP from other businesses, such as product platforms and resellers (see Figure 8). MSP collaborate with each customer group and provide two-sided interaction between the groups, while product platforms and resellers defy that. Product platforms provide a sale of an essential input; then, the final product is sold by another business. In contrast, the reseller provides only one-sided interaction between the two customer groups (Hagiu, 2015; Hanna, 2013).

Figure 8: Structure of a multisided platform
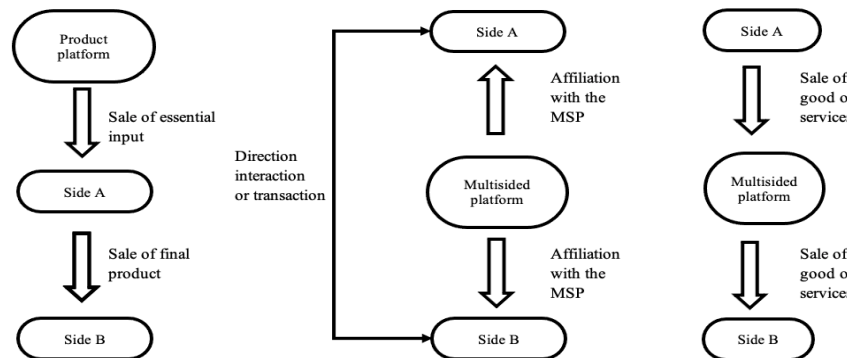
Source: Hagiu (2015).

A concept known as the cross-side network effect is another feature that follows the MSP business models. Hagiu (2015) affirms that the value presented to a certain customer group increases with the number of participating customers of the other group. This business model characteristic has its downside. On the one hand, it creates high barriers to entry, as it is difficult to compete with well-established and well-integrated companies. On the other hand, it is challenging to create high barriers to entry, as there is the chicken-or-egg problem – each side of the customer group is reluctant to join the platform without the other group joining it before (Hagiu, 2015; Hanna, 2013).

Furthermore, to keep the barriers to entry high for other MSPs, a platform must keep the switching costs and costs associated with participating to more than one platform high. An example of failure to keep the barriers high is American coupon providing platforms Groupon and LivingSocial. Due to their low switching cost and cost associated with participating in more than one platform, their company valuations were cut by more than half in the past decade (Hagiu, 2015; Hanna, 2013).

Some additional challenges and features distinguish MSPs from other businesses. Firstly, there is the issue of the number of customer groups to bring to the platform. For some companies, it is easier to identify the number of important customer groups that they should bring on board, as they are bounded by industry. For example, eBay easily identified its two customer groups; it connects buyers and sellers. Nevertheless, many MSPs are rethinking how many groups to involve, as they are faced with new means of value capture, customer needs and increasing revenue streams. For example, LinkedIn currently operates a three-sided platform; it connects users, recruiters and advertisers (Hagiu, 2015; Hanna, 2013).

Secondly, the way third parties are regulated and how the business model will be governed is another distinction of the MSP business model. MSPs need to decide who is allowed to join the platform and what activities are the customers' groups allowed to perform. The third distinction is the design of the MSP. At the end of 2010, eBay suspended its Ad Commerce advertising program, which allowed sellers to pay to be ranked higher on the eBay product list. They suspended it, so customers receive only the most relevant products (Hagiu, 2015; Hanna, 2013).

Lastly, there is the pricing structure to consider. Many MSPs understood that they must provide free services to one customer group and heap profits from the other side (see Table 16). Facebook and Google provide free content to their users and draw their profits from advertisers. Alibaba and eBay provide a free platform to its users to easily purchase third party products and draw profits from the sellers. Visa and American Express provide free services to their users and draw profits from merchants. Similarly, other MSPs are various video game consoles, PC operating systems, Ticketmaster and Fandango (Hagiu, 2015; Hanna, 2013).

Table 16: Pricing structures for multisided platforms

Multisided platform	Loss-leader side	Profit-making side
Advertising-supported media (newspapers, over-the-air TV networks, Facebook, Google)	Users	Advertisers
Alibaba.com, eBay, Rakuten	Buyers	Sellers
Payment services (American Express, Visa)	Users	Merchants
Video game consoles	Users	Game developers
PC operating systems (Windows, iOS)	Application developers	Users
Ticketmaster	Venues/event organisers	Users
Fandango	Movie theatres	Users

Source: Hagiu (2015).

The advantage of an MSP is that these business models typically have higher percentage margins (see Table 17). Because less investment capital is required, a company can achieve a return on investment more quickly. An MSP can avoid inventory costs, as they are only the intermediary between two parties and do not have to keep products in stock. If some products do not sell, it is at the expense of the sellers, not at the expense of MSP. Another valuable advantage is that when a company becomes the MSP leader, it is difficult for users to switch to other platforms (Hagiu, 2015; Hanna, 2013).

Conversely, as a disadvantage, MSPs must deal with the chicken-and-egg problem. As mentioned above, the cross-side networks effect is characteristic of MSPs, as the value to one group of customers increases with the number of participating customers of the other party. For start-up companies, this can be a major hurdle to overcome. In addition, governance of such a platform can be challenging as there are multiple interests to consider, and key potential MSP collaborators can resist. A great example of this case is Brightcove company, which attempted to create a four-sided platform, but later saw it was impossible to cater to all four parties. Additionally, MSPs have less control over the products or services offered on their platform, reflecting negatively on the MSP's brand. Since this model is less capital intensive and a well-established MSP tend to have high percentage margins, many companies attempted to build an MSP platform. However, many failed because the platform did not provide enough convenience to the parties involved (Hagiu, 2015; Hanna, 2013).

Table 17: Advantages and disadvantages of a multisided platform model

Advantages	Disadvantages
• Higher percentage margins. • Less capital needed (capital efficient). • No inventory costs. • Once a company is a MSP leader, it is hard for users to switch to another platform.	• Cross-side networks effect. • Governance complexity. • Resistance from key potential MSP collaborators. • Conflicting interests of the parties involved. • Lesser bargaining power regarding the assortment of products/services offered on the platform. • Not convenient enough for the parties involved.

Source: Hagiu (2015); Hanna (2013).

2   SMART HOMES

This chapter aims to define the theoretical background of the smart home concept, present the smart home development over time, describe the general smart home IoT framework, smart home management system and smart home types. The chapter will continue with a smart home market analysis. A general market overview will be presented, followed by key market indicators, market potential, a market overview of each segment, competitive landscape, smart home value chain, external environment analysis, trends and finishing the chapter with drivers and barriers.

2.1   Defining the smart home concept

Balta-Ozkan, Boteler and Amerighi (2014) defined a smart home as any form of residence with a communications network and sensored household devices that can be remotely monitored and controlled and offer services that serve the user's needs. They defined sensors as devices that collect sensed data regarding the state of the residence, such as energy usage, location and temperature. Household devices are any white or brown goods, such as refrigerators, washing machines, televisions, toasters, or phones. The smart grid network or home area network (HAN) that connects all devices into an interoperable system is fundamental to the smart home concept. There are four main activities of the smart home network:

- Data collection: the technology gathers and provides access to all sensed data;
- data processing: the technology processes and analyses the data;
- data presentation: the technology makes the data available to the end-user;
- control capabilities: the technology facilitates a bidirectional interface between the system and the end-user (Labaccaro, Carlucci & Lofstom, 2016).

According to Le, Nguyen and Barnett (2012), the are five central characteristics to the smart home:

- Automation: the technology regulates automatic devices and executes automatic functions;
- adaptability: the technology can learn, predict and meet the needs of end-users;
- interactivity: the technology enables interaction among end-users;
- multi-functionality: the technology executes orders from the end-user or produces different outcomes;
- efficiency: the technology executes functions efficiently and conveniently.

2.2 Development of the smart home concept

Basic home appliances started developing in the early 1900s with the invention of engine-powered vacuum cleaners. In the next decades, refrigerators, irons and washing machines were invented. Although nowadays we do not think of the abovementioned appliances as smart, they started the trend of improvements in-home technologies that lead to the development of the smart homes market that we know today (Hendricks, 2014). Smart living is an idea that progressed over many decades as the technology itself improved immensely in the meantime (Mohammadi & Hammink, 2015; Sung, 2019).

Table 18: Development of smart home products and services

Year	Phase	Technical background	Main function
1990s	Home automation	Broadband internet	Household automation
2000s	Home network	Smartphone and application	Remote monitoring and control
2010s	Smart home	IoT and AI	Context-awareness

Source: Yang, Lee & Lee (2018).

Smart home developments can be roughly clustered into three phases (see Table 18), marked by technological milestones that enabled smart home market developments. In the 1990s, the home automation phase commenced with the widespread dispersal of broadband internet. Before this period, the smart home concept was developing for many decades, but it was not until the creation of the internet that layed down the foundation for the market and created many new opportunities (Stanley, 2019; Yang, Lee & Lee, 2018).

By the 2000s, smart homes began to rise in popularity when new technological advancements, such as smartphones and applications, further built up opportunities for the market. Smartphones and application technologies commercialised the ability to communicate with and control home devices remotely. By the mid-2010s, technological advancements in IoT and artificial intelligence (AI) opened ways to context awareness by enabling the devices to gather information about its environment and adapt its functions accordingly. These technologies also enabled smart household assistance, which can be

voice-controlled – the possibilities created by these technologies are endless (Aldrich, 2003; Stanley, 2019; Yang, Lee & Lee, 2018).

2.3   IoT framework for smart home

Fundamentally, a smart home network is based on information and communication technology (ICT). ICT emphasises the role of interconnected communication and integration of electronic devices. A smart home is operated through ICT and a method of connecting electronic devices called IoT (Labaccaro, Carlucci & Lofstom, 2016; Domb, 2019).

Soon smart devices will be predominant on the market, and they will be present in households, which will drive the need for improved IoT based services and smart home services (Karnouskos, 2011). Lee and Lee (2015) categorised five fundamental technologies for developing IoT solutions and, thus, fundamental for developing smart home solutions: radio frequency identification, cloud computing, wireless sensor networks and application software. Risteska Stojkoska and Trivodaliev (2016), along with Xu, He and Li (2014) formed a general model for an IoT architecture applicable to the smart home domain (see Figure 9). It is a multilevel framework that generalises what each key component in the smart grid represents. The smart home component represents all household devices that communicate wirelessly. Each smart home has a wireless sensor network built-in, which gathers sensed data from each device and sends it to a central station, referred to as a home hub. Each node in the wireless sensor network is an intelligent piece of equipment computed and able to communicate. In the case of residential buildings, the home hub is called the residential hub, which has additional computations and features to manage residents' data separately and uniformly (Risteska Stojkoska & Trivodaliev, 2016; Xu, He & Li, 2014).

Figure 9: IoT framework for smart home
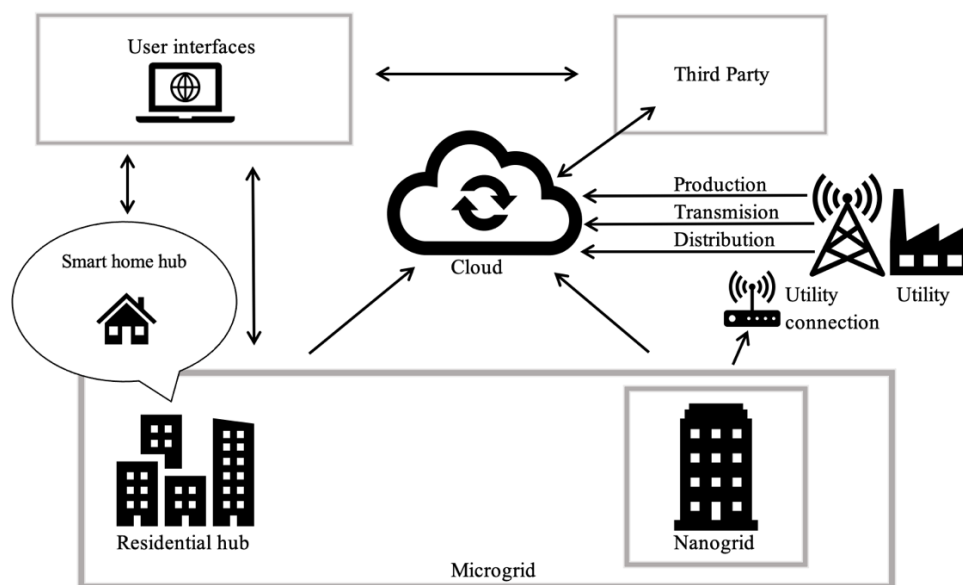
Source: Risteska Stojkoska & Trivodaliev (2016).

The cloud represents the central component of this framework, and it accumulates all the data from various sources; it accumulates everything from household's data to sensor measurements. It is the most progressive component in the whole framework, as it provides a processing infrastructure and enormous data storage. Utility refers to the remaining parts of the smart grid that send information to the cloud: production, transmission and distribution. Information like electricity price, consumption of a microgrid and distribution status is conveyed through these channels. Third-party cloud-based applications receive the data from the cloud, which they use to deliver a web-based smart home solution. The user interfaces component delivers data to the end-user through notifications and smart device control. This enables end-users to see their consumption patterns and evaluate their metrics (Risteska Stojkoska & Trivodaliev, 2016; Xu, He & Li, 2014).

The HAN differentiates the smart home from a home that is merely equipped with high technological elements. Looking at the smart home context on a broader scale, in the context of smart cities, the network will connect and communicate with other sectors as well, such as transportation and e-health services, making up an optimised, holistic and interconnected smart city grid (Balta-Ozkan, Boteler & Amerighi, 2014). Smart houses are able of intelligent heating control, smart lighting systems, smart blinds, smart sensors, video surveillance and security systems and smart entertainment devices. Smart home systems provide a safer, healthier, cleaner and socially connected environment for the occupants (Mohammadi & Hammink, 2015).

2.4   Smart home management system

Risteska Stojkoska and Trivodaliev (2016) developed a general smart home management framework (see Figure 10). The cloud-based management model enables centralised optimisation while considering a large number of parameters. Key tasks are executed at each stage.

Smart objects are home appliances, lights, shades, or sensors connected to transmission lines in the smart grid infrastructure (Byun, Jeon, Noh, Kim & Park, 2012). The smart devices continuously sense, process and communicate data to the hub. To sense and actuate the data, the smart object needs to perform A/D and D/A conversions, a convergence of data from digital to analogue or vice versa. If the network protocol permits it, the data can also be sent directly to the cloud. Smart devices should process basic data before sending it to the hub (Risteska Stojkoska & Trivodaliev, 2016; Viani et al., 2013).

Hubs are devices that collect raw or processed data from smart objects and send it further to the cloud. To reduce the amount of data that is sent to the cloud, when possible, the hub also carries out local data processing using edge computing (Zhu, Wang, Chen, Liu & Qin, 2010). In turn, the hub, which can function as a scheduler, load balancer or regulator, can send commands to connected smart objects (Byun, Jeon, Noh, Kim & Park, 2012). In the example

of residential buildings, the hub sends commands to smart devices that regulate electricity flow from and to the nanogrid to manage and regulate residents' energy usage appropriately. Since the smart objects cannot communicate with each other on their own, the hub aids in the interoperability between the smart devices. The number of hubs needed in a household depends on the complexity of the smart home services and the complexity of the smart home infrastructure. Henceforth, if full interoperability between the smart devices is achieved, the need for hubs will be obsolete (Risteska Stojkoska & Trivodaliev, 2016; Gubbi, Buyya, Marusic & Palaniswami, 2013; Heile, 2010).

Figure 10: General smart home management model
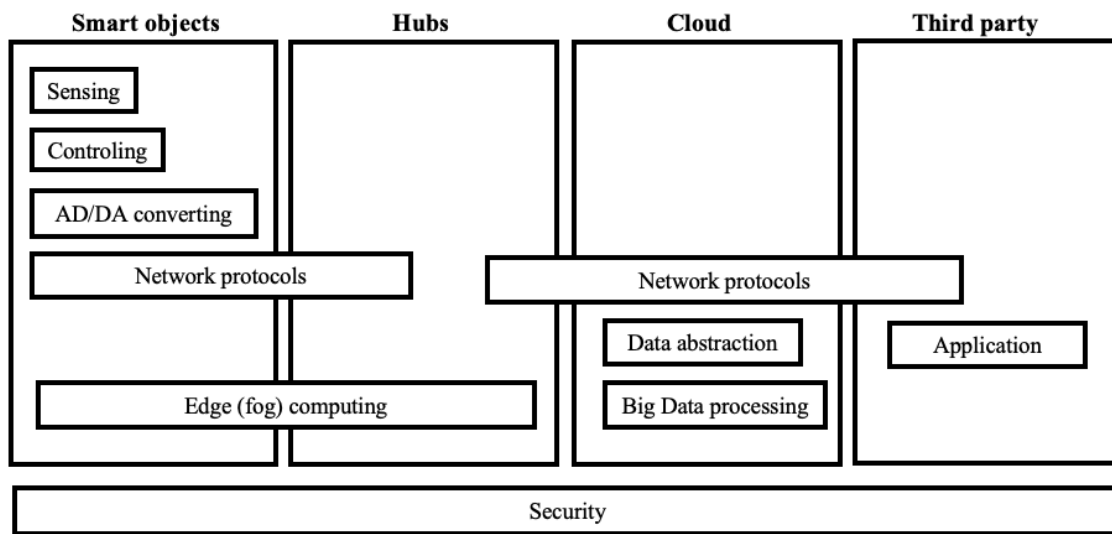
Source: Risteska Stojkoska & Trivodaliev (2016).

Cloud's principal task is to store the data collected. It is the most intricate part of the smart home management model. New algorithms based on time series processing, advanced analytics, and machine learning technology will enable further cloud capabilities (Xu, He & Li, 2014; Gubbi, Buyya, Marusic & Palaniswami, 2013). With the constant data streams that need to be processed, abstracted and analysed, the cloud converts the event-based data it receives to query-based processing, enabling big data to be processed and analysed. It also simplifies third-party application access and usage through data abstraction, as it processes the data in such a manner so that the application can read it (Risteska Stojkoska & Trivodaliev, 2016).

Third-party application providers develop their platforms for the end-user to use as tools of management. They develop regulators, schedulers, and load balancers to optimise smart home management for the end-user. A scheduler serves for defining time schedules of appliances, a regulator manages flexible devices, such as heaters and cooling, and load balancing optimises energy consumption (Fan et al., 2010; Risteska Stojkoska & Trivodaliev, 2016).

2.5 Smart home market

The following chapter will define and examine the smart home market globally and regionally. The market will be further individually examined by each segment (smart appliances, security, control and connectivity, home entertainment, energy management, comfort and lighting). Seven countries were selected to depict and compare market developments and segment developments between different countries and areas. The selected countries are United States, United Kingdom, China, Germany, Italy, Netherlands and Slovenia. United States, United Kingdom and China were chosen because they lead the smart home market in one way or another. Germany and Italy were chosen because they are important importers for Slovenia. While, Netherlands were chosen because Slovenia tends to look up to them for sustainability matters. The smart home market segmentation and data are retrieved from various sources, but predominantly from the statistical web source Statista. The data retrieved from the website are updated up to November 2020; as such, the data may vary with the actual figures by the time this paper is published. The chapter then analyses the external environment, value chain, competitive landscape and concludes with drivers, barriers, and trends.

2.5.1 Market overview

The smart home market is comprised of sales of networked devices and services that facilitate house automation for end users (B2C). Under the smart home market fall networked devices, whose main purpose is home management through monitoring, control and regulation of functions and services that enable automated home management:

- Interconnected and remotely controlled devices in a household network;
- cloud services, sensors and actuators that enable home automation;
- control hubs that interconnect and remotely control sensors and actuators;
- B2C sales of software and hardware;
- B2C sales of subscription and monitoring fees.

Products whose essential function is not home automation are excluded:

- Smartphones and smart tablets;
- smart TVs and other products that relate to the home segment but have limited functions in remote control;
- B2B and C2C sales (Statista, 2021).

2.5.2 Key market indicators

The undermentioned key market indicators provide a social and economic position of the selected countries and provide further understanding of relevant market developments.

2.5.2.1 Digital infrastructure

An adequate digital infrastructure is fundamental for developing a digital market like the smart home market. This statistic shows the estimated percentage of households having internet access in the Netherlands, United Kingdom, Germany, Slovenia, United States, Italy and China in 2020 (see Figure 11). While the world's average household internet penetration reached 62.7% as a share of the population in 2020, the penetration distribution is disproportionate across countries worldwide. From the countries selected, the Netherlands (97.1%) shows the highest percentage of household internet penetration, followed by the United Kingdom (93.7%) and Germany (91.1%). High household internet access indicates the potential market base for smart home market growth. Slovenia's household internet penetration (90.3%) is higher than the world's average (62,7%) and Europe's average (84,7%). While, on the other hand, we can observe that China (67.5%), Italy (72.8%) and United States (84.2%) have the least household internet penetration among the selected countries (Statista, 2021).

Figure 11: Household internet penetration in the selected countries in 2020
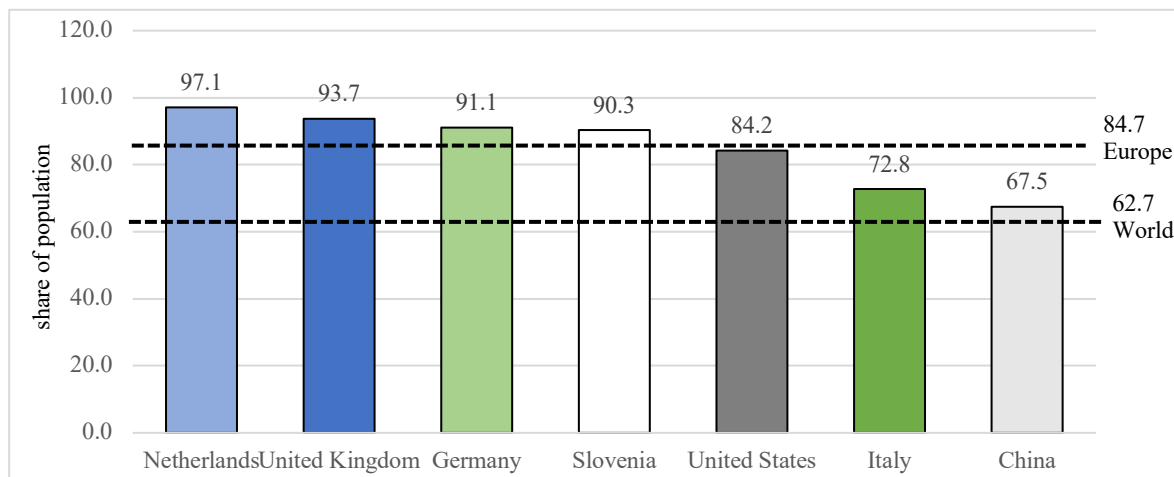
Source: Statista (2021).

Ramesh (2017), who studied the reasons behind disproportionate internet distribution across the world, observed that the larger the population of a country or territory is, the lesser is the household internet penetration. Along with other significant and complex factors, she noticed that penetration depends on the expenses involved with using internet services. Lower are the expenses, more users there will be. Furthermore, she detected that internet penetration directly depends on the country's internet usage policies and information access. Nevertheless, the household internet penetration rate does not fully represent the potential size of the smart home market. The case of the Netherlands, which has the highest household Internet penetration among selected countries, is a smaller market than China due to its country's size (Statista, 2021).

The digital economy is growing faster than other economies, and most of it is stimulated by broadband internet. The European Commission and other governmental bodies are

advancing the adoption of high-speed internet through various incentives, as they are aware it is fundamental to the growth of the digital markets (European Commission, 2014). Fixed broadband subscription is another key element of the knowledge economy and a key indicator of the digital infrastructure. The indicator refers to fixed subscriptions with high-speed access to the public internet, which is greater than 256 kbit/s. Extensive internet access promotes the economy, innovation and foreign direct investment (Lee & Brown, 2009; OECD, 2014).

Figure 12: Fixed broadband subscription and average connection speed forecast worldwide (2019-2024)
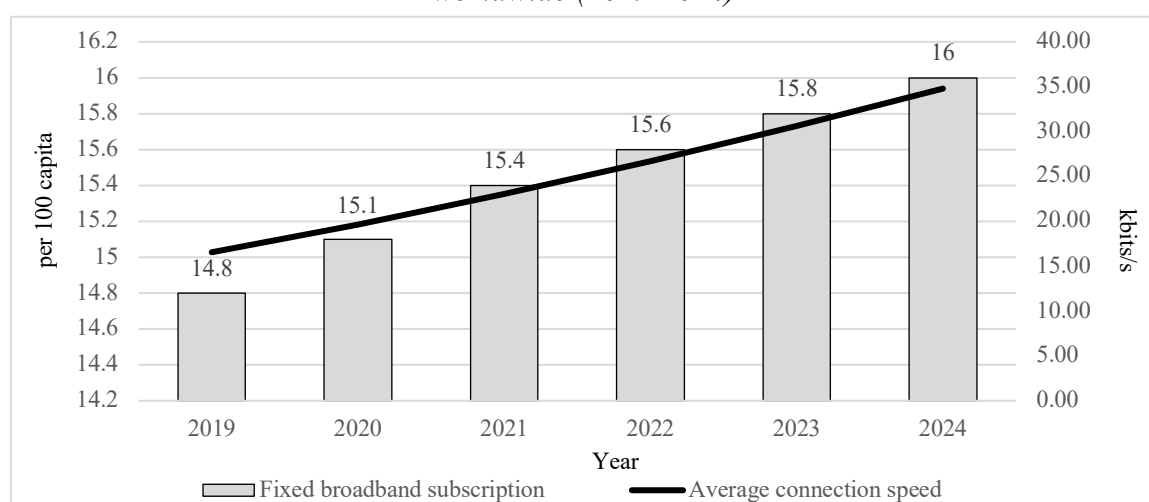
Source: Statista (2021).

The statistic shows the number of fixed broadband subscriptions per 100 inhabitants worldwide from 2019 to 2024 (see Figure 12). On the second axis, it shows the global average connection speed in kbit/s. Overall, we can observe that the global internet infrastructure is steadily increasing with the years that follow. In 2024 it is estimated that there will be 16 fixed broadband subscriptions per 100 inhabitants worldwide with a global average speed connection of 34.79 kbits/s (Statista, 2021). Over the years, the internet infrastructure has improved immensely, and its developments are being endorsed by many governments worldwide, as the many uses of the internet have hugely boosted the economy (Zhao, Fischer, Aker & Rigby, 2013).

The smartphone penetration rate is also inconsistent across the countries worldwide. Smartphone adoption depends on various social, economic and technological factors. Kakihara (2014) noticed that the smartphone penetration rate is generally greater in developed countries compared to underdeveloped countries and that the dispersal of ICT infrastructure does not assure a dispersal of smartphone adoption, making the two indicators uncorrelated.

Figure 13: The smartphone penetration rate in the selected countries in 2020
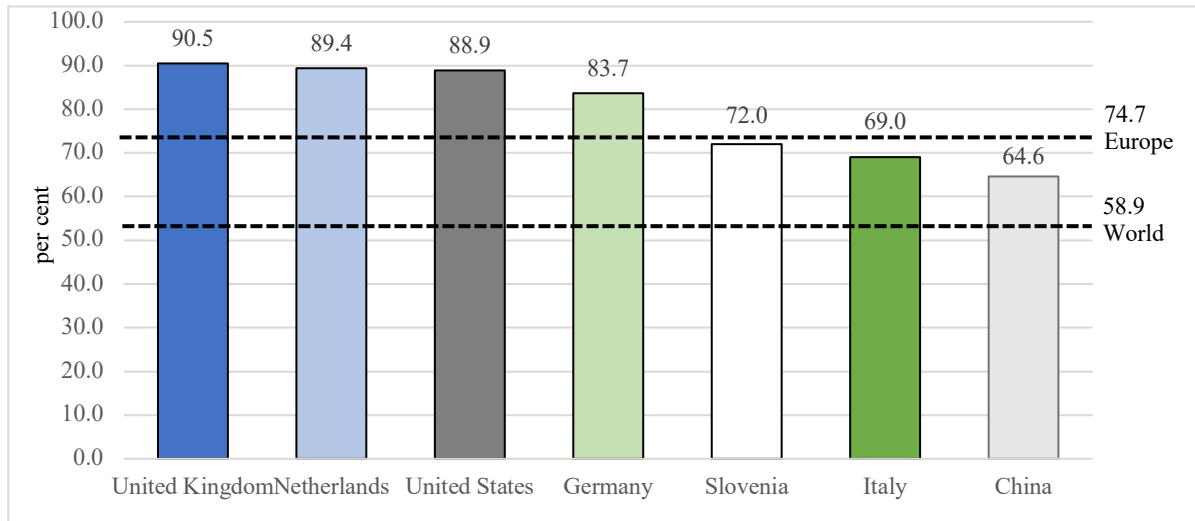
This statistic shows estimated smartphone penetration in the United Kingdom, Netherlands, United States, Germany, Slovenia, Italy and China in 2020 (see Figure 13). The penetration rate refers to the share of the total population. The United Kingdom has a 90.5% smartphone penetration, the highest rate out of the selected countries. Netherlands and United States show almost equivalent smartphone penetration rates at 89.4% and 88.9%. Germany's smartphone penetration at 83.7% is well above the world's average at 58.9% and Europe's average at 74.7%. While the smartphone penetration in Slovenia at 72%, Italy at 69% and China at 64.6% fall above the world's average but fall under Europe's average (Statista, 2021).

Figure 14: Worldwide IoT revenue and smart home revenue comparison (2019-2025)
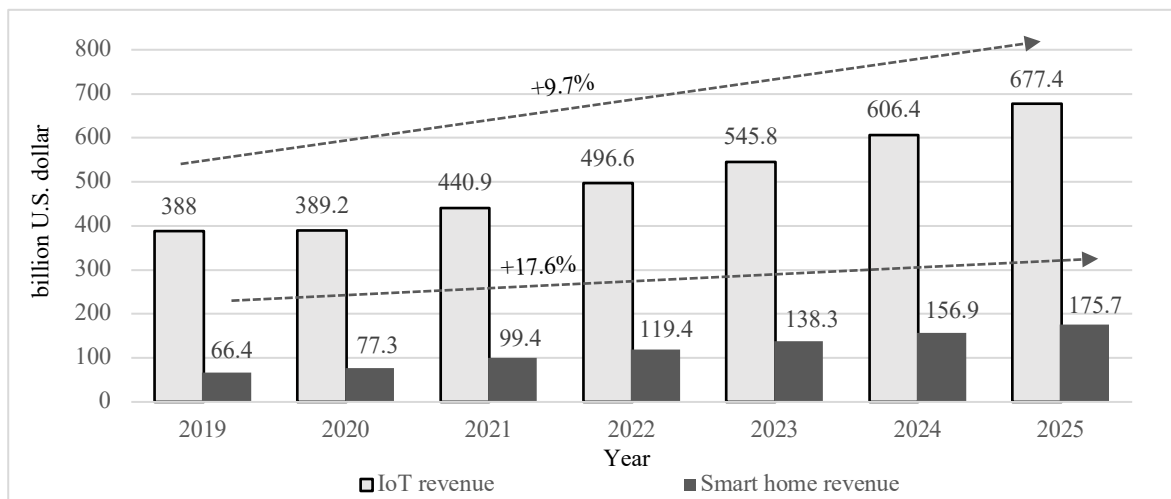
The smart home market falls under the IoT umbrella, as it is a fundamental concept to the smart home system; therefore, the smart home market potential is bound by the IoT infrastructure. It is estimated that the worldwide IoT revenue will amount to 677.4 billion

US dollars in 2025, while the worldwide smart home revenue will total 175.7 billion US dollars in 2025 (see Figure 14). Comparing the IoT revenue and smart home revenue forecast for the coming years, we can observe that smart home revenue will grow at a higher compound annual growth rate (CAGR) than the IoT revenue. While the IoT revenue will grow at 9.7% CAGR, the smart home revenue will grow at 17.6% CAGR. Thus, in 2025, the smart home segment will represent a higher share of the IoT revenue than it did in 2019. By 2025, the share of the smart home revenue will represent around 25% of the total IoT revenue (Statista, 2021).

2.5.2.2 Socio-economic overview

Social and economic factors continuously shape the business environment as a whole. Gross domestic product (GDP) per capita indicates a country's economic wellbeing by measuring how much of an economic production value can be accredited to each citizen.

Figure 15: GDP per capita in the selected countries in 2019
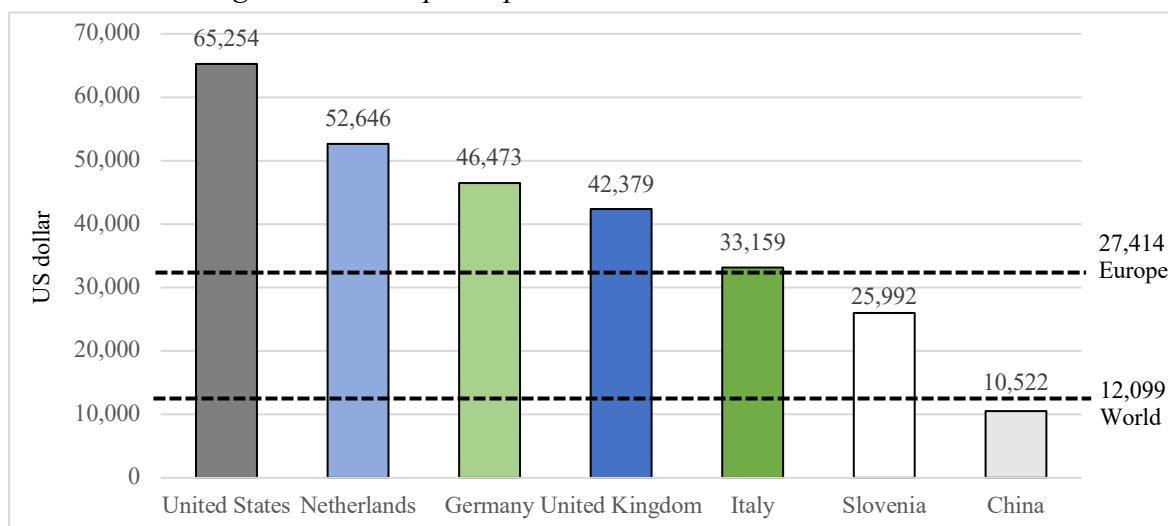
Source: IMF (2021a).

This statistic shows the GDP per capita in current prices in the United States, Netherlands, Germany, United Kingdom, Italy, Slovenia and China in 2019 (see Figure 15). In 2019, United States had the largest GDP per capita among the selected countries, amounting to 65,254 US dollars per capita. Netherlands recorded the second largest GDP per capita at 52,646 US dollars per capita, followed by Germany at 46,473 US dollars per capita and the United Kingdom at 42,379 US dollars per capita. Italy at 33,159 US dollars per capita and Slovenia at 25,992 per capita fall between Europe's average and the world's average GDP per capita. While China's GDP per capita, amounting to only 10,522 US dollars, falls under both averages (IMF, 2021a).

Figure 16: Consumer spending per capita in the selected countries in 2019
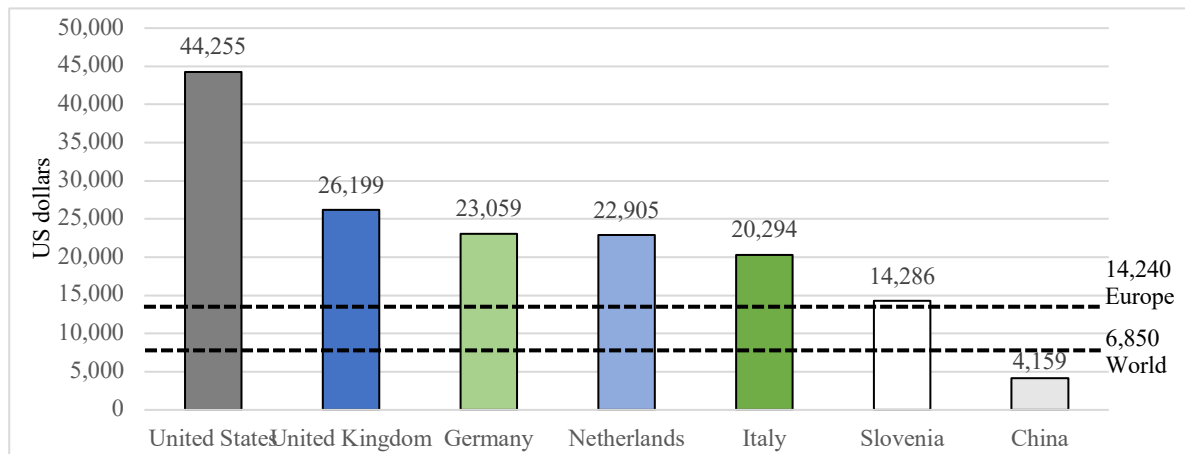
Consumer spending per capita encompasses the total amount of money spent on final goods and services per citizen. Spending by the state and corporations is not included. It is one of the fundamental indicators of economic prosperity. This statistic shows estimated consumer spending per capita in current prices (in US dollars) in the United States, United Kingdom, Germany, Netherlands, Italy, Slovenia, and China in 2019 (see Figure 16). The data are shown in nominal terms and has not been adjusted for inflation. Consumer spending per capita is by far the highest in the United States (44,255 US dollars). United Kingdom (26,199 US dollars), Germany (23,059 US dollars), and Netherlands (22,905 US dollars) are spending above Europe's average (14,240 US dollars). Slovenia's consumer spending per capita is around Europe's average. While China's consumer spending per capita below the global level at 4,159 US dollars (Statista, 2021).

Total population refers to the potential size of the market. The statistic shows the total population in China, United States, Germany, United Kingdom, Italy, Netherlands and Slovenia in 2019 (see Figure 17). China presents itself as the biggest market regarding the total number of inhabitants as they had around 1.4 billion inhabitants in 2019. United States presents itself as the second-largest market from the selected countries and the total population, as they have around 329 million inhabitants, followed by Germany, United Kingdom, Italy, Netherlands and Slovenia (IMF, 2021b).

