Kaunas University of Technology

School of economics and business

Overcoming Technology-push and Market-pull Challenges to Product Development in Information Communication Technology Business

Master's Final Degree Project

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Declaration of Academic Integrity

I confirm that the final project of mine, Lukas Gaidžiūnas, on the topic „Overcoming Technology-push and Market-pull Challenges to Product Development in Information Communication Technology Business " is written completely by myself; all the provided data and research results are correct and have been obtained honestly. None of the parts of this thesis have been plagiarised from any printed, Internet-based or otherwise recorded sources. All direct and indirect quotations from external resources are indicated in the list of references. No monetary funds (unless required by Law) have been paid to anyone for any contribution to this project.

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Gaidžiūnas Lukas. Overcoming Technology-push and Market-pull Challenges to Product Development in Information Communication Technology Business. Master's Final Degree Project supervisor Assoc. Prof. Rita Jucevičienė; School of economics and business, Kaunas University of Technology.

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Summary

The information communication technology sector is innovative and fast-developing, which attracts enormous investments and has huge potential. Product development is an essential part of the success of ICT companies. Sometimes companies are making product development decisions based on market demand, and some companies develop the technology or solution first and only after the creation offers it to the market. These two different approaches to product development are referred to as a technology-push or market-pull. These approaches bring not only benefits and opportunities but also challenges. The object of this research is the occurring challenges in product development of the companies that apply technology-push and market-pull approaches.

The **aim** of the thesis is to propose managerial solutions for the challenges related to technology-push and market-pull product development approaches in Lithuanian ICT business companies

The objectives:

1. To reveal the problematics of technology-push and market-pull approaches to product development
2. To describe key theoretical solutions for overcoming technology-push and market-pull challenges in product development
3. To substantiate the methodology for identification of preconditions to successfully overcome the challenges in technology-push and market-pull product development approaches in ICT business companies
4. To propose managerial actions for overcoming technology-push and market-pull product development challenges in Lithuania ICT companies

Research methods. Scientific literature analysis was performed in order to systematize barriers and theoretical factors to overcome them. A qualitative research strategy was applied for the empirical part of the thesis. Interviews with representatives from ICT companies were delivered. Four companies represented the technology-push approach and three companies-market-pull approach. Data were analyzed with MAXQDA software that allowed to synthesize the gathered data from expert interviews and propose managerial solutions for the challenges related to technology-push and market-pull product development approaches in Lithuanian ICT business companies.

The challenges related to data management and the customers (also the extraction of their needs) had the most significant impact on the technology-push and market-pull approaches. The managerial solutions are proposed by combining the analyzed theory and empirical results.

Structure of the thesis. The thesis consists of 4 chapters. The first chapter analyzes the ICT sector and identifies the challenges occurring in product development, applying the technology-push and market-pull approaches. The second chapter analyzes the theoretical solutions for product development challenges in the literature. The third section defines the research methodology, the research method, selection of the respondents. The fourth section describes the results and findings of an empirical stud; This section also offers the managerial solutions to overcome product development challenges for companies implementing technology-push and market-pull approaches.

The project is composed of 4 chapters, 21 figures, 8 tables, 79 pages, and 49 references.

Gaidžiūnas Lukas. Technologijų stūmimo ir rinkos traukimo prieigų produkto vystyme sąlygojamų iššūkių sprendimai informacinių komunikacinių technologijų versle. Magistro baigiamasis projektas vadovė Prof. Rita Jucevičienė; Kauno technologijos universitetas, Ekonomikos ir verslo fakultetas.

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Kaunas, 2021. 79 puslapiai.

Santrauka

Informacinių ir komunikacinių technologijų (IKT) sektorius yra inovatyvus ir sparčiai augantis, kuris pritraukia milžiniškas investicijas ir turi didžiulį potencialą. Produktų vystymas ir kūrimas yra būtina IKT įmonių sėkmės dalis. Kartais įmonės sprendimus dėl produkto vystymo priima remdamosi rinkos poreikiais, tuo tarpu yra eilė įmonių, kurios vysto savo technologijas bei sprendimus ir tik tuomet jas siūlo rikai. Šie du skirtingi būdai yra vadinami rinkos traukimo ir technologijų stūmimo prieigomis. Įmonės gali pasirinkti technologijų stūmimo ar rinkos traukimo prieigą kuriant ir vystant savo produktus. Šios prieigos suteikia ne tik privalumus, bet kelia ir iššūkius. Šio tyrimo objektas yra išsiaiškinti kylančius įmonių iššūkius, kurios pritaikė technologijų stūmimo ir rinkos traukimo prieigas.

Šio darbo **tikslas** yra pasiūlyti vadybinius sprendinius iššūkiams kylantiems Lietuvos IKT įmonėms, vystančioms produktus pritaikius technologijų stūmimo ir rinkos traukimo prieigas.

Uždaviniai:

1. Atskleisti technologijų stūmimo ir rinkos traukimo prieigų problematiką produktų vystyme.
2. Apibūdinti pagrindinius teorinius sprendimus, kaip įveikti produkto vystymo iššūkius technologijų stūmimo ir rinkos traukimo prieigose.
3. Pagrįsti metodiką, kuri leistų sėkmingai identifikuoti produkto vystymo iššūkių prielaidas ir juos įveikti IKT įmonėse, kurios taiko technologijų stūmimo ir rinkos traukimo prieigas.
4. Pasiūlyti vadybinius sprendinius siekiant įveikti technologijų stūmimo ir rinkos traukimo prieigų keliamus produkto vystymo iššūkius Lietuvos IKT įmonėse

Tyrimo metodai. Mokslinės literatūros analizė buvo atlikta siekiant susisteminti barjerus ir teorinius veiksnius jiems įveikti. Empirinėje tyrimo dalyje buvo pritaikyta kokybinio tyrimo strategija. Buvo atliekami pusiau struktūruoti interviu su IKT įmonių atstovais. Apklaustos keturios įmonės, kuriose yra taikoma technologijų stūmimo prieiga ir trys, kuriose taikoma rinkos traukimo prieiga. Duomenis buvo analizuojami pasitelkiant MAXQDA programine įranga, kuri leido susisteminti ekspertų interviu medžiagą ir pasiūlyti vadybinius sprendinius produkto vystymo iššūkiams technologijų stūmimo ir rinkos traukimo prieigas pritaikiusiose IKT įmonėse.

Duomenų valdymo ir su klientais susiję iššūkiai turėjo didžiausią įtaką abiejose prieigose, tiek technologijų stūmimo, tiek rinkos traukimo. Vadybiniai sprendiniai yra siūlomi apjungiant analizuotą literatūrą ir empirinės dalies rezultatus.

Šiame darbe atliekama literatūros analizė ir empirinis tyrimas. Buvo apklaustos 4 įmonės pritaikiusios technologijų stūmimo prieigą ir 3 įmonės pritaikiusios rinkos traukimo prieigą. Iššūkiai susiję su duomenų valdymų bei klientų poreikiais turėjo didžiausią įtaką įmonėms pritaikiusioms technologijų stūmimo ir rinkos traukimo prieigas. Vadybiniai sprendimai yra pateikiami apjungiant išanalizuotą teoriją ir empirinius rezultatus.

Darbo struktūra. Darbą sudaro 4 skyriai. Pirmajame skyriuje analizuojamas IKT sektorius ir nustatomi iššūkiai, atsirandantys vystant produktus, taikant technologijų stūmimo ir rinkos traukimo prieigas. Antrajame skyriuje analizuojami teoriniai produktų vystymo iššūkių sprendimai literatūroje. Trečiame skyriuje apibrėžta tyrimo metodika, tyrimo metodas, respondentų atranka. Ketvirtame skyriuje aprašomi empirinio tyrimo rezultatai; Šiame skyriuje taip pat siūlomi vadybiniai sprendimai, kaip įveikti produkto vystymo iššūkius įmonėms pritaikiusioms technologijų stūmimo ir rinkos traukimo prieigas.