Figure 17: The total population in the selected countries in 2019
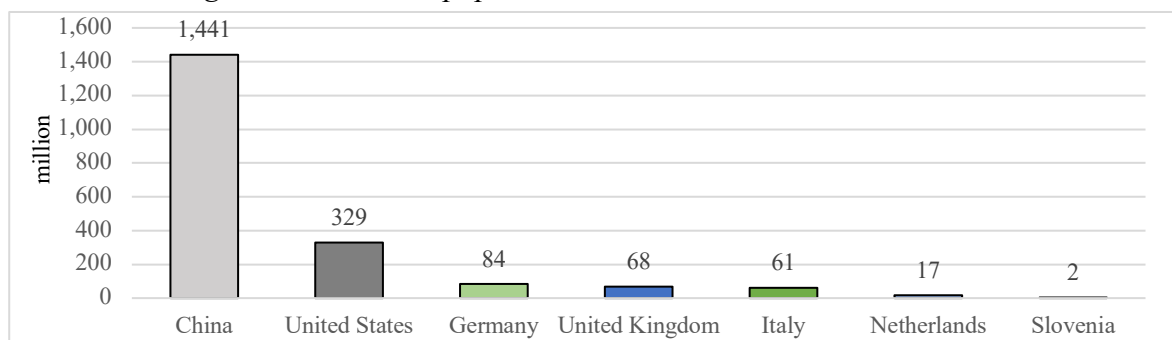
Overall, sustainable urbanisation aids in economic development. The urban population has been growing rapidly since the 1950s. To ensure that urbanisation benefits are inclusive to all, countries need to establish appropriate policies to manage urban growth by providing access to social and infrastructure services to every inhabitant. Otherwise, if the rapid urban growth is mismanaged, it can lead to the country's lower living standards and higher unemployment (UN, 2018). This statistic shows the total population living in urban areas in the Netherlands, United Kingdom, United States, Germany, Italy, China and Slovenia in 2019 (see Figure 18). In 2019, 55.9% of the world's population lived in urban areas. At 91.8% of the urban population share, Netherlands had the most urbanised population out of the selected countries, followed by United Kingdom (83.7%), United States (82.5%) and Germany (77.4%). Italy's (70.7%) and China's (60.5%) urban population share is between Europe's average (74.5%) and the world's average (55.9%). While Slovenia, at 54.8%, recorded the lowest urbanisation population share in 2019 between the selected countries (World Bank, 2020).

Figure 18: Urban population share in the selected countries in 2019
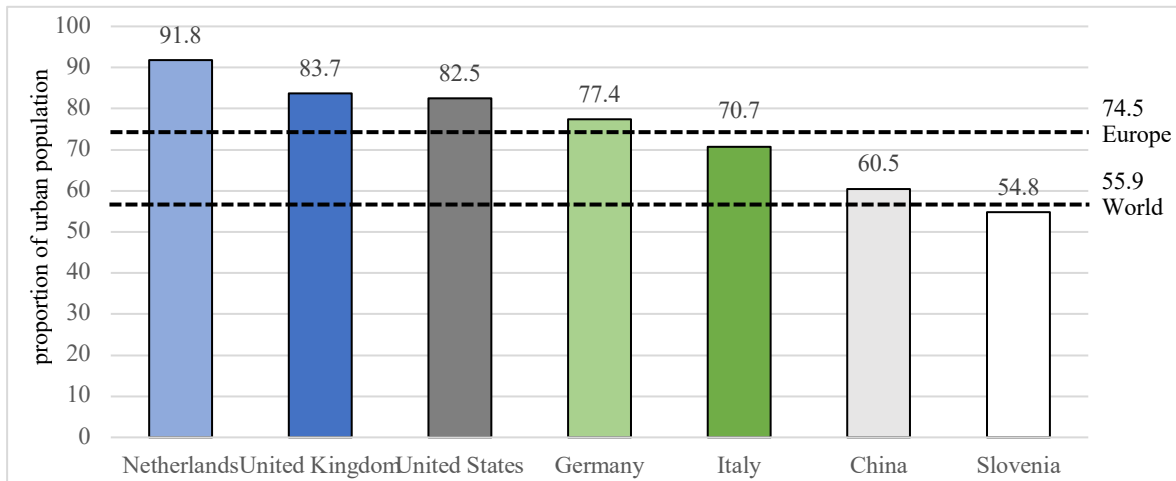
Source: World Bank (2020).

2.5.3 Market potential

The IoT concept has thrilled both the technology industry and consumers, yet the integration of the IoT into households has been a slow process. This statistic depicts the global smart home revenue partitioned by segment and CAGR forecast from 2019 to 2025, which is adjusted for the expected impact of COVID-19 (see Figure 19). The statistics show a steady 17.6% CAGR of the global smart home revenue, estimated to reach 175.7 billion US dollars in 2025. The biggest segment of the global revenue remains smart appliances, followed by control and connectivity, security, home entertainment, comfort and lighting and energy management (Statista, 2021).

Source: Statista (2021).

Some countries have experienced a relatively fast development of the smart home market, and some countries are catching up. The statistic shows the total smart home revenue and CAGR forecast in the selected countries in 2025 (see Figure 20). United States presents itself as the biggest smart home market by revenue in 2019 and 2025, with a CAGR of 13.4%. Europe's market is predicted to increase with a higher CAGR (26.7%) than the United States, reaching 44.9 billion US dollars in 2025. Out of the selected countries, China portrays the highest estimated CAGR at 21%, even though it will still stay the third-largest market, preceded by the United States and Europe's average. United Kingdom is estimated to reach 11,9 billion US dollars in smart home revenue in 2025, making it the biggest market among the selected countries in Europe, followed by Germany (9.6 billion US dollars), Netherlands (2.3 billion US dollars) and Italy (1.4 billion US dollars). Slovenia is estimated to grow at 20.1% CAGR, yet it will remain the smallest market (18 million US dollars) between the selected countries due to its geographical size and population count. A country's size and population play an essential role in what the revenue potential can reach (Statista, 2021).

Figure 20: Total smart home revenue and CAGR forecast in the selected countries in 2019 and 2025
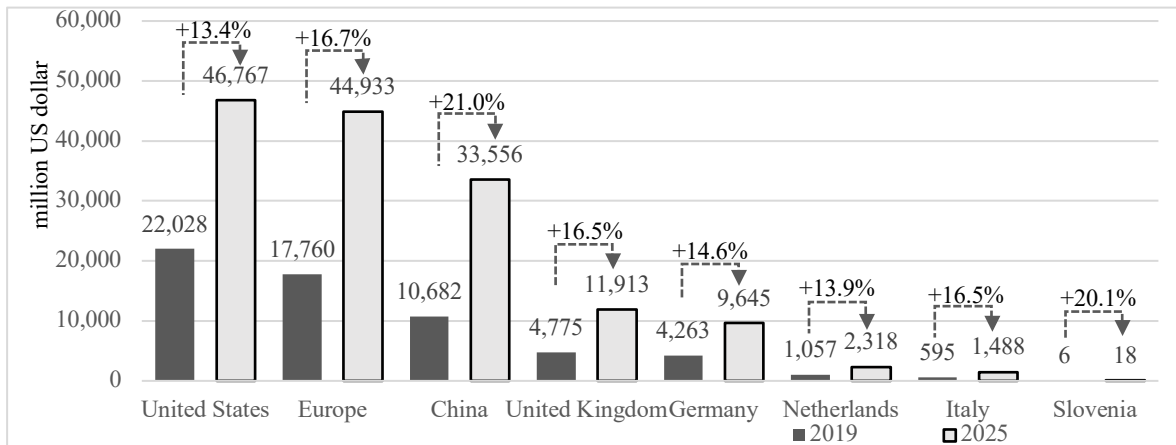
Source: Statista (2021).

The widespread economic impact of the COVID-19 pandemic affected industries and markets differently. Regarding the impact of the pandemic on the smart home market, the sale of consumer electronics decreased as shops have been closed, manufacturing was on hold, and logistics were obstructed, all of which influenced the smart home revenue. The statistic shows pre-COVID-19 and post-COVID-19 comparison of the global smart home revenue and CAGR forecast in 2020 (see Figure 21). The statistic depicts that the estimated worldwide smart home total revenue decreased by 8% due to the pandemic impact. It is estimated to decrease from 83.5 billion US dollars to 77.2 billion US dollars when adjusted for the COVID-19 impact, while the market's growth slowed down for most countries (Statista, 2021).

Figure 21: Pre COVID-19 and post COVID-19 comparison of global smart home revenue forecast in 2020
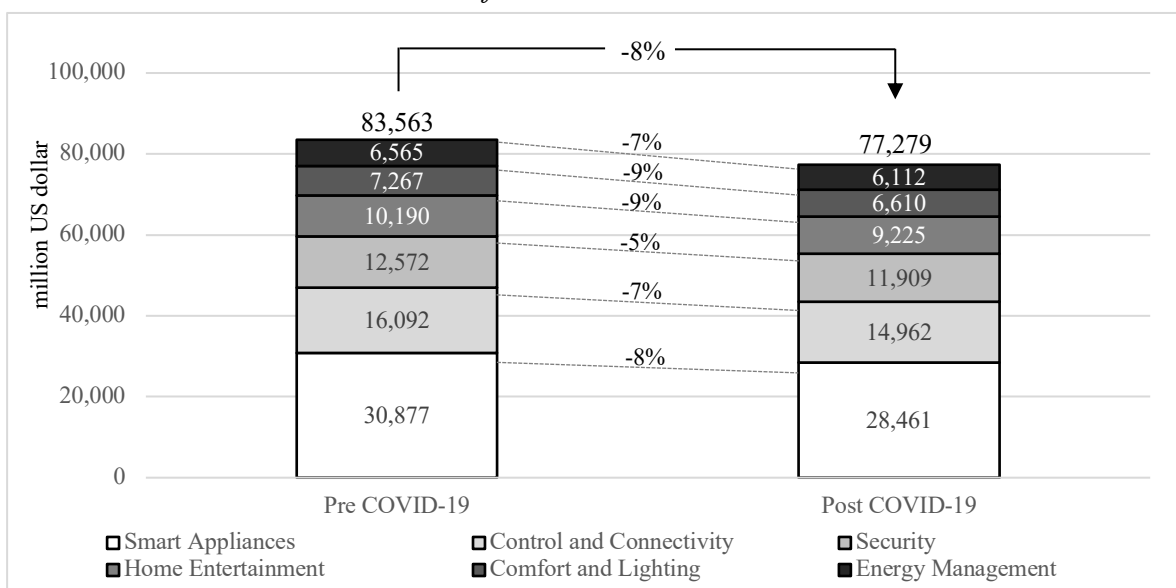
Source: Statista (2021).

The market is closely linked to household services and consumer spending for appliances; therefore, the decline in total smart home revenue will decrease spending in those areas. Observing the segments separately, the statistic shows that the most affected segments are home entertainment (-9%), comfort and lighting (-9%) and smart appliances (-8%), as the sale of durable goods declines the most in economic recessions. More indispensable everyday devices, such as security systems (-5%), will be less affected by the pandemic than devices that serve entertainment purposes. Despite countries' market differences, the logistics obstacles caused by the pandemic did slow down the growth of smart home revenue worldwide (Statista, 2021).

Figure 22: Pre COVID-19 and post COVID-19 global smart home revenue forecast comparison (2017-2025)
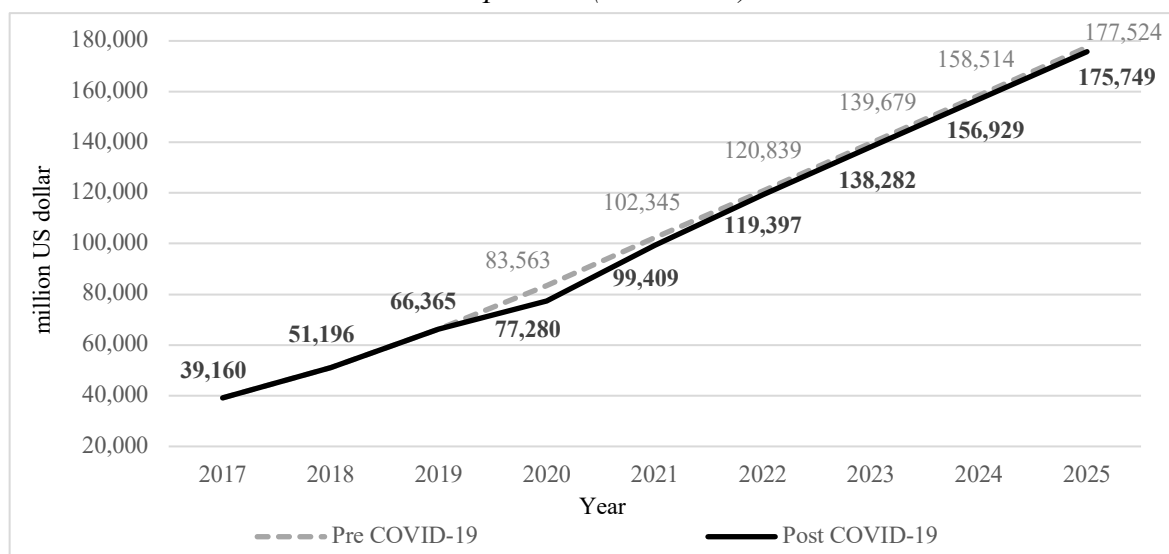
Source: Statista (2021).

The statistic shows pre-COVID-19 and post-COVID-19 global smart home revenue forecast comparison from 2017 to 2025 (see Figure 22). The statistics data was published in November 2020 while the pandemic was still ongoing, so the forecast may be subject to change. Overall, the statistic displays a slight tilt in the global smart home revenue growth in 2020. It shows that the global smart home revenue growth slowed down during the year of the pandemic. However, from 2021 to 2025, the statistic shows that the global smart home revenue will catch up quickly with the pre-COVID-19 forecast. In 2025, the post-COVID-19 global revenue will be around two billion US dollars short compared to the pre-COVID-19 forecast (Statista, 2021).

The statistic presents the smart home household penetration rate in the selected countries in 2020 (see Figure 23). It shows the share of smart homes from the total number of households. The diffusion of innovation presents sequential consumer groups adopting smart home products at a different rate. Generally, innovative products are not adopted immediately by all. Alternatively, people are more inclined to adopt the innovation in a manner of time sequence, which can be clustered into five adopter categories: Innovators, early adopters,

early majority, late majority, laggards. A 100% adoption rate is theoretically possible but realistically improbable, as the diffusion curve depicts the degree to which innovations are dispersed among consumers. The technology curve runs out, and the product life cycle starts to decline when late adaptors and laggards start to use the product. In the next years, smart home adoption is estimated to slowly but steadily grow (Kakihara, 2014; Statista, 2021; Rogers, 2003).

Figure 23: The smart home household penetration rate in the selected countries in 2020
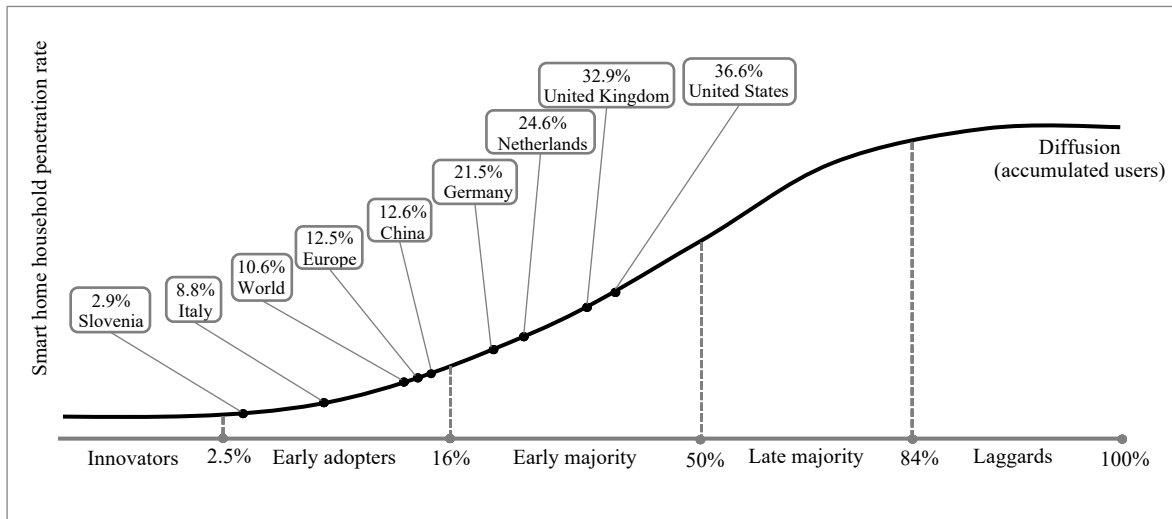
Adapted from Statista (2021) and Rogers (2003).

Apart from being the largest smart home market by revenue, United States also leads in the smart home household penetration rate in 2020 at 36.6%. The United Kingdom, with a 32.9% household penetration rate, is in second place from the selected countries, followed by Netherlands (24.6%), Germany (21.5%), and China (12.6%). Considering that the household internet penetration is relatively low in Italy (72.8%) (see Figure 11), it is expected that the smart home household penetration will be relatively low. Because the internet household penetration is high in Slovenia (90.3%), it is odd that the smart home household penetration is the lowest (2.9%) from the selected countries. A high household internet penetration and a relatively low smart home household penetration indicate smart home adoption barriers (Statista, 2021).

2.5.4   Smart home segments

The various services that comprise the smart home market are clustered into six segments: Smart appliances, security, control and connectivity, home entertainment, energy management and comfort and lighting (Statista, 2021). Described individually below are the segments.

2.5.4.1 Smart appliances

The smart appliances segment covers all IoT enabled household appliances:

- Small appliances including microwaves, vacuums and other kitchen robots;
- large appliances including washing machines, fridges, ovens and dishwashers;
- all directly or indirectly IoT enabled household appliances.

The segment does not include:

- Any household appliances that cannot be connected via the IoT platform;
- any other smart home devices, which are partially referred to as appliances;
- B2B and C2C sales (Statista, 2021).

The benefits of replacing existing household appliances with smart appliances are numerous, even though the benefits depend on the appliances themselves. The IoT devices can be controlled remotely, which increases the safety and comfort factor. Smart ovens can be automatically turned off in potentially dangerous circumstances, and smart vacuums can automatically operate according to a set schedule, while coffee machines can be set to brew a coffee at the time user's morning alarm rings. These incremental innovations and their benefits are primarily driven by the customer's demand for home safety, although customisable functionalities can cater to different customer's needs. Experts are certain the incremental innovation is bound to replace existing household appliances in the long run. Experts predict further developments in:

- Automated re-stock of products, such as food, drinks and detergents;
- energy management, such as washing machine automatically finding the optimal time and program for minimal costs and externalities;
- customisation and pattern identification, such as a coffee machine's user recognition technology, which brews a coffee to the user's specific liking (Statista, 2021; Trulsson, 2021).

Market size

The statistic depicts the smart appliances worldwide revenue and CAGR forecast from 2019 to 2025 (see Figure 24). The data is adjusted for the COVID-19 impact. In 2021, the segment is expected to reach 37.2 billion US dollars in global revenue. Overall, the graph denotes a steady 18.5% CAGR of the smart appliances segment, reaching 67.6 billion US dollars in 2025.
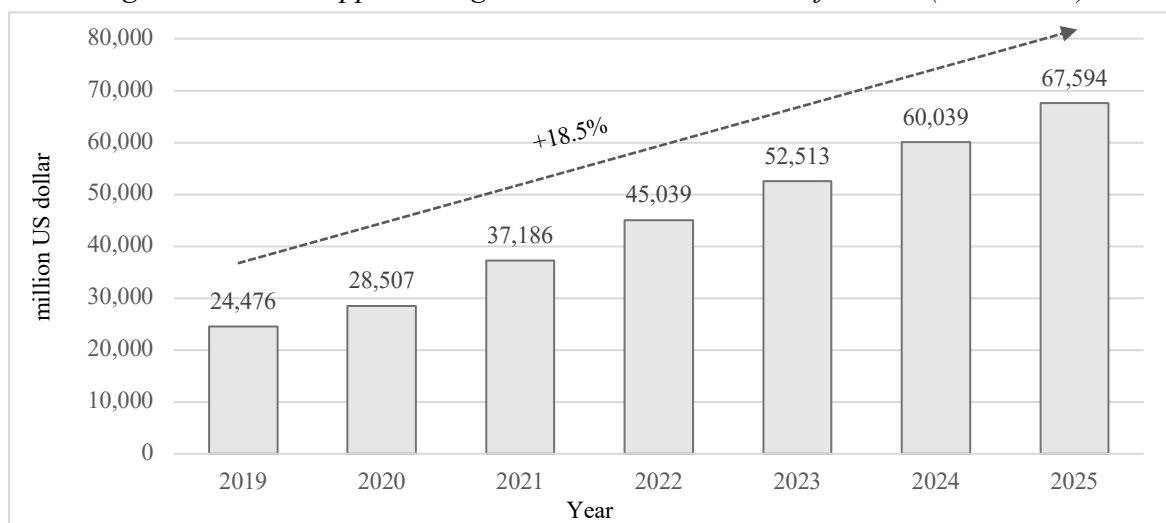
Source: Statista (2021).

A geographical comparison of the selected countries discloses that the largest smart appliances revenue will be generated in China, aggregating 17.1 billion US dollars in 2025 with a 20.7% CAGR (see Figure 25). United States will grow with a CAGR of 13.6% by 2025, lower than Europe's average (17.6%). Out of the selected European countries, United Kingdom's (3.3 billion US dollars) and Germany's (3.2 billion US dollars) smart appliances market will be the largest, growing at 17.1% and 15.3% CAGR, respectively. Due to its size and population count, Slovenia is the smallest smart appliances market, reaching 7 million US dollars in 2025 (Statista, 2021).

Smart appliances' average revenue per smart home is estimated to decrease in the future. As increasingly more people adopt smart appliances, the technology becomes cheaper to produce due to economies of scale and new market entrants, which provide cheaper alternatives, will further saturate the market as the years continue. United States recorded the highest average revenue per smart home (790.18 US dollars) in 2019, and it is estimated that in 2025 it will still earn the highest revenue per smart home (526,82 US dollars) (see Appendix 2). Out of the selected European countries, United Kingdom is estimated to generate the highest average revenue per smart home (497.83 US dollars) in 2025, even though, Netherlands generated more average revenue per smart home (787.22 US dollars) in 2019 than the United Kingdom (781.41 US dollars). China generated the lowest average revenue per smart home (183.19 US dollars) in 2019 and is estimated to generate the lowest revenue in 2025. Slovenia ranks the second lowest in this category, estimated to earn 207.2 US dollars per smart home (Statista, 2021).

Figure 25: Smart appliances total revenue and CAGR forecast in the selected countries in 2019 and 2025
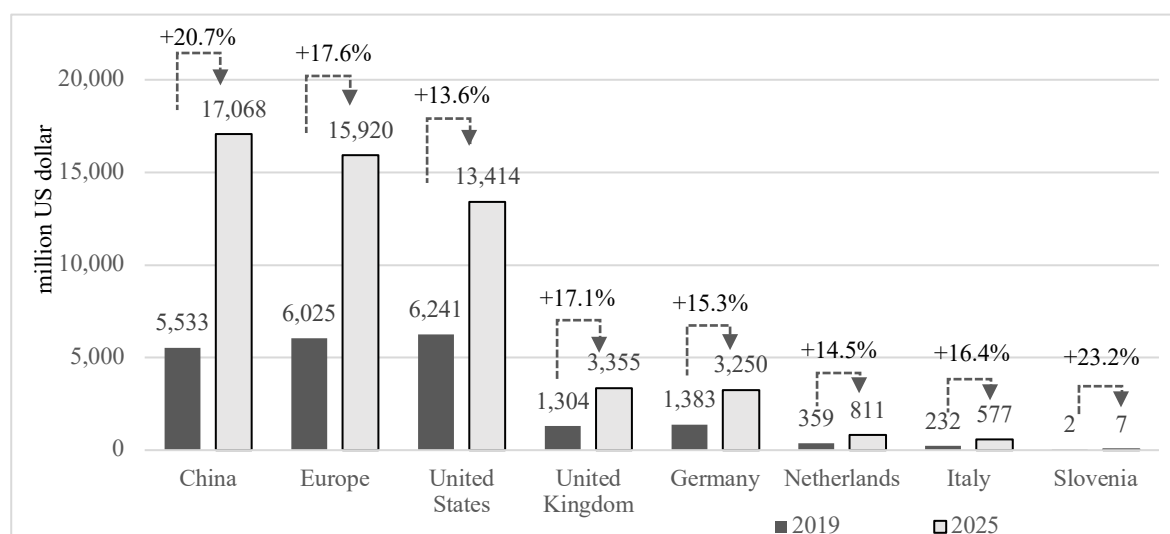
The statistic shows smart appliances household penetration rate in the selected countries in 2020 (see Figure 26). It depicts the share of smart homes from the total number of households of the selected segment. Smart appliances household penetration is the highest in the Netherlands (7.5%), closely followed by the United States (7.4%), United Kingdom (7.2%) and Germany (7.1%). Considering that China will be the largest smart appliances market in 2025, its penetration rate is low (4.9%). This is an indication that China exports a large share of produced smart appliances to other countries. While the penetration of smart appliances in Italy (2.9%) and Slovenia (1.2%) is below the world's average (3.4%) and Europe's average (3.8%) (Statista, 2021).

Figure 26: Smart appliances household penetration rate in the selected countries in 2020
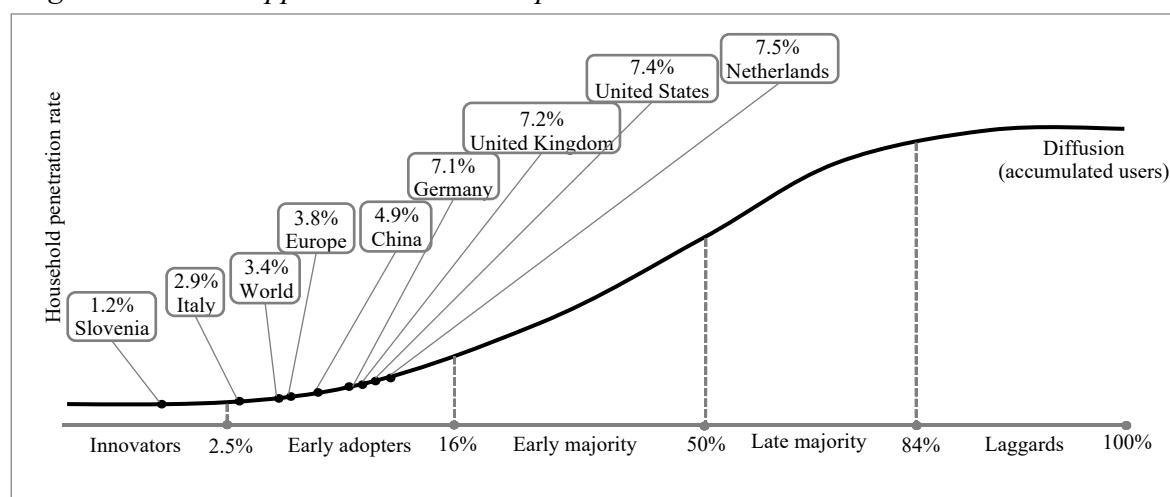
The smart appliances segment is further categorised into small appliances and big appliances (see Appendix 3). Until 2021, small appliances, such as vacuum robots, are pushing the

adoption of smart appliances. From 2022 on, it is estimated that big appliances will take the lead in the adoption rate, as existing smart ones replace big appliances due to the natural end of their product life cycle (Statista, 2021).

2.5.4.2 Security

The security segment covers the sale of services and devices, whose primary purpose is management and control of households:

- IoT enabled surveillance services;
- digitally connected and controllable security devices;
- smart door locks, motion sensors, alarms, transmission services and security cameras;
- hazard prevention connected devices that enabled risk monitoring, such as humidity sensors and smoke detectors.

The security segment does not include:

- Security devices that cannot be connected to the IoT network;
- emergency security services and remote surveillance, which are not relating to the smart home concept;
- B2B and C2C sales of any kind (Statista, 2021).

The security segment caters to consumers' needs for a secure home. Connected security devices can monitor the household while the user is away, prevent burglaries or autonomously call emergency responders. In case of any home intrusion, homeowners are immediately notified and are able to control the home to minimise the damage remotely. The security devices are controlled wirelessly through provided mobile applications. Furthermore, installing connected security devices is decreasing drastically, making the devices appeal to a wider public. Experts predict the following security trends:

- Cybersecurity will remain a top priority;
- security segment division will blur, as security devices will function for other aspects as well, such as comfort or energy management;
- a fundamental factor to success for the security segment and other smart home areas will be to become a customer-centred company by emphasising the product's uses (e.g. burglary prevention or hazard prevention) instead of the product itself (Statista, 2021; Fidler, 2020).

<u>Market size</u>

The security segment accumulated 11.9 billion US dollars in revenue worldwide in 2020 (see Figure 27). From 2020 to 2023, the global revenue will almost double, generating 27.2

billion US dollars. The segment is estimated to reach 27.2 billion US dollars in revenue in 2025, growing at an average rate of 18.3% (Statista, 2021).

Figure 27: Security global revenue and CAGR forecast (2019-2025)
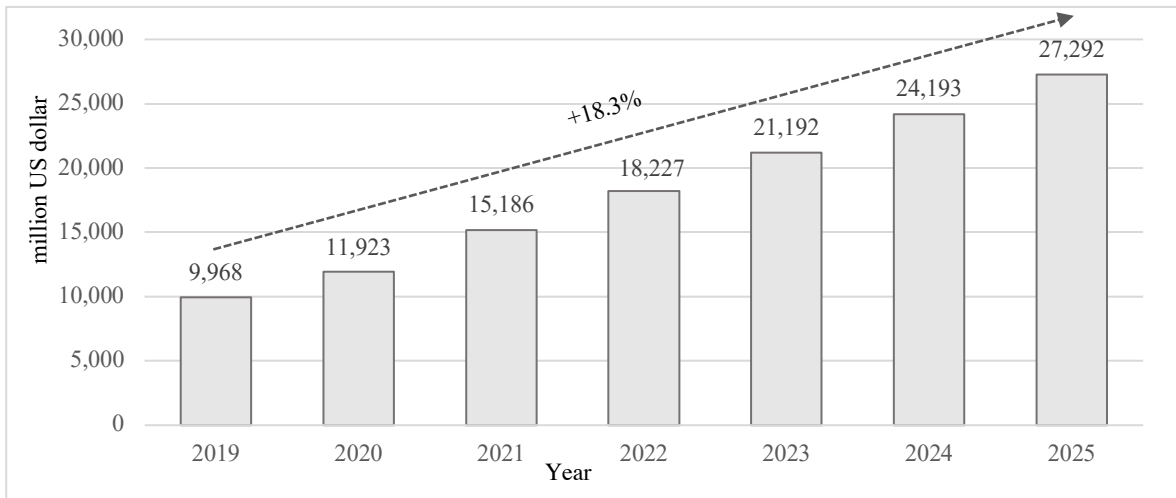
Source: Statista (2021).

The statistic shows that United States will stay the biggest market for smart security, attaining 8.1 billion US dollars in revenue and 14% CAGR in 2025 (see Figure 28). In 2025 the size of China's smart security revenue (5.4 billion US dollars) is estimated to increase to Europe's level (5.2 billion US dollars). From the selected European countries, United Kingdom will generate the largest revenue (1.2 billion US dollars), followed by Germany (990 million US dollars), Netherlands (307 million US dollars), Italy (177 million US dollars) and Slovenia (4 million US dollars) (Statista, 2021).

Figure 28: Security total revenue and CAGR forecast in the selected countries in 2019 and 2025
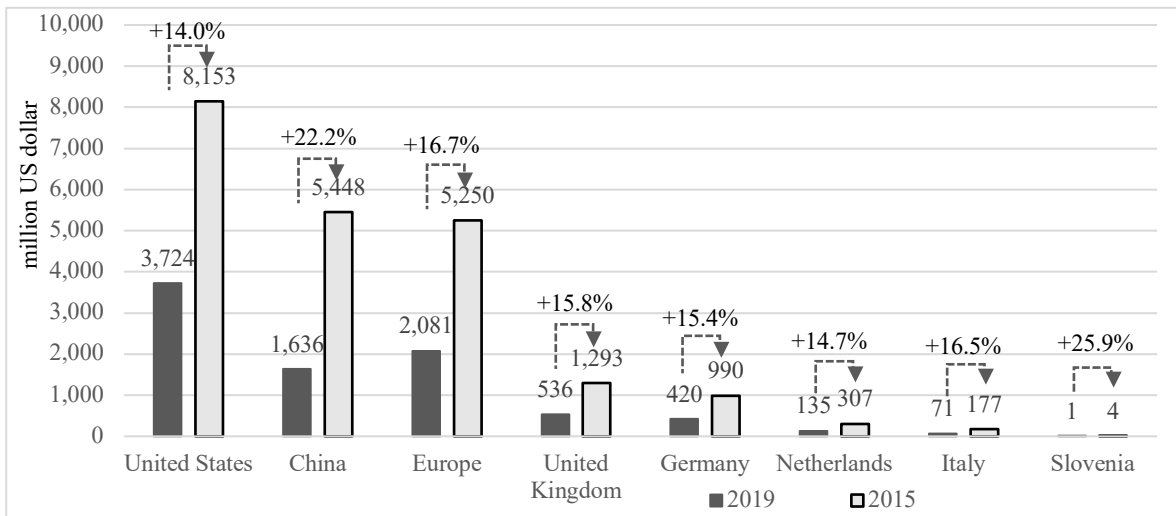
Source: Statista (2021).

The United States, yet again, will have the largest average revenue per smart home in the security segment (170.49 US dollars) in 2025 (see Appendix 4). The second-largest average

revenue per smart home will be in Slovenia (126.57 US dollars), closely followed by United Kingdom (125.21 US dollars). Even though the Netherlands made the highest average revenue in 2019, it is estimated that it will make 104.77 US dollars per smart home, ranking fourth from the selected countries. Germany will earn 80.9 US dollars per smart home in the security segment in 2025, which is around Europe's average (92.8 US dollars). China will still produce the smallest average revenue per smart home in 2025, attaining only 62.03 US dollars per smart home security segment (Statista, 2021).

The United States leads in security adoption at a rate of 14.6% (see Figure 29). From the selected European countries, United Kingdom (9.2%), Netherlands (8.4%) and Germany (6.8%) have a security adoption rate higher than Europe's average (4.3%). Given that China's total security revenue will grow at 22.2% CAGR (see Figure 28), its security household penetration rate is relatively low (4.8%). Italy's (3.3%) and Slovenia's (1.2%) security adoption rate is the lowest, ranking lower than Europe's average (4.3%) and the world's average (4%) (Statista, 2021).

Figure 29: Security household penetration rate in the selected countries in 2020
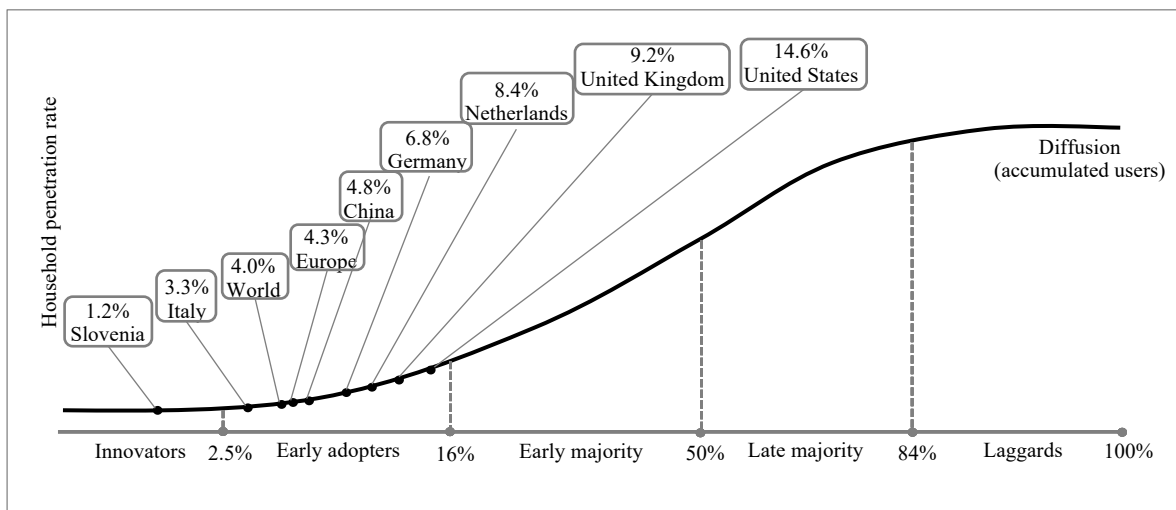
Adapted from Statista (2021) and Rogers (2003).

From a product perspective, the statistic indicates that smart security cameras have been and will be most popular among consumers, as the adoption rate is the highest at 2% in 2020 (see Appendix 5). By 2025 it is estimated that the smart security cameras penetration rate will increase to 6%. Smart locks rank second, with a 1.4% penetration rate in 2020 and estimated growth to 4.6% in 2025. Smoke detectors have an estimated penetration rate of 3.9% in 2025, followed by motion detectors (1.5%), flood detectors (0.5%), I-surveillances (0.3%) and lastly AAL products (0.1%) (Statista, 2021).

2.5.4.3 Control and connectivity

The control and connectivity segment covers services and equipment that make up the intelligent and automated home network:

- Communication and control units, such as hubs and gateways that are capable of controlling connected devices from all smart home segments;
- smart plugs, smart home panels, smart sockets and programmable control keys (voice control or touch control);
- hardware services such as control applications and connectivity services;
- smart speakers, whose main function is control and digital assistance, such as Google Home and Amazon Echo.

The segment does not include:

- Smart speakers, whose main function is entertainment;
- any smart home appliances;
- smartphones and smart tablets;
- B2B and C2C sales (Statista, 2021).

The control and connectivity segment delivers a fundamental infrastructure for connecting the IoT home devices and enables communication between the devices and their users. The central piece of the connected infrastructure is a hub, which connects the IoT devices and enables the convenient user management of the devices. Experts predict the following trends:

- The issue of interoperability will be addressed in the future, as new entrants enter the market with products that support multiple communication standards;
- in the long term, it is predicted that smart home hubs will become obsolete, as leading providers of Wi-Fi routers are adding smart home features to their existing routers;
- demand for virtual voice-activated assistants is estimated to increase as AI capabilities evolve;
- clear partitions between the smart home segments will blur as companies are starting to produce highly integrable and multifunctional products so that customers will not need too many devices for a single purpose (Statista, 2021; Adilin, 2021; Ali & Yusuf, 2018).

Market size

The control and connectivity segment is the second-largest by revenue out of the smart home segments, after smart appliances. It is estimated to reach 36.1 billion US dollars in 2025, with an average growth of 18.7% (see Figure 30). Comparing the average growth among the segments reveals the highest for the control and connectivity segment, even though the differences in estimations are slim (Statista, 2021).

Figure 30: Control and connectivity global revenue and CAGR forecast (2019-2025)
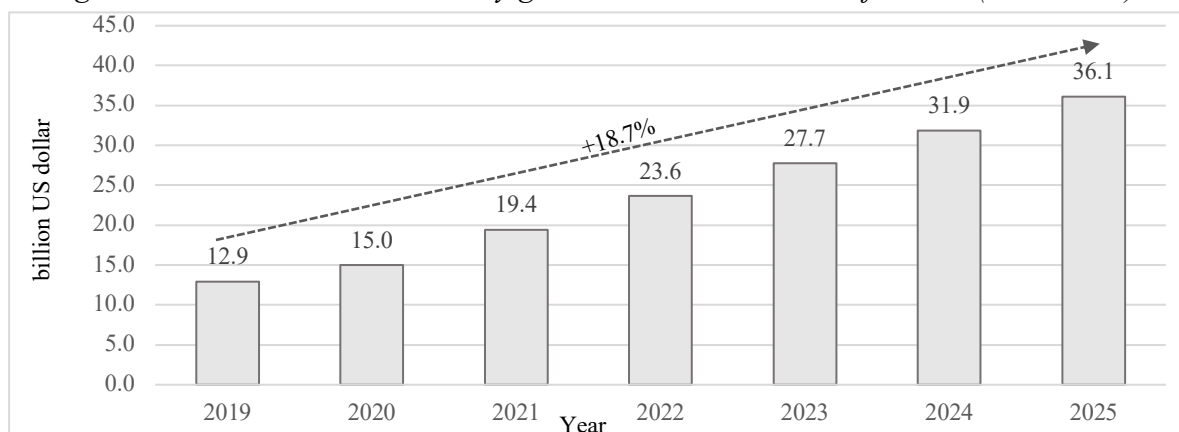
Source: Statista (2021).

A geographical comparison reveals the United States as the largest market by far for the control and connectivity segment, estimated to attain 12.3 billion US dollars in revenue in 2025 with an average growth of 15.4% (see Figure 31). China's control and connectivity segment will grow at an average of 18.8%, realising an estimated 10.2 billion US dollars in revenue in 2025. Out of the selected European countries, United Kingdom's market (3.7 billion US dollars) will lead in 2025, followed by Netherlands (358 million US dollars, Italy (305 million US dollars) and Slovenia (2 million US dollars) (Statista, 2021).

Figure 31: Control and connectivity total revenue and CAGR forecast in the selected countries in 2019 and 2025
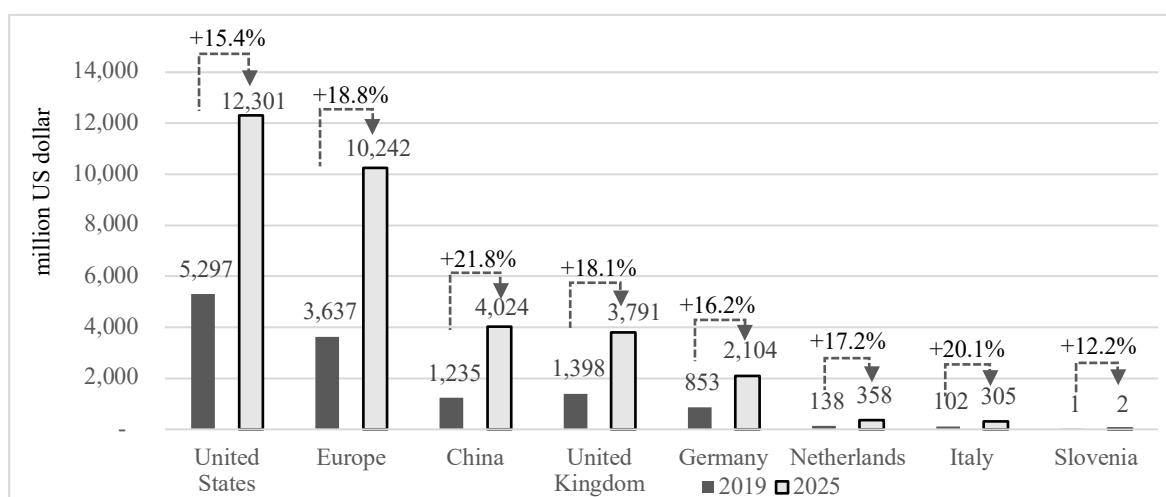
Source: Statista (2021).

In 2019, the highest generated average revenue per smart home was in the Netherlands (386.92 US dollars), followed by United Kingdom (307.29 US dollars), Europe's average (262,59 US dollars), Germany (228.14 US dollars), United States (222.65 US dollars), Italy (155.48 US dollars), China (91.64 US dollars) and Slovenia (45.68 US dollars) (see Appendix 6). By 2025, the average revenue will decrease overall but differently in each country. In 2025, United States (180.79 US dollars) will earn the largest average revenue per smart home, followed by Netherlands (167.03 US dollars), United Kingdom (160.24 US

dollars), Europe's average (141.96 US dollars), Italy (114.39 US dollars), Germany (102.09 US dollars), China (59.55 US dollars) and Slovenia (34.58 US dollars) (Statista, 2021).

United States (21.9%), followed by United Kingdom (20.6%), lead in control and connectivity household adoption rate in 2020 (see Figure 32). Germany's (11.7%) and the Netherlands' (6%) adoption rate is above Europe's average (5.2%). China (3.8%), Italy (3.1%) and Slovenia (2.7%) appear to be below the world's average (4.4%) in the adoption rate of this segment (Statista, 2021).

Figure 32: Control and connectivity household penetration rate in the selected countries in 2020
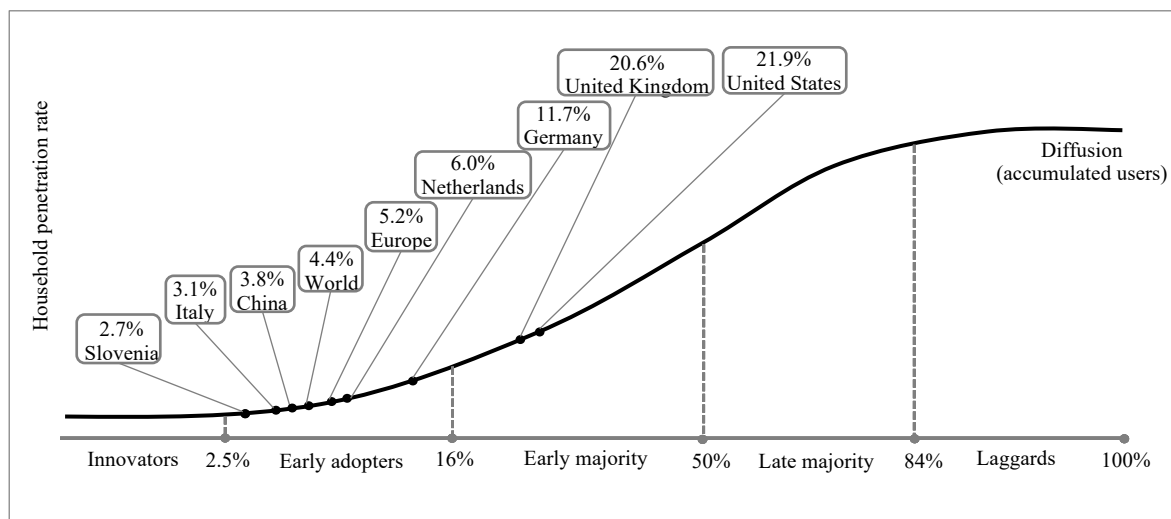
Adapted from Statista (2021) and Rogers (2003).

Product comparison reveals that smart speakers have the highest household penetration rate among control and connectivity products within the presented timeframe (see Appendix 7). By 2025, a noticeable increase in adoption rate is visible for smart speakers (15.3%), smart plugs (6.3%) and control buttons and panels (4%). Meanwhile, gateways will have an adoption rate of only 1.8% by 2025 (Statista, 2021).

2.5.4.4 Home entertainment

The home entertainment segment covers the sale of products and services related to home entertainment, remote controls and streaming devices:

- Digitally connected and controllable devices, whose main purpose is entertainment;
- streaming devices, such as Google Chromecast and Amazon Fire TV stick;
- multi-room entertainment systems, such as sound and video systems;
- entertainment remotes.

The segment does not cover:

- Smart TVs and receivers that are not IoT enabled;
- traditional entertainment systems that are not IoT enabled;
- smart speakers, whose primary purpose is control and connectivity;
- B2B and C2C sales of any kind (Statista, 2021).

The home entertainment devices can be connected wirelessly, which can keep the installation costs low, and they can be remotely controlled, which allows for smooth integration into all smart home processes. The multi-room entertainment systems can be managed through remote controls, smartphones, smart tablets, smart assistants, or other applications. Along with entertainment purposes, home entertainment systems can be integrated with security devices for safety purposes. When security devices detect motion around the house, they can activate entertainment devices to simulate presence in the house. Experts predict the following trends:

- The smart entertainment systems will become cheaper, which will drive high-price home entertainment companies to partner up with other low-price smart home providers to offer inexpensive solutions;
- the streaming devices market share will decrease, as smart TVs will incorporate similar features into the hardware;
- smartphones will become the main entertainment control devices;
- the need for interoperability of smart home entertainment systems with smart assistants might degrade smart home entertainment companies to hardware manufacturers that only provide the basis for the smart assistants (Statista, 2021; CES, 2019).

Market size

Globally, the home entertainment segment accumulated 9.2 billion US dollars in 2020 and is estimated to reach 15.5 billion US dollars in 2025, growing at an estimated 11.3% CAGR (see Figure 33). Out of the smart home segments, the home entertainment segment shows the slowest growth (Statista, 2021).

Figure 33: Home entertainment global revenue and CAGR forecast (2019-2025)
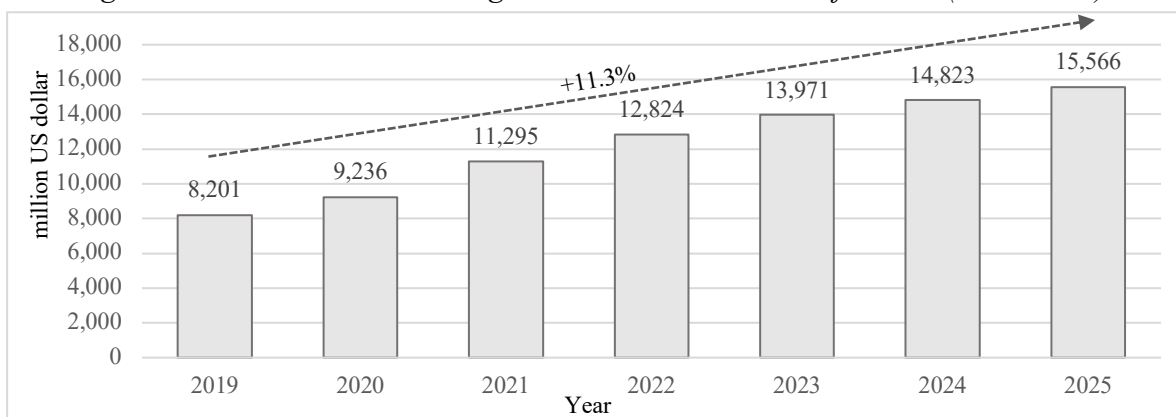
Source: Statista (2021).

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The geographical comparison indicates that Europe will be the largest market for home entertainment, reaching 4.1 billion US dollars in 2025, followed by United States (3.9 billion US dollars) and China (2.8 US dollars) (see Figure 34). Although China is in third place regarding revenue, it will experience the largest average growth out of the selected countries and territories, at 17.3% CAGR by 2025. Out of the selected European countries, United Kingdom will accumulate the largest revenue (1.04 billion US dollars) in the home entertainment segment, followed by Germany (934 million US dollars), Netherlands (207 million US dollars), Italy (111 million US dollars) and Slovenia (2 million US dollars) (Statista, 2021).

Figure 34: Home entertainment total revenue and CAGR forecast in the selected countries in 2019 and 2025
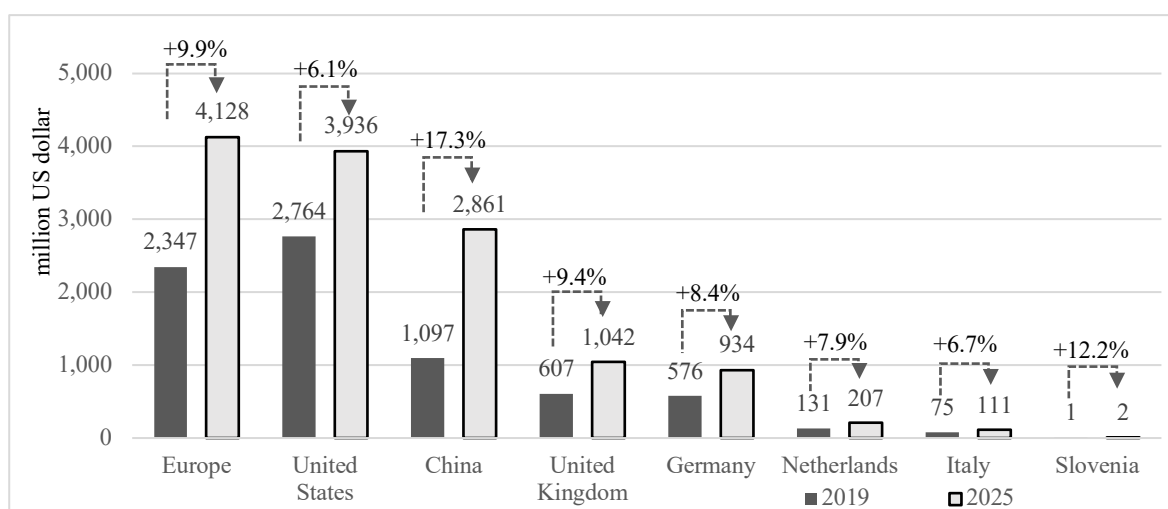
Source: Statista (2021).

In 2019, Germany accrued the largest average revenue per smart home (300.68 US dollars), followed by United Kingdom (286.46 US dollars), United States (267.69 US dollars), Netherlands (242.66 US dollars), Europe's average (212.73 US dollars), Italy (153.49 US dollars), Slovenia (107.6 US dollars) and China (63.5 US dollars) (see Appendix 8). By 2025, the sequence will change. By 2025, it is estimated that the United States will generate the largest average revenue per smart home (138.14 US dollars), followed by United Kingdom (112.82 US dollars), Italy (80.94 US dollars), Netherlands (78.7 US dollars), Europe's average (78.13 US dollars), Germany (61.89 US dollars), Slovenia (60.6 US dollars) and China (37.73 US dollars) (Statista, 2021).

The home entertainment household adoption rate in 2020 was the highest in the United States (9.4%) and closely followed by United Kingdom (9.3%) (see Figure 35). Netherlands' (8.8%) and Germany's (6.4%) penetration rates are well above Europe's average (4.1%) and the world's average (3.7%). In comparison, China's (4.8%) penetration rate is at around Europe's average. Italy's (2.2%) and Slovenia's (1.6%) home entertainment adoption rates again fall below Europe's and the world's average (Statista, 2021).

Figure 35: Home entertainment household penetration rate in the selected countries in 2020
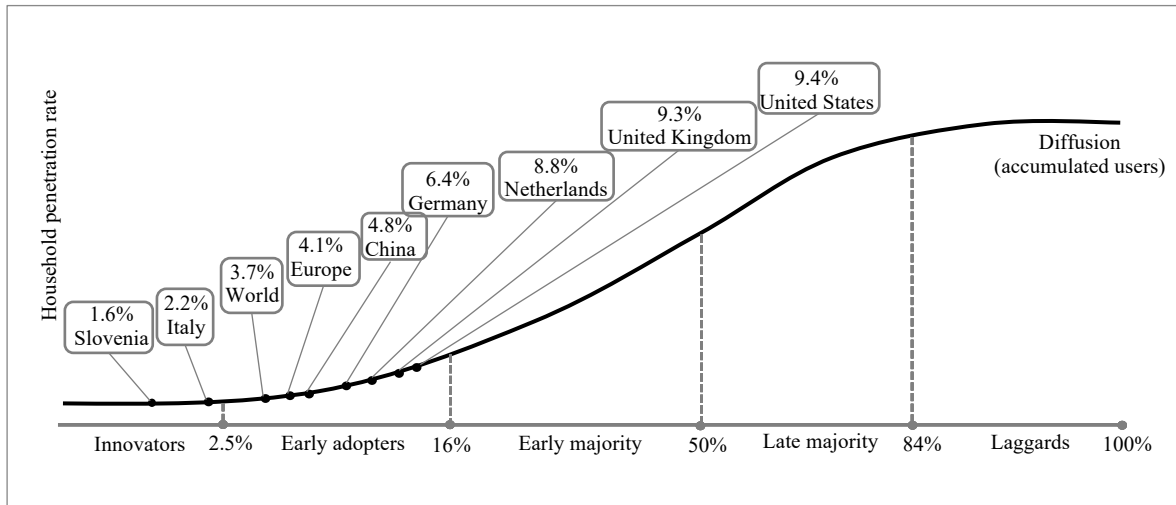
Adapted from Statista (2021) and Rogers (2003).

The statistic shows that multi-room entertainment systems have the highest adoption rate, estimated to reach 6.8% by 2025 (see Appendix 9). Streaming devices will penetrate the market at a rate of 5.1% in 2025. The lowest adoption rate will obtain smart remotes, estimated to reach 2% by 2025, which coincides with experts predictions that smartphones will slowly replace smart remote controls (Statista, 2021).

2.5.4.5 Energy management

The energy management segment covers the sale of services and products, whose purpose is the control and management of energy consumption:

- IoT connected and controlled devices, whose main purpose is energy-saving;
- digitally connected sensors, such as sunlight, temperature, precipitation, wind and humidity sensors;
- IoT enabled radiator controls, air condition controls and thermostats;
- weather forecast services that can be connected to the smart home network (Statista, 2021).

The segment does not cover:

- Digitally connected light bulbs, smart meters, smart plugs and smart sockets,
- IoT enabled window and door sensors;
- IoT connected household appliances;
- B2B and C2C sales of any kind (Statista, 2021).

Cost savings and added comfort are the two prevalent factors that drive customers to procure smart energy management systems. Thermostats, which are connected to air condition

systems and radiator controls, provide temperature control and management. The temperatures can be remotely adjusted individually to each room connected to the smart home grid. Some devices offer the ability to learn patterns and propose routines so that users can adjust different settings to day or night actions. Some smart air condition systems can measure indoor air quality as well, such as air humidity and pollution. Weather forecast services specialise for smart home management purposes calculate the weather surrounding the household and adjust the house settings accordingly. As such, the smart energy management system tackles the energy savings aspect and partially the added comfort factor. Experts predict the following trends:

- Companies in the traditional energy management sector are IoT enabling their existing products to compete with the emerging smart home trend;
- although the current smart home focus is on energy perseverance, it is expected that there will be a shift towards energy storage and energy production;
- electric vehicles will be integrated into the smart home grid and used for power storage purposes (Statista, 2021; Porter, Thompson, Wellener, Sanborn & Ashton, 2021).

The statistic shows the energy management global revenue and CAGR forecast from 2019 to 2025 (see Figure 36). Oil prices and demand for energy management are directly proportional. In case of an oil crisis, the sales in the energy management segment would substantially increase accordingly. As there are no such market indicators, the estimate is based on the steady energy price rise. In 2020, the energy management segment generated 6.1 billion US dollars in global revenue. By 2025, it is estimated to reach 14.06 billion US dollars, with a compounded average growth of 18.5%. Overall, the share of services is substantially lower than the share of hardware sales in the energy management revenue overall (Statista, 2021).

Figure 36: Energy management global revenue and CAGR forecast (2019-2025)
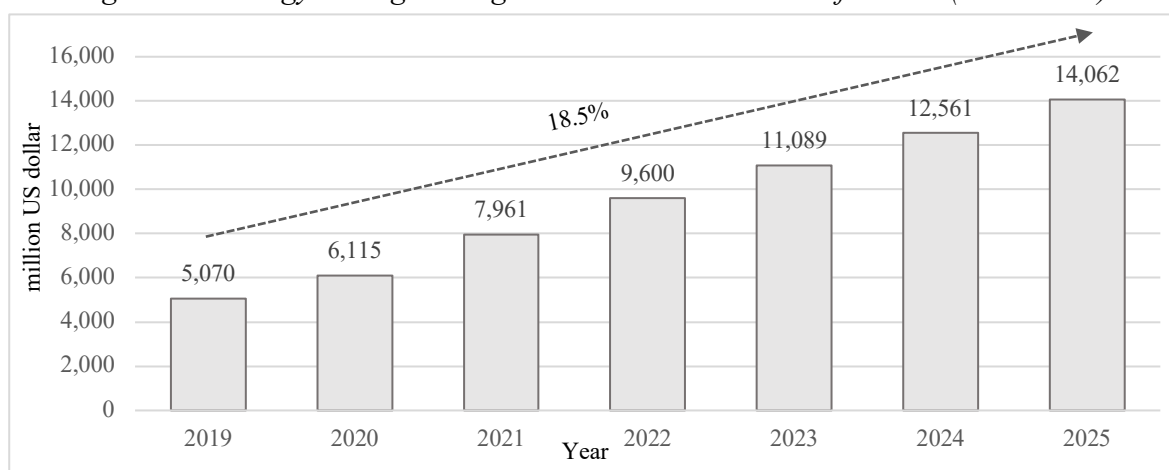
Source: Statista (2021).

A regional comparison reveals that United States leads in this segment, attaining 4.6 billion US dollars in 2025 (see Figure 37). The second largest is Europe's market, realising 4.2

billion US dollars in 2025. China's pollution issues are pressing the Chinese government to push forward new environmental policies, consequently increasing demand for energy management solutions. Thus, China will experience the largest compounded average growth (22.7%) by 2025, attaining 2.04 billion US dollars. Out of the selected European countries, Germany will generate the most revenue (1.1 billion US dollars) in 2025, followed by United Kingdom (921 million US dollars), Netherlands (343 million US dollars), Italy (141 million US dollars) and Slovenia (1 million US dollars) (Statista, 2021).

*Figure 37: Energy management total revenue and CAGR forecast in the selected countries in 2019 and 2025*
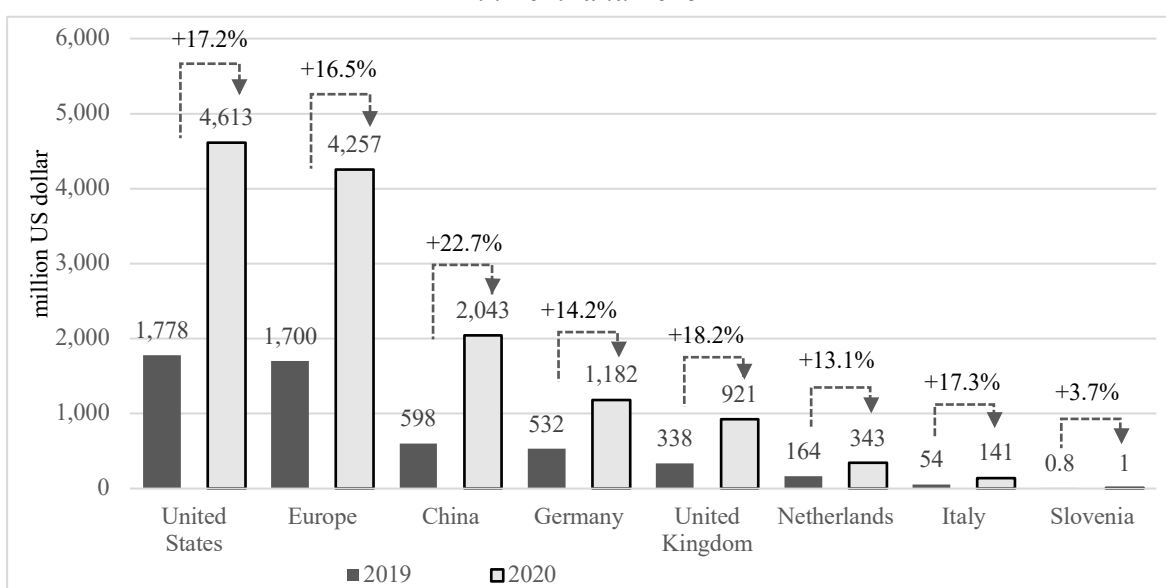
Source: Statista (2021).

At first, smart homes were luxurious households with high installation costs. Nowadays, new smart home developments are driving down production costs, making smart homes a possibility for middle-class households. In 2019, Netherlands generated the most average revenue per smart home (250.86 US dollars) in the given segment (see Appendix 10). By 2025, the largest average revenue per smart home will be made in United States (114.17 US dollars). Netherlands' (80.02 US dollars) and Germany's (77.2 US dollars) average revenue per smart home will remain higher than Europe's average (68,12 US dollars) for the predicted period. Whereas, United Kingdom (65.69 US dollars), Italy (60.34 US dollars), and Slovenia (19 US dollars) fall below Europe's average. China shows a low average revenue per smart home (24.1 US dollars) in 2025. The household income distribution in China is heterogeneous, which corresponds with the low average revenue per smart home as there is a wide prosperity gap between its inhabitants (Statista, 2021).

Slovenia's low average revenue per smart home can be linked to its low energy management household adoption rate (1.1%) (see Figure 38). The following statistic shows the share of smart homes from the total number of households with smart energy management components in their household in 2020. Along with Slovenia, Italy (2.7%) also displays a lower energy management penetration rate than the world's average (3.2%). Out of the

selected European countries, Netherlands (11.2%) has the highest adoption rate, followed by United Kingdom (10.8%) and Germany (8.4%), which is well above Europe's average (4.2%). The United States is the world's leader in energy management adoption, penetrating the market at 11.3% in 2020 (Statista, 2021).

Figure 38: Energy management household penetration rate in the selected countries in 2020
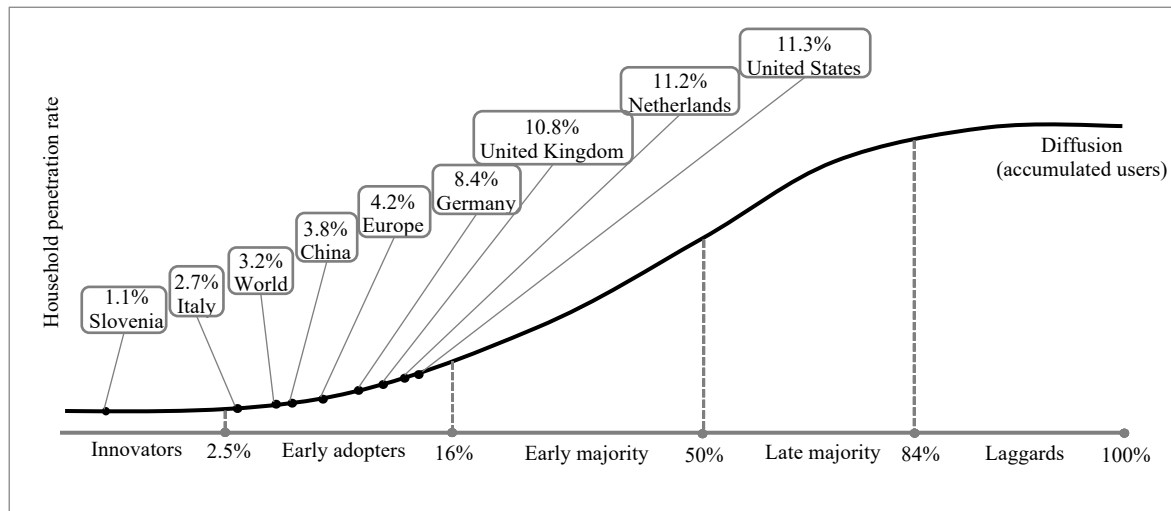
Adapted from Statista (2021) and Rogers (2003).

The energy management segment is classified into five product types: AC controls, multi measuring units, radiator controllers, smart thermostats and weather services. Smart thermostats have the highest adoption rate, expected to reach 4.7% by 2025, followed by radiator controller (3.1%), AC controls (2.4%) and multi measuring units (2.1%) (see Appendix 11). Weather services show the lowest expected household adoption rate, estimated to reach 0.4% by 2025 (Statista, 2021).

2.5.4.6 Comfort and lighting

The comfort and lighting segment covers the sale of devices, whose main purpose is the general improvement of the household's living atmosphere and lighting system:

- Actuators and sensors, such as window sensors, door sensors that can be connected to the smart home grid;
- IoT connected and controllable shades, shutters and garage door controls;
- IoT connected and controllable light bulbs (Statista, 2021).

The segment does not cover:

- Gateways, hubs and control buttons;
- smart TV's;
- digitally connected and controllable devices, whose main purpose is entertainment;

- IoT enabled and programmable power sockets;
- B2B and C2C of any kind (Statista, 2021)

Uses from the comfort and lighting segment can be integrated into other areas of the smart home domain. Smart bulbs can be programmed to simulate home presence when the homeowner is away for a longer period, and window sensors can be programmed so that the heating is shut down for the time the windows are open. Because the smart bulbs are relatively low-price and the installation costs are low, products from this segment are usually a starting point for smart home integration into their households. Experts predict the following trends:

- Apart from the basic smart bulb functions of on/off switching, colour-changing and dimming, there is a trend to develop other functionalities for the smart bulbs, such as smoke detection and speaker functions;
- the manufacturers of traditional light bulbs will have to integrate the IoT connected smart home concept into their existing products to compete in the long run with new smart home entrants (Statista, 2021; Higuera, Llenas & Carreras, 2018).

The comfort and lighting segment generated 6.6 billion US dollars globally in 2020 (see Figure 39). By 2025, it is estimated to reach 15.3 billion US dollars, growing annually at 17.5%. Projections show that the comfort and lighting segment's popularity grows among people as prices for smart bulbs decrease (Statista, 2021).

Figure 39: Comfort and lighting global revenue and CAGR forecast (2019-2025)
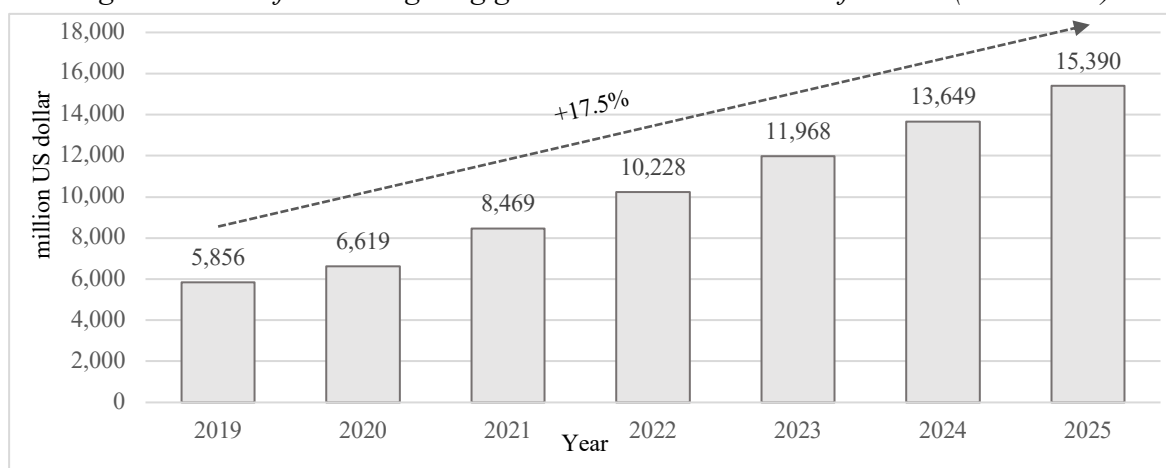
Source: Statista (2021).

The prices of light bulbs depending on the cost of the components needed to assemble them. As semiconductors are an essential part of lightbulbs, their price consequently affects the price of the light bulb. With its ability to procure inexpensive semiconductors, China will experience the largest CAGR (24%) out of all of the selected countries in this segment, generating 2.1 billion US dollars in revenue in 2025 (see Figure 40). Europe, the market as a whole, will be the largest market for the comfort and lighting segment, accumulating 5.1 billion US dollars by 2025. United States was the biggest market by revenue in 2019, making

2.2 billion US dollars, and it will grow at 11.8% CAGR by 2025, reaching 4.3 billion US dollars. Out of the selected European countries, United Kingdom leads in this segment, estimated to make 1.1 billion US dollars in 2025. Germany's comfort and lighting segment will also surpass the one billion US dollars revenue mark by 2025. While Netherlands, Italy and Slovenia present the three smallest markets for this segment (Statista, 2021).

Figure 40: Comfort and lighting total revenue and CAGR forecast in the selected countries in 2019 and 2025
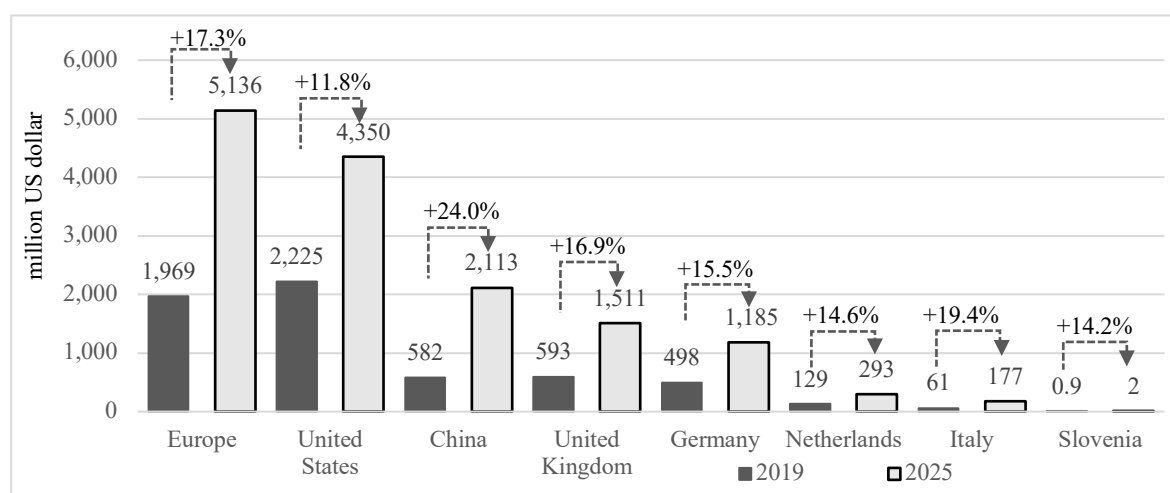
Source: Statista (2021).

An overall decrease in the average revenue per smart home is noticeable for this segment (see Appendix 12). Production costs are decreasing as new developments in this segment are made. New entrants into the segment, such as IKEA, provide cheaper smart lighting solutions, thus catering to the lower-income segment. United Kingdom (231.92 US dollars) makes the largest revenue per smart home in 2019, and it is estimated it will make the largest revenue per smart home (115.43 US dollars) in 2025. By 2025, Netherlands's (83.04 US dollars) average revenue per smart home is expected to decrease more than it will decrease in the United States (111.08 US dollars), yet it is expected to be higher than Europe's average (74.29 US dollars). Italy (71.39 US dollars), Germany (58.97 US dollars) and Slovenia (43.02 US dollars) fall below Europe's average revenue per smart home. Due to their relatively cheap material and labour costs, China's average revenue per smart home in this segment is estimated to be around 24.02 US dollars by 2025 (Statista, 2021).

The United States has reached the level of mass adoption in the comfort and lighting segment, as the adoption rate was 11.7% in 2020 (see Figure 41). From the selected European countries. The adoption rate is the highest in the United Kingdom (11.5%) and Germany (11.5%), followed by Netherlands (10.4%). China's adoption rate (4.9%) is in between Europe's (5.2%) and the world's average (4.1%). In comparison, Italy (3.4%) and Slovenia (1.5%) fall below the two averages again in this segment as well (Statista, 2021).

Figure 41: Comfort and lighting household penetration rate in selected countries in 2020
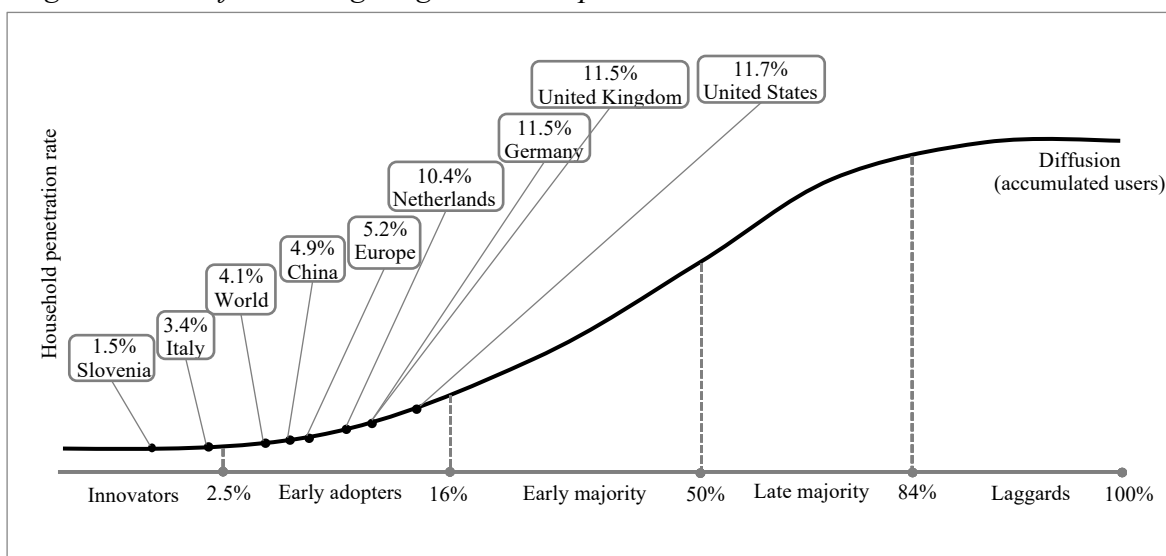
Adapted from Statista (2021) and Rogers (2003).

Comfort and lighting segment can be categorised into three product types: smart bulbs, shadowing and window and door sensors. Smart bulbs are integrated into more smart homes than the other two product types, as their adoption rate is estimated to reach 7.8% by 2025 compared to the window and door sensors (2.7%) and shadow (1.4%) adoption rate (see Appendix 13) (Statista, 2021).

2.5.5   Smart home ecosystem

The value network in the smart home ecosystem is comprised of many elements (see Figure 42). On the supply side are the manufacturers that produce IoT enabled household devices and smart home service providers who offer software control and connectivity services. On the retail side, there are website providers and physical stores, which can be owned by the manufacturer or owned by a third party. Technicians are the ones that sell, install and service smart home systems (Kortuem & Kawsar, n.d.; Statista, 2021).

On the demand side is the customer ecosystem, where customers use the manufactured smart home products. The IoT is the fundamental platform that enables interconnectedness and remote access to household devices. On the demand side, products and services from all six segments are connected through gateways (devices that provide connectivity between two or more smart home devices) and controlled through smartphones, tablets or other connected control panels (Kortuem & Kawsar, n.d.; Statista, 2021).