Darbą sudaro 4 skyriai, 21 paveikslas, 8 lentelės, 79 puslapiai ir 49 šaltiniai.

Table of contents

List of figures

List of tables

List of abbreviations and terms

Abbreviations:

Assoc. prof. – associate professor;

Terms:

ICT - Information and communications technology an extensional term of information technology

IoT – the network of physical objects, “thing” embedded with sensors and software, to exchange the data over the Internet

Technology-push – a business approach where the main driving force is the technology

Market-pull – a business approach where the main driving force is market (customers)

Introduction

Information and communications technology (ICT) is innovative and rapidly growing sector. ICT creates and innovative products and services with very high added value. New technologies attract large amounts of investments, which helps for even faster growth of this sector. High qualifications of information technology specialists and extensive experience contribute to the rapid growth of the sector. In 2018, this sector generated 682 million Eur value (VšĮ Versli Lietuva, 2020). The ICT sector is one of the most minor compared to other European countries. However, it ranks sixth in terms of intangible fixed assets in Europe (VšĮ Versli Lietuva, 2020). The companies are implementing one of the most demanding technology-push or market-pull approaches to focus on the company's values: technology or market and staying competitive.

Technology-push and market-pull concepts are not only guidelines for an organization's focus, but they have many other benefits. The concepts of the market-pull and technology push are defined in the literature as the origins of innovation and the motives for innovators (Van Den Ende & Dolfsma, 2005). The technology-push approach is focused on the new technologies pushing to the market. Usually, the inventions are radical and groundbreaking. The researchers emphasize the connection between science with technologies and their importance - "While science and technology provide the trajectories of innovation, demand is a crucial component to direct the trajectory towards the right economic venues" (Dosi 1982 in Di Stefano et al., 2012). The demand is the key success factor of every company, so the companies should consider whether there will be a demand for the newly created product. The market-pull is another approach where the idea originated not from the technology but from the market demand. The companies tend to choose the approach on their objectives. The technology-push companies are working on their strengths and trying to commercialize them, while the market-pull companies are constantly on the market research to gather the needs of the customers. Some companies are implementing both approaches or at least the most valuable properties of them.

Scientific literature (Ameka & Dhewanto, 2013; Design Technology, n.d.; Kess Pekka, 2011) separates technology-push and demand-pull concepts, but Dosi (Dosi 1982 in Di Stefano et al., 2012) emphasizes the importance of demand in the technology-pushed concept. It means that they are related and even can be combined. Technology-driven innovation can be a result of market needs (market/demand-pull). When the new technology-driven idea meets the community's needs, and the new invention is adapted by the community (technology push), that becomes beneficial to new needs of customers (Ameka & Dhewanto, 2013). Sometimes the business orientation can not be expressed explicitly, or it can be mixed. The highest percentage of business focus determines the orientation of the company. In other words, what driving force plays a crucial role.

The technology-push and market-pull approaches bring not only the benefits but also the challenges. Technology-push companies face challenges: intellectual property challenges, how to sustain the intellectual property; product launch date estimation; having difficulties to overcome technological feasibility barriers; extracting actual needs of the customers; having difficulties in product commercialization; having difficulties educating and involving the customers to use a newly created product; managing and processing large amounts of data; ensuring privacy and security of the data. The market-pull companies are facing challenges: targeting the right customers' segment; evaluating the idea potential; communicating with the customers and extracting their needs; frequently changing customers' needs.

Information technologies have made a massive impact on the global economy. However, only a few or no researches were performed on technology-push and market-pull challenges in Lithuania's ICT sector. This Master's thesis fills the literature gap in technology-push and market-pull challenges in Lithuania's ICT sector. It extracted the challenges from both orientations and suggested managerial solutions that could be taken to overcome them.

Research aim: to proposed managerial solutions for the challenges related to technology-push and market-pull product development approaches in Lithuanian ICT business companies

Tasks of the research:

1. To reveal the problematics of technology-push and market-pull approaches to product development
2. To describe key theoretical solutions for overcoming technology-push and market-pull challenges in product development
3. To substantiate the methodology for identification of preconditions to successfully overcome the challenges in technology-push and market-pull product development approaches in ICT business companies
4. To propose managerial actions for overcoming technology-push and market-pull product development challenges in Lithuania ICT companies

Research methods: scientific literature analysis was performed to identify the challenges and theoretical solutions for product development of companies applying technology-push and market-pull approaches. Based on the theoretical finding, qualitative research strategies were selected. Semi-structured interviews with seven experts of ICT companies representatives that are implemented technology-push and market-pull product development approaches. Empirical study data were processed using MAXQDA software. MAXQDA software helped to structure the data, find data coding occurrence frequencies and data relationships.

Structure of the thesis: the thesis consists of 4 chapters. The first chapter analyzes the ICT sector and identifies the challenges occurring in product development, applying the technology-push and market-pull approaches**.** The second chapter analyzes the theoretical solutions for product development challenges in the literature. The third section defines the research methodology, the research method, selection of the respondents. The fourth section describes the results and findings of an empirical stud; This section also offers the managerial solutions to overcome product development challenges for companies implementing technology-push and market-pull approaches.

1. Problem analysis

The ICT sector is constantly changing at a fast pace. In a short period, the use of computers and their significance have increased dramatically. In the 1990's it was a rare product that was only found in businesses and rarely in the household. Currently, most of us have even more than one computer at home. The number of ICT devices is constantly growing, and now the main aim is to connect them the one single network – the Internet, or in other words IoT – the Internet of things. Cisco has forecasted the IoT devices number in 2021; based on the forecasting, there will be over 27.1 billion networked devices (Krakul.eu, 2020). The ICT sector of Lithuania takes sixth place in terms of intangible fixed assets and R&D investment in Europe (VšĮ Versli Lietuva, 2020). The Lithuanian ICT sector ranks the sixth place in terms of relative investment in Europe. Investments provide an opportunity for the sector to grow faster and create more value. With the company's growth and the number of investments, the problems of the ICT sector also become apparent.

There are many reasons for the ICT sector to proliferate, but a few of them are forecasted to snowball: communication, data transfer, and digitalization. 2021 is forecasted for the rise of IoT development partnerships, which will enhance the integration between products and satisfy customers and business needs. The forecasted solutions are integration, usability, security, interoperability, user safety, and fast return on investment (ROI) (Krakul.eu, 2020). These factors will drive the growth of the IoT market share and might have the opposite effect on another side, like security due to larger scales. If we compare the human computing power versus computer, the result is obvious. Computers can count and combine data much faster than humans, so all fields' impact, including business, is enormous. It creates great opportunities for IoT sector growth in many subfields.

IoT could lead to faster operations in a more specific case, reduce the number of activities, and more centralized and digitized data. Furthermore, that is not the end, and the IoT is forecasted to proliferate in the future. To overcome make a matrix to what are the most critical factors, for example, they could be: price, improve speed, reduce the number of operations, ease data transfer, digitalize to stay competitive.

The most popular and having the highest potentials are artificial intelligence, machine learning, neural networks, and the Internet of things (IoT). The Internet of Things is forecasted to proliferate in the next few years. Based on Cisco, up to 27.1 billion devices are connected to the Internet (Krakul.eu, 2020). IoT is emerging in monitoring the data. IoT devices can be connected to the network, and it can digitalize even the whole city and make it more intelligent to suit the citizens' needs which are constantly growing. The emergence of new technologies or significant expansion of existing technologies can reveal unknown problems, which can be related to security, processing speeds, managerial actions, and integrations between different existing platforms.

The national context of the IoT sector is promising. The IoT sector is estimated to grow globally up to 27.1 billion networked devices. The global market situation and occurring challenges are similar to the local market. The most significant concern is securing the product. Since the device is connected to the network, it becomes more vulnerable than the same device in the local network. It encourages to prepare for attacks and possible data breaches. Connectivity bottlenecks are another problem in the IoT sector. The more significant amount of devices increases latency, and data travel takes longer. These delays might not significantly impact all the fields, but the latency is crucial for a field like autonomous vehicles. IoT is still new and emerging, while the governments are not well

prepared for regulations and standards. One giant step forwards - the emergence of the new standard general data protection regiment, which reduces the personal information usage and storage in company servers. Many different vendors create IoT devices, and the compatibility and maintenance (launching updates) are becoming more apparent. To have a substantial inter-compactible devices network, companies must pay attention to solve compatibility issues. While it is still new technology, there is lacking trust in the customers. According to a German study, 90 percent of the customers lack trust (Sampera Ernest, 2019). The main fear comes from the mind that the hacker might steal the data and control the devices.

The global IoT market will be dominated by North America, West Europe, and Pacific Asia. The market of pacific Asia is estimated to grow more than 30 percent of the total IoT market. The global market is estimated to grow around 10.2 percent CAGR. The market is forecasted to grow from 916.9 billion USD (2020) to 1994.3 (2029) billion USD (Businesswire.com, 2021). IoT drivers will be growing support infrastructure, enlarged internet connectivity, an increased adaptation of mobile and cellular IoT, optimization of the resources, and data analysis. Businesswire mentions the possible challenges related to security, the data's liability, problems of standardization, and government regulations. These described drivers will force the IoT sector to grow faster, taking into account the possible problems in the process.

1.1. Product development challenges of companies applying the technology-push approach

Technology-push or product-oriented companies develop new products, and later they subsequently try to integrate the created product into the existing market. This business orientation's primary focus is technology, which often raises one of the problems: the product needed in the market and whether it will be exciting and bought. In any case, the problem is influenced by too little contribution to market research and customer needs. Technology-driven companies face technological implementation problems when the technology is new, and the company has to solve the problems first. Solving new and unresolved issues requires a lot of effort and resources. Sometimes, due to a lack of technological knowledge, a product may not be complete and launched on the market. The problem with this: is that the launch time is unknown, and if a deadline is set or it is realistic. Technology companies need to anticipate several possible product development paths due to technological feasibility problems that might occur during the product creation process. The technological capabilities should be evaluated before launching the product or at least a few planned to choose. The most crucial emphasis is not to get stuck in one technological implementation.

When developing new products, it is crucial to protect the work that has been created - intellectual property. When most of the products are digitally accessible worldwide, intellectual property protection gains enormous importance. Protecting intellectual property from replicators can help gain a foothold in the market and prevent competitors from being easily copied. Losing intellectual property can lead to enormous company losses. There two most popular intellectual property securitization alternatives: patenting and copyrights. Nowadays, when the principal asset is digital data – intellectual property securitization is becoming even more critical than ever before.

The sensors and IoT devices generate large amounts of data that require processing and storing; these factors arise the data management challenge. The data can be collected from a wide variety of devices connected to the shared network. For example, American Airlines uses various sensors to collect the data through the flight. The sensors can gather up to 30 terabytes throughout the whole flight, and

this data can be used for preventive service maintenance of the aircraft(Lee & Lee, 2015). Currently, the American Airlines fleet size is 886 aircraft. If we approximate that they have one flight daily, there would be generated at least 26 580 terabytes of flight data yearly. The companies face data management problems; they are not sure where to save their data and how to achieve higher performance and reduce the complexity of the data processing. Data management problem is closely related with the data distribution among the servers or even data centers. The number of IoT devices' growth increases the amount of collected data that needs the right place to be stored and the computational power to be processed appropriately.

The growth of the data amount creates the necessity for data processing and analysis; the large amounts of data arise the data mining/processing challenge. The gathered data is useless without proper processing and analysis. The massive amounts of the data need to be combined and analyzed to make it more valuable. These calculations require a lot of computation power. With the adequately made analysis, the managers can make the right managerial actions to overcome the problem or forecast the upcoming challenges quickly. The airplane sensors can gather up to 30 terabytes of data in one flight, and this data can be used to prevent aircraft failures and increase the accuracy of problem detection, and help to do the maintenance(Lee & Lee, 2015). However, to reach this goal, the data must be converted appropriately to from bytes to a more human-friendly format.

IoT and other electronic devices' fast growth created the possibility for faster access to our private data, which is not only beneficial but a massive threat to our privacy. The more data we gather or upload, the higher loss can occur. Some people and websites say that nowadays, digital privacy does not even exist (Lang Marissa, 2017). It comes to everything digital: conversations, calls, health information, photos, search logs. There are many data breaches from popular websites Facebook, Microsoft, MyFitnessPal, CityBee. According to a Pew survey from 2016, only 12% of Americans and 9% of social media consumers have high trust in the government, and tech giants keep their personal information safe and stable (Aaron, 2017). "The truth is there is no silver bullet," said John Breyault, vice president of public policy at the National Consumers League. He mentions that there is no failsafe way to keep privacy and data secure from the government. However, people may take several necessary and straightforward actions to reduce their risk. The growth of the ICT services increased the privacy vulnerability risk. Currently, the privacy of the data should be the top value in the digital age.

The growth of ICT systems and networked devices increased hackers' attention, the data becomes easier accessible, and the cybersecurity challenge occurs. Previously, when the digital age did not emerge, the common phenomenon was physical thefts, but now, we can face the digital space's thefts. It is more difficult to detect and identify them in the digital space. Companies that do not pay enough attention to the security of their ICT infrastructure can face tremendous losses and drop their public image. It is not so hard to imagine what could happen if the hacker takes over the control of the company's IoT devices or can take over the control of the whole factory or modern building. Companies without or with a low focus on ICT security can become hackers' victims: their data can be stolen, encrypted, or modified.

The technology-push companies are the source of innovations. They focus on the new product development and not on the replication. The new product development process requires a lot of effort and knowledge. Solving the new and never resolved problems brings many challenges and requires a lot of time and resources. The problems can occur from the lack of knowledge in the field, from the

planning because it is hard to estimate the product completion date. With the emergence of new technologies, data management and processing challenges became frequent because of the large amounts of data. The constant growth of the new devices connected to the world wide web emerges privacy and security challenges. The device users' data needs to be stored in the servers connected to the world wide web to create easier access. However, the more accessible data can be accessed easier not only by the customers but also by hackers. The technology push companies are always on the tension due to the security of the data, possible breaches, and attacks. The technology push challenges are more technological than managerial.

1.2. Product development challenges of companies applying the market-pull approach

Market-oriented companies create products according to the needs of their customers. The main focus of this type of company is their customer or, on a broader scale, the market. The market-oriented companies put the most effort into meeting the customers' needs and expectations. The customer is not only a value but also a source of challenges. The biggest problems occur with the customers. One of the most noticeable problems is to extract the actual customer needs. The company struggles with ambiguity and unclear needs of the customer. The company needs to seek new technologies and constantly improve its strategy to stay competitive. The researcher has the same opinion about the strategy „In order for an organization to adopt the best strategies it needs to coordinate its approaches in establishing industry positions and/or by relying on its resources, competences and capabilities in an effort to achieve a fit with its internal and external environments and in turn achieve a sustained" (Masa'deh et al., 2018). The company's knowledge must be up to date and preprocessed to be sustainable.

Market-oriented companies are not only facing the unclear customers' needs but also the frequent change of them. The market is not a static object, and it constantly changes. The desires and needs frequently change what might cause even more significant expenses in the market research. The companies need to evaluate the current needs and expectations and forecast them to reduce the frequency and expenses of the research. Bernie Jarovski and Ajay Kohli also emphasized the constant change in the customers' needs and the technology (Kohli, 2017). The lack of market knowledge can negatively affect the companies performance (Ozkaya et al., 2015). It means that the company needs to pay enough attention to their customers, check the market constantly, and update its existing knowledge.