Figure 42: Value network in the smart home ecosystem
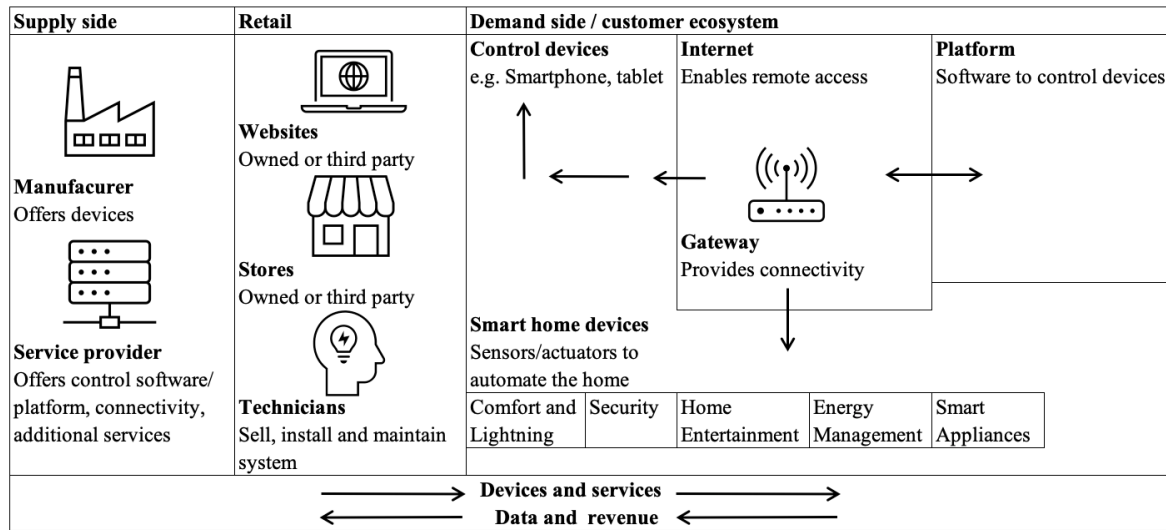
Source: Statista, (2021); Kortuem & Kawsar (n.d.).

2.5.6   Competitive landscape

The smart home competitive landscape is filled with dedicated smart home segment companies and players entering the market from other industries. The table below presents a list of leading smart home players categorised by type and segment (see Table 19). Although the list is extensive, it is not exhaustive (Statista, 2021).

Table 19: Smart home key players by type and segment

Source: Statista (2021).

The table above depicts that although there are many dedicated smart home companies, plenty of companies entered the smart home market from other industries. Companies in the

smart home market need to stay competitive against new market entrants entering the market from another industry (Statista, 2021; Yusuf, 2018).

Companies like Amazon (with Echo), Google (with Google Home) and Apple (with HomePod) are the most known multinational corporations that expanded into the smart home market, and they demonstrated that they are already leading the market. They recognised that digital assistance would be an opportunity to take over the smart home ecosystem. The devices generate large amounts of data regarding consumer behaviour, which is an invaluable resource for companies. Of course, there are many more players besides those mentioned above that are trying to get a cut of the market. Acquisitions by larger companies is another characteristic of the smart home market. Companies like Amazon, Samsung, Alibaba, and Alphabet (Google) are known to be aggressive investors in the market, as they have paid high premiums in the past for some of the acquired companies. Amazon is recognised as the market leader due to its smart speaker, Samsung is acknowledged as a top competitor, as it has a vast assortment of smart household products, and Google is quickly catching up with its Google Assistant. Even though Apple's penetration into the market was successful, it was not to the extent of its competitors. Overall, the competitive landscape is quite intense due to the continuous technological developments that need to be continuously updated and because a few strong key players saturate the market (Yusuf, 2018).

2.5.7   External environment

PEST analysis was conducted to gather a holistic view of the forces affecting the smart home market. The macro-environmental analysis framework identifies factors and how these factors can create opportunities and threats for organisations operating within a given market. Monitoring and confronting these factors can have prosperous effects for organisations in the long run. The smart home external factors analysis was conducted on a European Union level and is presented below.

2.5.7.1 Political factors

Technological advancements have created endless new opportunities, and governments worldwide have realised the importance of their role in establishing a national digital infrastructure. Governments launched various new initiatives for developing a nationwide digital smart grid by focusing on internet connectivity, data, cybersecurity and tackling the digital skills gap. Many such policies pertain to households and thus relate to the smart home market (European Commission, 2014; McGourty, Maciejewski & Ratcliff, 2020).

One of the European Commission's priorities is the establishment of a single digital market. In 2010, the European Commission initiated the Digital Agenda for Europe. The agenda is to provide broadband connectivity to all EU areas, increase cybersecurity, and promote

digital skills by investing in technologies like 5G network, blockchain, quantum computing, and e-ID (European Commission, 2014; McGourty, Maciejewski & Ratcliff, 2020).

Moreover, the European Green Deal emphasised how a clean energy transition of traditional buildings to green buildings can achieve climate neutrality by 2025. In 2020, it published a Renovation Wave Strategy for the buildings sector, which will improve buildings' energy performance in the EU area and imposes stronger standards and regulations on buildings' energy performance for Energy Performance Certificates. As part of the Clean Energy initiative, the EU's main legal instrument to stimulate optimum energy performance of residential and non-residential buildings is the Energy Performance of Buildings Directive. Countries are taking steps towards energy optimisation, energy storage, implementing smart meters, and striving towards a smart built environment. Although, the EU's member states are implementing EU's directives each at their own pace. In conclusion, the EU's digital and sustainability strategies are favourable to the smart home market (De Groote, Volt & Bean, 2017; European Commission, 2021a; European Commission, 2021b; Omer, 2009; Balta-Ozkan, Boteler & Amerighi, 2014; Mariottini, 2016; Labaccaro, Carlucci & Lofstom, 2016).

2.5.7.2 *Economic factors*

Inflation for the Euro area is estimated to grow at 2.27% in annual rate for 2021. Out of the selected countries in 2021, United States has the highest estimate (3.72%), followed by Germany (3.48%), China (2.93%), Netherlands (18.5%), Italy (1.81%), United Kingdom (1.67%) and Slovenia (1.53%) (OECD, 2021b). European Central Bank's cost of borrowing for corporations, which aggregates interest rates on all loans, by March 2021 decreased by six basis points to 1.42% since the beginning of the year, while the cost of borrowing for households remained unchanged at 1.31%. In March 2021, the compounded cost of borrowing for households in Slovenia was 1.78%, which is comparable to Netherlands' interest rate (1.76%) and higher than Germany's interest rate (1.19%) (ECB, 2021).

In June 2020, because of the coronavirus pandemic, the European Commission projected that the GDP of European countries would shrink by at least 10 per cent for that year. At the end of 2020, Slovenia's real GDP was 5.53% lower compared to 2019, while European Union's real GDP decreased by 6.12% compared to 2019. (IMF, 2021). Nonetheless, the covid pandemic worsened the economic instability across the world. As the virus spread across the globe, it shut down supply chains, crashed oil prices, and brought tourism and the airline industry to unprecedented losses. As the paper is written, the pandemic is still ongoing, so the following findings will have to be updated as the crisis unfolds (European Union, 2020). The smart home market was estimated to generate 8% less in the total global smart home revenue in 2020 than the estimate before the pandemic (Statista, 2021). The property market is connected to the smart home market to a large extent. Data gathered from OECD shows that real estate in the European market has, over the years, increased in price

and mortgage rates have substantially decreased. This entails all the selected countries, apart from Italy (OECD, 2021a).

Another economic factor that pertains to smart home companies is the worsening of the global semiconductor supply. The shortage started with few delays here and there and escalated to a global issue. Apple and Samsung, the two largest buyers of semiconductors for their products, had to postpone their new phone launches in 2020 and 2021 due to the shortage. Prices are rising and are expected to increase further, as it is estimated that the semiconductor shortage will continue for the next few years (Sweney, 2021).

2.5.7.3 Sociological factors

From the 19th century forward, the world population has risen exponentially. Since the 1960s, when the population growth rate reached its peak, the population is growing at a decreasing rate, amounting to approximately 7.7 billion people in 2019. Despite the decreasing growth rate, the world population is still growing rapidly. Every year the world population increases by approximately 80 million people or around 220,000 people per day. If the trend persists, the United Nations (UN) predicts that the world population will continue to grow to 11.2 billion people by the end of the century. The increasing population and growing urbanisation increase concerns around overconsumption, resource management, and sustainable living, all of which drive the demand for a more efficient housing system (Roser, 2019; Population Institute, 2021).

It is estimated that by 2060 the number of people over 65 years old living in the EU area will increase to over 30%. Household healthcare robots can aid the elderly in daily tasks, such as lifting or calling emergency in case of a fall. Beneficiaries are not only the elderly, but users of every age can also better manage their health with the help of technology. Because of the many benefits, the demand for eldercare devices and services is estimated to increase in the future, and it is estimated that ICT can improve the efficiency of healthcare by 20%. With the growing population and people's longer life expectancy, social care and healthcare costs are estimated to increase to around nine per cent of the EU's GDP by 2050. Integrating ICT into eldercare devices and services promises to decrease these costs by increasing the efficacy (European Commission, 2014). In the modern-day world, the accelerating pace of life impedes people from establishing a healthy work-life balance and maintaining their household environment. A smart home system enables users to manage their household better and thus helps them manage their time more efficiently. Convenience is one of the main appeals of smart home technology. By remotely monitoring and controlling the household, users can spare more time for other matters in life. The abovementioned sociological factors drive the demand for smart home devices and services (Sovacool & Furszyfer Del Rio, 2020).

2.5.7.4 Technological factors

The development of the smart home market was greatly, if not the most, influenced by technological factors. The developments in 5G, IoT, cloud computing, AI and ICT made way into many industries and markets. The disruptive technologies opened up many smart home market opportunities as well. Companies in the smart home market need to keep up with the continuous technological developments to stay competitive. Moreover, as demand for electricity increases, clean energy developments will indirectly boost the adoption of smart home devices. Worldwide developments of national smart grids and smart cities are just a couple of many technological trends that give considerable support to the smart home market development. While, the negative technological factors to the smart home market, which consumers express, are concerns about energy blackouts or shortages and cybersecurity (Brown & Zhou, 2013; Heile, 2010). The smart home technology adoption rate is different for every country. The smart home household penetration rate in Europe is 12.5%, which is higher than the world's average 10.6%. Nevertheless, United States is a market leader in this area, as the smart home household adoption rate is 36.6% (Statista, 2021).

2.5.8   Porter's five forces

According to Porter (1979), any industry or market is driven by five competitive forces (bargaining power of supplier, bargaining power of the consumer, threat of new entrants, threat of substitutes and competitive rivalry). Described individually below are each of the competitive forces that affect the smart home market.

2.5.8.1 Threat of new entrants

New entrants in the smart home market will face several barriers. There is the barrier of high startup costs, rooted technology and the many layers of IT infrastructure. Another barrier to entry is the few key market leaders that dominate the market. The incumbents can gather an immense amount of consumer data, which they use to improve their products and services even further. This way, it is easier for those few key market leaders to nurture customer's loyalty than for new entrants, who do not have that great insight into the customers' behaviour. The increase in customer loyalty also affects the switching costs, thus, further raising barriers for new entrants. However, barriers for new entrants may decrease when new entrants release new IoT connected products, which have made a milestone in development. When incumbents may not develop new products as fast as others can, then barriers to entry decrease. Moreover, corporations from other industries are entering the smart home market (e.g. Apple with its HomePod), showing that entry barriers can be low in such cases (Porter & Heppelmann, 2014).

2.5.8.2 Threat of substitutes

The threat of substitute products or services is low when comparing the connected devices to the traditional ones because the connected products offer more functions, customisation and better customer value. Nevertheless, the threat of substitutes is higher when observing the connected devices independently. Smart home technology is continuously developing; therefore, new products with a wider array of functions are being put on the market every year, making the older devices less in demand. Another trend that increases the threat of substitutes is that smart home products move from single-purpose devices to multi-purpose devices, so household owners will need to purchase fewer devices to have more functions available (Yusuf, 2018; Porter & Heppelmann, 2014).

2.5.8.3 Bargaining power of consumer

Through the use of usage data, smart home devices allow companies to build much better customer relationships. As companies gather more consumer data, the switching costs to a new supplier increase for the consumer; therefore, their bargaining power decreases. Alternatively, smart home devices can increase consumers bargaining power by allowing the consumers to see the product's utility. Consumers can use the usage and performance data to evaluate if the product performs to their expectations and compare it to other substitute products, which increases their bargaining power. Furthermore, product as a service business model can increase the bargaining power of consumers as the switching costs are lower (Porter & Heppelmann, 2014).

2.5.8.4 Bargaining power of supplier

The technological developments in the smart home area are also transforming the traditional supplier relationships and reallocating bargaining power. Because the components that make up a smart home network delivered plenty more value than their cost, traditional suppliers have had high bargaining power in the past. Now, the technology has developed to the extent that fewer components are needed to build a smart home network, and some components could even be replaced by software. The bargaining position of traditional suppliers is estimated to worsen in the next few years. Then again, some tech giants from other industries have released smart home products that manufacturers never knew they needed, resulting in many collaborations between traditional manufacturers and new suppliers (e.g. collaboration between GE, Qualcomm and Apple). The bargaining power of these new suppliers is higher and will further increase with their expansion (Yusuf, 2018; Porter & Heppelmann, 2014).

2.5.8.5 Competitive rivalry

On the one hand, smart home technology may be shifting rivalry from traditional providers and opening up many new opportunities for smart home products and services. Through

technology and the consumer data gathered, new ways to serve more specific customer segments are created. On the other hand, the rivalry among competitors is intense as incumbents (providers of traditional household devices) are now fighting with the new entrants (providers of smart home products) for a place in consumer's households. Not only are the incumbents pushed to innovate and upgrade their traditional products, but there is intense rivalry in the smart home market as well (Porter & Heppelmann, 2014).

2.5.9   Smart home trends

The ICT is applied to almost all sectors in the economy. Especially developments of national smart grids around the world have shown significant support for the smart home market. The establishment of a nationwide interconnected smart grid infrastructure is a long-term strategy of many countries worldwide. With bidirectional electricity and information flow between consumers and utilities, the smart grid network can address problems with energy waste, demand response, and energy distribution. The long-run goal is for all households and other non-residential buildings to be part of the smart grid, where energy can be stored, consumed, produced and remotely managed by consumers and utility companies (Brown & Zhou, 2013).

The smart home segments used to be distinguishable, and now those differences are blurring. Consumers want devices whose functions are not limited to single purposes and prefer products that cater to many potential needs or wants. For smart home companies, this means that they have to either integrate other segment functions into their products or deliver devices that can interoperate with others, which will facilitate cross-segment integration (Statista, 2021).

A new trend in the smart home market is the expansion into AI. Several companies, like Google, Amazon and Samsung, have already released their smart assistant devices. Google released its Google Home device, Amazon introduced its Echo, LingLong created its DingDong, Apple released its HomePod and Samsung made its Galaxy Home speaker. The AI in these devices enables synchronisation, management and automation of all interconnected devices. Thus, further AI applications in the smart home domain are expected (Newman, 2018).

Multinational corporations, such as Apple, Amazon, Alibaba and Google, have entered the smart home market with their IoT devices, which for other companies created new market opportunities and caused market consolidation. The large multinationals are expanding their products and services into the smart home market through R&D and M&A. It is estimated that multiple key players will have a strong presence in every segment (Chanda, 2019).

The idea that a person who lives carefully ought to pay less for his insurance than a person who is more likely to need an insurance payment has extended to the household area as well. Usage-based insurances are a trend that pertains to the smart home market. Sensors in the

IoT home devices have made it possible to measure and analyse consumption patterns, which can detect any potentially unsafe situations. With such insurance, both sides are beneficiaries; consumers pay less for the insurance, and insurance companies have fewer claims. The main issue with this trend is data security (Jain, 2021).

Consumers already expressed concerns regarding data sharing and home security, and smart home providers will have to respond to those concerns in the future. The demand for cybersecurity of IoT connected devices is expected to increase as increasingly more people adopt the smart home system. New data transfer solutions will be needed in the future as AI-driven devices gather a mass amount of data, which will be of great interest to companies (Hall & Maglaras, 2020).

The cross-segment integration will extend across market borders as well, causing cross-market integration. As mentioned above, consumers want fewer products that cater to more needs and can be integrated into other areas in life, such as a car and other devices. Not only will they need all of their smart home devices to connect and interoperate, but they will also need to connect their streaming services to all situations (Statista, 2021).

2.5.10 Drivers and barriers of the smart home market

The drivers of the smart home market can be clustered into several categories (see Table 20). The first driver relates to convenience as it is the consumer's leading cause for a smart home purchase. It is convenient for consumers to have access to their home control system on their phones to ease their day-to-day activities. Through ambient lighting and house scheduling, consumers can increase their comfort (Hartman, 2021; Alaa, Zaidan A., Zaidan B. & Talal, 2017; Robles & Kim, 2010).

Energy conservation is another driver because consumers are motivated to reduce their energy waste to lower their expenses and reduce their carbon footprint. Environmental concerns also support the demand for energy conservation. Smart home systems allow consumers to analyse their consumption and adapt the controls of the house, accordingly resulting in energy efficiency (Hartman, 2021; Robles & Kim, 2010; Wilson, Hargreaves & Hauxwell-Baldwin, 2017).

The rapid digitalisation and technological developments around IoT, cloud computing, 5G, machine learning and AI are opening new opportunities for smart home companies. The technologies are slowly being implemented in many different city and industrial areas to create efficient, interconnected infrastructures. The fast pace of technological developments makes the smart home accessible to increasingly more people as older technology becomes cheaper and more accessible to consumers (Morgan, 2014; Da Xu & He, 2014).

There are also advantages related to uses for healthcare purposes. Consumers can benefit from having IoT devices, as they can communicate with health institutions, send treatment

alerts and provide medical services. Overall, smart home functions can ease the everyday activities of elderly or physically disabled (Alaa, Zaidan A., Zaidan B. & Talal, 2017; Robles & Kim, 2010).

Growing urbanisation is another driver of the smart home market. By 2050, the UN estimated that 68 per cent of the world population would live in urban areas. Combining that with the increase in the total number of the global population, the demand for resource-efficient housing will increase. The increase in population causes supply and demand constraints, which in turn affects prices. Already in many cities worldwide, governments are implementing new technologies and smart sensors to improve city life by making it safer and more efficient (UN, 2018; European Commission, 2014).

Governmental policies and incentives are other drivers of the smart home market. Several countries, including China, Germany, Brazil, India, Canada and South Korea, are introducing many new policies, including green building guidelines. This initiative would help create immense opportunities for the smart home market in the coming years. It will also help drive the adoption of smart energy management devices such as thermostats, smart meters and smart plugs. Several initiatives and projects have been launched by governments across many regions to encourage green buildings. Apart from this, advancements in data communication technology and smart city projects are some of the key emerging opportunities that would boost the revenue of the smart home market (Morgan, 2014; European Commission, 2021b; Wilson, Hargreaves & Hauxwell-Baldwin, 2017).

The growing need for automation of security systems is another driver of the market. Apart from functions like video surveillance, smart locks and alarm systems, smart homes can be programmed to automatically regulate the voltages for different devices, provide energy to plugged-in outlets, disconnect short circuit power and detect fire and water leaks. Such functions drive the need for a smart home network as they can prevent the likelihood of homes being burglarised or prevent accidents. Furthermore, by installing security and safety devices at home, consumers can reduce their insurance rates (Hartman, 2021; Robles & Kim, 2010; Smiljanic, 2021).

Lastly, a rise in the smart real estate value is another factor that supports the market. With the growing environmental concerns and growing prices, demand for more sustainable and efficient real estate has risen substantially in the last decade. Although consumers voiced their concerns regarding eco-certified buildings being overpriced and often not sustainable enough. Some are exploiting these market conditions by building smart real estate to yield higher financial benefits. Overall, even though eco-certified or energy-efficient buildings are overpriced, the rise in real estate value is still more of a market driver than a barrier (Ullah, Sepasgozar & Wang, 2018).

Table 20: Drivers and barriers of the smart home market

Drivers	Barriers
• Energy efficiency/cost saving. • Healthcare purpose. • Convenience. • Technological developments (IoT, 5G, AI, etc.). • Growing urbanisation. • Governmental policies. • Growing need for automation of security systems. • Rise in smart real estate value.	• Long real estate replacement cycles. • High price/installation costs. • Device interoperability. • Reliability of smart home devices. • Difficulty of operability. • Data security and privacy issues.

Source: Morgan (2014); Balta-Ozkan, Boteler & Amerighi (2014); Heetae, Wonji & Hwansoo (2018); Alaa, Zaidan A., Zaidan B. & Talal (2017); Hartman (2021), Da Xu & He (2014); European Commission (2014), European Commission (2021b); UN (2018); Smiljanic (2021); Ullah, Sepasgozar & Wang (2018); Deloitte (2016); Wilson, Hargreaves & Hauxwell-Baldwin, (2017); Hall & Maglaras (2020).

On the other hand, smart home challenges could be expressed as consumer concerns, which can be clustered into different categories. Long real estate replacement cycles and long replacement cycles of durable goods play a substantial role in the slow growth of IoT within the smart home market. Because IoT household products are costly, people tend to wait till the product lifecycle ends when they buy new smart appliances. Overall, consumers are aware of the advantages of the IoT, but replacement costs and their perceptions regarding its practicality still impede them from buying (Balta-Ozkan, Boteler & Amerighi, 2014).

Price and high installation costs are key obstacles for many people. Deloitte did a survey in 2016, where 48 per cent of survey participants agreed that it is a barrier preventing them from buying more IoT devices. This is a barrier that will diminish in the future, as smart home technology will become cheaper to produce and thus be accessible to more people (Heetae, Wonji & Hwansoo, 2018; Deloitte, 2016; Balta-Ozkan, Boteler & Amerighi, 2014).

There is a concern about device interoperability. It is a problem for consumers when IoT devices from different providers are not compatible with each other and, thus, consumers cannot connect the devices and experience the full benefits of a smart home. Because of competitive rivalry between companies, many companies in the smart home market position themselves in the market by making devices compatible with providers of their choosing (Heetae, Wonji & Hwansoo, 2018; Balta-Ozkan, Boteler & Amerighi, 2014).

Another barrier is the mistrust in the reliability of smart home devices. As mentioned above, IoT devices can also be used for healthcare purposes; providers can receive information from the consumer's IoT device instantaneously, which allows the medical service provider to act faster in case of an elderly fall, heart attack or any other possible health emergency. However, consumers are apprehensive about trusting their life in the hands of an IoT device and the smart home provider in case there is a failure to connect the smart home IoT device,

smart home provider, or health care service provider (Heetae, Wonji & Hwansoo, 2018; Balta-Ozkan, Boteler & Amerighi, 2014).

Deloitte (2016) also noticed that another obstacle for more smart homes to be adopted by consumers is the difficulty of the operability of the devices. Some consumers stated in the survey that the current systems are either too hard to understand or do not provide the automation level they desired. Establishing a balance between the complexity of operability and automation will be necessary to satisfy consumers' demands and needs functionally.

Along concerns mentioned above, consumers also have great security and privacy concerns. Consumers are worried about data management, its large data flow and control complexity. In addition, they are worried about security attacks and private data leakages. Overall, consumers wonder if the smart home system provides enough safety for its residents. They believe that the technology for the smart home market needs to develop further before a consumer could enjoy all the benefits a smart home can offer (Heetae, Wonji & Hwansoo, 2018; Deloitte, 2016; Alaa, Zaidan A., Zaidan B. & Talal, 2017; Hall & Maglaras, 2020).

2.5.11 Opportunities and threats in the smart home market

The following risk matrix depicts market opportunities and threats to their probability of happening and its effect on the companies operating in the smart home market. The following opportunities and threats are summarised from the previous chapters in the paper on smart homes and combined below (see Figure 43).

Opportunities for companies in the smart home market are numerous. (1) The EU's digital and sustainability policies encourage the smart home market by creating opportunities for companies to take advantage of subsidies and policies. (2) The technological advancements created many new market opportunities and continue to do so. The fast pace of technological developments creates new possibilities for smart home companies to reinvent their business models and keep up with consumer needs. (3) The value of data will keep rising, and smart home companies have the opportunity to accumulate household usage data through their products. (4) Smart home technology is becoming more accessible as it is becoming cheaper to produce. Companies can take advantage of this opportunity, as they can target more people as technology progresses. (5) Smart home companies also have the opportunity to prove that they can have a positive environmental impact if they position themselves as such. (6) The increasing demand for better management of households creates growth opportunities for smart home companies. (7) Smart city and smart grid initiatives are also giving smart home companies opportunities to target non-residential buildings and residential buildings. (8) The ageing population presents itself as an opportunity for smart home companies, as companies can target the growing segment by providing eldercare solutions.

Figure 43: Risk matrix of smart home market external factors

	Effect of an event		
	Positive	Indifferent	Negative
Probability of an event happening — High	O1, O3		T3, T6, T2
Probability of an event happening — Medium	O4, O6, O2	T1	T5, T4
Probability of an event happening — Low	O8, O5	O7	

Opportunities	Threats
O1 – EU's digital and sustainability policies.	T1 – Disruptive technologies.
O2 – Technological developments.	T2 – Cybersecurity.
O3 – Data collection.	T3 – Multi-segment smart home solutions.
O4 – Technology accessibility.	T4 – Key player market dominance.
O5 – Environmental impact.	T5 – Economic instability.
O6 – Increasing need for better management of households.	T6 – Semiconductor shortage.
O7 – Smart city and smart grid initiatives.	
O8 – Aging population.	

Source: Own work.

On the other hand, companies in the smart home market should be cautious about the following threats. (1) Disruptive technologies have put out of business companies that never saw that coming. Smart home companies should keep up with the latest technological advancements and adjust their business model according to the ever-changing market conditions and consumers preferences. (2) Cybersecurity measures should be established and updated regularly in every smart home company, as these issues are a concern for companies in this market. (3) Smart home companies have started to release multi-segment smart home solutions, thus changing the competitive landscape. (4) Key player market dominance is another threat to be cautious about. International corporations like Google, Apple and Amazon have entered the smart home market from other industries and proved that they could compete well with other incumbents. (5) Smart home companies need to be cautious about the economic uncertainty due to the COVID-19 pandemic. (6) Companies should expect high volatility in semiconductor prices as chip shortage continues to persist.

3   EMPIRICAL RESEARCH

The analysis thus far demonstrated that the smart home concept is perceived by users differently than companies perceive it, and the perception and needs are continuously changing. To better understand what consumers want and need from smart home products and services, we conducted a consumer survey and interview with a representative from a smart home company. The survey and interview serve as support to the findings from the theoretical implications and market research. From the survey and interview, we intend to answer the following research questions:

- What kind of smart home business model do consumers in Slovenia prefer?
- What smart home features/functions consumers find most useful/valuable?
- What marketing and sales channels are most effective for smart home devices?
- What are the most important product properties for consumers in Slovenia?
- Which payment type do consumers in Slovenia prefer?
- What are the drivers and barriers to purchasing smart home devices for consumers in Slovenia?
- Who are important partners for smart home companies?
- How can smart home companies increase their environmental benefits?
- How can smart home companies increase their social benefits?

3.1   Methodology

After combining the results from the theoretical implications and market analysis for the empirical research, a mixed-method was chosen (quantitative analysis of the questionnaire and qualitative analysis of the interview). Both methods were chosen to gather all the information necessary to see what opportunities there are in designing a triple-layered business model canvas for companies operating in the smart home market.

We chose an online survey (on the 1ka platform) for the quantitative research, with which we achieved non-probability convenience sampling. The survey was active from 2.6.2021 until 24.6.2021 and was distributed on social media. The survey gathers consumer preferences about smart home business models. In addition, for the qualitative research, an interview was conducted with one of the owners of the smart home companies in Slovenia to gather information about smart home business models that is of internal nature and cannot be gathered from the survey. By combining the market analysis, survey and interview, we gathered the information used to construct an optimal business model for a firm operating in the smart home market (see Appendix 14).

The quantitative analysis started by refining and editing the input data, followed by comparing the data and formulating groups based on selected input data. For statistical

analysis, the SPSS program was used. Only statistically significant comparisons are considered, i.e., comparisons whose Pearson chi-square value is less than 0.05.

When formulating groups, we first reduced the number of components by the principal components method (PCA) using 20 items combined in questions one and two (see Appendix 15). Based on PCA, we have identified that only four factors serve as principal components based on eigenvalues of more than one. When we were identifying the general characteristics of each principal component, only the items from question one could be seen as distinguishable characteristics among the four principal components (e.g., based on correlation (> 0.4), we could assign each factor to one principal component) whereas items from question two were correlated only with principal component one. As such, we have decided to use the central values of the item set from question one as the basis for segmentation since the factors could be distinguished among the principal components. We did not use the values of the components for segmentation because each item set in question one described behaviour that could serve as the basis for segmentation. Thus, when searching for a general characteristic of each principal component, the factors were already segmenting the sample. For segmentation, we have used the method of leaders (K-means clustering) where k = 4. We assumed the number of clusters must be four as four distinguishable principal components were found. The groups are further presented and analyzed in detail.

3.2   Quantitative research

The following section relates to quantitative research. The section starts with sample description, continuous on with key findings and concludes with segmentation.

3.2.1   Sample description

We commenced the survey with a GDPR question, where 332 out of 411 surveyed said they agree with their data collection. The other 79 who did not agree with their collection of data were discarded. Out of 332 respondents, 52 did not complete the demographic questions; however, they were still part of our main analysis. Six out of 332 respondents were not included in the analysis as their responses were not valid.

The figure (see Figure 44) shows the age structure of the entire sample according to gender. The population is mostly equally represented as almost half of respondents is represented by males. However, there is a certain bias towards the younger population as the most frequent age group is 18-29 years old, followed by 30-39 years old.

Figure 44: The age structure of the survey sample partitioned by gender (n =274)
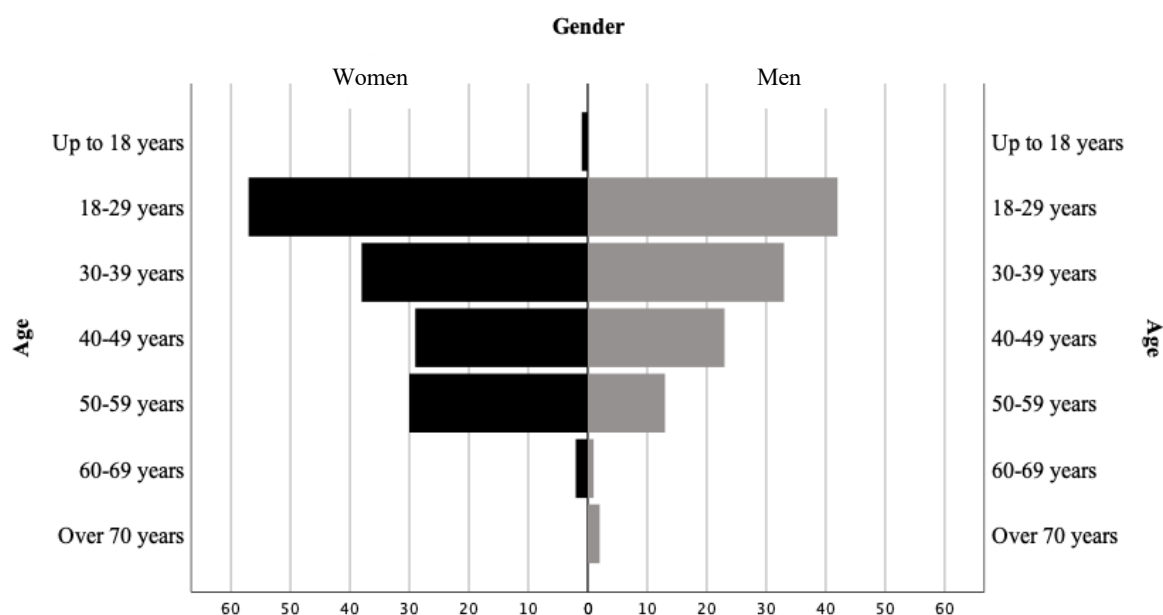
Source: Own work.

Table (see Table 21) shows the proportions of the sample responses to the fundamental question regarding smart home device ownership. 44.0% of all respondents own a smart home system or at least one smart home device, while the other 56.0% states that they do not own a smart home device. Out of the 56.0% who do not own a smart home device, when asked whether they are thinking about buying a smart home device, 58.0% said they are thinking about purchasing. Overall, 76.5.% of all respondents already own or are thinking about buying smart home devices. Only 23.5% of all respondents do not own a smart home device or think about purchasing them.

Table 21: Answers of all respondents to sociodemographic questions

1. Do you own a complete smart home system or a device that is part of a smart home (e.g. robotic vacuum cleaner, smart air conditioning)? (n=332)	
Yes	No
44.0%	56.0%
2. Are you thinking of buying smart devices? (n=186)	
Yes	No
58.0%	42.0%

Source: Own work.

Below (see Table 22) compares sociodemographic differences between owners of smart home devices and non-owners of smart home devices. We performed crosstab analysis for every comparison. The numbers in the table are percentages of respondents that answered the questions. The question about the net income of respondents shows that smart home device owners have a higher net income on average than non-owners. When looking at the net income of owners, 17.0% have a monthly income from 2501€ to 3000€, 15.2% have an income from 3501€ to do 4000€, and 15.2% have an income of 4001€ and more. While 21%

of non-owners have a net monthly income from 1001€ to 1500€, 13.0% have an income from 1501€ to 2000€ and 12.3% have an income up to 1000€.

Table 22: Respondents' answers to sociodemographic questions divided between smart home device owners and smart home device non-owners (n =274)

1. Net monthly income										
	Up to 1000€	From 1001€ to 1500€	From 1501€ to 2000€	From 2001€ to 2500€	From 2501€ to 3000€	From 3001€ to 3500€	From 3501€ to do 4000€	4001€ and more	Do not want to answer	Pearson Chi-Square value
Smart home device owner	4.5%	8.9%	9.8%	10.7%	17.0%	6.3%	15.2%	15.2%	12.5%	p= 0.001
Smart home device non-owner	12.3%	21.0%	13.0%	11.1%	7.4%	10.5%	8.0%	6.8%	9.9%	
5. Status of employment										
	Student		Employed (full time or part-time)		Unemployed		Retired		Other	
Smart home device owner	15.2%		83.0%		0.9%		0.0%		0.9%	p = 0.022
Smart home device non-owner	13.0%		76.5%		6.2%		4.3%		0.0%	
6. Formal education level										
	Elementary school		High school		Undergraduate degree			Master's degree / PhD		
Smart home device owner	0.0%		29.5%		42.0%			28.6%		p = 0.479
Smart home device non-owner	1.2%		27.2%		47.5%			24.1%		

Source: Own work.

Regarding employment status, 6.2% of non-owners are unemployed, which is 5.3 percentage points more than owners. Otherwise, there is no other significant difference between smart home device owners and non-owners. The majority of owners and non-owners are employed (full time or part-time), which is unsurprising as the most frequent age group of the sample is 18-29 years old. The 0.9% of respondents that answered other status was because they prefer not to reveal their status. Furthermore, results regarding the formal education level do not show any statistical differences among the compared groups.

The question regarding the respondents' region shows that no statistical differences exist among the groups (see Table 23). The same conclusion also applies to the question regarding the type of town where the respondents live. By looking at the type of real estate, the statistic shows that a higher percentage of owners (75.0%) live in a house compared to non-owners (59.9%), with a difference of 15.1 percentage points. Also, more non-owners (22.8%) live in an apartment than owners of smart home devices (15.2%), with a difference of 7.6 percentage points.

Table 23: Respondents' answers to sociodemographic questions divided between smart home device owners and smart home device non-owners (n =274)

4. Region										
	Osrednjeslovenska	Pomurska	Gorenjska	Podravska	Koroška	Savinjska	Zasavska	Juhovzhodna	Primorska	Pearson Chi-Square value
Smart home device owner	55.4%	2.7%	5.4%	8.9%	1.8%	7.1%	0.0%	11.6%	7.1%	p = 0.174
Smart home device non-owner	66.0%	1.2%	7.4%	4.3%	1.9%	4.3%	3.1%	8.0%	3.7%	
7. Type of town										
	City (more than 5,000 citizen)			Bigger town (1,000 – 5,000 citizens)		Smaller town (100 – 1,000 citizens)		Village (less than 100 citiens)		
Smart home device owner	44.6%			18.8%		20.5%		16.1%		p = 0.565
Smart home device non-owner	51.9%			17.9%		19.1%		11.1%		
8. Type of real estate										
	Apartment			Apartment in a residential house			House			
Smart home device owner	15.2%			9.8%			75.0%			p = 0.032
Smart home device non-owner	22.8%			17.3%			59.9%			

Source: Own work.

The next question relates to the interoperability of smart devices (see Table 24). Respondents were asked which operating system they use to see, which systems are adopted by the majority as smart home companies need to offer products that can interoperate well with other devices. 71.4% of smart home device owners said they use the Android operating system, and 79.0% of non-owners said they use the Android operating system. However, these differences are not statistically significant, as indicated by the p-value. 36.3% of smart home device owners and 23.5% of smart home device non-owners said they use the iOS

operating system. However, we should note that the question allowed both responses; as such, we cannot fully ascertain whether one group has only android devices or only iOS devices. Based on practical experience, one could have an iOS phone, computer and tablet, whereas a TV would be an android device.

Table 24: Respondents' answers to sociodemographic questions divided between smart home device owners and smart home device non-owners (n =274)

1. User of Android operating system			
	no	yes	Pearson Chi-Square value
Smart home device owner	28.6%	71.4%	p = 0.149
Smart home device non-owner	21.0%	79.0%	
2. User of iOS operating system			
	no	yes	
Smart home device owner	63.4%	36.6%	p = 0.018
Smart home device non-owner	76.5%	23.5%	

Source: Own work.

3.2.2   Key findings

Continuing with the main takeaways from the survey, all respondents were asked about their utility perception regarding smart home functions and features (see Figure 45).