Sometimes the companies are paying too much attention to the idea with low potential. The development of this kind of idea costs many resources and does not bring noticeable benefit. The unclear customers' needs or lack of quality in the market research can raise this problem or make it more noticeable. The idea with low potential will decrease the interest of investors and the willingness to invest (Krebs & Ranze, 2015).

Market-pull companies also face the problem of what is the right customer. This problem might arise because the market can be extensive with billions of people. If the company cannot define the right customer and target the potential buyer more accurately, this can lead to loss of focus, unachieved goals, and significant expenses. The search for the right customer reinforces the need for market segmentation. The segmentation process involves the customers' selection by specific criteria, and the result of the segmentation is the more accurate customer (Business Wire, n.d.). There are many possible segmentation options, but the most popular and practical are geographical, psychographic, demographic, behavioral types of segmentation. The aim of the companies should be to define what their actual customers are, extract their needs, fulfill them. The extracted customers' needs must be adapted to the company's policy and suit the company's goals and objectives.

Market-orientation companies face the information overload problem (Kohli, 2017). The emergence of technologies has increased the amount of data on the Internet dramatically. The managers the researchers currently face the information overload problem. Which data we can rely on and which one we need to reject. The information overload problem has not only the cons but the pros too. Currently, researchers can gather even more formation about the customer, his behavior, and

preferences. Nowadays, when the price of marketing communications decreased significantly (comparing to the 1990s), companies can access customers more efficiently. With well-aggregated data and decreased prices of the marketing channels, the companies achieve great results.

The challenges occur for all available business orientations. Market-oriented companies most frequently face challenges related to the market and its customers. The most common problems: extracting the actual customer needs (they are tangled and sometimes full of ambiguity); the relevant problem is the frequent change of the market's needs and desires, so the companies are pushed to do frequent market research keep up to date. Without proper market research and adequate evaluation, the company might notice that the idea is with low potential and is not worth to be developed further. Defining and extracting target customers from the whole market is a crucial success factor of the company. The emergence of the new technologies created an ability to gather even more information than ever before about our market and customers; the researchers and the managers can get confused from the amount of available data, so consistency and the central company values should be the key. The market orientation has pros and cons, which should be considered before creating or changing the company's orientation.

This sector is fast-growing and perspective. The ICT market of Lithuania consists primarily of small and medium enterprises. It is constantly increasing demand for various ICT solutions. One of the most demanding sectors is the Internet of things. It enables the ability to access devices from a distance, collect and transfer data and analyze it. The fast and perspective sector has not only pros but cons too. Market-oriented companies have most of the difficulties with customers' needs. They are usually ambiguous and not clearly understood. Another common problem in market-oriented companies is market research. Most of the technology-push challenges occur in realization, feasibility, market uncertainty, security, and data management. This master thesis will fill the gap in the literature about the occurring challenges from the technology-push and market-pull ICT companies of Lithuania. It will propose managerial solutions to overcome them.

This master thesis will examine occurring challenges in technology-push and market-pull businesses of the ICT sector and propose managerial solutions to overcome them. The scope of this project is Lithuanian business-to-business ICT companies. Business-to-business is the cooperation between businesses that provide commodities, services, or information for other businesses. Lithuania was chosen because the growth of the ICT sector is rapid, there are many investments, and there are not similar researches conducted in the ICT sector of Lithuania. The ICT sector of Lithuania was chosen because technology-push and market-pull orientations are clearly expressed in ICT companies.

2. Theoretical solutions

This section will examine theoretical solutions for market and product-oriented companies. Literature analysis and scientific articles will be used as sources. It will first look at how a new product is being developed, which is common to both market-oriented and product-oriented companies. Product-oriented and market-oriented companies, their emerging problems, and possible theoretical solutions to emerging problems will be discussed below. The following section will compare product-oriented and market-oriented companies and describe their differences. In the end, the whole chapter of theoretical solutions will be summarized.

2.1. Approaches to product development

There is an existence of two company types: technology-push (product-oriented) or market-pull (demand-pull). Both technology-push and market-pull orientations are common in the contemporary world. Having clear objectives and the proper business focus can help to achieve better outcomes. Business orientation is chosen based on the priorities of the company. The product-oriented company focuses on market research and customers, and a technology-oriented company focuses on its main strengths and innovation. The orientation itself means that greater attention is delegated to how the idea originates. In this case, it can come from the research and development or from the expressed market (customer's) needs (Figure 1 represents the technology-push and market pull flow).

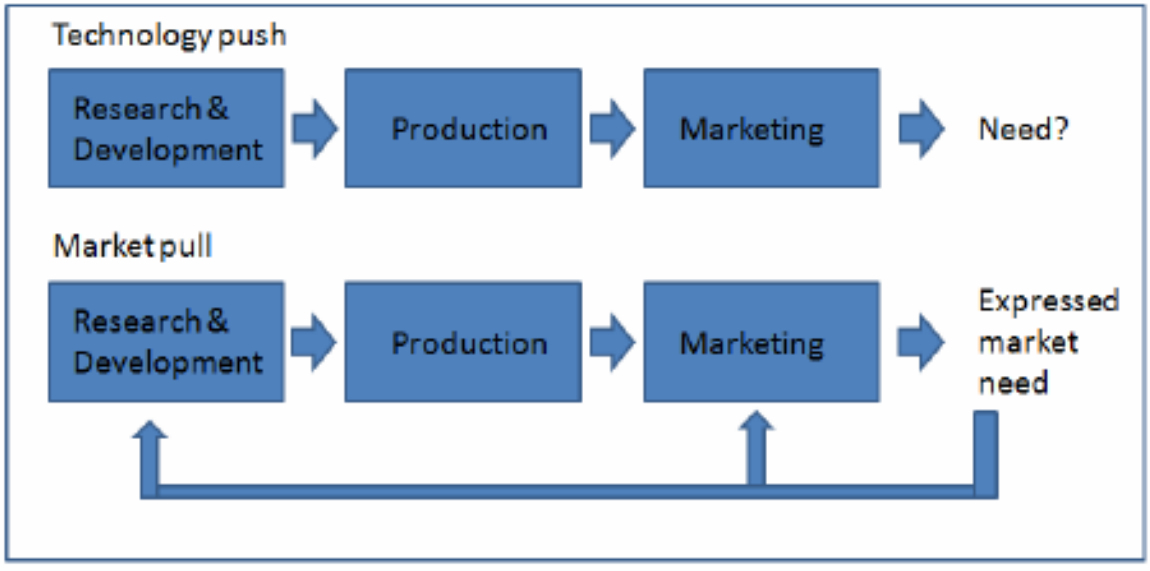

Figure 1 Technology-push and market-pull approaches (Kess Pekka, 2011)

Figure 1 represents the processes flow in technology-push and market pull strategies. At first glance, we can notice that the market pull originated from the expressed market need. The technology push originated from newly developed technology. This image reveals one drawback of the technology-push strategy that there is uncertainty with the buyers; in other words, the technology can be created, but there is no need in the market for that product.

The main difference between the two approaches is what is the origin of the idea. If it needs the customer, he needs some changes or a new product to fulfill his needs, and then it is a market-pull (market pulls the process). If the companies who invent new technologies and devices decide and see the new idea's potential, it tries to push the new product to the market (new technology is pushed to the market). Market-oriented companies primarily focus on collecting the customers' needs, summarizing them, and fulfilling the final needs. The technology push is mainly concerned about the newness, the technology, and it may exceed the customer's expectations. Most of the customers had not known that they need this new item before.

Table 1 defines the differentiation between technology push and market pull strategies. There are pros and cons then comparing them by attributes, where HIGH means great significance and LOW means low significance. The companies might use this table as a guideline to find out the specific criteria.