The features are listed in order from the highest average to the lowest average. Therefore, the most useful features for the respondents are (1) automatic/remote temperature control (5.8 avg), (2) energy production and storage and automatic control (5.7 avg), (3) mutual communication of devices to achieve optimal temperature and energy efficiency (5.5 avg), (4) measurement and analysis of electricity consumption (5.3 avg), (5) automatic/remote control of the garden watering system (5.3 avg), (6) automatic/remote control of blinds (5.2 avg), (7) automatic/remote control of the alarm system (5.2 avg), (8) management via scenes/ambiences (5.1 avg), (9) home charger for electric car (4.9 avg), (10) automatic/remote control of lights (4.8 avg), (11) remote control of the intercom system (4.7 avg), (12) automatic/remote control of sockets (4.5 avg), (13) automatic/remote control of household appliances (4.4 avg) and (14) voice assistance control (4.1 avg).
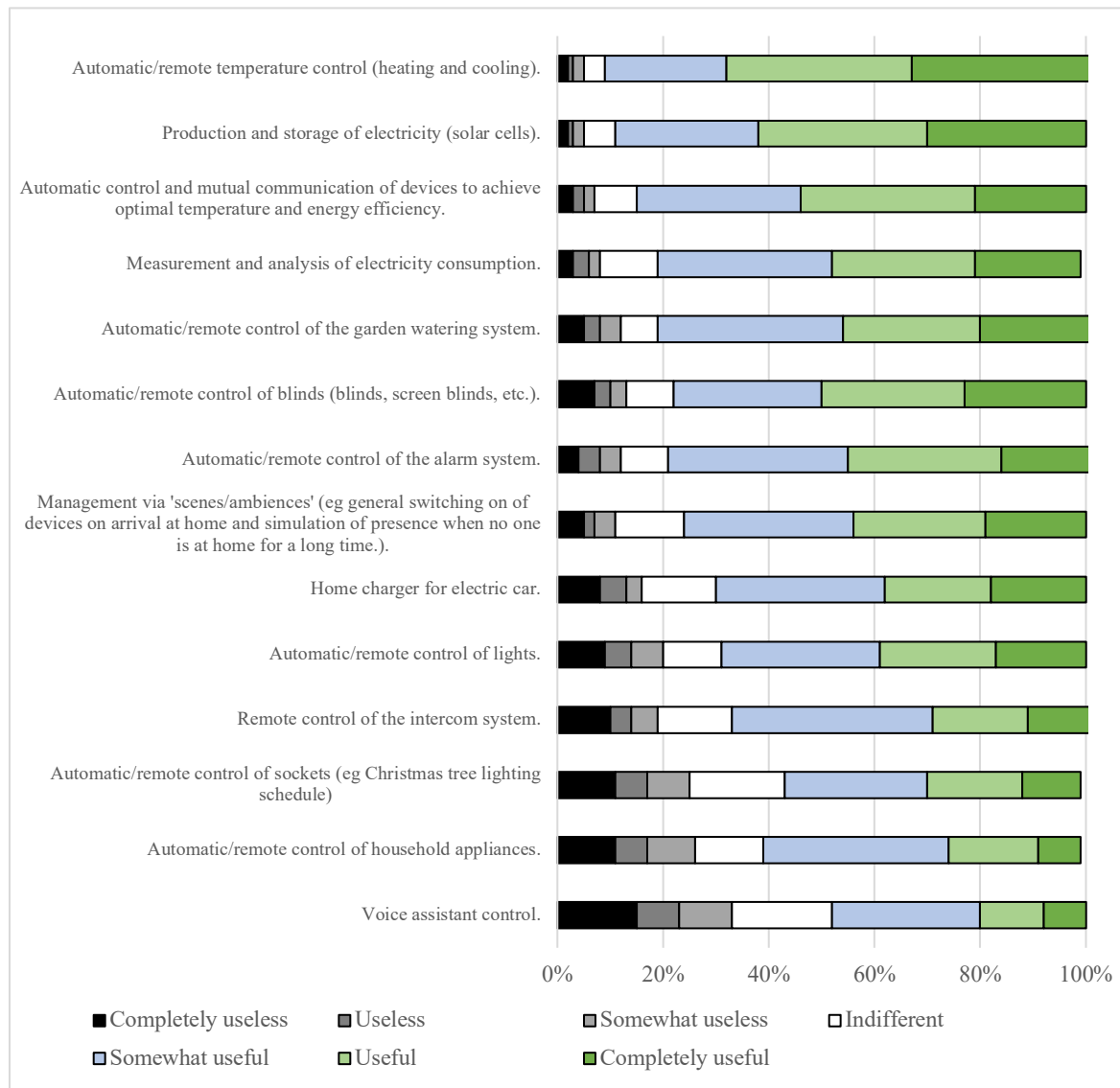
Source: Own work.

Next question related to smart home segment adoption (see Figure 46). This question was asked to respondents who own a smart home system or a smart home device, which is 44% of all respondents. Respondents were able to choose multiple segments. The segment that most respondents have is (1) smart appliances (89 out of 112 respondents have it), (2) energy management (69 out of 112 respondents have it), (3) home entertainment (61 out of 112 respondents have it), (4) comfort and lighting (57 out of 112 respondents have it), (5) security (54 out of 112 respondents have it) and (6) control and connectivity (50 out of 112 respondents have it).

Figure 46: In which segments belong the smart devices that you own? (n=112)
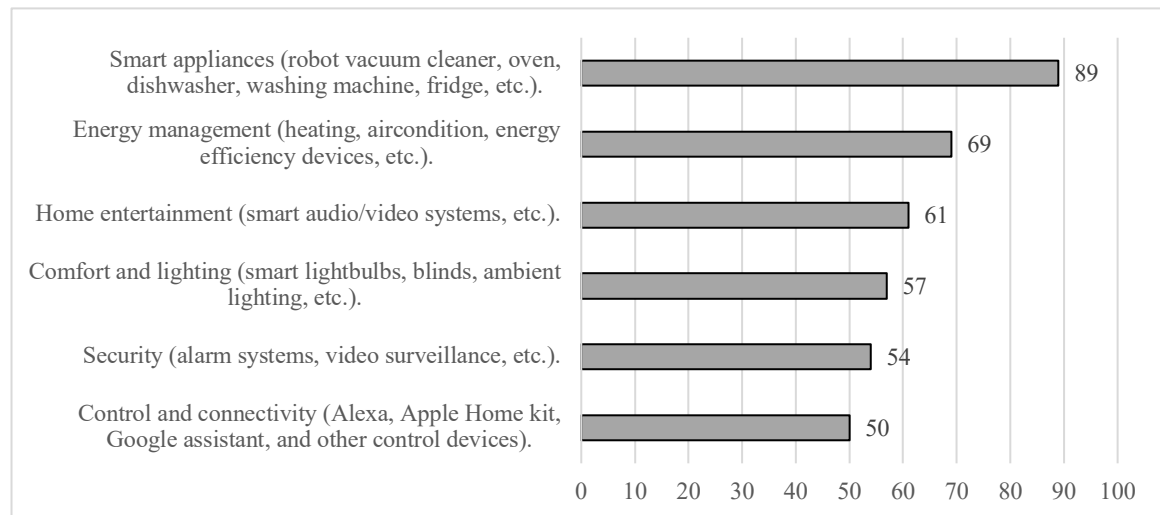
Source: Own work.

The following question was asked to respondents who own a smart home system or a smart home device and respondents who do not yet own a smart home device but are thinking about purchasing, which is 76.5% of all respondents (see Figure 47). The questions relate to the functional value of a smart home perceived by consumers. The top three reasons for purchasing a smart home system or smart home device are: (1) increase in living comfort (6.0 avg), (2) better control of home (5.9 avg) and (3) increases in security (5.5 avg). The survey reveals that the reason for purchase with the lowest average score is environmental friendliness (4.9 avg).

Figure 47: To what extent do you agree with the following statements regarding your reasons for purchasing a smart home system or a smart device that is part of a smart home? (n=203)
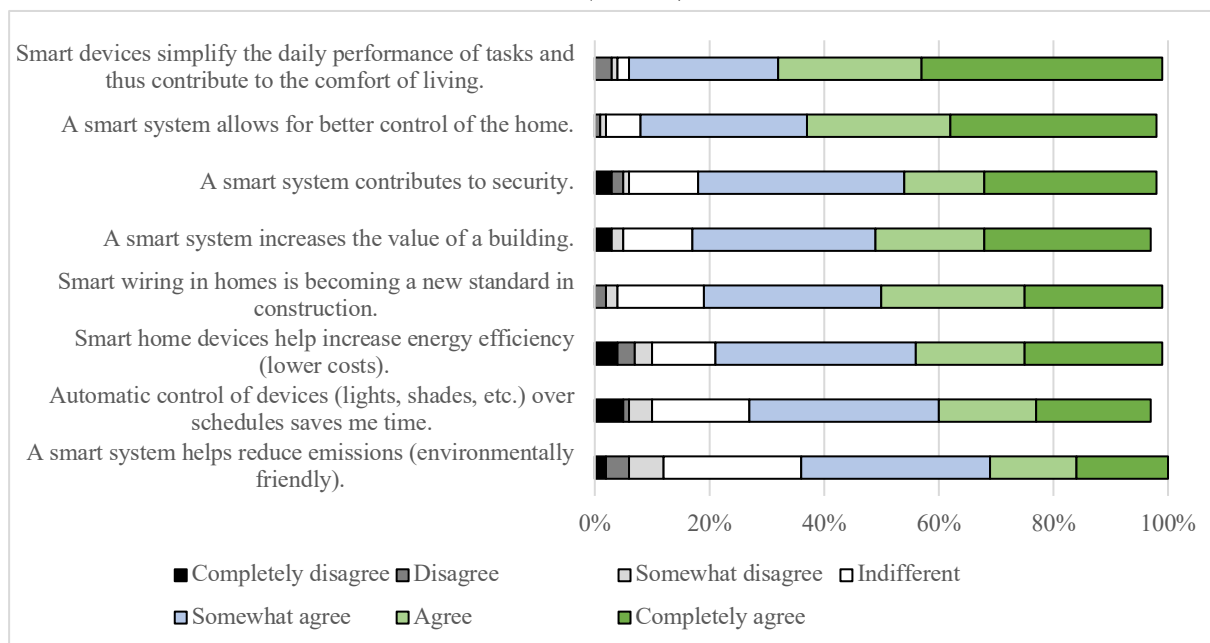
Source: Own work.

This question also asked respondents who own a smart home system or a smart home device and respondents who do not yet own a smart home device but are thinking about purchasing, which is 76.5% of all respondents (see Figure 48). The results depict that safety is the most important product property (6.3 avg), followed by reliability/quality (6.3 avg), product functions (6.0 avg), warranty (5.6 avg), interoperability (5.6 avg) and price (5.5 avg). Respondents, on average, care least about the origins (3.9 avg) and the brand (3.9 avg) of smart home devices.

Figure 48: Evaluate the importance of the product properties listed below when deciding to purchase a smart home device. (n=203)
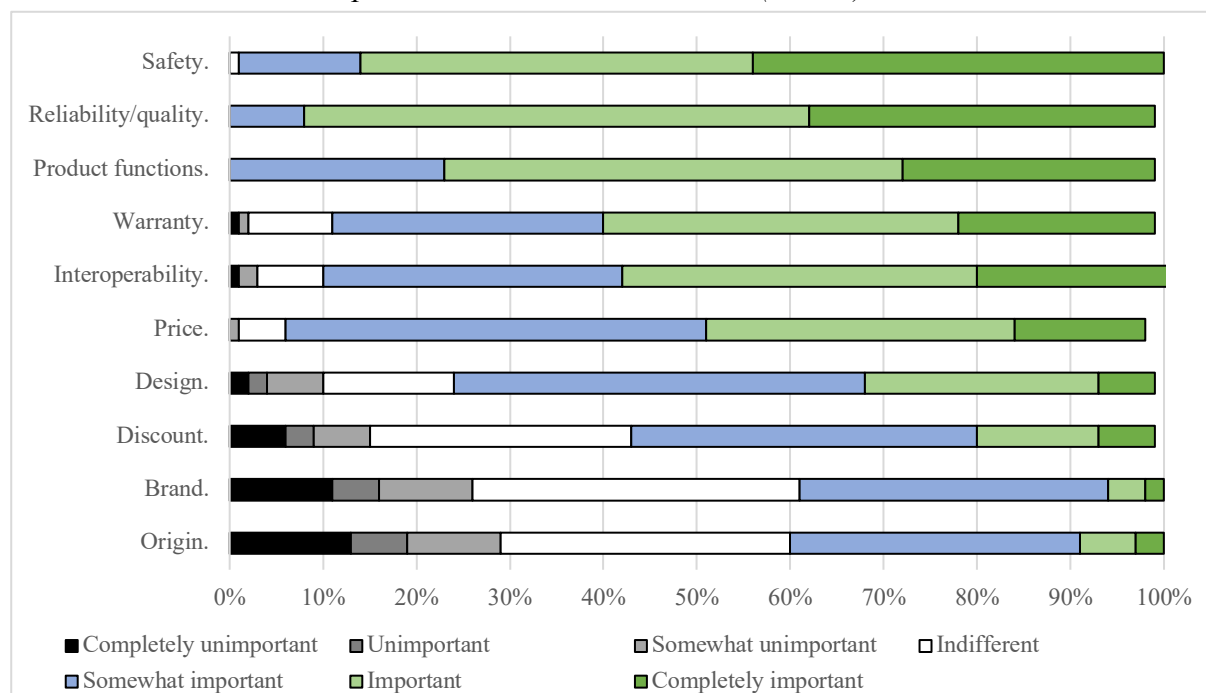
Source: Own work.

The question about the barriers to purchasing smart home devices was asked to respondents who do not own a smart home system, a smart home device nor are thinking of buying smart home devices, which is 23.5% of all respondents (Figure 49). The question reveals the most common barriers that respondents have toward smart home devices. The barriers are listed in order from the highest average to the lowest. The highest barriers to purchase are that repairs for smart devices are more expensive than classic products (5.2 avg) and the lack of need for smart devices (5.1 avg). About 40% of all respondents either agree or strongly agree that classic home management is enough for them, and the same percentage thinks that repairs for smart devices are too expensive. Considering that the third barrier also related to price issues, the results demonstrate price to be the biggest barrier to purchase smart home devices. Data sharing (4.3 avg) and security issues (4.2 avg) are in fourth and fifth place. About 28% of respondents disagree or completely disagree that technology has not yet developed enough.

Figure 49: To what extent do you agree with the following statements regarding your reasons discouraging you from purchasing smart home devices? (n=73)
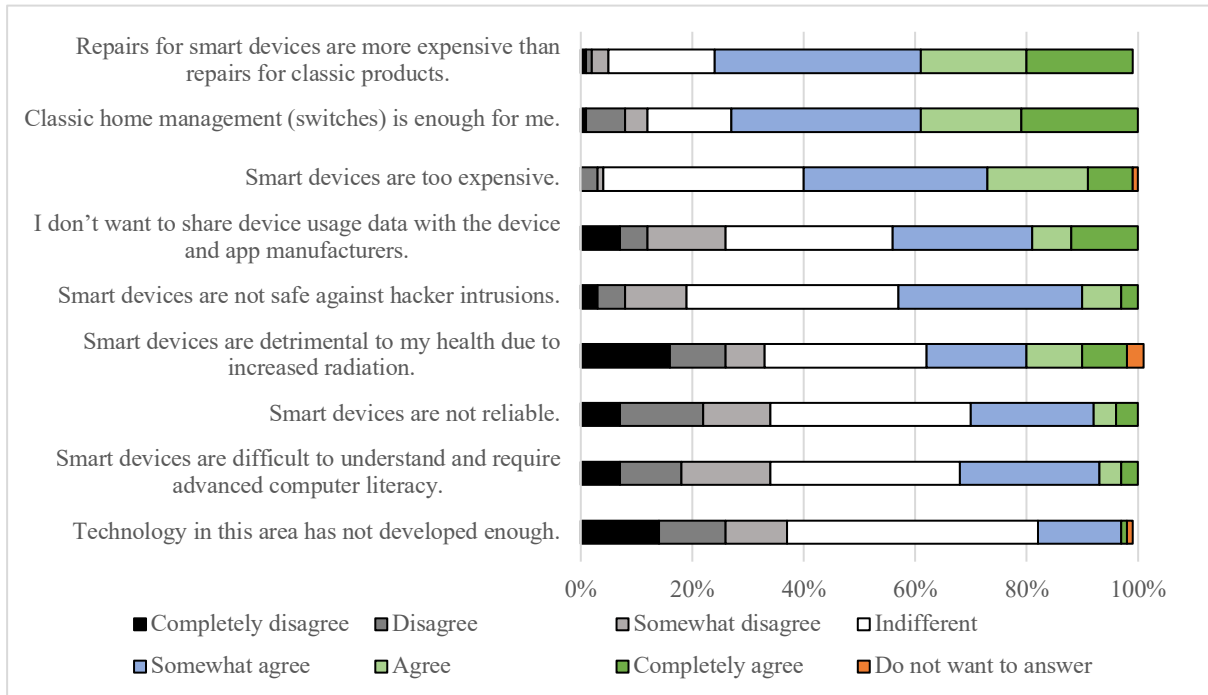
Source: Own work.

The results below show which marketing channels are most effective for the respondents (see Figure 50). This question was asked to respondents who own smart home devices and those who do not but are thinking of buying, which is 76.5% of all respondents. The most effective channel is the internet (5.4 avg), followed by recommendations from friends and family (4.0 avg) and social media (3.3 avg). The least effective channels are an electrical designer (2.2 avg) and an architect (2.2 avg).

Figure 50: Through which channels do you get information about smart home devices? (n=216)

Source: Own work.

91
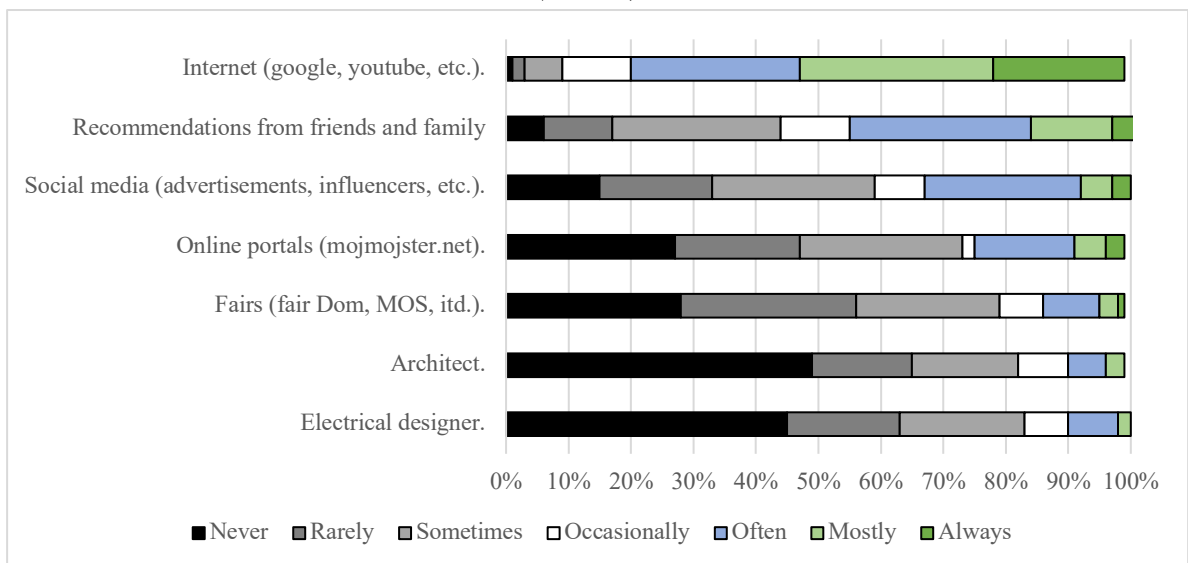
Similarly to the previous question, this question received 76.5% of all respondents (see Figure 51). The purpose of this question was to see which sales channel is most effective. The most effective channel is the internet, as more than 60% of respondents said they either often or more frequently turn to the internet to purchase smart home devices. About 50% of respondents said they either often or more frequently buy directly from the manufacturer, making it the second most effective channel. Fairs received the lowest score, as around 85% of respondents said they either sometimes or less frequently go to fairs to purchase smart home devices.

Figure 51: Through which sales channels did/would you buy smart home devices? (n=203)
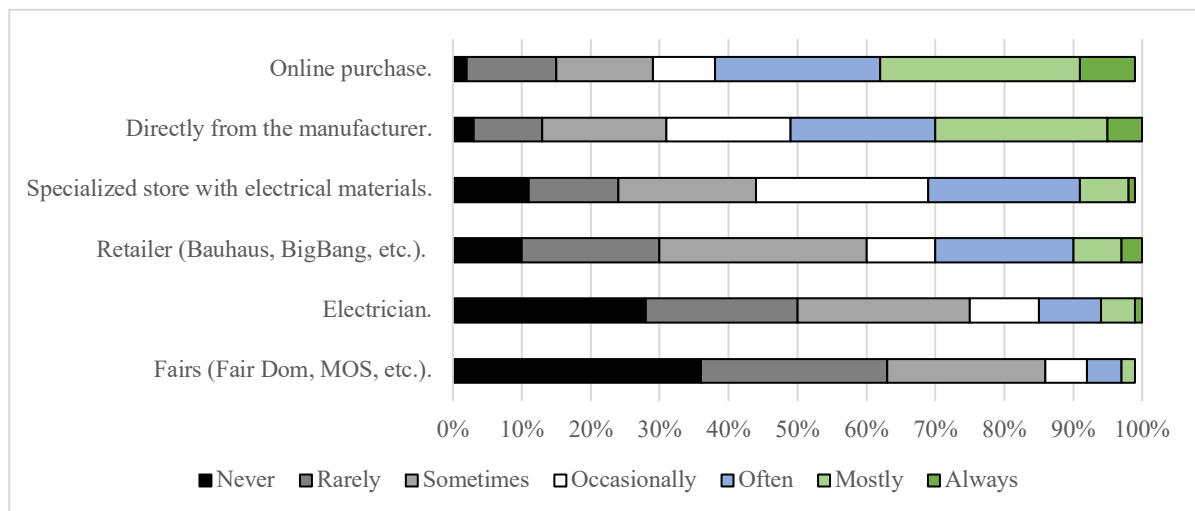
The following table shows respondents' answers to price perception questions (see Table 25). The following two questions were asked to respondents who own a smart home system or a smart home device and respondents who do not yet own a smart home device but are thinking about purchasing, which represents 76.5% of all respondents. The purpose was to test people's perception of how expensive they think smart home systems are. The average cost for a smart home system for an apartment is 4618.6€, and the average cost of a smart home system for a house is 9062€. Although, the high standard deviation for both questions indicates high variability in opinion.

Table 25: Respondents' answers to price perception questions (n=203)

1. How much, in your opinion a comprehensive system (management of all lighting, blinds and heating) costs for a smart apartment (70m2) in EUR?				
n	Average	St.dev.	Minimum	Maximum
203	4618.6	5384.96	75	30000
2. How much, in your opinion a complete system (management of all lighting, blinds and heating) costs for a smart house (160m2) in EUR?				
n	Average	St.dev.	Minimum	Maximum
203	9062.9	14839.41	200	160000

The purpose of the next question is to see which pricing model respondents prefer (see Figure 52). This question was asked to respondents who own a smart home system or a smart home device and respondents who do not yet own a smart home device but are thinking about purchasing, which represents 76.5% of all respondents. 43% of respondents chose one-time immediate payment as their prefered choice, followed by 31% who prefer to pay in instalments, and 25% prefer a subscription model.

Figure 52: What payment method would you choose when purchasing a complete smart home system (managing all lighting, blinds and heating)?(n=203)
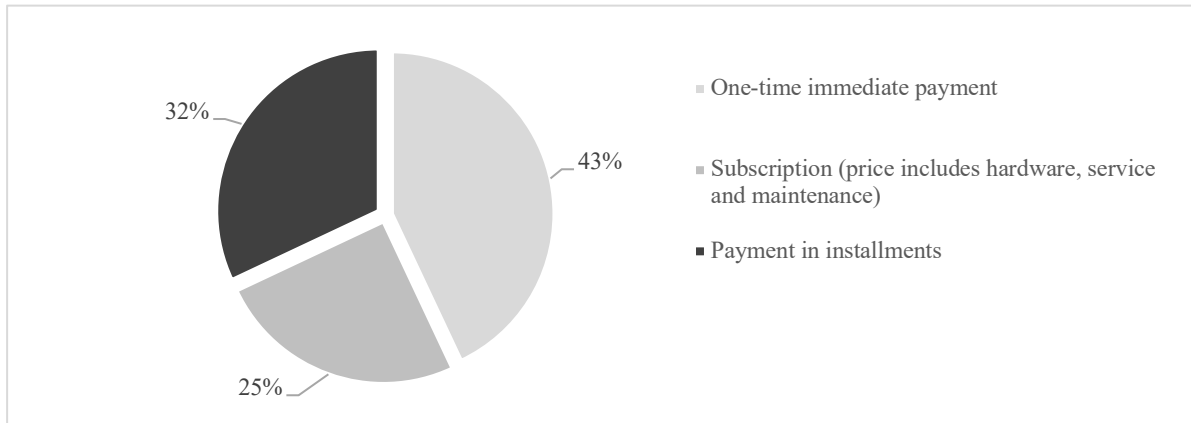
Source: Own work.

The 25% of respondents who prefer the subscription model as their choice of payment were then asked how much they are willing to pay for such a model (see Table 26). The average price respondents answered is 104.8€, with a standard deviation of 86.61€

Table 26: Respondents' answers to subscription pricing question (n=50)

1. How much are you willing to pay for a monthly subscription for a comprehensive smart home system (management of lights, shades and heating) in EUR?				
n	Average	St.dev.	Minimum	Maximum
50	104.8	86.61	1	400

Source: Own work.

3.2.3 Segmentation

The centred or standardised values of six item sets of the first question (see Appendix 15) were used as the basis to derive the four clusters using the K-mean clustering method. The graph (see Figure 53) shows the differences among the clusters for each item set, which were used to derive an initial cluster description. Additional differences were derived by comparing standardised values of certain item sets per cluster using crosstabs or line graphs. All relevant differences are presented in Appendices 16 and 17.

Figure 53: Standardised scores of six factors per cluster (n = 332)
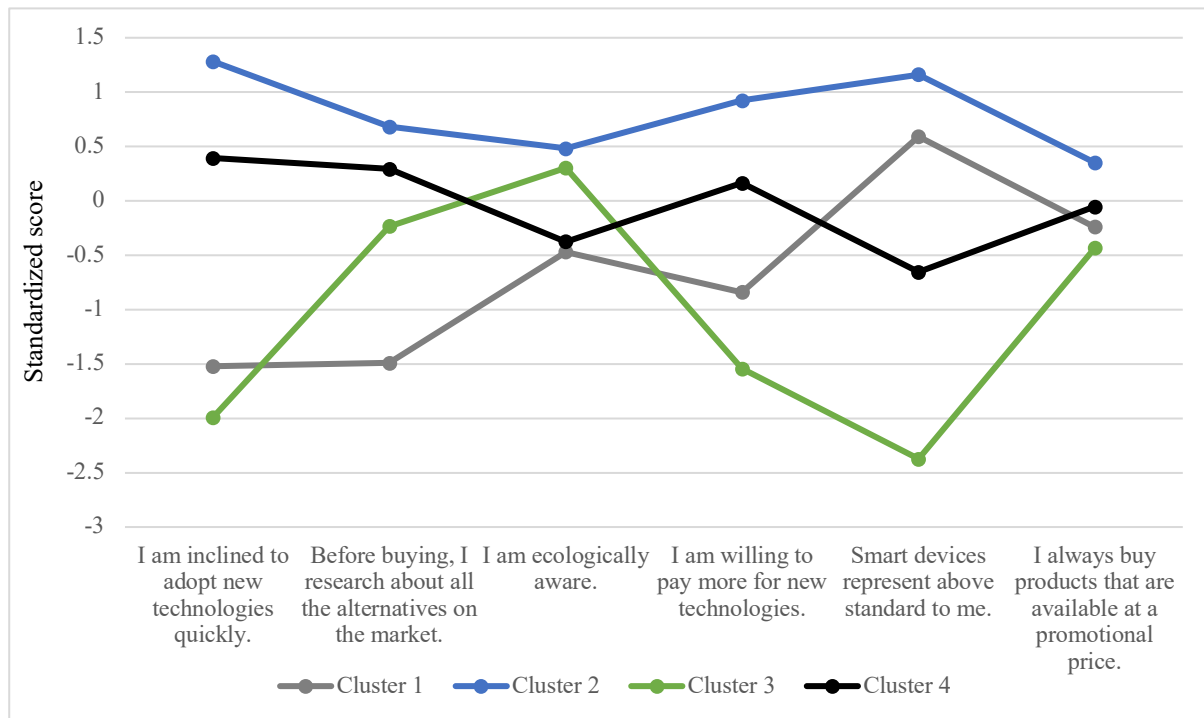
Source: Own work.

Cluster 1 (Negative Nancy): This segment represents 19.8% of all respondents. Although this segment is not inclined to adopt new technologies quickly, they think that smart devices represent above standard. Before buying, they do not research all alternatives on the market, and promotions and discounts can influence them as they care about the price of a product. Regarding product properties, they care the least about the product functions and do not emphasize the importance of reliability or quality. The most effective marketing and sales channels are fairs and recommendations from other experts in the market. 71.2% of them do not own a smart home system or smart home devices. Although, 44.7% are thinking about purchasing a smart home device. In case of purchase, 42.9% would prefer to pay in instalments, and 35.7% would prefer one-time immediate payment.

Cluster 2 (Tech Ted): This is the biggest segment. It represents 35.3% of all respondents and has the highest share of males (52.4%). This group also has the highest share of smart home system/device owners (59.8%). This segment, which is most inclined to accept new technology, is willing to pay more for new technology and believes that smart devices represent above standard. Before buying, they research all the alternatives on the market. Regarding the product, they care most about the design and interoperability of the device. They are mostly influenced by recommendations of family and friends and are the only cluster that sometimes uses various online portals (mojmojster.com) to inform themselves about the market. No cluster gets informed about smart home devices by attending various fairs, but this segment attends them the most out of all. This segment's most effective sales channels are the internet (online purchase) and the manufacturer directly, as 64% use these channels the most. This segment has the best perception regarding the benefits of smart

devices. Those who do not have any smart home device (40.2%) is because they do not want to share usage data with the manufacturer as classic home management (switches) are enough for them. Out of those who do not own a smart home system/device, 83% think of purchasing. In case of a purchase, the majority prefers one-time immediate payment.

Cluster 3 (Earthy Eve): This segment represents 13.5% of all respondents. 75.6% in this segment do not own smart home systems/devices, and out of that, 75.6%, 70.6%, do not think of purchasing them either. They are the most pessimistic segment when it comes to smart home devices. They are ecologically aware, unwilling to accept new technology quickly and do not think smart devices represent above standard. Regarding the products, they least care about the design. They mostly want to have good quality/reliability and high safety in smart home products. This cluster is very against social media advertisement. 62% would search for and buy smart home devices from retailers (Bauhaus and others). In case of purchase, the majority of this segment prefers payment in instalments. The least preferred payment type for them is one-time immediate payment. This segment is most lenient toward the subscription model (31.3%).

Cluster 4 (Average Anna): This is the second-largest segment, representing 31.4% of all respondents. 44.2% of them own a smart home system/device, and out of those 44.2%, 65.5% are thinking about buying a smart home system/device. They are considered the average Anna, as they do not have a strong opinion about anything yet are relatively quickly willing to adopt new technologies. Even though they believe smart devices are hard to understand and require high computer literacy. Regarding product properties, they care most about the product's brand and value safety the least. They rarely inform themselves about smart home products through friends and family recommendations. They use the internet the most to inform themselves about smart home products. The most effective sales channels for them are the manufacturer directly. In the case of a purchase, 44.3% prefer one-time immediate payment, and 36.1% prefer payment in instalments.

3.3   Qualitative research

For the qualitative research, we interviewed a smart home company X representative (see Appendix 18). The company belongs in the control and connectivity segment and is based in Slovenia. It develops and produces its smart home equipment. They also customise and program the equipment to customers' wishes. The company's organizational structure is horizontal, and work is team-based. The company has 11 employees and numerous partners. The employee reward system is based on performance and is reviewed once a year. R&D and other core activities are done in-house, other non-core activities are outsourced.

From the interview, we gathered the following key takeaways:

- Price and privacy/security issues are the biggest consumer barriers;
- heating, lighting and shades are most wanted smart home functions;

- importance of businesses digitalizing core activities;
- importance of heavily investing in R&D;
- important partners are architects, electrical designers, builders, and electricians;
- good working conditions and a stimulating environment increase social benefits;
- producing long-lasting products, reusing and recycling increase the environmental benefits;
- exchanging intergenerational views and ideas indirectly stimulates innovation.

3.4 Triple-layer business model design for a firm operating in the smart home market

Combining the results from the literature review, market analysis, survey and interview, a triple-layer business model for a firm operating in a smart home was constructed. To complete all three layers, we focus on each building block and summarise key takeaways.

3.4.1 Economic business model canvas

This layer of the business model focuses on the economic side of the business (see Table 27). The fundamental building block for every company is the value proposition. The value proposition of smart home companies is to provide consumers with a vast assortment of products and services for a smart, safe and energy-efficient home. From the survey, we gathered that companies in this market have the opportunity to offer devices and product features that consumers perceived to have high utility (see Figure 45). The survey revealed that apart from the basic smart home functions, there is also demand for more intricate systems, such as gardening systems and energy production and storage systems, which coincides with the market trends. The market analysis also showed that the company should develop and provide customisable cross-segment solutions that interoperate well with other devices to keep their value proposition in the long run. In addition to the products offered, the company offers its customers an application to manage and control their smart home devices and energy consumption, which can be customised to customers' preferences. According to most respondents, they want smart home devices to be reliable and of good quality. They also expressed the importance of the company offering product warranty.

To deliver the value proposition, a company must gather all the necessary resources. The main resources needed for the smart home company are employees, offices, showrooms and the products offered. The activities building block focuses on what a company does to make the business model work. The analysis revealed that cybersecurity would remain a top priority for companies in the smart home market. Thus, all core activities should be done in-house, such as R&D, IT, production, sales, logistics, accounting and marketing. From the survey, we gathered that a strong digital marketing strategy is very effective for firms in the smart home market, and high investment in R&D will keep the company competitive in the

long run. Other non-core yet important activities also involve gradually widening and upgrading the product assortment to adapt to the evolving customer demands.

Companies in the smart home market need reliable partners, as safety and quality of smart home devices are most important for most respondents (see Figure 48). The company should partner up with those who offer smart home devices that the companies chose not to produce. So ultimately, the company offers products that it produces in-house and products for which it is only an intermediary. The purpose is to make the company a one-stop place for customers to get everything they need for a smart home. Since most respondents least care about the origins and brand of smart home devices and components, the company can partner with low-cost yet reliable suppliers from China. From the interview (see Appendix 18), it was gathered that architects, electrical designers, builders, electricians are also good partners to target. Other partners related to this building block are banks, landlords of rented offices, utility providers and providers of services that the company outsources.

Table 27: Economic business model canvas for a smart home company

Partners	Activites	Value proposition	Customer relationship	Customer segments
Partner up with companies and offer smart home devices that have the high utility perception.	R&D. Logistics. Sales. IT. Marketing.	Products offered: Offering products that have high utility perseption.	Web page. Social media. Fairs. Discount for partners.	Tech Tom. Average Anna. Earthy Eve.
Partner up with arhitecht, project leaders, investors, construction companies.	**Resources** Offices.	Locally based company Low cost smart home system provider.		Negative Nancy.
Import other products from China.	Showroom. Products. Brand. Employees.	High quality products. Warranty.	**Channels** Web page. Social meda (FB, IG, etc.). Advertisments in construction stores, fairs.	
Costs Offices rent/utility bills. COGS. Inventory. Sales. Accounting. Debt payments.	Marketing (advertisement). Fairs. R&D. High initial investment for COGS, R&D and IT.		**Revenue** B2B B2C. Partners program. Tenders & projects (State, EU, Municipal). Payment types: one-time immediate payment & in instalments. Subscription model for consumption analysis services.	

Source: Own work.

Successful companies know their customers well. Knowing which customer segments to target gives companies an extra competitive advantage, as the company can build strong brand loyalty and customer relationships. The typical smart home customers are people from the segment Tech Tom (35.3%). They are predominantly male, inclined to accept new technology quickly, willing to pay more for new technology and research all alternatives on the market before buying. The second-largest segment is Average Anna (31.4%). They do not have a strong opinion about anything and can easily be influenced to purchase smart home devices through proper branding, as this segment cares about product brands. Consumers in the segment Negative Nancy (19.8%) need more nourishment to establish brand awareness and be educated about the benefits of smart home devices. Earthy Eve (13.5%) is most pessimistic about smart home benefits and is unwilling to adapt to new technology quickly. This segment would need to be convinced more about how they can cut

their emissions by adopting smart devices to make them more inclined to purchase. The marketing strategy needs to be analysed and adjusted yearly to meet the segments' demands.

Quality customer relationships need to be established to target all segments. Since most respondents research and buy smart home devices online, a digital presence is of the essence. The company also establishes a tighter connection with potential customers by showing them the showroom, where all products are displayed. The after-sale relationship is nurtured through an application, where customers can control their home and reach customer support. Moreover, those customers who establish a partnership with the company are offered a partner's discount.

Survey proved that the most effective channels for smart home companies to reach their customers are digital, as most respondents research and buy smart home devices online. Reaching the customers through digital channels, the company targets segment Tech Ted and Average Anna, the two largest segments. A strong digital presence is necessary to reach the targeted segments. One segment said that they would turn to retailers to purchase smart home devices, so brand presence in those stores could increase brand awareness for smart home companies. From the interview was gathered that fairs are also a good channel to increase a company's brand awareness and sales.

The smart home companies' costs to deliver the value proposition relate to R&D, salaries, office rent and other utility bills, cost of goods produced, accounting, marketing and fairs. In the case of a start-up company, high initial investment is needed for the products and R&D. Multiple revenue streams increase a company's competitive advantage. Smart home companies can use the B2C and B2B channels to target a larger audience and create programs for partners, creating additional revenue streams and building brand loyalty. The survey showed that 43% of respondents prefer one-time immediate payment, and 31% prefer to pay in instalments. Especially segment Negative Nancy cares about the price the most, and 42.9% would prefer to pay in instalments. Another revenue stream smart home companies can utilise is the subscription model, as customers who use the application to control their smart home devices also can pay a monthly subscription to get a complete and thorough energy consumption analysis. Finally, the market analysis revealed that the EU's digital and sustainability strategies and policies are favourable to the smart home market. Thus, taking advantage of public tenders and other governmental subsidies is another way to buffer the loss from certain projects that are less profitable.

3.4.2 Environmental business model canvas

The second layer of the triple business model canvas is the environmental layer (see Table 28). The environmental issues the world is facing nowadays is making companies re-evaluate their environmental footprint. The functional value of smart home companies is to provide smart home products and services that increase control, energy efficiency and self-sustainability in residential and non-residential buildings. By emphasizing the positive

environmental effects, the company can target the segment Earthy Eve, as it is the segment, which is most ecologically aware.

The fundamentals for a company to deliver the functional value are the materials. For a smart home company, these include components and products for a smart home system, IT equipment needed to digitalize core activities, offices and showrooms. Continuing to the production, the building block describes the core activities that create value for the company. Smart home companies produce home solutions (products and services) that increase energy efficiency and reduce energy waste. Production and materials building blocks relate to the company's core activities and supplies and outsourcing components relate to other activities needed to deliver functional value. This includes other office supplies, electricity, water, telephone service provider, internet and marketing materials (brochures). Although they are not core activities, the environmental impact they can generate adds up quickly. Reusing and recycling policies should be incorporated in every company.