Table 1 Technology-push and market-pull approaches in product development (Brem & Voigt, 2009)

Attribute	**Technology-push**	**Market-pull**
Technological uncertainty	High significance	Low significance
Research & Development expenses	High significance	Low significance
Research & Development duration	Long significance	Short significance
Sales market-related uncertainty	High significance	Low significance
Time to market	Uncertain/unknown	Certain/known
R&D customer integration	Difficult to integrate	Easy to integrate
Market research	Qualitative-discovering	Quantitative-verifying
Need for change in customer behavior	Extensive change of the customer	Minimal change of the customer

Table 1 shows much beneficial information about both approaches. Here might be created the assumption that technology-push related with higher risk. For example, technological uncertainty, linked with long duration and high accumulated expenses in research & development. All differences are interconnected to each other, and one is changing; the change can impact other differences. There is uncertainty when the product will be launched to the market, which means that there is no guarantee that the customer will buy it or even it will be launched. In other words, the newly emerged technology is riskier, more expensive. It has many uncertainties, but the successful outcome can create a better profit and bring the whole new technology or product compared with the market focus.

The market-pull perspective shows significant benefits and less uncertainty, which means that when the company knows the customer's proper needs, it is easier to implement than technology-push when new technology is invented and pushed to the market without clear customer need.

2.2. New product development: theoretical approaches

The new product development is an integral part of innovation. Both market-pull and technology-push companies create new products to sustain competitiveness in the market. Companies use and implement innovation management to plan and control new product development processes systematically. Depending on the business orientation, the company can select the different new product development approaches and realizations. The new product development process is constant and infinitive due to growing customer needs and the emergence of the technologies.

The new product development consists of 5 significant steps: fundamental research; technology development; pre-development activities; product and process development; product and market introduction. All five significant steps are illustrated in Figure 2. These five significant steps cover the whole new product development process.

The product development process begins with fundamental research, which covers mainly idea generation, brainstorming, and evaluation. The process starts with fundamental research, where the theory, demand in the market should be analyzed. After that stage goes Technology development, where the development project is created, the technological feasibility is evaluated. Another step utilizes the developed project to create the prototype. Currently, there is a modern approach to create a minimum viable product (MVP) as soon as possible with minimal effort to evaluate we should go further or not. If the management decides that it is worth continuing, then the next step comes in. In Product and process development, the existing product is getting in better shape with many improvements. Finally, when the product is finished, it is introduced to the market.

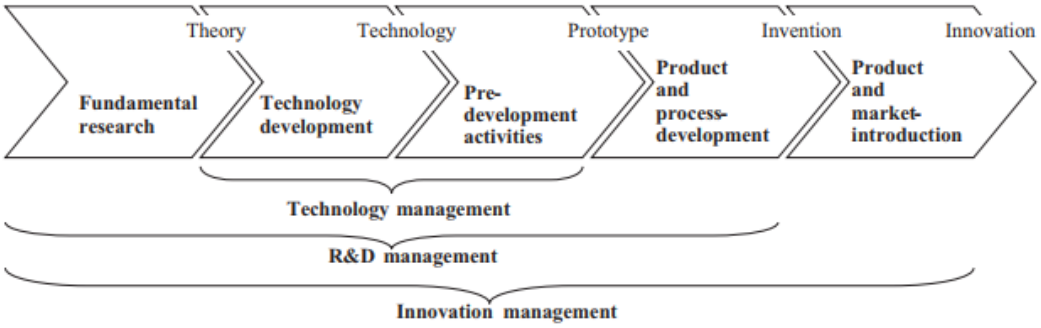

Figure 2 Classification of technology, R&D, and innovation management (Specht, 2002 in Brem & Voigt, 2009)

Thom (Thom 1980 in Brem & Voigt, 2009) has introduced the corporate innovation process's standardized stages (Figure 3). This framework shows the flow from idea generation to idea acceptance and finally the realization. All the steps are essential and should be completed carefully to create a successful idea with a higher chance. In other words, this framework is called the "fuzzy front-end," which means that the product is in the earliest stage. It is a great tool to eliminate the possible weaknesses that could arouse and increase its success.

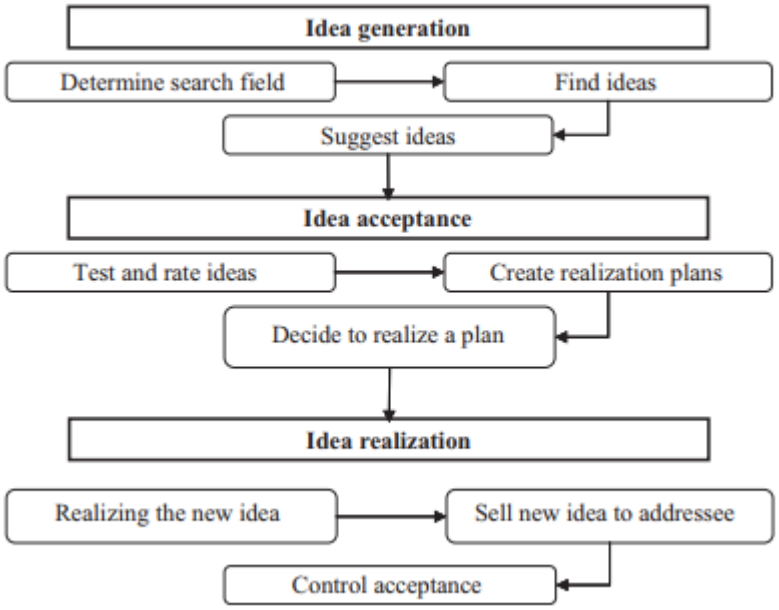

Figure 3 Standardized staged of the corporate innovation process (Thom 1980 in Brem & Voigt, 2009)

Figure 4 shows the example with idea generation that ideas can be created and collected from the existing market. Both created or collected ideas can be grouped and evaluated and reevaluated, and if necessary, rejected. Ideas filtering is a constant process that involves many efforts. This process is similar to a funnel; at first, we have many untested unpurified ideas that must pass all the stages to be successfully implemented. During the filtering process, many ideas are rejected due to some reasons. The perspective but not the right ideas for this moment are put back to the other list. After checking, refining, and evaluating the ideas, the output is the list of ideas with the highest potential ideas. The funnel is represented in Figure 4, where all phases are listed and commented. After successful idea refinement, the management can take action to bring the realization stage even closer.

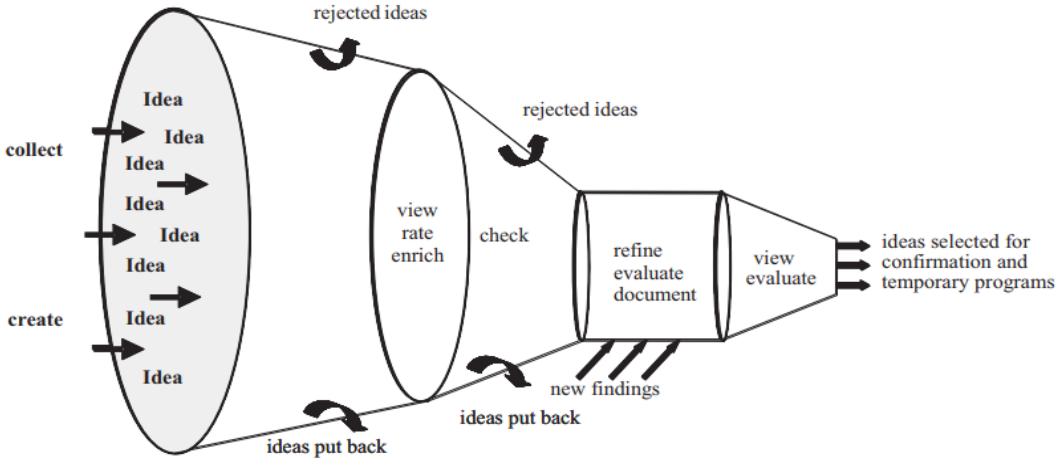

Figure 4 The idea tunnel (Deschanps et al., 1995 in Brem & Voigt, 2009)

According to Boeddrich (2004), several requirements are mandatory to fulfill to increase the refined idea's success rate. The Ideas to be successful should meet the general requirements:

- Suits the corporate strategy of the company;
- Explicit benefits of the product for the target audience and the company;
- A systematically planned and performed process of concept recognition;

In other terms, the ideas must meet the vision and mission of the company. The idea should not conflict with current objectives and set goals. The new idea should be along the way of the company to achieve the best result and synergy.