Table 28: Environmental business model canvas for a smart home company

Supplies and outsourcing	Production	Functional value	End of life	Use phase
Importing/production of products sold. Offices. Electricity, water, etc. Telecommunications (phone, wi-fi). Accounting. Marketing (brochures, etc.). Loan.	Production of smart home system solutions. Increases energy efficiency. Decreases energy waste.	Offering products that increase energy efficiency and self-sustainability. Increases users control over his home functions.	Smart home products have a long life cycle (10-20 years).	Electricity bills. Water bills. Utility bills. Energy used to power the IoT devices.
	Materials		**Distribution**	
	Components or products for smart home systems (from varios SH segments). Quality control, recycling. Digitalisation of core activities.		Train, ships (imports). Cardboard boxes (recyclable). Supply chain reduction.	
Environmental impacts			**Environmental benefits**	
Extra energy consumed to power the IoT devices. E-waste.			Increased energy efficiency. Pollution decrease due to remote control. Less pollution due to supply chain reduction.	

Source: Own work.

Distribution of goods would be through various channels, such as personal pick-up or post office. For imported or exported components and products, transportation by train and ship are options with lower negative externalities. Supply chain reduction will lower the environmental impacts of the company.

After the purchase, the customer enters the use phase. During this phase, the customer creates environmental impacts. Smart home devices are powered by electricity, so the electricity consumption may increase, but they can also reduce energy consumption compared to functions of classical substitutes. In addition, smart home devices and smart home systems are built to last for a decade or two, so the product life cycle is long. Therefore, smart home devices do not necessarily produce higher environmental impacts. The end-of-life components concerns with how products are disposed of. As mentioned above, smart home

devices are built to last for a long time and are not disposable, but e-waste does accumulate over time. By offering products that are of good quality prolongs the product-life cycle.

To conclude, the company should evaluate their environmental benefits and impacts. As clean energy will be more abundant, the extra energy consumption that comes from using smart home devices will be negligible as they will be powered by clean energy. The largest environmental impact of smart home companies is e-waste. On the other hand, smart home companies provide products that increase energy efficiency and decrease pollution due to automatic/remote control.

3.4.3   Social business model canvas

Apart from the environmental benefits, a smart home company can have a positive social impact as well. The following layer in the business model canvas looks at the impacts and benefits from a stakeholder perspective (see Table 29). The market analysis unveiled that the increasing population and growing urbanisation increase concerns around overconsumption, resource management, and sustainable living, all of which drive the demand for a more efficient housing system. The social value smart home companies provide is that they improve customers' lives by providing a system that increases comfort, convenience and control over their homes. The key component to deliver social value are the company's employees. The smart home company should establish a positive and encouraging working environment. It should establish a reward system and provide education and training opportunities for its employees. Providing education programs encourages the transfer of knowledge and providing a stimulating work environment and employee growth opportunities, helps the company retain and attract a skilled workforce.

Governance defines what the company structure is and how its decisions are made. The interview revealed that a horizontal organizational structure where work is team-based is effective and stimulating for small and medium-sized companies in the smart home area. Moreover, privately held companies usually have more freedom to experiment and invest more in R&D, even if not all projects turn out profitable. Another stakeholder of a company are local communities. The more companies shorten their supply chain, the more the local communities benefit. By partnering up with local companies and outsourcing some activities, smart home companies benefit the local communities. Smart home companies also benefit the neighbourhoods by providing residents with smart home energy-efficient solutions. The company's scale of outreach defines the activities through which the company builds its relationship with its stakeholders. In the case of the smart home company, the main activities are event organization for establishing and maintaining customer and supplier relationships, training programs for its employees, education programs for partners, fair attendance and digital marketing channels. Another important stakeholder is the **end-user**. Consumers benefit from the smart and remotely controlled household as it increases their

living comfort, security and energy efficiency. By establishing a strong customer relationship, the company can keep up with evolving customer demands in the long run.

Table 29: Social business model canvas for a smart home company

Local communities	Governance	Social Value	Societal culture	End user
Neighbourhood benefits from smart energy-efficient buildings. Supporting local companies by establishing partnerships.	Business transparency. Privately held company. Horizontal, team-based organisational structure.	Improving consumers lives by providing a system that increases comfort, control and convenience.	The company culture supports: Environment (by recycling). Supplier-customer relationship. Equal opportunities & positive working conditions. Reward system for employees.	The end user benefits from the smart remotely controlled household as it increases comfort, security and energy efficiency.
	Employees Good working conditions. Employee reward system. Training opportunities for employees. Company culture.		**Scale of outreach** Event organization for partners. Training programs for employees and education programs for partners. Fair presence.	Strong customer relationship.
Social impacts The high costs associated with smart home purchase & installation costs are making it unaccessible for people with lower purchasing power. Hacking concerns.			**Social benefits** Supporting local companies through partnerships. Smart neighbourhoods are more efficient. Providing stimulating working environment for employees.	

Source: Own work.

Continuing, the impact of the smart home company on the societal culture can be portrayed by evaluating the societal benefits and impacts of the company. On the one hand, some of the biggest barriers to smart home adoption are price and high installation costs. Because it is a cost carried by the consumer, it represents a negative societal impact. Another significant impact the research showed is cybersecurity, which is a risk also carried by the consumer. On the other hand, the smart home company supports the societal culture by establishing a company culture that supports the environment (through recycling policies), suppliers (through customer relationship policies), employees (through reward policies and growth opportunities), consumers (by providing safe and smart home devices) and other stakeholders. Since the smart home company strives to make high quality, long-lasting products that increase customer's living comfort and energy efficiency while maintaining good working relationships with its other stakeholders, the social benefits outweigh the social impacts.

3.5 Discussion with implications

Companies need to be aware of the changing market forces and innovate their business model as market conditions and consumer demands change. Scientific literature provided recommendations on how companies can innovate their business models successfully. Osterwalder's (2010) business model canvas tool is widely used as a strategic analysis tool and used to make comparisons and analyse different business models. Schrumpeter (1934), Casadesus-Masanell and Zhu (2011) along with Sledzik (2013) are several of many authors who emphasized that companies need to continuously innovate their value creation, value capture and value delivery as the business environment and consumer demands are

everchanging. Binns, Harreld, O'Reilly and Trushman (2015) argued that four indicators signal whether a firm is ready for strategic renewal of its business model. When those indicators light up, a company needs to seek new opportunities for its business model. Cooper (1994) and McGrath (2010) stressed the importance of the stage-gate business model innovation process as an ongoing process full of flexibility and experimentation. Moreover, Chesbrough (2007) emphasized the significance of effectuation and discovery-driven method as entrepreneurs must not dwell on overanalyzing but rather go straight to testing the idea. Taken as a whole, the literature provided the general business model innovation process, which can help companies to stay competitive in the long run.

The smart home market today is a result of decades of technological developments. The market analysis shows a steady 17.6% CAGR of the global smart home revenue, estimated to reach 175.7 billion US dollars by 2025. In 2020, due to the pandemic impact, the worldwide smart home total revenue decreased by 8%, generating about 6.3 billion US dollars less than estimated for the same year. By 2025, the total smart home market revenue is estimated to catch up with the forecasts prior to the pandemic. Observing the segments separately, the most affected segments by the pandemic are home entertainment (-9%), comfort and lighting (-9%) and smart appliances (-8%), as the sale of durable goods declines the most during economic recessions. More indispensable everyday devices, such as security systems (-5%), were less affected by the pandemic than devices that serve entertainment purposes (Statista, 2021).

Out of the selected countries, predominantly the United States, but also China are the market leaders. The United States generates the highest total smart home revenue (around 22 billion in 2019), has an estimated 13.4% CAGR by 2025 and has the highest smart home adoption rate (36.6%). Apart from that, it has the highest consumer spending (44,255 US dollars) and the largest GDP per capita (65,254 US dollars) out of the selected countries. In the smart home adoption rate, United Kingdom (32.9%), Netherlands (24.6%) and Germany (21.5%) have also proved themselves to be well above the world's or Europe's average. Notably, Netherlands has the highest urban population share (91.8%) and has the second-largest GDP per capita (52,646 US dollars) out of the selected countries. On the other spectrum is Slovenia, with the lowest smart home adoption rate out of the selected countries (2.9%). It also has the lowest urban population share (54.8%), below the world's and Europe's average, and a GDP per capita of 25,992 US dollars (Statista, 2021).

Each of the smart home segments' expectations showed that smart appliances and control and connectivity represent the two largest shares of the total smart home revenue and have the two highest CAGR estimates. The United States presents itself as the market leader by total segment revenue and segment adoption rate for all segments apart from smart appliances. For smart appliances, China is catching up quickly and will generate the highest revenue by 2025. Although, the Netherlands has the highest smart appliances adoption rate (7.5%). The control and connectivity segment has the highest adoption rate in the United States and the United Kingdom, which is predominantly due to the sales of smart speakers

and that those countries have an English speaking population. By product, comparisons revealed that the highest adoption rate has smart speakers (15.3%), followed by smart bulbs (7.8%), multi-room entertainment systems (6.8%), smart security cameras (6.2%) and big appliances (6.0%) (Statista, 2021).

Governmental policies, such as the European Green Deal and EU's Digital Agenda, are stimulating the smart home market. The fast pace of technological developments is opening many new opportunities for value creation. The data value will continue to grow and presents itself as an opportunity for smart home companies to grasp. As an effect of smart city and smart grid initiates, smart home companies also have the opportunity to establish and present themselves as companies with a positive social and environmental impact (European Commission, 2014; European Commission, 2021a McGourty, Maciejewski & Ratcliff, 2020). Cross-segment integration, cross-market integration and market dominance of key players are a few main market trends that are reshaping the competitive landscape. Companies like Amazon (with Echo), Google (with Google Home) and Apple (with HomePod) are the most known multinational corporations that expanded into the smart home market, caused market consolidation and demonstrated that they are becoming market leaders. Consumers want devices whose functions are not limited to single purposes and prefer products that cater to many potential needs or wants. For smart home companies, this means that they have to either integrate other segment functions into their products or deliver devices that can interoperate with others (Chanda, 2019; Statista, 2021; Yusuf, 2018).

3.6   Limitations and future research opportunities

The research had certain limitations. The survey sample is not representative of the population because convenience sampling was done. Subsequently, the sample does not represent the whole population, but only people with social media accounts and were group members where the survey was posted. Additionally, the sample is biased towards the younger population, and the survey fell short when testing consumers' price perception regarding the cost of smart home systems. The price perception questions were not specific enough for all respondents to understand the same. The high deviation in answers confirmed the high variability of answers, thus making the results unrepresentable of what was attempted to test. Moreover, qualitative research was based on interviews of one company, as other companies were unavailable. A suggestion for future research would be to gather a bigger sample to strengthen the findings and incorporate more interviews with multiple company owners and market experts to gather a more holistic view of expert opinions.

The triple-layered business model canvas has its limitations as well. (1) It is a tool that does not explain the business processes in detail, as the purpose of the tool is to present more of a general overview of the business model (and the effect on the environment and its stakeholders) and (2) the tool does not involve the company strategy and the execution process. Just by observing the business model canvas, it is unclear how the company strategy

is executed (Joyce & Paquin, 2016). Recommendations for future research would be to incorporate the areas that the triple business model canvas lacks. For future research it would also be interesting to test the difference in companies' performance when they consider only the economic layer or when they take into account all three layers of the business model canvas.

CONCLUSION

Combining the scientific literature and the macroeconomic analysis with empirical research, we concluded the research and translated theory into practise by developing a triple-layered business model for a company operating in the smart home market. The triple-layered business model is the combined result of market analysis, consumer preferences (gathered from the survey) and expert's opinions on their business practice (gathered from the interview). The survey gave an insight into consumer preferences. By testing utility perception, respondents showed which smart home features/functions they find most valuable, which helped determine the value proposition of a smart home company. The market analysis also provided insights into the external forces affecting the market, as companies need to innovate their business models according to market circumstances. Respondents also expressed which marketing and sales channels they prefer for purchasing smart home devices, what product properties they find most important in smart home devices and what payment structure they favour. The survey and the macroeconomic analysis also revealed what are the consumer drivers and barriers when it comes to purchasing. Overall, the survey gave an insight into consumer preferences, but for those business activities that are more internal, the interview provided the rest of the information. The interview delivered insights on how a business practice of a smart home company in Slovenia is and how the company is structured. Overall, we were able to get a more holistic sense of a successful smart home business practice and see how can smart home companies increase their environmental and social benefit. The development of the triple layer business model through the process described in the thesis can serve as a guideline for any company operating in the smart home market.

REFERENCE LIST

1. Adilin, B. (2021). *Smart home trends that will dominate 2021 and beyond.* Retrieved from https://www.analyticsinsight.net/smart-home-trends-that-will-dominate-2021-and-beyond/
2. Aghion, P., Bergeaud, A. & Van Reenen, J. (2019). The Impact of regulation on Innovation. *National Bureau Economic Research Working Paper Series.* Retrieved from https://www.nber.org/system/files/working_papers/w28381/w28381.pdf

3. Ajaykumar, A. (2019). *Major Machine Vision Trends for 2020.* Retrieved from https://www.arcweb.com/blog/major-machine-vision-trends-2020

4. Al-Debei, M., El-Haddadeh, R. & Avison, D. (2008). *Defining the Business Model in the New World of Digital Business.* Retrieved from https://bura.brunel.ac.uk/bitstream/2438/2887/1/AMCIS2008.pdf

5. Alaa, M., Zaidan, A., Zaidan, B. & Talal, M. (2017). A review of smart home applications based on internet of things. *Journal of Network and Computer Applications*, 97, 48-65. Retrieved from https://doi.org/10.1016/j.jnca.2017.08.017

6. Aldrich, F. K. (2003). Smart Homes: Past, Present and Future. *Inside the Smart Home* (p. 17-36). Springer.

7. Ali, S. & Yusuf, Z. (2018). *Mapping the Smart Home Market.* Retrieved from https://www.bcg.com/publications/2018/mapping-smart-home-market

8. Balta-Ozkan, N., Boteler, B. & Amerighi, O. (2014). European smart home market development: Public views on technical and economic aspects across the United Kingdom, Germany and Italy. *Energy Research & Social Science*, 3, 65-77. Retrieved from https://doi.org/10.1016/j.erss.2014.07.007

9. Barbier, E. & Homer-Dixon, T. (1999). Resource Scarsity and Innovation: Can Poor Countries Attain Endogenous Growth? *Ambio*, 28(2), 144-147. Retrieved from https://www.jstor.org/stable/4314865

10. Bhattacharya, J. (2020). *Is Netflix a SaaS? 25 Examples of SaaS Companies That Are Rocking It.* Retrieved from https://www.singlegrain.com/saas/examples-of-saas-companies/

11. Binns, A., Harreld, B., O'Reilly, C. & Trushman, M. (2015). The Art of Strategic Renewal. *MIT Sloan Management Review*, 55, 1-3. Retrieved from http://marketing.mitsmr.com/PDF/STR0715-Top-10-Strategy.pdf

12. Boutin, P. (2004). *A Technological Revolution.* Retrieved from https://www.nbcnews.com/id/wbna6186351

13. Brown, M. & Zhou, S. (2013). Smart-grid policies: An international review. *Wiley Interdisciplinary Reviews: Energy and Environment,* 2(2), 121-139. Retrived from https://doi.org/10.1002/wene.53

14. Byun, J., Jeon, B., Noh, J., Kim, Y. & Park, S. (2012). An intelligent self-Adjusting Sensor for Smart Home Services based on ZigBee Communications. *IEEE Transactions on Consumer Electronics*, 58(3), 794-802. Retrieved from https://doi.org/10.1109/TCE.2012.6311320

15. Casadesus-Masanell, R. & Zhu, F. (2013). Business Model Innovation and Competitive Imitation: The case of Sponsored-Based Business Models. *Strategic Management Journal*, 34(4), 464-482. Retrieved from https://doi.org/10.1002/smj.2022

16. Catalyst. (2019). *Generations: Demographic Trends in Population and Workforce.* Retrieved from https://www.catalyst.org/research/generations-demographic-trends-in-population-and-workforce/

17. CES. (2019). 8 Key Consumer Tech Trends for Entertainment. Retrieved from https://www.ces.tech/Articles/2019/8-Key-Consumer-Tech-Trends-for-Entertainment.aspx

18. Chanda, N. (2019). *Apple, Amazon, Google Unite for Smart Home Project.* Retrieved from https://marketrealist.com/2019/12/apple-amazon-google-unite-for-smart-home-project/

19. Charlton, G. (2015). *The pros and cons of subscription ecommerce models*. Retrieved from https://econsultancy.com/the-pros-and-cons-of-subscription-ecommerce-models/

20. Chesbrough, H. (2007). Business model innovation: it's not just about technology anymore. *Strategy & Leadership*, 35(6), 12-17. Retrieved from https://doi.org/10.1108/10878570710833714

21. Chesbrough, H. (2009). Business Model Innovation: Opportunities and Barriers. *Long Range Planning*, 43(2-3), 354-363. Retrieved from https://doi.org/10.1016/j.lrp.2009.07.010

22. Comes, S. & Berniker, L. (2008). Business Model Innovation. In Pantaleo D., Pal N. (Eds.), *From Strategy to Execution* (pp. 65-86). Springer, Berlin, Heidelberg. Retrieved from https://doi.org/10.1007/978-3-540-71880-2_4

23. Cooper, R. (1994). *Perspective Third-Generation New Product Processes*. Elsevier Science Inc. Retrieved from https://www.researchgate.net/profile/Robert-Cooper-40/publication/222050288_Third_Generation_New_Product_Process/links/5cd18f3b299bf14d957e50b0/Third-Generation-New-Product-Process.pdf

24. Crossan, G., Hupfer, S., Loucks, J. & Srinivasan, G. (2018). *Accelerating agility with XaaS. Many companies are using IT as-a-service to steer their way to competitive advantage.* Deloitte. Retrieved from https://www2.deloitte.com/content/dam/insights/us/articles/4557_accelerating-agility-with-XaaS/DI_accelerating-agility_with-XaaS.pdf

25. Da Xu, L. & He, W. (2014). Internet of Things in Industries: A Survey. *IEEE Transactions on Industrial Informatics*, 10(4), 2233-2243. Retrieved from https://doi.org/10.1109/tii.2014.2300753

26. De Groote, M., Volt, J. & Bean, F. (2017). *Is Europe ready for the smart buildings revolution? Mapping smart-readiness and innovative case studies.* Building Performance Institute Europe (BPIE). Retrieved from https://bpie.eu/wp-content/uploads/2017/02/STATUS-REPORT-Is-Europe-ready_FINAL_LR.pdf

27. Deloitte. (2016). *Switch on to the connected home.* Retrieved from https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/consumer-business/deloitte-uk-consumer-review-16.pdf

28. Deloitte. (2017). *Everything-as-a-service: Modernizing the core through a services lens*. Deloitte Insights. Retrieved from: https://www2.deloitte.com/us/en/insights/focus/tech-trends/2017/everything-as-a-service.html

29. Dodd, C. (2017). *Is A Subscription Model Right For Your Business? Pros vs Cons*. Moon Clerk. Retrieved from https://www.moonclerk.com/subscription-business-model-pros-vs-cons/

30. Domb, M. (2019). Smart Home Systems Based on Internet of Things. *Internet of Things (IoT) for Automated and Smart Appliances*, 1-13. Retrieved from https://doi.org/10.5772/intechopen.84894

31. Duan, Y., Fu, G., Zhou, N., Sun, X., Narendra, N. & Hu, B. (2015). Everything as a Service (XaaS) on the Cloud: Origins, Current and Future Trends. *2015 IEEE 8th International Conference on Cloud Computing,* 621-628. Retrieved from https://doi.org/10.1109/CLOUD.2015.88

32. ECB. (2021). ECB MFI Interest Rate Statistics. *European Central Bank Statistical Data Warehouse*. Retrieved March 17th 2021 from https://sdw.ecb.europa.eu/reports.do?node=1000005691

33. ESDS. (2015). *IaaS vs. DaaS vs. PaaS vs. SaaS - Which Should You Choose?* Retrieved from https://www.esds.co.in/blog/iaas-vs-daas-vs-paas-vs-saas-which-should-you-choose/#sthash.qcM9BxJP.7cG5BDfR.dpbs

34. European Commission. (2021a). *A European Green Deal. Striving to be the first climate-neutral continent.* Retrieved from https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

35. European Commission. (2021b). *Renovation Wave: Doubling the renovation rate to cut emissions, boost recovery and reduce energy poverty*. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1835

36. European Commission. (2014). *The European Union Explained: Digital agenda for Europe*. Retrieved from https://doi.org/10.2775/41229

37. European Union. (2020). *The geopolitical implications of the COVID-19 pandemic.* Policy Department for External Relations. Retrieved from https://doi.org/10.2861/526114

38. Fan, Z., Kalogridis, G., Efthymiou, C., Sooriyabandara, M., Serizawa, M. & McGeehan, J. (2010). *The New Frontier of Communications Research: Smart Grid and Smart Metering*. Retrieved from https://www.iith.ac.in/~tbr/teaching/presentations/17.pdf

39. Farrelly, F. & Quester, P. (2004). Competitive Advantage through Sponsorship. *European Journal of Marketing*, 38(8), 1013-1030. Retrieved from https://doi.org/10.1108/03090560410539140

40. Fidler, M. (2020). *Smart Home Security Trends to Watch in 2020*. Retrieved from https://guardianprotection.com/blog/smart-home-security-trends-to-watch-in-2020/

41. FIFA. (2020). *FIFA World Cup Qatar 2022 - Partners*. Retrieved from https://www.fifa.com/worldcup/organisation/partners/

42. Foote, K. (2017). *A Brief History of Cloud Computing*. Retrieved from https://www.dataversity.net/brief-history-cloud-computing/

43. Francisco, J. (2020). *What Kind of Organizational Culture Supports Innovation?* Retrieved from https://blog.bridgepointeffect.com/what-kind-of-organizational-culture-supports-innovation

44. FranCity. (2019). *Types of Franchises.* Retrieved from https://francity.com/about-franchising/types-of-franchises/

45. Frater, J. (2007). *Top 7 Wonder of the Technological World.* Retrieved from https://listverse.com/2007/09/07/top-7-wonders-of-the-technological-world/

46. Goldberg, E. (n.d.). *The Benefits of the Franchise Model.* Retrieved March 12th 2020 from https://www.franchising.com/guides/benefits_of_the_franchise_model.html

47. Gorey, R., Dobat, D. & Sweeney, L. (2018). *Managing in the knowledge era.* System Thinker. Retrieved from https://thesystemsthinker.com/managing-in-the-knowledge-era/

48. Gubbi, J., Buyya, R., Marusic, S. & Palaniswami, M. (2013). Internet of Things (IoT): A Vision, Architectural Elements, and Future Directions. *Future Generation Computer Systems*, 29(7), 1645-1660. Retrieved from https://doi.org/10.1016/j.future.2013.01.010

49. Hagiu, A. (2015). Strategic Decisions for Multisided Platforms. *MIT Sloan Management Review*, 55, 4-13. Retrieved from http://marketing.mitsmr.com/PDF/STR0715-Top-10-Strategy.pdf

50. Hall, F. & Maglaras, L. (2020). *Smart Homes: Security Challenges and Privacy Concerns.* Retrieved from https://www.researchgate.net/publication/344971583_Smart_Homes_Security_Challenges_and_Privacy_Concerns

51. Hammond, A. (2020). *The 20 Biggest Advances in Tech Over the Last 20 Years.* Foundation for Economic Education. Retrieved from *https://fee.org/articles/the-20-biggest-advances-in-tech-over-the-last-20-years/*

52. Hanna, J. (2013). *Three-Dimensional Strategy: Winning the Multisided Platform.* Harvard Business Review. Retrieved from https://hbswk.hbs.edu/item/three-dimensional-strategy-winning-the-multisided-platform

53. Hannon, E., Magnin-Mallez, C. & Vanthournout, H. (2016). *The circular economy: Moving from theory to practice.* McKinsey & Company. Retrieved from https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/The%20circular%20economy%20Moving%20from%20theory%20to%20practice/The%20circular%20economy%20Moving%20from%20theory%20to%20practice.ashx

54. Hartman, D. (2021). *The Advantages of a Smart Home.* Retrieved from https://homeguides.sfgate.com/advantages-smart-house-8670.html

55. Hayes, A. (2019). *Franchise.* Investopedia. Retrieved March 15th 2020 from https://www.investopedia.com/terms/f/franchise.asp

56. Heetae, Y., Wonji, L. & Hwansoo, L. (2018). IoT Smart Home Adoption: The Importance of Proper Level Automation. *Journal of Sensors*, 2018, 1-11. Retrieved from https://doi.org/10.1155/2018/6464036

57. Heile, B. (2010). *Smart Grids for Green Communications*. Retrieved from https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=5490972

58. Hendricks, D. (2014). *The History of Smart Homes.* Retrieved from https://www.iotevolutionworld.com/m2m/articles/376816-history-smart-homes.htm

59. Higuera, J., Llenas, A. & Carreras, J. (2018). *Trends in smart lighting for the Internet of Things.* Retrieved from https://www.researchgate.net/publication/327434241_Trends_in_smart_lighting_for_the_Internet_of_Things

60. Horwitz, L. (2019). *Top IoT trends to Watch in 2020.* Retrieved from https://www.channelfutures.com/iot/top-iot-trends-to-watch-in-2020

61. IMF. (2021a). GDP per capita (in US dollars). World Economic Outlook Database: April 2021 Edition. *International Monetary Fund*. Retrieved from https://www.imf.org/en/Publications/WEO/weo-database/2021/April

62. IMF. (2021b). Total population (in millions). World Economic Outlook Database: April 2021 Edition. *International Monetary Fund*. Retrieved from https://www.imf.org/en/Publications/WEO/weo-database/2021/April

63. IMF. (2021c). EU's Real GDP growth (annual percentage change). World Economic Outlook Database: April 2021 Edition. *International Monetary Fund*. Retrieved from https://www.imf.org/en/Publications/WEO/weo-database/2021/April

64. Jain, R. (2021). *7 Smart home technology trends to watch out for in 2021*. Retrieved from https://itmunch.com/7-smart-home-technology-trends-2021/

65. Joyce, A. & Paquin, R. (2016). The triple layered business model canvas: A tool to design more sustainable business models. *Journal of Cleaner Production*, 135, 1474-1486. Retrieved from https://doi.org/10.1016/j.jclepro.2016.06.067

66. Kakihara, M. (2014). Grasping a global view of smartphone diffusion: an analysis from a global smartphone user study. *2014 International Conference on Mobile Business.* Retrieved from https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1011&context=icmb2014

67. Karnouskos, S. (2011). Crowdsourcing information via mobile devices as a migration enabler towards the Smart Grid. *IEEE International Conference on Smart Grid Communications* (pp. 67-72). Retrieved from https://doi.org/10.1109/SmartGridComm.2011.6102394

68. Keeney, R. L. (1999). The Value of Internet Commerce to the Customer. *Management Science,* 45(4), 533-542. Retrieved from https://web.archive.org/web/20081010112846id_/http://fisher.osu.edu:80/~butler_267/courses/filesSA/VFT-ecom.pdf

69. Kortuem, G. & Kawsar, F. (n.d.). *The Case for Open Ecosystems for the Internet of Things*. Computing Department, Lancaster University. Retrieved from https://www.fahim-kawsar.net/papers/Kortuem.CIoT2010.Camera.pdf

70. Kuepper, J. & Cheng, M. (2020). *The Impact of Globalization on Economic Growth.* Retrieved April 7th 2020 from https://www.thebalance.com/globalization-and-its-impact-on-economic-growth-1978843

71. Labaccaro, G., Carlucci, S. & Lofstom, E. (2016). A Review of Systems and Technologies for Smart Homes and Smart Grids. *Energies*, 9(5), 1-33. Retrieved from https://doi.org/10.3390/en9050348

72. Laubscher, M. & Marinelli, T. (2014). *Integration of Circular Economy in Business*. Retrieved from https://www.researchgate.net/profile/Thomas-Marinelli/publication/270207909_Integration_of_Circular_Economy_in_Business/links/54a2674e0cf257a63603867e/Integration-of-Circular-Economy-in-Business.pdf

73. Le Merle, M. (2012). *It's Time for 'Service as a Service'*. Retrieved from https://www.ft.com/content/f88bc87a-0e4b-11e2-8b92-00144feabdc0

74. Le, Q., Nguyen, H. B. & Barnett, T. (2012). Smart Home for Older People: Positive Aging in a Digital World. *Future Internet*, 4(2), 607-617. Retrieved from https://doi.org/10.3390/fi4020607

75. Lee, I. & Lee, K. (2015). The Internet of Things (IoT): Applications, investments, and challenges for enterprises. Business Horizons, 58(4), 431-440. Retrieved from https://doi.org/10.1016/J.BUSHOR.2015.03.008

76. Lee, S. & Brown, J. (2009). *A Cross-Country Analysis of Fixed Broadband Deployment: Examination of Adoption Factors and Network effect*. Retrieved from https://www.researchgate.net/publication/228354879_A_Cross-Country_Analysis_of_Fixed_Broadband_Deployment_Examination_of_Adoption_Factors_and_Network_Effect

77. Macarrone, D. (2019). *10 relevant IoT trends in 2020*. Retrieved from https://www.loriot.io/blog/IoT-trends-2020.html

78. Mariottini, F. (2016). *Overview of EN 15232 standard on impact of bulding automation, controls, and building management*. Retrieved from https://www.buildup.eu/en/node/49756

79. Markides, C. & Charitou, C. (2004). Competing with dual business models: A contingency approach. *Academy of Management Perspectives*, 18(3), 22-36. Retrieved from https://doi.org/10.5465/AME.2004.14776164

80. McGourty, A., Maciejewski, M. & Ratcliff, C. (2020). *Digital Agenda for Europe*. Retrieved from https://www.europarl.europa.eu/factsheets/en/sheet/64/digital-agenda-for-europe

81. McGrath, R. (2010). Business Models: A Discovery Driven Approach. *Long Range Planning*, 43(2-3), 247-261. Retrieved from https://doi.org/10.1016/j.lrp.2009.07.005

82. Mohammadi, M. M. & Hammink, C. J. H. W. (2015). Standards for Smart Living: A Historical Overview. *Handbook of Smart Homes, Health Care and Well-Being*, 1-14. Retrieved from https://doi.org/10.1007/978-3-319-01904-8_30-1

83. Moira, M. (2018). *The Pros And Cons Of Subscription Pricing*. Retrieved from BlackCurve: https://blog.blackcurve.com/the-pros-and-cons-of-subscription-pricing

84. Mont, O. (2002). Clarifying the concept of product-service system. *Journal of Cleaner Production*, 10(3), 237-245. Retrieved from https://doi.org/10.1016/S0959-6526(01)00039-7

85. Morgan, J. (2014). *A Simple Explanation Of "The Internet Of Things".* Retrieved from https://www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/?sh=30a61f711d09

86. Newman, P. (2018). *Voice assistant integration is the top smart-home trend at CES.* Retrieved from https://www.businessinsider.com/voice-assistant-integration-top-smart-home-trend-ces-2018-1

87. OECD. (2014). The development of fixed broadband networks. *OECD Digital Economy Papers*, 239. Retrieved from https://doi.org/10.1787/5jz2m5mlb1q2-en

88. OECD. (2021a). *Housing prices (indicator).* Retrieved June 28th 2021 from https://doi.org/10.1787/63008438-en

89. OECD. (2021b). *Inflation forecast (indicator).* Retrieved June 28th 2021 from https://doi.org/10.1787/598f4aa4-en

90. Omer, A. M. (2009). Energy use and environmental impacts: A general review. *Journal of Renewable and Sustainable Energy*, 1(5), 1-29. Retrieved from https://doi.org/10.1063/1.3220701

91. Osterwalder, A. (2004). *The Business Model Ontology: A Proposition in a Design Science Approach.* (doctoral dissertation) Ecole des Hautes Etudes Commerciales Universite de Laussane Retrieved from http://www.hec.unil.ch/aosterwa/PhD/Osterwalder_PhD_BM_Ontology.pdf

92. Osterwalder, A. & Pigneur, Y. (2010). *Business Model Generation.* John Wiley & Sons, Inc., Hoboken, New Jersey.

93. Patrick, C. (2020). *The most common subscription pricing models, and the only one you should be using.* Retrieved from https://www.priceintelligently.com/blog/subscription-pricing

94. Pergande, B., Nobre, P., Nakanishi, A., Zancul, E., Loss, L. & Horta, L. (2012). Product-Service System Types and Implementation Approach. *Leveraging Technology for a Sustainable World*, 43-48. Retrieved from https://doi.org/10.1007/978-3-642-29069-5_8

95. Population Institute. (2021). *Why Population Matters.* Retrieved from https://www.populationinstitute.org/resources/why-population-matters/

96. Porter, M. (1979). *How competitive forces shape strategy.* Retrieved from https://hbr.org/1979/03/how-competitive-forces-shape-strategy

97. Porter, M. (2001). *Strategy and the Internet.* Retrieved from https://hbr.org/2001/03/strategy-and-the-internet

98. Porter, M. & Heppelmann, J. (2014). *How smart, connected products are transforming competition.* Retrieved from https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition

99. Porter, S., Thompson, J., Wellener, P., Sanborn, S. & Ashton, H. (2021). *Smart energy management for industrials.* Retrieved from https://www2.deloitte.com/us/en/insights/industry/power-and-utilities/smart-energy-management.html

100. Posey, B., Botelho, B. & Steele, C. (2020). *Desktop as a Service (DaaS).* Retrieved from https://searchvirtualdesktop.techtarget.com/definition/desktop-as-a-service-DaaS

101. Ramesh, P. (2017). Internet a change agent: An overview of internet penetration and growth across the world. *International Journal of Information Dissemination and Technology*, 7(2), 83-91. Retrieved from https://doi.org/10.5958/2249-5576.2017.00001.2

102. Richter, F. (2015). *The biggest growth drivers in the tech industry.* Retrieved from https://www.statista.com/chart/3733/growth-drivers-in-the-tech-industry/

103. Risteska Stojkoska, B. L. & Trivodaliev, K. V. (2016). A review of Internet of Things for smart home: Challanges and solutions. *Journal of Cleaner Production*, 140, 1454-1464. Retrieved from https://doi.org/10.1016/J.JCLEPRO.2016.10.006

104. Robles, R. & Kim, T. (2010). Context Aware Systems, Methods and Trends in Smart Home Technology. *Security-Enriched Urban Computing and Smart Grid*, 149-158. Retrieved from https://doi.org/10.1007/978-3-642-16444-6_20

105. ROBO Global. (2019). *2020 Trends in Robotics, AI, and Healthcare Innovation.* Retrieved March 8th 2020 from https://www.roboglobal.com/wp-content/uploads/2020/01/ROBO_2020_Outlook.pdf

106. Rogers, E. (2003). *Diffusion of innovations* (Fifth Edition). The Free Press, New York.

107. Roser, M. (2019). *Future Population Growth*. Retrieved from https://ourworldindata.org/future-population-growth

108. Rotunno, T. (2012). *Armstrong Loses Eight Sponsors in a Day*. CNBC News. Retrieved from https://www.cnbc.com/id/49462583

109. Santos, J., Spector, B. & Van Der Heyden, L. (2009). *Toward a Theory of Business Model Innovation within Incumbent Firms.* INSEAD. Retrieved from https://flora.insead.edu/fichiersti_wp/inseadwp2009/2009-16.pdf

110. Schroth, L. (2020). *The Drone Market Size 2020-2015: 5 Key Takeaways.* Retrieved from https://droneii.com/the-drone-market-size-2020-2025-5-key-takeaways

111. Schumpeter. (1934). *The Theory of Economic Development*. Harvard University Press.

112. Shim, T. (2020a, October 17). *15 Popular Platform as a Service (PaaS) Examples*. WHSR. Retrieved from https://www.webhostingsecretrevealed.net/blog/web-business-ideas/paas-examples/

113. Shim, T. (2020b, October 12). *15 Infrastructure Software as a Service (IaaS) Examples*. WHSR. Retrieved from https://www.webhostingsecretrevealed.net/blog/web-business-ideas/iaas-examples/

114. Sledzik, K. (2013). Schumpeter's View on Innovation and Etrepreneurship. *SSRN Electronic Journal*, 89-95. Retrieved from https://doi.org/10.2139/ssrn.2257783

115. Smiljanic, S. (2021). *An In-Depth View into Smart Home Statistics*. PolicyAdvice. Retrieved from https://policyadvice.net/insurance/insights/smart-home-statistics/

116. Solaimani, S. K.-B. & Bouwman, H. (2013). What we do - and don't - know about the smart home: an analysis of the Smart Home literature. *Indoor and Built Environment*, 24(3), 370-383. Retrieved from https://doi.org/10.1177/1420326X13516350

117. Solomon, M. (2017). *Five Important Trends in Customer Service Expectations. Customer Service*. Retrieved from https://www.conversocial.com/blog/five-important-trends-in-customer-service-expectations

118. Sonderman, J. & Tran, M. (2013a). *Managing risks, maintaining standards and ethics in sponsored content*. American Press Institute. Retrieved from https://www.americanpressinstitute.org/publications/reports/white-papers/managing-risks-maintaining-standards-and-ethics-in-sponsored-content/

119. Sonderman, J. & Tran, M. (2013b). *The four business models of sponsored content*. American Press Institute. Retrieved from https://www.americanpressinstitute.org/publications/reports/white-papers/the-four-business-models-of-sponsored-content-2/

120. Sovacool, B. & Furszyfer Del Rio, D. (2020). Smart home technologies in Europe: A critical review of concepts, benefits, risks policies.

121. Stanley, J. (2019). *The History of Smart Home Technology*. FamilyHandyMan. Retrieved from https://www.familyhandyman.com/article/the-history-of-smart-home-technology/

122. Statista. (2021). Smart Home Report 2021 - Statista Digital Market Outlook. *Statista – The Statistics portal*. Retrieved May 18th 2021 from https://www.statista.com/study/42112/smart-home-report/

123. Sung, D. (2019). *Smart home visions through the ages: The history of home automation*. The Ambient. Retrieved from https://www.the-ambient.com/features/visions-through-the-ages-history-of-home-automation-178

124. Sweney, M. (2021). *Global shortage in computer chips "reaches crisis point"*. The Guardian. Retrieved from https://www.theguardian.com/business/2021/mar/21/global-shortage-in-computer-chips-reaches-crisis-point

125. The Tokyo Organizing Comittee of the Olympic and Paralympic Games. (2020). *The Worldwide Olympic Partners*. Retrieved from https://tokyo2020.org/en/organising-committee/marketing/sponsors/

126. Trulsson, N. (2021). *Four Trends in Smart Appliances and Features at CES*. Retrieved from https://www.houzz.com/magazine/4-trends-in-smart-appliances-and-features-at-ces-2021-stsetivw-vs~144978484

127. Ullah, F., Sepasgozar, S. & Wang, C. (2018). A systemic review of smart real estate technology: Drivers of, and barriers to, the use of digital disruptive technologies and online platforms. *Sustainability*, 10(9), 3142. Retrieved from https://doi.org/10.3390/su10093142

128. UN. (2018). *68% of the world population projected to live in urban areas by 2050*. United Nations. Retrieved from https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

129. Velis, C. (2018). No circular economy if current systemic failures are not addressed. *Waste Management & Research*, 36(9), 757-759. Retrieved from https://doi.org/10.1177/0734242X18799579

130. Viani, F., Robol, F., Polo, A., Rocca, P., Oliveri, G. & Massa, A. (2013). Wireless Architectures for Heterogenous Sensing in Smart Home Applications: Concepts and Real Implementation. *Proceedings of the IEEE*, 101(11), 2381-2396. Retrieved from 10.1109/JPROC.2013.2266858

131. Vorbach, S., Wipfler, H. & Schimpf, S. (2017). Business Model Innovation vs. Business Model Inertia: the Role of Disruptive Technologies. *BHM Berg – Huttenmannische Monatshefte* 162(9), 382–385. Retrieved from https://doi.org/10.1007/s00501-017-0671-y

132. Wang, C. L., Zhang, Y., Ye, L. R. & Nguyen, D. D. (2005). Subscription to fee-based online services: What make consumer pay for online content? *Journal of Electronic Commerce Research*, 6(4), 304-311.

133. Warrillow, J. (2015). *The Automatic Customer.* Penguin Group, New York.

134. Weier, T. (2018). *Key Barriers To Businesses Innovation*. Retrieved from https://www.digitalistmag.com/digital-economy/2018/11/22/key-barriers-to-businesses-innovation-06194263/

135. Whitler, K. (2016). *How the subscription economy is disrupting the traditional business model.* Forbes. Retrieved from https://www.forbes.com/sites/kimberlywhitler/2016/01/17/a-new-business-trend-shifting-from-a-service-model-to-a-subscription-based-model/

136. Wilson, C., Hargreaves, T. & Hauxwell-Baldwin, R. (2017). Benefits and risks of smart home technologies. *Energy Policy*, 103, 72-83. Retrieved from https://doi.org/10.1016/j.enpol.2016.12.047

137. WIPO. (2020). *China Becomes Top Filer of International Patents in 2019 Amid Robust Growth For WIPO's IP Services Treaties and Finances*. Retrieved from https://www.wipo.int/pressroom/en/articles/2020/article_0005.html

138. World Bank. (2020). Urban population share. World Development Indicators. *The World Bank DataBank*. Retrieved from https://databank.worldbank.org/source/world-development-indicators

139. Xu, L., He, W. & Li, S. (2014). Internet of Things in Industries: A Survey. *IEEE Transactions on Industrial Informatics*, 10(4), 2233-2243. Retrieved from https://doi.org/10.1109/TII.2014.2300753

140. Yang, H., Lee, W. & Lee, H. (2018). IoT Smart Home Adoption: The Importance of Proper Level Automation. *Journal of Sensors*, 2018, 1-11. Retrieved from https://doi.org/10.1155/2018/6464036

141. Yusuf, Z. (2018). *Mapping the Smart Home Market*. Boston Consulting Group. Retrieved from https://www.bcg.com/publications/2018/mapping-smart-home-market

142. Zhao, R., Fischer, W., Aker, E. & Rigby, P. (2013). *White Paper: Broadband Access Technologies*. Retrieved Februar 27th 2020 from:

http://www.ftthcouncil.eu/documents/Publications/DandO_White_
Paper_2_2013_Final.pdf

143. Zhu, Q., Wang, R., Chen, Q., Liu, Y. & Qin, W. (2010). IoT Gateway: Bridging Wireless Sensor Networks into Internet of Things. *2010 IEEE/IFIP International Conference on Embedded and Ubiquitous Computing*, 2010, 347-352. Retrieved from https://doi.org/10.1109/EUC.2010.58

144. Zott, C. & Amit, R. (2001). Value creation in e-business. *Strategic Management Journal* 22(6-7), 493-520. Retrieved from https://doi.org/10.1002/smj.187

145. Zott, C., Amit, R. & Massa, L. (2011). The Business Model: Recent Developments and Future Research. *Journal of Management*, 37(4), 1019-1042. Retrieved from https://doi.org/10.1177/0149206311406265

APPENDICES

Appendix 1: Povzetek (Summary in Slovene language)

V zadnjih 30 letih so tehnološki napredki na področju IoT, umetna inteligenca in 5G povzročili vse večje zanimanje potrošnikov za sisteme za avtomatizacijo in nadzor objektov. Naraščujoča zanimanja podjetji iz različnih panog, ki prodirajo na trg pametnih domov nakazuje na neizkoriščene priložnosti (Solaimani & Bouwman, 2013). Zaradi nenehnega in hitrega tehnološkega razvoja so podjetja, ki delujejo na tem trgu prisiljena nenehno razmišljati o novih načinih in priložnostih trženja (Casadesus-Masanell & Zhu, 2013).

Mikroekonomsko in makroekonomsko okolje skupaj s konkurenco se nenehno razvija, z razvojem tehnologije pa se spreminjajo tudi poslovni modeli. Medtem ko podjetja veliko vlagajo v razvoj novih idej in tehnologij, imajo pogosto le malo sposobnosti da te inovacije spremenijo v dodano vrednost (Solaimani & Bouwman, 2013). Namen tega magistrskega dela je pokazati priložnosti za inovacije na področju poslovnih modelov za podjetja, ki poslujejo na trgu pametnih domov. Za dosego tega je bilo potrebno:

- Definirati teoretično ozadje in razvoj poslovnih modelov, procesa inovacije poslovnega modela, ter opredeliti ovire, dejavnike in trende na omenjenih področjih.
- Definirati teoretično ozadje in razvoj pametnih domov.
- Analizirati trg pametnih domov in ugotoviti potencialne prednosti, slabosti in trenutne trende in druge pomembne zunanje dejavnike, ki ga obdajajo.
- Ugotoviti želje in zahteve potrošnikov in prakse podjetji, ki poslujejo v Sloveniji na trgu pametnega doma.

Podjetja se morajo zavedati spreminjajočih se tržnih trendov in prenoviti svoj poslovni model, skladno s spreminjanjem tržnih razmer in povpraševanjem potrošnikov, če želijo ostati konkurentni na dolgi rok. Odgovore kako uspešno prenoviti svoje poslovne modele lahko najdemo v Osterwalderjevi (2010) knjigi Poslovni model canvas (Business model canvas), ki se pogosto uporablja kot orodje za strateško analizo in primerjavo poslovnih modelov različnih podjetji. Schrumpeter (1934), Casadesus-Masanell in Zhu (2011) ter Sledzik (2013) izstopajo med številnimi avtorji, ki so poudarili, da morajo podjetja nenehno prenavljati in skrbeti za inovacije na področju ustvarjanja vrednosti, saj se poslovno okolje in zahteve potrošnikov nenehno spreminjajo. Binns, Harreld, O'Reilly in Trushman (2015) trdijo, da obstajajo štirje kazalniki, ki prikazujejo ali je podjetje pripravljeno na strateško prenovo svojega poslovnega modela. Podjetje mora poiskati nove priložnosti za spremembo poslovnega modela, ko kazalniki kažejo v to smer. Cooper (1994) in McGrath (2010) sta poudarila pomembnost procesa inovativnosti in poslovnega modela, ki je poln nenehnega prilagajanja in eksperimentiranja. Poleg tega je Chesbrough (2007) poudaril pomen metode, ki temelji na odkritju, saj se podjetniki ne smejo pretirano ukvarjati z analizo, ampak bi po njegovem morali neposredno preizkušati idejo oziroma produkt. Iz literature je razbrati, da je proces inovativnosti poslovnega modela pomemben saj lahko podjetjem pomaga dolgoročno ostati konkurenčen.

Trg pametnih domov je sestavljen iz šest segmentov (energetska učinkovitost, razsvetljava in udobje, nadzor in povezljivost naprav, pametni gospodinjski aparati, varnost in avdio/video sistemi). Potrošniki lahko integrirajo sisteme iz vseh segmentov ali le iz nekaterih segmentov in tako si vzpostavijo sistem za pametni dom. Analiza trga prikazuje povprečno 17,6% letno stopnjo rasti prihodkov na svetovnem trgu naprav pametnega doma, ki naj bi do leta 2025 dosegla 175,7 milijarde ameriških dolarjev. Leta 2020 so se zaradi vpliva epidemije skupni prihodki na trgu naprav pametnih domov zmanjšali za 8%, kar je približno 6,3 milijarde ameriških dolarjev manj, kot je bilo predvideno za to leto. Ocenjuje se, da bodo do leta 2025 skupni prihodki na trgu naprav pametnega doma dosegli napovedi pred pandemijo. Zaradi pandemije so najbolj prizadeti sektorji: Avdio/video sistemi (-9%), razsvetljava in udobje (-9%), ter pametni gospodinjski aparati (-8%) saj se v času gospodarske krize najbolj zmanjšuje prodaja trajnih dobrin. Pandemija je na manj nepogrešljive vsakdanje naprave, kot so varnostni sistemi (-5%) vplivala manj, kot na naprave, ki služijo zabavi (Statista, 2021).

Med državami izbranimi za namen analize so Združene države Amerike (ZDA) in Kitajska vodilne na trgu. ZDA ustvarijo najvišje skupne prihodke na trgu naprav pametnega doma (okoli 22 milijard v letu 2019), imajo ocenjeno letno rast 13,4% do leta 2025 in najvišjo stopnjo povpraševanja po napravah za pametni dom (36,6%). Poleg tega imajo največjo potrošnjo na prebivalca izmed izbranih držav (44.255 ameriških dolarjev) in imajo največji BDP na prebivalca (65.254 ameriških dolarjev) med obravnavanimi državami. ZDA so vodilne na trgu skupnih prihodkov pri vseh segmentih, razen pametnih gospodinjskih aparatov. Na tem področju jih Kitajska hitro dohiteva in bo do leta 2025 ustvarila največ prihodkov v tem segmentu. Segment nadzora in povezljivosti je najbolj zaželjen v ZDA in Združenem kraljestvu, kar je predvsem posledica prodaje pametnih zvočnikov (npr. Alexa) in tega, da imajo te države angleško govoreče prebivalstvo. Države v katerih se poleg ZDA največkrat odločijo za naprave za pametni dom so tudi Združeno kraljestvo (32,9%), Nizozemska (24.6%), in Nemčija (21.5%) kar je precej nad svetovnim in evropskim povprečjem. Nizozemska ima največji delež mestnega prebivalstva (91,8%) in drugi največji BDP na prebivalca (52.646 ameriških dolarjev) med obravnavanimi državami. Nasprotno pa imajo v Sloveniji potrošniki najnižjo stopnjo opremljenosti z napravami za pametni dom med izbranimi državami (2,9%). Slovenija ima tudi najnižji delež mestnega prebivalstva (54,8%) in je pod svetovnim in evropskim povprečjem. BDP na prebivalca znaša le 25.992 ameriških dolarjev (Statista, 2021).

Vladne politike Europske komisije, kot so evropski zeleni dogovor (The European Green Deal) in digitalni plan (The Digital Agenda), spodbujajo razvoj trga pametnih domov. Hiter tehnološki razvoj na tem področju odpira številne nove tžne priložnosti. Vrednost podatkov se bo še naprej povečevala in nudila priložnost podjetjem, ki se ukvarjajo z napravami za pametne domove, da izkoristijo podatke za izboljšanje odnosov s potrošniki. Ponudniki pametnih sistemov imajo priložnost, da svoja podjetja in produkte predstavijo in uveljavijo kot podjetja s pozitivnim socialnim in okoljskim vplivom in s tem pomagajo odpraviti

okoljevarstvene in socialne probleme s katerimi se svet sooča (Evropska komisija, 2014; McGourty, Maciejewski & Ratcliff, 2020). Medsektorska integracija ter prevladovanje ključnih akterjev na trgu so nekateri izmed glavnih tržnih trendov, ki preoblikujejo konkurenco. Podjetja, kot so Amazon (z Echo), Google (z Google Home) in Apple (z HomePod), so najbolj znane multinacionalne korporacije, ki so se razširile na trg pametnih domov, povzročile konsolidacijo trga in pokazale, da postajajo vodilne na trgu. Potrošniki želijo naprave, katerih funkcije niso omejene na en sam namen, in imajo raje izdelke, ki ustrezajo številnim potencialnim potrebam ali željam. Za podjetja, ki ponujajo naprave za pametne domove to pomeni, da morajo v svoje izdelke vključiti druge funkcije segmenta ali nuditi naprave, ki lahko operirajo z drugimi (Chanda, 2019; Statista, 2021; Yusuf, 2018).

Z združevanjem znanstvene literature in makroekonomske analize z empirično raziskavo sva razvila troslojni poslovni model za podjetja, ki delujejo na trgu pametnih domov in s tem predstavila priložnosti poslovnih modelov, ki jih podjetja na tem trgu imajo. Troslojni poslovni model je skupen rezultat analize trga, preferenc potrošnikov v anketi ter mnenj strokovnjakov o njihovi poslovni praksi iz intervjuja. Raziskava je dala vpogled v preference potrošnikov in najbolše prakse podjetij. S preizkušanjem zaznavanja uporabnosti so anketiranci povedali, katere funkcije pametnega doma se jim zdijo najbolj uporabne, kar je pomagalo pri določitvi vrednosti (value proposition) podjetja z napravami za pametne domove. Anketiranci so izjasnili katere tržne in prodajne poti so jim ljubše za nakup naprav za pametni dom, katere lastnosti izdelkov se jim zdijo najpomembnejše pri napravah za pametni dom in kakšno plačilno strukturo imajo raje. Analiza trga je omogočila tudi vpogled v trenutne zunanje dejavnike, ki vplivajo na trg, saj morajo podjetja nenehno prenavljati svoje poslovne modele glede na tržne razmere. Raziskava in makroekonomska analiza sta razkrila tudi, kaj so gonila in ovire pri nakupu potrošnikov. Za pridobitev informacij o internih poslovnih dejavnostih sva uporabila podatke iz intervjuja. Iz intervjuja sva lahko dobila bolj celosten vpogled v uspešne poslovne prakse podjetja za pametni dom in tako videla, kako lahko podjetja s pametnim domom povečajo svojo okoljsko in socialno korist. Razvoj troslojnega poslovnega modela s postopkom, opisanim v magistrski nalogi, lahko služi kot vodilo skozi proces inovacij poslovnih modelov za vsako podjetje, ki deluje na trgu pametnih domov.

Appendix 2: Smart appliances average revenue per smart home forecast in the selected countries

Figure 1: Smart appliances average revenue per smart home forecast in the selected countries in 2019 and 2025
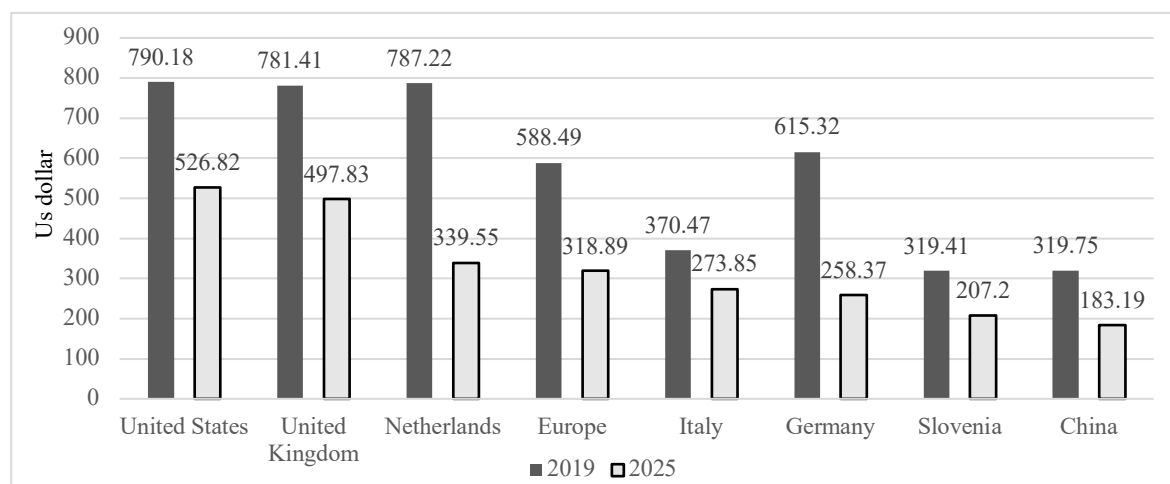
Source: Statista (2021)

Appendix 3: Smart appliances household penetration rate worldwide by product type

Figure 2: Smart appliances household penetration rate worldwide by product type (2017-2025)

Source: Statista (2021)

Appendix 4: Security average revenue per smart home in the selected countries

Figure 3: Security average revenue per smart home in the selected countries in 2019 and 2025

Source: Statista (2021)

Appendix 5: Security worldwide household penetration rate forecast by product type

Figure 4: Security worldwide household penetration rate forecast by product type (2017-2025)
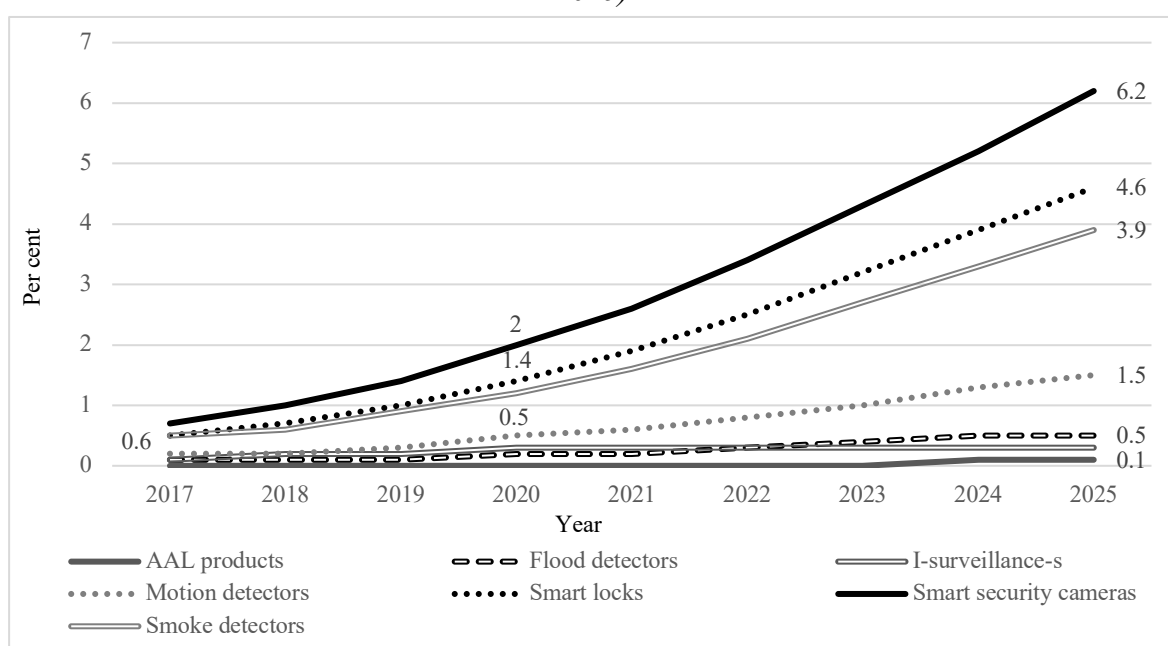
Source: Statista (2021)

Appendix 6: Control and connectivity average revenue per smart home in the selected countries

Figure 554: Control and connectivity average revenue per smart home in the selected countries in 2019 and 2025
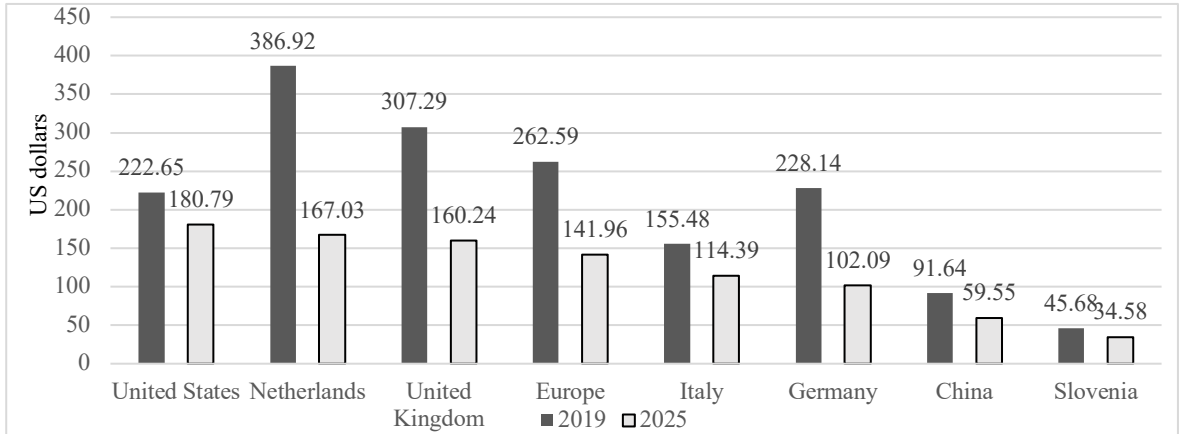
Source: Statista (2021)

Appendix 7: Control and connectivity household penetration rate worldwide by product type

Figure 6: Control and connectivity household penetration rate worldwide by product type (2017-2025)
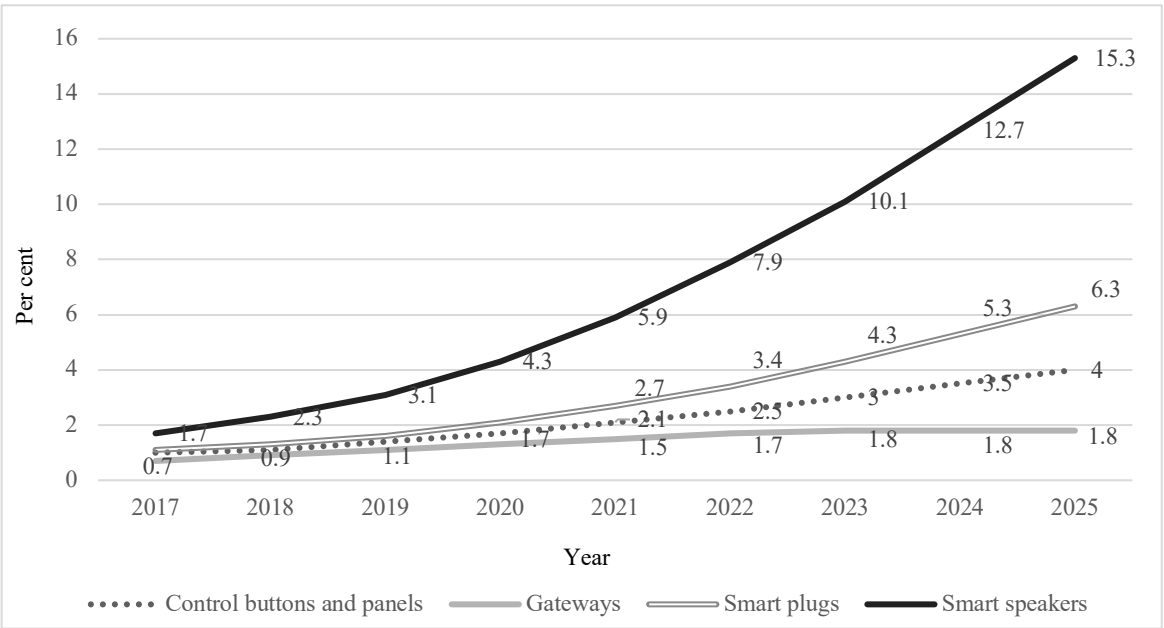
Source: Statista (2021)

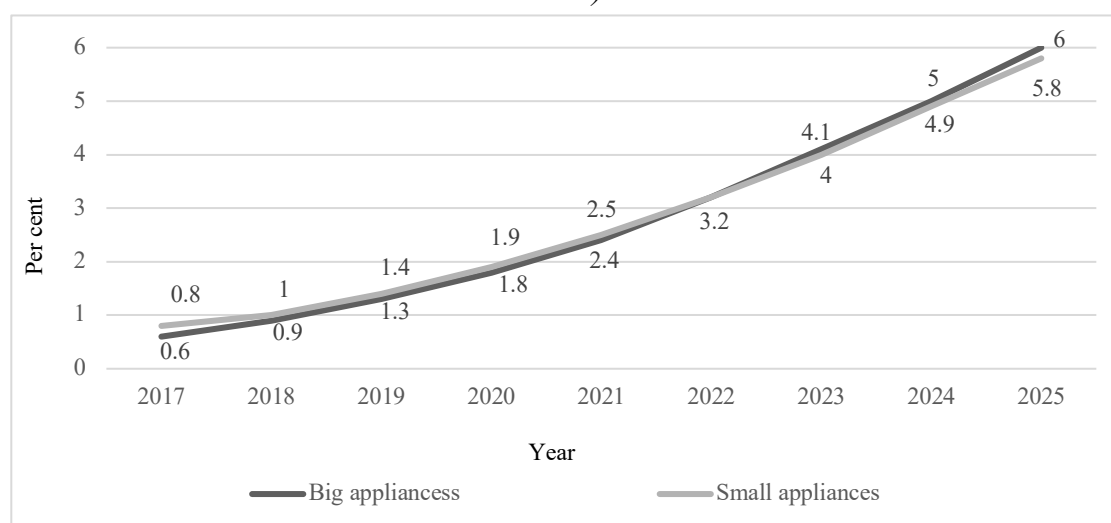**Appendix 8: Home entertainment average revenue per smart home in the selected countries**

Figure 7: Home entertainment average revenue per smart home in the selected countries in 2019 and 2025
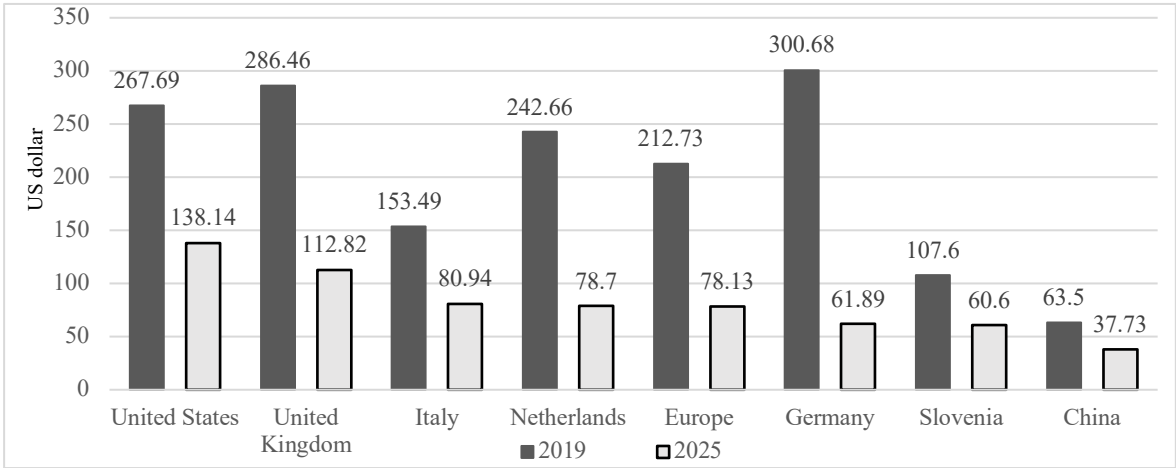
Source: Statista (2021)

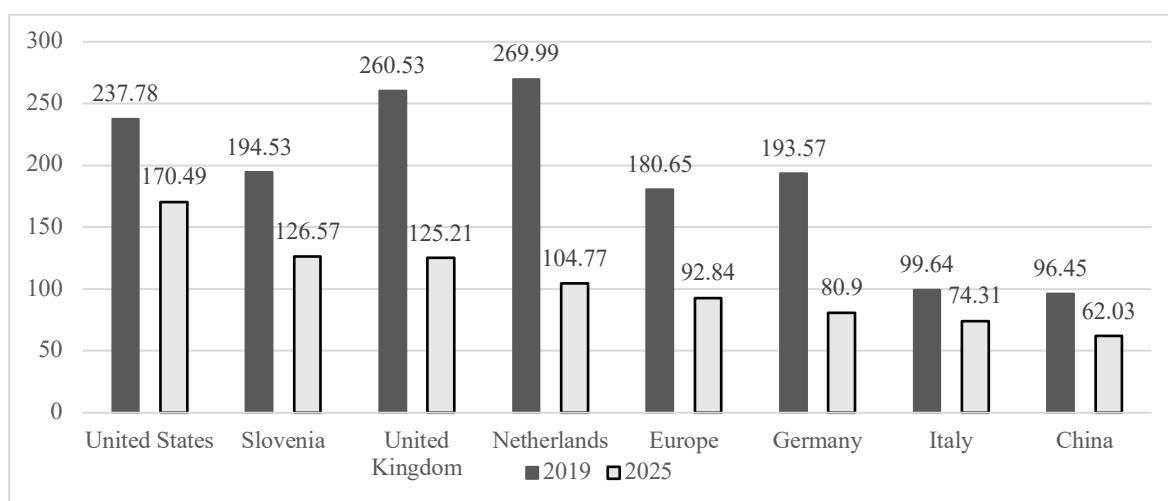**Appendix 9: Home entertainment household penetration rate worldwide by product type**

Figure 8: Home entertainment household penetration rate worldwide by product type (2017-2025)
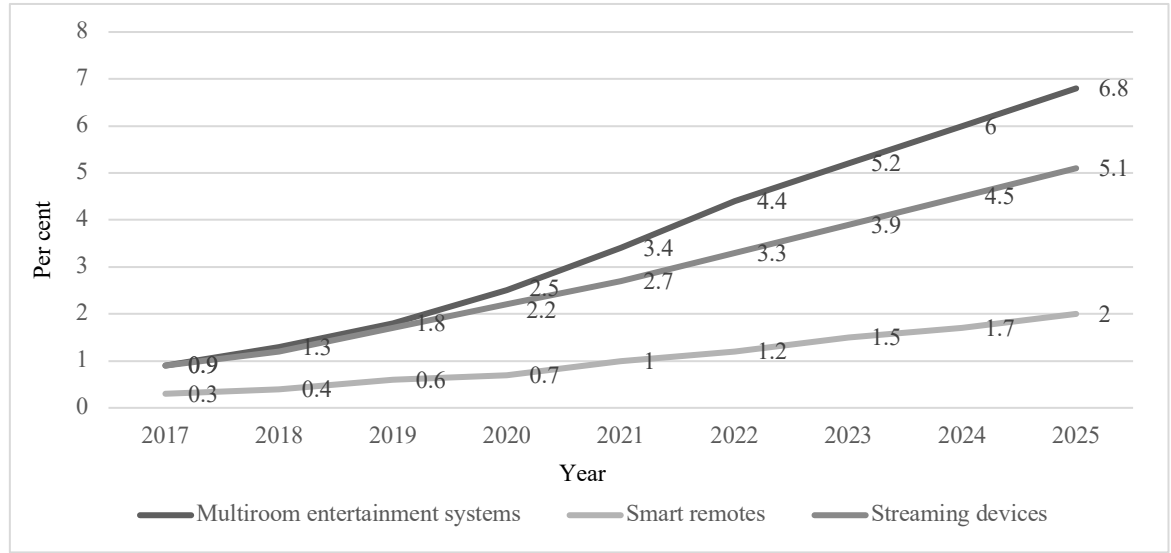
Source: Statista (2021)

Appendix 10: Energy management average revenue per smart home in the selected countries

Figure 9: Energy management average revenue per smart home in the selected countries in 2019 and 2025
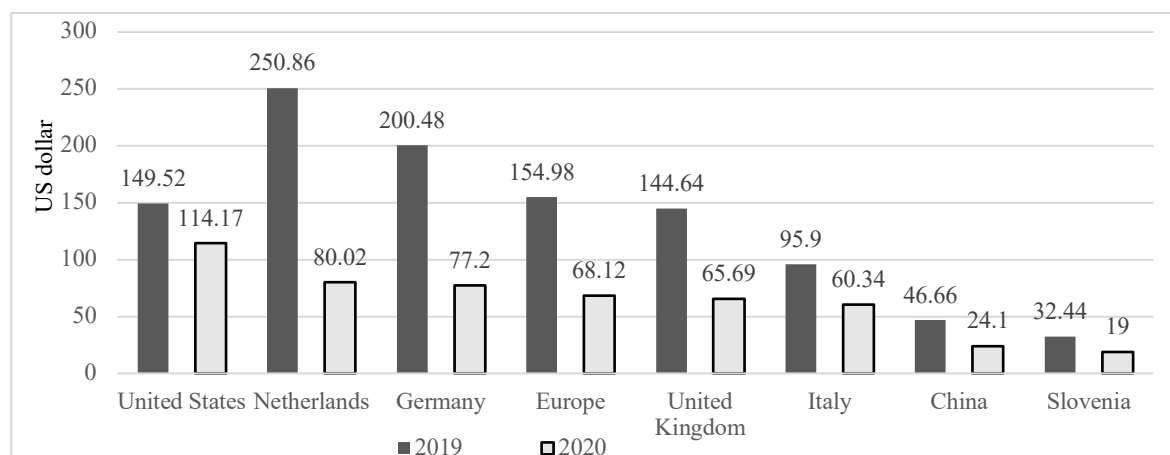
Appendix 11: Energy management household penetration rate worldwide by product type

Figure 10: Energy management household penetration rate worldwide by product type (2017-2015)
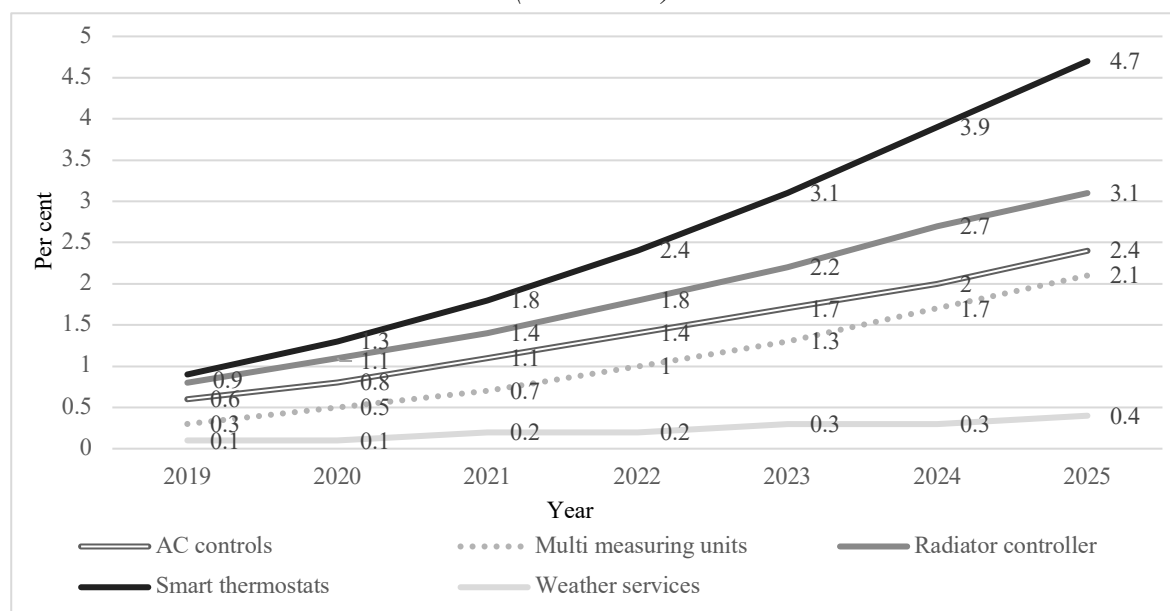
Appendix 12: Comfort and lighting average revenue per smart home in the selected countries

Figure 11: Comfort and lighting average revenue per smart home in the selected countries in 2019 and 2025
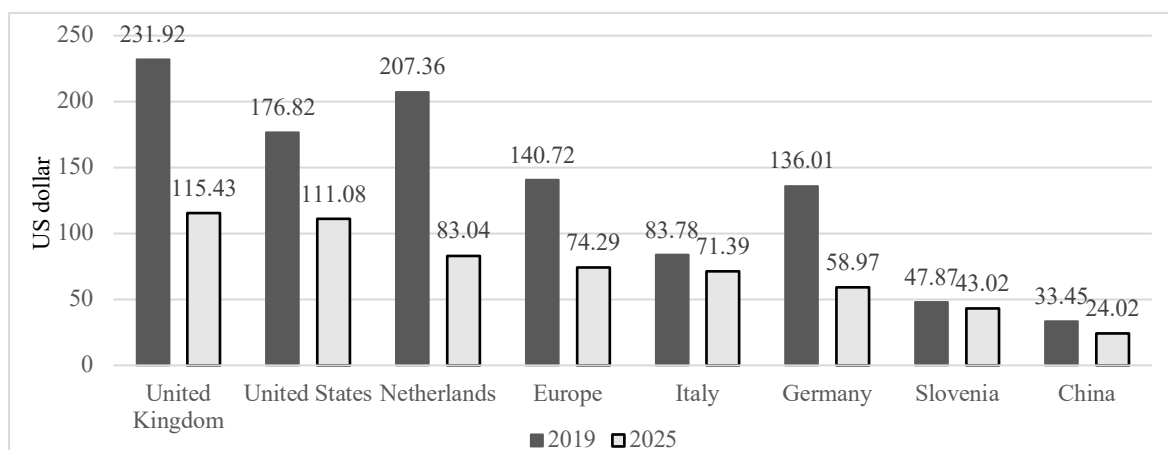
Appendix 13: Comfort and lighting household penetration rate worldwide by product type

Figure 12: Comfort and lighting household penetration rate worldwide by product type (2017-2015)

9
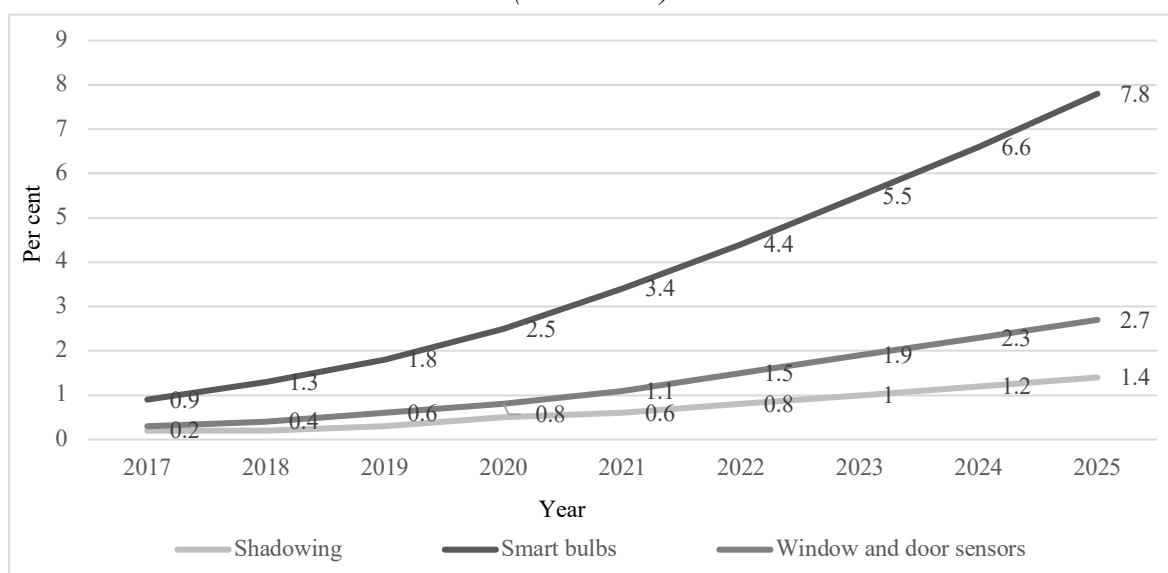
Appendix 14: Triple-layered business model canvas research questions

Table 1: Triple-layered business model canvas research questions

Economic building block	Survey	Interview
Value proposition	Q2, Q5, Q7, Q8, Q9	Q1, Q2, Q3, Q4
Customer segments	Q1, Q3, Q4, Q10, Q17, Q18, Q19, Q20, Q21, Q22, Q23, Q24, Q25, Q26	Q9
Customer relationship	Q11, Q12	Q8
Channels	Q11, Q12	Q7
Partners	Q2, Q8	Q5, Q14
Activities	/	Q6, Q17
Resources	/	Q15, Q16
Costs	/	Q10
Revenue	Q13, Q14, Q15, Q16	Q11, Q12, Q13
Environmental building block	**Survey**	**Interview**
Functional value	Q2, Q7	/
Use phase	Q2	/
End-of-life	/	Q15
Production	Q2	Q1
Distribution	/	Q14
Materials	/	Q14, Q15
Supplies and out-sourcing	/	Q5, Q6
Environmental impacts	/	Q16
Environmental benefits	Q7	Q14
Social building block	**Survey**	**Interview**
Social value	Q7	/
End-user	Q7	Q7
Local communities	Q5, Q8, Q14	/
Societal culture	Q7, Q19, Q20	/
Scale of outreach	Q11, Q12	Q7
Governance	/	Q18
Employees	/	Q19, Q20
Social impacts	Q9	Q4
Social benefits	/	Q14, Q19, Q20

Source: Own work

Appendix 15: Anketa (Survey in Slovene language)

Pozdravljeni,

sva študenta Ekonomske Fakultete v Ljubljani in pripravljava magistrsko nalogo na temo pametnega doma (smart home). Pred vami je vprašalnik, s pomočjo katerega želimo raziskati trg naprav za pametni dom. Cilj magistrske naloge je raziskati, kakšna je potrošnikova percepcija na pametni dom, kaj je potrošnikom pomembno in kaj vpliva na nakup pametnih naprav. Poleg tega želimo prepoznati morebitne ovire, s katerimi se soočajo kupci naprav za pametni dom. Prosimo vas, da izberete odgovore, ki najbolj ustrezajo vaši presoji. Vprašalnik je popolnoma anonimen in traja približno 10 minut. Odgovori bodo uporabljeni izključno za namen magistrske naloge. V primeru kakršnihkoli vprašanj nas lahko kontaktirate preko email naslova: karin.mohar@icloud.com ali koscak.jak@gmail.com

Za vaše sodelovanje se vam prijazno zahvaljujemo.