There is another front-end proposal by Boeddrich in Figure 5. This framework shows the differentiation between single process steps and organizational responsibilities. Boeddrich identified preconditions for successful management of the front-end activities, which has confirmations from other studies:

- The company should have company-specific categories for ideas.
- Companies should commit to company-specific evaluation methods and evaluation criteria.
- Management commitment.
- Use creativity and the creativity scopes of the company.
- Define stages in detail for management.
- Involve stakeholders in the process creation process.

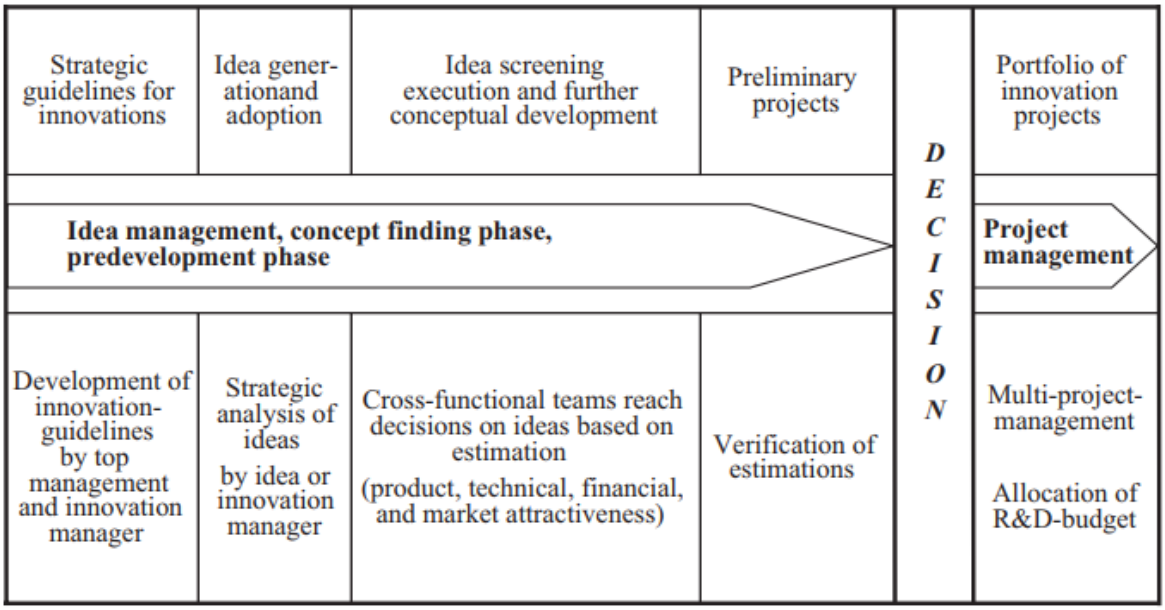

Figure 5 Front end model proposal (Boeddrich, 2004) (Brem & Voigt, 2009)

Figure 5 emphasizes the need for cross-functional teams that might provide the different viewpoints of experts to create higher product attractiveness.

Sandmeier (2004) has identified the process model that was very detailed and went directly into the subject of market pull vs. technology push Figure 5. This model consists of 3 phases:

- focus on market and technology opportunities (there should be from one to two opportunities and search fields to go to the next stage),
- product and business ideas (the actual idea generation and evaluation)
- draft concept of product and business plan (this stage pushes already generated ideas into business plans and product concepts).

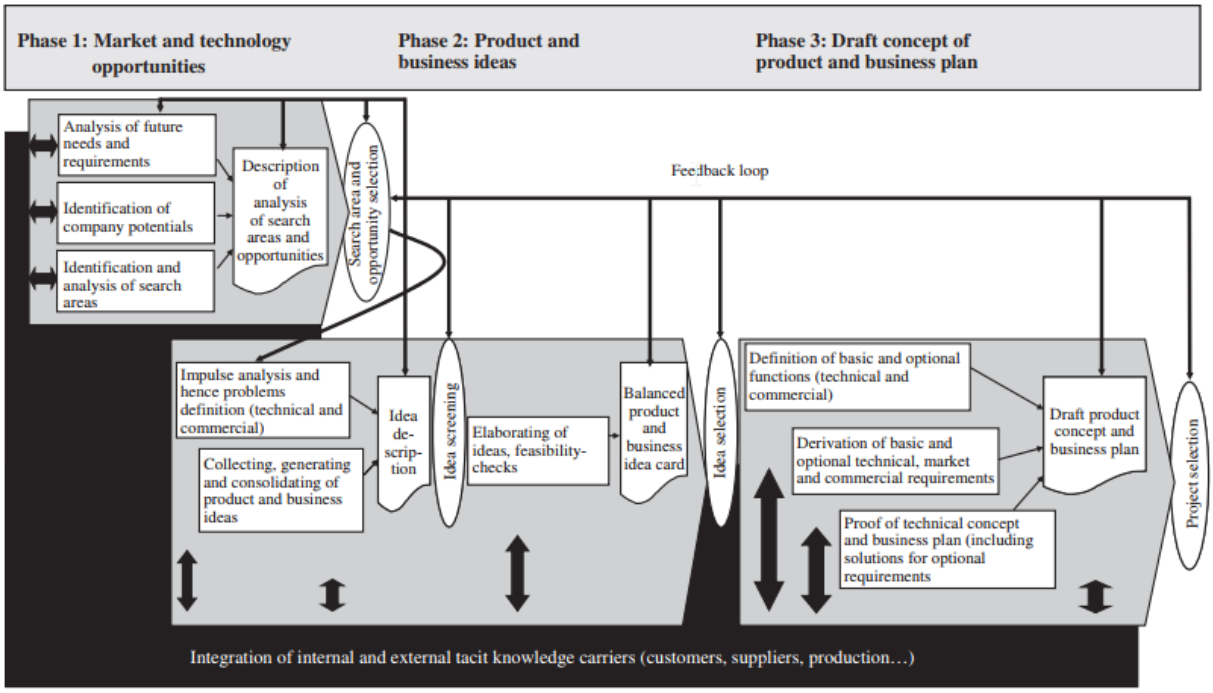

Figure 6 Integrated front end process model (Sandmeier et. al., 2004) (Brem & Voigt, 2009)

As a result of the fuzzy stage, its challenges and threats seem very similar across the companies.

The front-end process model takes many things into account (Figure 6). This model emphasizes that opportunities might come from the market and technology. It is the first phase in the integrated front-end process model. In this stage, the future needs and requirements are analyzed. Simultaneously the potential of the company should be evaluated, and areas of research should be decided. It is similar to brainstorming.

The second stage is product and business ideas. The ideas are grouped, screened, and the outcome is the ideas with the highest potential, usually the main idea. The clarified idea for the final project is checked, and its feasibility is evaluated.

The third stage is the draft concept of the product and business plan. It emphasizes the task that creators should note what minimum functionality should be. It will evaluate the market to go into the market with this idea, what are the main requirements of the market. When we have a draft project, we can create a minimum viable product to check the idea.

The new product development is a long process and takes many different approaches into account. In most cases, the new product development consists of five main stages: fundamental research; technology development; pre-development activities; product and process-development; product and market introduction. In between, the ideas are collected using the standardized stages of idea generation. The idea generation has three main stages: idea generation, idea acceptance, and idea realization. Suppose the collected or generated ideas list is enormous. In that case, the funnel model can be used: the whole list of ideas goes through the funnel and is filtered constantly, while the outcome is the few ideas with the highest potential. The progressive ideas must meet the company's objectives and go along with its vision and mission.

2.3. Technology-push approach to product development

This chapter introduces the technology-push approach to product development. It will provide the origin of the idea applying this approach and the concept of product development. This chapter has two sections the first one analyzes the occurring challenges in the companies applied the technology-push approach and the second the possible theoretical solutions to the occurring challenges.

The technology push could be called a model that performs in a linear direction (Figure 7). It represents that the process begins with the idea or discovery. Sometimes this approach might be called "idea push." An individual who has a creative idea, technological knowledge, and practical skill might transform the idea into a purchasing product. The main driving aspects in technology push companies are developing the new technology, increasing existing products' performance, and providing an innovative product for customers they do not know they had not known they wanted. Technology-push companies focus on their key strengths and develop a new high-quality product. Most users did not even know that this could be possible, and they did not even know that they would like it.

Figure 7 The model of the technology-push approach (OpenLearn, 2021a)

Figure 8 Example of Sony Walkman success (OpenLearn, 2021a)

In the 1980s, Sony was the first company who launch this innovative product to the market (Figure 8). Inside the company, there was skepticism because they tried to launch the product without recording feature, but A. Morita, Co-Founder of Sony, pushed this idea further. From the beginning, this idea was successful. If there were market research conducted, it would not indicate the need for such a product. The success came from encouraging customers and providing a product they had not know they wanted. The development of technology-push ideas requires the intuition of what customers would enjoy and use.

The technology push does not always work as intended. The mechanical typewriters have faced constantly stuck and jammed typing machines. The solution to this problem was the QWERTY keyboard layout, which Christopher Latham Sholes created. This layout reduced the typing speed and jammed machines accordingly. When the faster and more efficient typing machines were invented, the QUERTY layout's benefit disappeared and caused slower typing rates. Currently, most devices are using QUERTY layout, and we need to type slower than we could. (OpenLearn, 2021a)

The technology-push approach is a stimulus for new products from internal or external research. The goal is to apply accumulated know-how for commercial use. This strategy does not pay attention to whether a particular demand exists or not. It can be described as creative or destructive with new or significant improvements.

When the technology becomes available, the product is prepared for commercial or individual use and pushed to the market. Commonly, if the research and development are isolated from the entire existing business process, the productivity is reduced. The sole focus only on the technology can lead to the engineers' reinventing the existing things or reinventing the wheel. For example, when the touch screens were invented, they were in the labs for some period. After a decent amount of time, they were pushed to the market. When the new technology is pushed to the market (supply), the new demand is created.

Technology-push orientation is more than a simple model, and it involves creative ideas generation, which may change the future. With this approach, there is the highest risk of loss, but also it is possible to change the customers' understanding and let them know what they had not known what they want.

Technological and technology-oriented companies are usually more influenced by new technologies than other companies, especially in the business-to-business field. The technology-push strategy focuses on new product creation or on upgrading existing ones. They pay attention to ease the process or enhance the existing product.

2.3.1. Product development challenges of companies applying the technology-push approach

The technology-push approach brings not only benefits but also challenges. The technology-push approach brings a lot of uncertainty and a lack of knowledge because the technology-push companies are the ones who solve the problems first, while there is not existing answer in the market. It requires a lot of effort and resources. The companies that applied the technology-push approach are facing intellectual property, customers' needs extraction, proper evaluation of feasibility, estimation of the product launch, commercialization, inability to change the customers' behavior, large amounts of data, security and privacy challenges.

Not able to protect intellectual property.

Researchers have identified one of the most critical drawbacks of the companies' applied technology-push strategy. Here is a significant change in getting started with what can be easily researched and evaluated or getting replicated easily (Brem & Voigt, 2009). The companies that did not implement any intellectual property securities have a high chance of getting replicated by competitors and might lose their accumulated market share and competitive advantage. This challenge is critical for companies that develop software and intellectual products. The companies should research the law system of the country they are working in to get more familiar with the available intellectual property management solutions.

Not able to extract the actual needs of the customer.

Product development is not possible without the requirements. The requirements are created from the customers' needs and desires. The extraction of the customers' needs is usually challenging for most companies applied the technology-push approach. Brem and Voigt mentioned that the technology-push approach is prone to understand not a typical customer or the wrong needs (Brem & Voigt, 2009). The company can face significant losses in case they develop the product by the wrong customers' needs. It means that the product will not be trending and successful. The extraction of the customers' needs is very close work with the clients and the company. The requirements must be without ambiguity and must be straightforward.

Not able to predict and manage technological feasibility barriers.

The companies cannot finish and launch the product to the market due to technological feasibility barriers. The companies are not evaluating the feasibility in the analysis stage, or new unforeseen technological barriers appear. Risk in getting stuck in one technological solution, narrow thinking, only about one possible solution is the drawbacks mentioned by Brem and Voigt (Brem & Voigt, 2009). Unforeseen technological barriers in product development can lead to the failure of the product development.

Not able to estimate product launch date accurately.

The technology-push companies face time planning challenges when they cannot estimate the product launch date accurately what might lead to possible losses. Suppose the company launches the product too early. It might not be beneficial for the company that applies for the follower position. It is also not beneficial if the market leader launches the product too late. The leaders tend to launch the product earlier than the followers (Su & Rao, 2011). The company should evaluate the market and the competitive environment in product development.

Not able to successfully commercialize the product to the market.

Companies applied the technology-push approach tend to face challenges or difficulties in product commercialization. The critical problems of technology commercialization have been described in the literature as weaknesses in the commercialization phase, market environment issues, flawed operational framework, inadequate project management, insufficient collaboration with non-governmental industries, inability to cooperate with stakeholders, and overlapping political attitudes (Khalil Zadeh et al., 2017). The lack of analyzing the market, the absence of the target audience, the absence of understanding the customers' needs can lead companies to fail in the commercialization(Ameka & Dhewanto, 2013)

The commercialization problem can occur if there are other competitors in the field. Koc and Ceylan noticed that commercialization is a significant problem within the companies (Koc & Ceylan, 2007). The technology needs to be developed as fast as possible and delivered to the market for a greater chance at achieving the market's acceptance, standing the new technology as a new standard. Fast development may help to achieve the market's leading position and competitive advantage.

Companies who own only one approach, in this case, the technology-push company having a tunnel vision, may fail in commercialization. The case study of technology university innovation commercialization has shown that it is hard to commercialize the new products from the technology-push approach (Ameka & Dhewanto, 2013). Many factors cause the ideas to fail, but the main is the lack of attention to the market needs. It means that even the product is based on the technology-push approach, it is necessary to know the market needs.

Companies are not able to change customer's behavior or are facing difficulties.

The companies that applied the technology-push approach tend to create innovative and radical products. The radical inventions are not comfortable for a large number of customers. The conservativism or the fear of change is stopping the possible customer from trying the product. The lack of customer education can face the challenge when it is very hard to change the customer's existing behavior (Herstatt & Lettl, 2004). The customers lacking curiosity might even reject the new and radical inventions.

Not able to manage large amounts of data necessary for efficient system performance.

With the emergence of new technology and the constant growth of the devices connected to the internet, the amount of data is generated at a fast pace. A large amount of data creates various difficulties in the company. The data needs to be stored and processed. A large amount of data and unoptimized systems reduce the performance and slow down the overall company performance.

The sensors and IoT devices generate large amounts of data that require processing and storing; these factors arise the data management challenge. The data can be collected from a wide variety of devices connected to the shared network. For example, American Airlines uses various sensors to collect the data through the flight. The sensors can gather up to 30 terabytes throughout the whole flight, and this data can be used for preventive service maintenance of the aircraft(Lee & Lee, 2015). Currently, the American Airlines fleet size is 886 aircraft. If we approximate that they have one flight daily, there would be generated at least 26 580 terabytes of flight data yearly. The companies face data management problems; they are not sure where to save their data and how to achieve higher

performance and reduce the complexity of the data processing. Data management problem is closely related with the data distribution among the servers or even data centers. The number of IoT devices' growth increases the amount of collected data that needs the right place to be stored and the computational power to be processed appropriately.