Pametni dom se za namen tega vprašalnika razume kot integracijo sistemov, naprav in komponent v enoten inteligentni sistem upravljanja z domom. Pametna naprava je elektronski pripomoček, ki povezuje naprave in

komunicira s svojim uporabnikom in/ali z drugimi pametnimi napravami. Oddaljeno upravljanje je možnost uporabe določene pametne naprave preko aplikacije/daljinskega upravljalnika.

Anketa, ki je pred vami, zbira osebne podatke in podatke, ki jih posredujete v anketi:

Ker bomo skupaj z vašimi odgovori zbirali zgoraj navedene osebne podatke, vas prosimo, da se pred izpolnjevanjem strinjate z zbiranjem vaših osebnih podatkov. Posredovanje anketnih in osebnih podatkov je prostovoljno in pogoj za sodelovanje v anketi. V primeru, da podatkov ne posredujete, ne morete nadaljevati z izpolnjevanjem ankete. Podrobnosti o zbiranju, hranjenju in obdelovanju vaših podatkov v tej anketi si lahko preberete tukaj. Politika zasebnosti in splošni pogoji so dostopni na tej povezavi.

Prosimo, označite, ali se strinjate z zbiranjem vaših osebnih podatkov:

 Ne, ne strinjam se z zbiranjem mojih osebnih podatkov

 Da, strinjam se z zbiranjem mojih osebnih podatkov

BLOK (2) (Segmentacija in uporabnost pametnega doma)

Q1 - Ocenite, v kolikšni meri spodnje trditve držijo za vas.

Sem oseba, ki:

	Sploh ne drži.	Delno ne drži.	Nekoliko ne drži.	Niti drži niti ne drži.	Drži.	Zelo drži.	Popolnoma drži.
Sem nagnjen/a k hitrem sprejemanju novih tehnologij.							
Se pred nakupom dobro pozanimam o vseh alternativah na trgu.							
Sem ekološko ozaveščen/a.							
Sem za nove tehnologije pripravljen/a plačati več.							
Mi pametne naprave predstavljajo nadstandard.							
Vedno nakupujem produkte, ki so na voljo							

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	po promocijski ceni.						

BLOK (2) (Segmentacija in uporabnost pametnega doma)

Q2 - Kako uporabna vam je vsaka od naštetih funkcij pametnega doma?

	Sploh ni uporabno.	Delno ni uporabno.	Nekoliko ni uporabno.	Niti ni uporabno, niti ni neuporabno.	Uporabno.	Zelo uporabno.	Popolnoma uporabno.
Avtomatsko/ oddaljeno upravljanje alarmnega sistema.							
Oddaljeno upravljanje domofonskega sistema.							
Avtomatsko/ oddaljeno upravljanje gospodinjskih aparatov.							
Avtomatsko/ oddaljeno up ravljanje svetil.							
Avtomatsko/ oddaljeno up ravljanje senčil (žaluzi je, screen rolo, itd.).							
Proizvajanje in hranjenje električne energije (son čne celice).							
Avtomatsko/ oddaljeno up ravljanje temperature (gretje in hlajenje).							
Avtomatsko upravljenje in medsebojna komunikacij							

a naprav za dosego optimalne temperature in energetske učinkovitosti.							
Domača polnilnica za električni avto.							
Upravljanje preko 'scen/ambientov' (npr. generalni vklop naprav ob prihodu domov in simulacija prisotnosti, ko ni nikogar doma dlje časa.).							
Upravljanje preko glasovnega pomočnika (voice assistant).							
Avtomatsko/oddaljeno upravljanje vtičnic (npr. urnik za razsvetljavo novoletne smreke).							
Avtomatsko/oddaljeno upravljanje zalivalnega sistema na vrtu.							
Merjenje in analitika porabe električne energije.							

BLOK (2) (Segmentacija in uporabnost pametnega doma)

Q3 - Ali imate v lasti celovit sistem za pametni dom ali pametno napravo, ki je del pametnega doma (Npr. robotski sesalnik, pametna klima, ...)?

 Da.

Ne.

IF (3) Q3 = [2]

Q4 - Ali razmišljate o nakupu pametnih naprav?

Da

Ne

(5) Q3 = [1]

Q5 - V katere segmente spadajo pametne naprave, ki so del vašega pametnega doma? (Možnih je več odgovorov)

Nadzor in povezljivost naprav (Alexa, Apple Home kit, Google assistant in drugi sistemi za integracijo pametnih naprav)

Razsvetljava in udobje (luči, senčila, ambient, itd.)

Varnost (alarmni in videonadzorni sistem, itd.)

Energetska učinkovitost (gretje, klima, merjenje in optimizacija energije, itd.)

Gospodinjski aparati (robotski sesalec, pečica, pomivalni stroj, pralni stroj, hladilnik, itd.)

Audio/video sistemi (TV, zvočniki, igralne konzole itd.)

IF (5) Q3 = [1]

Q6 - Lastnik katerega pametnega sistema/naprave pametnega doma ste? V tem primeru tablični računalnik in mobilni telefon nista vključena. (Možnih je več odgovorov)

Amazon Alexa

Andivi VIA

Apple Home Kit

Entia

Fibaro

Gira

Google Assistant

Loxone

iRobot

Somfy

Sonoff

Siemens

Drugo:

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IF (6) Q4 = [1] or Q3 = [1]

Q7 - V kolikšni meri se strinjate z naslednjimi trditvami glede vaših razlogov za nakup sistema za pametni dom ali pametne naprave, ki je del pametnega doma?

	Sploh se ne strinjam.	Delno se ne strinjam.	Nekoliko se ne strinjam.	Niti se strinjam, niti se ne strinjam.	Strinjam se.	Zelo se strinjam.	Popolnoma se strinjam.	Ne želim odgovoriti.
Naprave za pametni dom pripomorejo k večji energetski učinkovitosti (nižji stroški).								
Pametne naprave poenostavijo vsakodnevno opravljanje opravil in s tem pripomorejo k udobju bivanja.								
Pametni sistem zviša vrednost zgradbe.								
Pametni sistem pripomore k varnosti.								
Pametni sistem pripomore k manjšem emisijskem onesnaženju (okolju prijazno).								
Pametna napeljava v domovih postaja novi standard v gradbeništvu.								
Pametni sistem								

omogoča boljšo kontrolo nad domom.							
Avtomatsko upravljanje naprav (luči, senčila, itd.) preko urnikov mi prihrani čas.							

IF (6) Q4 = [1] or Q3 = [1]

Q8 - Ocenite pomembnost spodaj naštetih lastnosti, ko se odločate za nakup pametnih naprav za dom.

	Sploh ni pomembno.	Delno ni pomembno.	Nekoliko ni pomembno.	Niti ni pomembno, niti ni nepomebno.	Pomebno.	Zelo pomembno.	Popolnoma pomembno.
Videz/design.							
Cena.							
Znamka.							
Poreklo izvora.							
Promocija (popust).							
Zanesljivost/ kakovost.							
Varnost.							
Funkcije produkta.							
Garancija.							
Sposobnost integracije z drugimi napravami.							

IF (7) Q4 = [2]

Q9 - V kolikšni meri se strinjate z naslednjimi trditvami glede vaših razlogov, ki vas odvračajo od nakupa naprav za pametni dom?

	Sploh se ne strinjam.	Delno se ne strinjam.	Nekoliko se ne strinjam.	Niti se strinjam, niti se ne strinjam.	Strinjam se.	Zelo se strinjam.	Popolnoma se strinjam.	Ne želim odgovoriti.
Pametne naprave so predrage.								
Pametne naprave so težko razumljive in zahtevajo napredno računalniško pismenost.								
Pametne naprave niso varne proti hekerskim vdorom.								
Podatkov o uporabi naprav v mojem domu ne želim deliti z proizvajalci naprav in aplikacij.								
Tehnologija na tem področju še ni dovolj napredovala.								
Klasično upravljanje doma (stikala) je zame dovolj.								
Pametne naprave niso zanesljive.								
Pametne naprave škodijo mojemu zdravju								

zaradi povišanega sevanja.							
Popravila za pametne naprave so dražja kot popravila za klasične produkte.							

IF (7) Q4 = [2]

Q10 - Ali se informirate o napravah za pametni dom?

 Da

 Ne

IF (8) Q10 = [1] or Q4 = [1] or Q3 = [1]

Q11 - Preko katerih kanalov se informirate o napravah za pametni dom?

	Nikoli.	Redko.	Včasih.	Praviloma.	Pogosto.	Večinoma.	Vedno.
Priporočila prijateljev in znancev.							
Splet (google, youtube, itd.).							
Sejmi (sejem Dom, MOS, itd.).							
Online portal (mojmojster.net).							
Socialna omrežja (oglasi, influencerji, itd.).							
Preko elektro projektanta.							
Preko arhitekta.							

IF (9) (Q3 = [1] or Q4 = [1]) and NOT (Q10 = [1] or Q4 = [2])

Q12 - Preko katerih prodajnih kanalov bi/ste kupili naprave za pametni dom?

	Nikoli.	Redko.	Včasih.	Praviloma.	Pogosto.	Večinoma.	Vedno.
Direktno od proizvajalca.							
Spletni nakup.							
Preko električarja.							
Specializiran a trgovina z elektromateri alom.							
Preko sejmov (seje m Dom, MOS, itd.).							
Trgovec na drobno (Bauhaus, BigBang, ...).							

IF (9) (Q3 = [1] or Q4 = [1]) and NOT (Q10 = [1] or Q4 = [2])

Q13 - Koliko po vašem mnenju stane celovit sistem (upravljanje celotne razsvetljave, senčil in gretja) za pametno stanovanje (70m2) v EUR? _____

IF (9) (Q3 = [1] or Q4 = [1]) and NOT (Q10 = [1] or Q4 = [2])

Q14 - Koliko po vašem mnenju stane celovit sistem (upravljanje celotne razsvetljave, senčil in gretja) za pametno hišo (160m2) v EUR? _____

IF (9) (Q3 = [1] or Q4 = [1]) and NOT (Q10 = [1] or Q4 = [2])

Q15 - Za kakšen način plačila bi se odločili ob potencialnem nakupu celovitega sistema za pametni doma (upravljanje celotne razsvetljave, senčil in gretja)?

Enkratno takojšne plačilo

Naročniško razmerje (cena vključuje hardware, servis in vzdrževanje)

Plačilo na obroke

IF (10) Q15 = [2]

Q16 - Koliko ste pripravljeni plačevati za mesečno naročniško razmerje za celovit sistem pametnega doma (upravljanje svetil, senčil in gretja) v EUR? _____

(11) (Demografska vprašanja)

Q17 - Uporabnik katerega operacijskega sistema ste? (Možnih je več odgovorov)

Android

iOS

BLOK (11) (Demografska vprašanja)

Q18 - V katero starostno skupino spadate?

Do 18 let

18-29 let

30-39 let

40-49 let

50-59 let

60-69 let

Nad 70

BLOK (11) (Demografska vprašanja)

Q19 - Spol

Moški

Ženski

Ne želim odgovoriti

Drugo:

BLOK (11) (Demografska vprašanja)

Q20 - Kakšen je neto (po plačanih davkih in odbitkih) mesečni dohodek vašega gospodinjstva?

Do 1.000

1.001 do 1.500

1.501 do 2.000

2.001 do 2.500

2.501 do 3.000

3.001 do 3.500

3500 do 4000

4.001 in več

Ne želim odgovoriti

BLOK (11) (Demografska vprašanja)

Q21 - V kateri regiji prebivate?

Osrednjeslovenska

Pomurska

Gorenjska

Podravska

Koroška

Savinjska

Zasavska

Jugovzhodna

Primorska

BLOK (11) (Demografska vprašanja)

Q22 - Kakšen je vaš trenutni status zaposlitve?

Študent

Zaposlen s polnim ali polovičnim delovnim časom

Brezposelni

Upokojen

Drugo:

IF (12) Q22 = [2]

Q23 - Kako ste zaposleni?

Sem samozaposlen

Imam svoje podjetje

Zaposlen sem v manjšem podjetju

Zaposlen sem v večjem podjetju

Zaposlen sem v javni upravi

BLOK (11) (Demografska vprašanja)

Q24 - Kakšna je vaša najvišja dosežena formalna izobrazba?

Osnovnošolska izobrazba

Srednješolska/Gimnazijska izobrazba

Diploma

Magisterij/doktorat

BLOK (11) (Demografska vprašanja)

Q25 - V kakšnem tipu naselja trenutno živite?

Mesto (več kot 5.000 prebivalcev)

Večji kraj (1.000 – 5.000 prebivalcev)

Manjši kraj (100 – 1.000 prebivalcev)

Vas (manj kot 100 prebivalcev)

BLOK (11) (Demografska vprašanja)

Q26 - V kakšnem tipu nepremičnine živite?

Stanovanje v bloku

Stanovanje v večstanovanjski hiši

Hiša

Drugo:

BLOK (11) (Demografska vprašanja)

Q27 - Imate mogoče še kaj za dodati o sistemih za pametni dom ali pametnih napravah za dom?

Appendix 16: Results of final cluster

Table 2: Initial cluster centres

	Cluster			
	1	2	3	4
Q1a_center	-2.88	1.12	-3.88	-.88
Q1b_center	-4.23	1.77	1.77	1.77
Q1c_center	-1.23	1.77	1.77	-3.23
Q1d_center	-1.61	2.39	-3.61	-1.61
Q1e_center	2.59	2.59	-3.41	-2.41
Q1f_center	.50	-2.50	-2.50	2.50

Source: Own work

Table 3: Iteration history

Change in Cluster Centers

Iteration	1	2	3	4
1	3.662	3.842	3.875	4.091
2	.257	.275	.372	.387
3	.139	.197	.310	.292
4	.078	.121	.227	.193
5	.054	.135	.141	.163
6	.067	.070	.114	.093
7	.041	.063	.000	.091
8	.050	.025	.000	.054
9	.000	.000	.000	.000

Source: Own work

Table 4: Final cluster centres

Cluster

	1	2	3	4
Q1a_center	-1.52	1.28	-1.99	.39
Q1b_center	-1.49	.68	-.23	.29
Q1c_center	-.47	.48	.30	-.37
Q1d_center	-.84	.92	-1.54	.16
Q1e_center	.59	1.16	-2.37	-.65
Q1f_center	-.24	.35	-.43	-.05

Source: Own work

Table 5: Distances between final cluster centres

Cluster	1	2	3	4
1		4.150	3.417	3.061

Table 5: Distances between final cluster centres (continued)

2	4.150		5.541	2.388
3	3.417	5.541		3.519
4	3.061	2.388	3.519	

Source: Own work

Table 6: ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
Q1a_center	179.442	3	1.122	328	159.897	<.001
Q1b_center	70.649	3	1.231	328	57.397	<.001
Q1c_center	20.108	3	.903	328	22.261	<.001
Q1d_center	85.033	3	1.018	328	83.506	<.001
Q1e_center	158.978	3	1.072	328	148.335	<.001
Q1f_center	8.863	3	2.050	328	4.323	.005

Source: Own work

Table 7: Number of cases in each cluster

Cluster	1	66.000
	2	117.000
	3	45.000
	4	104.000
Valid		332.000
Missing		79.000

Source: Own work

Appendix 17: Segmentation

Table 8: Segmentation statistics (arithmetic mean, std.deviation, std. error, ANOVA)

Segment	Arithmetic mean	Std. deviation	Std. error	ANOVA	
				F	Sig.
1.		**Do you own a smart home system or a smart home device?**			
1	1.71	0.456	0.056	8.936	<0.001
2	1.40	0.492	0.046		
3	1.76	0.435	0.065		
4	1.56	0.499	0.049		
2.		**Are you considering of purchasing a smart home device?**			
1	1.55	0.503	0.073	10.853	<0.001
2	1.17	0.380	0.055		
3	1.71	0.462	0.079		
4	1.34	0.479	0.036		

Source: Own work

Table 9: Segmentation statistics (percentage)

| Segment	Yes	No
1.	**Do you own a smart home system or a smart home device?**	
1	28.8%	71.2%
2	59.8%	40.2%
3	24.4%	75.6%
4	44.2%	55.8%
2.	**Are you considering of purchasing a smart home device?**	
1	44.7%	55.3%
2	83.0%	17.0%
3	29.4%	70.6%
4	65.5%	34.5%

Source: Own work

Table 10: Segmentation statistics (percentage)

| Segment	One-time immediate payment	Subscription (payment includes hardware, servis, and maintanance)	Payment in installments
1.	**What type of payment would you prefer in case of smart home system purchase**		
1	35.7%	21.4%	42.9%
2	49.0%	27.6%	23.5%
3	18.8%	31.3%	50.0%
4	44.3%	19.7%	36.1%

Source: Own work

Figure 13: In case of a purchase, through which channel would you buy smart home device?
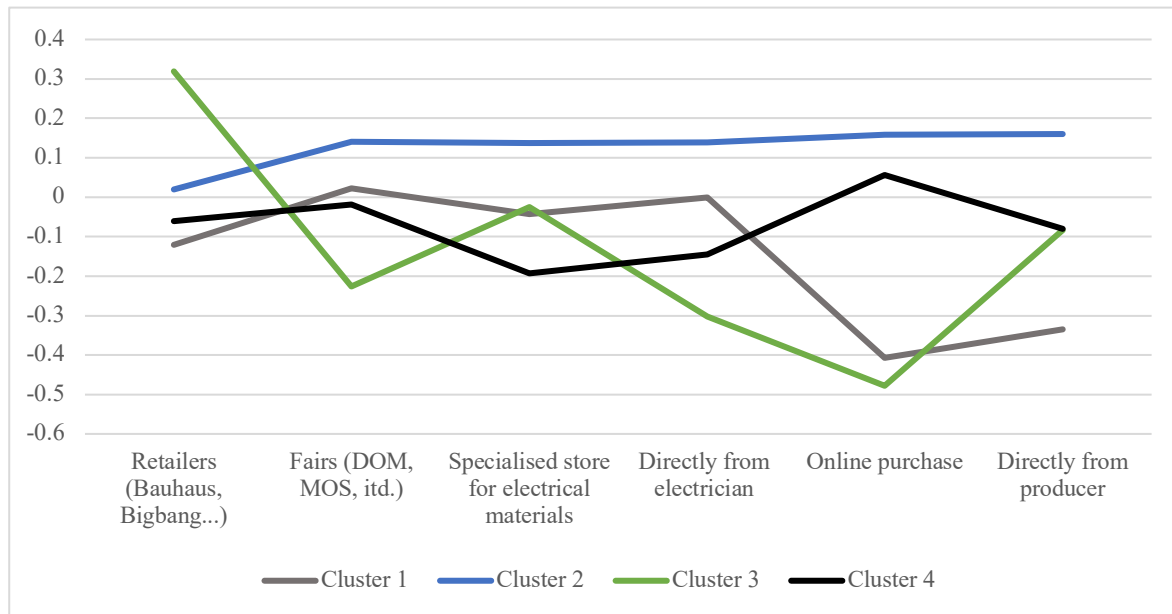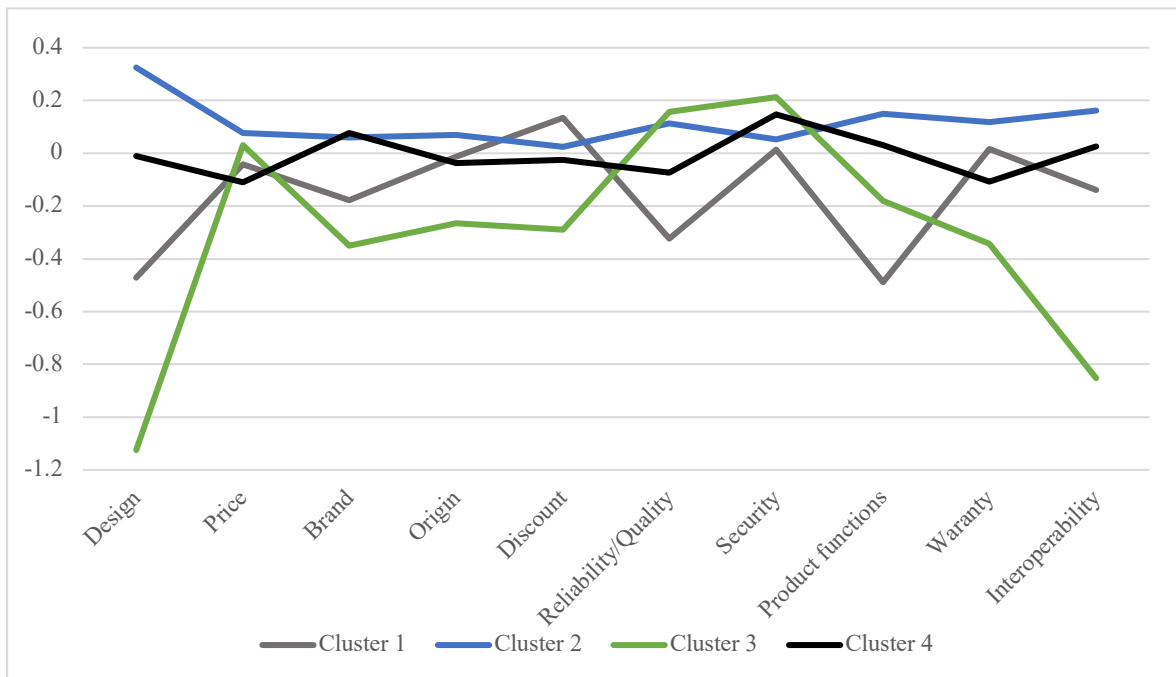
Source: Own work

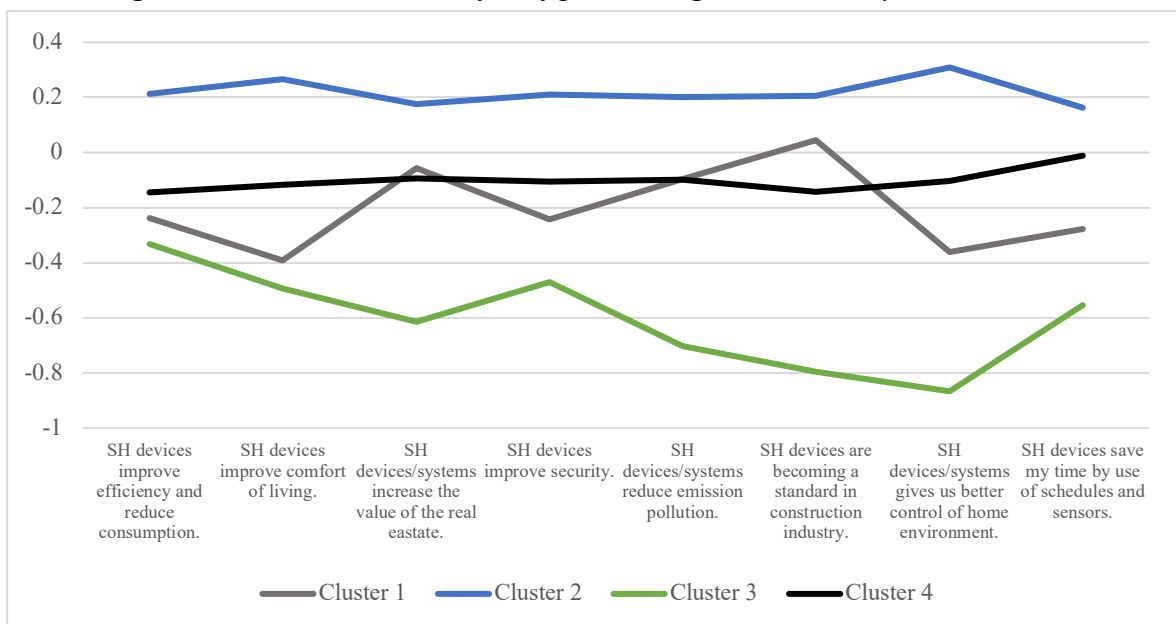*Figure 14: Through which channels do you inform yourself about smart home devices?*
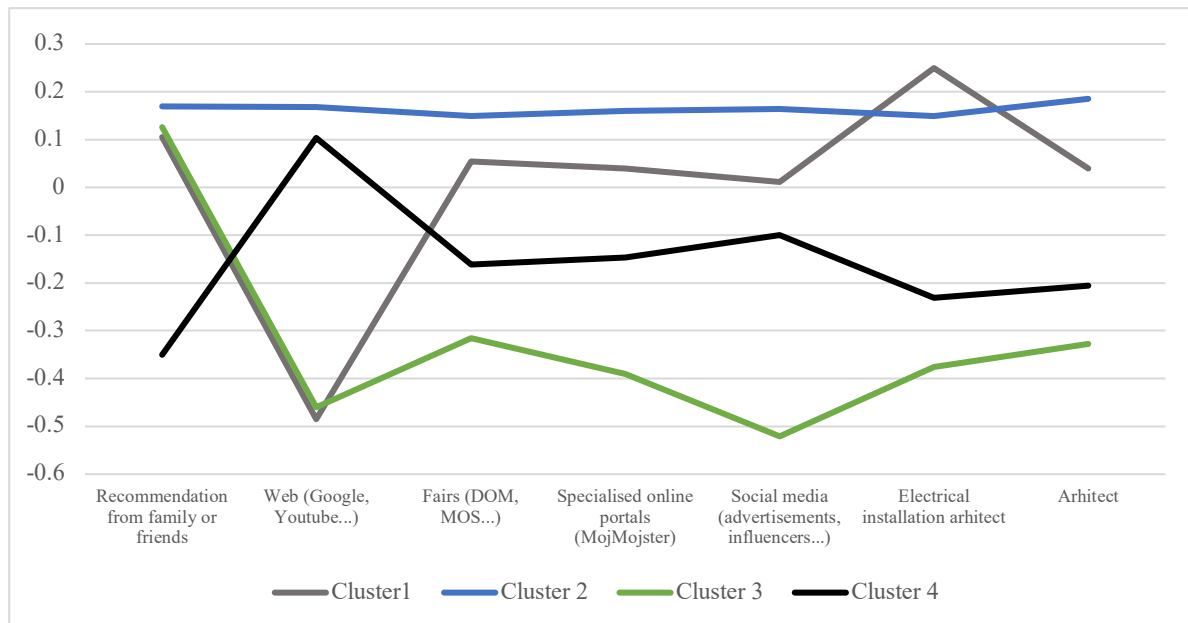
Source: Own work

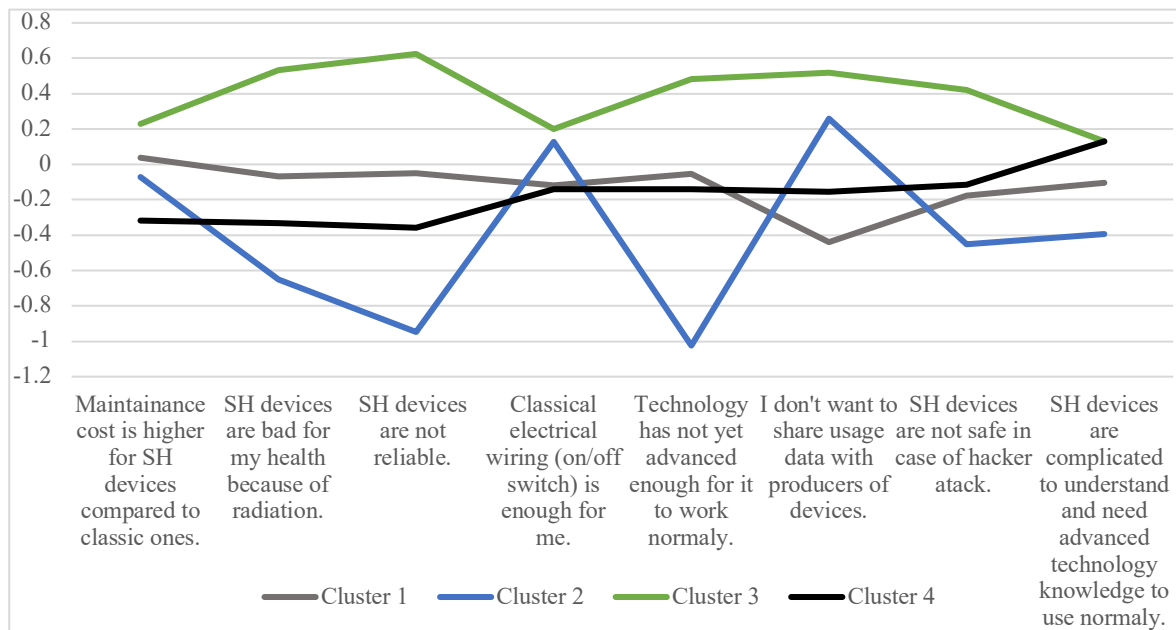*Figure 15: Which product properties do you prefer for smart home devices?*

Source: Own work

Figure 16: What are the benefits of purchasing smart home system/devices?

Source: Own work

Figure 17: What are some of the barriers hindering you from purshasing smart home system/devices?

Source: Own work

Appendix 18: Interview notes with a smart home company X representative

Ljubljana, 17.6.2021

(Q1) WHICH PRODUCTS AND SERVICES DOES THE COMPANY OFFER?

We mainly develop and produce our own equipment, we design the wiring diagrams for the electrician at the facility, which is the contractor. In the end, we also configure our equipment to fit the functions of the smart home to the user.

(Q2) WHO DO YOU RECOGNIZE AS YOUR COMPETITION AND WHAT SEPARATES THIS COMPANY FROM THEM?

As a competition we mostly consider systems on a wire, which are similar to ours mainly in terms of quality. Our competitors mostly have higher prices and are only intermediaries of equipment that they do not produce themselves.

(Q3) WHAT ARE THE MOST WANTED FEATURES/FUNCTIONS THAT CUSTOMERS WANT IN THEIR HOME?

Customers most commonly opt for the basic functions. Heating, lighting, and shades are most frequent preferences for households.

(Q4) WHAT ARE THE MOST COMMON BARRIERS THAT IMPEDE POTENTIAL BUYERS FROM PURCHASING A SMART SYSTEM?

Smart wiring is a higher investment compared to classic electrical wiring and people's distrust of technology - some think Alexa and other voice assistants are filming what's going on in their apartment. Meanwhile, all concerned users have a smartphone in their pocket with applications such as facebook and instagram.

(Q5) DOES THE COMPANY HAVE OTHER BUSINESS PARTNERS IN ADDITION TO SUPPLIERS?

Of course in construction it is wise to have many partners. These are architects, electrical designers, builders, electricians. Investors of multi-apartment buildings are also our partners, as we can cooperate with them on several projects. We also work with companies that are manufacturers of their own equipment. It is important to us that our partners are local because they are responsive and appreciate our cooperation. This is very much appreciated by customers, as they often want to buy a smart home in its entirety and like to see that we are connected to each other and have common products.

(Q6) DOES THE COMPANY DEAL WITH ANY OTHER ACTIVITIES BESIDES THE PRODUCTION AND SALE OF SMART HOME PRODUCTS?

Without other activities today, the company cannot be competitive. When it comes to marketing, we have employees who write content for ads. In addition, we also have several external marketing consultants.

(Q7) THROUGH WHICH CHANNELS DO YOU TARGET YOUR POTENTIAL CLIENTS?

Mostly thorugh Fairs (home, ambient, mos), social media, and other digital marketing channels. Also, where people ask for contractors is portals like MojMojster. Due to the increased reputation of the company and the product, customers also find to us and we try to attract others through marketing. That is why maintaing strong customer relatioships is important.

(Q8) WHAT RELATIONSHIP DO YOU HAVE WITH YOUR CUSTOMERS? DO YOU HAVE ANY LOYALTY REWARD SYSTEM?

We always have a professional relationship with customers. We do not currently have a customer reward system, but we do have discounts for our partners. We have more than 100 certified partners.

(Q9) WHICH CUSTOMER SEGMENTS DO YOU TARGET?

Our product is created by the mission of bringing a smart home closer to all people. This means that we do not target only high end customers but all people who are building or renovating a house or apartment. Recently, we also have a lot of non-residential projects like business premise and facilities for sports activities for example.

(Q10) WHAT ARE SOME OF THE LARGEST COSTS THAT THE COMPANY HAS?

Product development and application updates are considered to be major costs. In addition, costs related to business premises and employee salary. Other higher costs are the stand that we use at fairs, which is updated every year, and other marketing activities.

(Q11) WHAT METHOD OF PAYMENT DO MOST CUSTOMERS PREFER?

The price of our smart home system is lower than competition's, which is why people mostly opt for immediate payment. We also provide the possibility to pay in installments, but few opt for this option.

(Q12) ARE YOU APPLYING FOR PUBLIC TENDERS?

Yes, tenders help us mainly in the development of new products. We also cooperate with other companies in this segment and together we develop various solutions.

(Q13) IN YOUR OPINION, IS THERE ENOUGH INCENTIVES FROM THE GOVERNMENT AND THE EU IN THE FORM OF SUBSIDIES AND PURBLIC TENDERS?

There are quite a few incentives for companies in our market. Subventions like this are always good for society and help in development in areas that may not be the most profitable, but are positive for the stakeholdes.

(Q14) FROM HOW WIDE OF A GEOGRAPHICAL AREA ARE YOUR SUPPLIERS? COULD YOU SAY YOU OFFER LOCAL PRODUCTS?

Our products are the result of Slovenian knowledge. Most of the manufacturers we work with are located in Slovenia. We order only rare materials from China, for example, we order boxes for our products. We want to support local communities as much as possible.

(Q15) HOW DO YOU DO QUALITY CONTROL OF YOUR PRODUCTS AND WHAT DO YOU DO WITH DEFECTIVE PRODUCTS?

The products that our company offers are used for a couple of decades, so quality is most important. Every product goes though a quality check. Unlike phones and tablets, our products are classified as industrial electronics and are not subject to malfuntions. If, for example, lightning strikes a building and destroys one of our products, we replace it, and in this case the bill is settled by the insurance company.

(Q16) WHAT MEASURES HAVE YOU ESTABLISHED IN THE COMPANY TO REDUCE PROCESS POLLUTION?

All materials and products that can still be used are mostly used for the development and purpose of testing new products. Packaging waste is always recycled.

(Q17) TO WHAT EXTENT IS THE COMPANY DIGITALIZED?

The company is highly digitalized, all the core activities are digitalized. This became apparent during the Covid-19 epidemic when our work did not change significantly. Last year showed the importance of businesses having a so called digital twin.

(Q18) WHAT IS THE ORGANIZATIONAL STRUCTURE OF THE COMPANY?

The organizational structure is horizontal. The work is team-based, divided between sales, execution and development.

(Q19) WHAT KIND OF REWARD SYSTEM DO YOU HAVE FOR EMPLOYEES?

Employees have the opportunity to be promoted according to work performance. Each year we review and evaluate yearly performance of the company and employees, who are then compensated accordingly. Rewards are paid out once a year.

(Q20) DO THEY HAVE ANY SPECIAL BENEFITS OR OPPORTUNITIES FOR PERSONAL DEVELOPMENT?

Employees have the chance to visit conferences though out the year. We give young people the opportunity to show themselves. We take in several students for internship every year. We believe its a great way to exchange intergenerational views and ideas, which indirectly stimulates creativity.