The growth of the data amount creates the necessity for data processing and analysis; the large amounts of data arise the data mining/processing challenge. The gathered data is useless without proper processing and analysis. The massive amounts of the data need to be combined and analyzed to make it more valuable. These calculations require a lot of computation power. With the adequately made analysis, the managers can make the right managerial actions to overcome the problem or forecast the upcoming challenges quickly. The airplane sensors can gather up to 30 terabytes of data in one flight, and this data can be used to prevent aircraft failures and increase the accuracy of problem detection, and help to do the maintenance(Lee & Lee, 2015). However, to reach this goal, the data must be converted appropriately to from bytes to a more human-friendly format.

Inability to ensure privacy and security of the data from hackers and data breaches.

IoT and other electronic devices' fast growth created the possibility for faster access to our private data, which is not only beneficial but a massive threat to our privacy. The more data we gather or upload, the higher loss can occur. Some people and websites say that nowadays, digital privacy does not even exist (Lang Marissa, 2017). It comes to everything digital: conversations, calls, health information, photos, search logs. There are many data breaches from popular websites Facebook, Microsoft, MyFitnessPal, CityBee. According to a Pew survey from 2016, only 12% of Americans and 9% of social media consumers have high trust in the government, and tech giants keep their personal information safe and stable (Aaron, 2017). "The truth is there is no silver bullet," said John Breyault, vice president of public policy at the National Consumers League. He mentions that there is no failsafe way to keep privacy and data secure from the government. However, people may take several necessary and straightforward actions to reduce their risk. The growth of the ICT services increased the privacy vulnerability risk. Currently, the privacy of the data should be the top value in the digital age.

The growth of ICT systems and networked devices increased hackers' attention, the data becomes easier accessible, and the cybersecurity challenge occurs. Previously, when the digital age did not emerge, the common phenomenon was physical thefts, but now, we can face the digital space's thefts. It is more difficult to detect and identify them in the digital space. Companies that do not pay enough attention to the security of their ICT infrastructure can face tremendous losses and drop their public image. It is not so hard to imagine what could happen if the hacker takes over the control of the company's IoT devices or can take over the control of the whole factory or modern building. Companies without or with a low focus on ICT security can become hackers' victims: their data can be stolen, encrypted, or modified.

Table 2 Product development challenges of Technology-push companies

Factor	**Challenges**
Intellectual property	Not able to protect intellectual property
Time planning. Unknown time to market	Not able to estimate product launch date accurately
Technological feasibility	Not able to predict and manage technological feasibility barriers
Confusing needs of customers	Not able to extract actual needs of the customer
Commercialization	Not able to successfully commercialize the product to the market
Customer' behavior needs to adapt to the new product.	Companies are not able to change customer's behavior or are facing difficulties
Large amounts of data. Need to process and analyze the data	Not able to manage large amounts of data necessary for efficient system performance
Privacy Security	Inability to ensure privacy and security of the data from hackers and data breaches

The companies that are applied the technology-push approach face various challenges. The summary of the occurring challenges in the technology-push approach is listed in Table 2. The technology-push approached companies are unable to protect intellectual property, estimate the product launch time accurately, appropriately evaluate the technological barriers, extract customers' needs, commercialize the product, change the customers' behavior while introducing the new product, manage large amounts of data and ensure the privacy and security.

2.3.2. Solutions to challenges stemming from the adoption of the technology-push approach to product development companies

The technology-push approach brings not only benefits but also challenges. In this chapter, eight solutions to product development challenges of the technology-push approach will be discussed. Each challenge has at least or more suggested theoretical solutions. The data management challenge can be applied not only for the technology-push approach but also to the market-pull approach and, overall, to most IT companies.

1 challenge: Not able to protect intellectual property.

Theoretical Solution: Implementing patenting or copyrights.

The technical and technological revolution of the 20th century had a significant impact on developing new technologies. With the emergence of new technologies and the increasing number of consumers, there is a need to protect intellectual property. It prevents from software pirates and illegal intellectual product distribution. The two most common ways to protect intellectual property are patenting and copyright.

Patenting is most common among corporations and companies, leading to high fees. Firms can use this intellectual property as a tool to put pressure on other firms by creating costly patent portfolios. Sometimes there are even cross-agreements between companies that allow each other to use their patents free of charge. Patent law gives up to 20 years of competitive advantage, which leads to the frequent formation of monopolies. Patents need to be registered, which can cost as much as $ 10,000 (Liuiza & Stirbys, 2008)

Copyright protects only the program itself, not its generalized idea. Copyright protects intellectual property as long as the author is alive and for some time after that. It does not need to be registered, which makes it significantly cheaper compared to patents. Copyright does not impede competition.

There is a recommendation to consider patenting to secure intellectual property. Patenting might help prevent the invention from replication. This method is a better choice for corporations who want to secure the concept. The patenting allows the formation of monopolies (Liuiza & Stirbys, 2008).

If the company decides to use patenting for intellectual protection, it must meet the Patent office's requirements. According to The U.S. Supreme court, most software patents are rejected due to abstractness. For example, "The U.S. Supreme Court has clarified that performing an abstract process on a general-purpose computer does not make it patent-eligible" (MacCord, 2016). The patenting might not only protect the intellectual property but it must be disclosed to the public. It creates an opportunity for others to implement the invention without any experimentation. The public will understand what is protected and what is not, so it creates an opportunity for easier replication with minimum changes in the concept. Before taking the patenting step, the company must consider what is worth patenting and what is better to keep in secret.

Patenting and copyrights both secures intellectual property but have cons and pros. Patenting suits better for large companies who want to prevent the concept and the software itself. Besides, it costs more than copyrights, but it allows to create valuable patent portfolios, pressure other companies, and

share them when contracting with cross-agreements between companies. Suppose the company is not large enough or wants to secure only the software itself when using copyrights. In that case, it prevents illegal use of intellectual property until the author is alive and some years after. It does not need to be registered as a patent, so it will cost less than patenting. Before taking the intellectual property securitization step, the company needs to ensure what exactly they want to secure.

2 challenge: Not able to estimate product launch date accurately.

Theoretical Solution: Implementing time planning, Agile method, self-organized groups, and evaluating the market situation and the company's position (leader or follower).

Managers may say the exact launch time easier with small projects, and it is much harder to predict the correct date with larger ones. To overcome the launch time to the market uncertainty problem, managers should implement time planning activities. To ensure that the deadlines are realistic, the managers need to provide the deadlines with time padding to compensate for possible timeouts and delays.

A few decades ago, the agile methodology was invented; it helps deal with the most common problems in the software creation process. The agile method offers the concept of a self-organizing role to reduce the time to launch. The same person in different hours might take different roles. It would be beneficial when it is difficult to express the situation to different people. The same can do it much quicker than introducing a different person's task (R. Hoda et al., 2013). The most common roles: a mentor who guides and supports the team, coordinator who manages customer expectations and collaborates with the team, a translator who translates from customer business language to technical language and vice versa, champion who collaborates with senior management, a promoter who promotes the involvement of the customer and ensures efficient functioning and terminator who identifies team members who threaten the productivity and eliminates them with the help of senior management. The person can shift on those in different periods in the same or multiple projects.

Before the preannouncement and launch of the product, the company should evaluate the current situation of their products and competitors. The research in the microprocessors market has validated the model of Meng Su and Vithala Rao, which emphasizes the importance of product announcement and launch time (Su & Rao, 2011). They recommend taking into account the current market situation and in creating the new demand, "A firm should not preannounce early unless the preannouncement is effective in creating pent-up demands" (Su & Rao, 2011). There is another point of view in their model. The company should rush the launch if the product quality and the possible profit margin are high. The product announcement and launch should be postponed if the competitors' product market share is already high. If the company is the leader in the market, it should announce the product earlier if the company is the follower appropriately later.

By implementing all the suggested solutions, the company might predict the launch time easier by implementing the Agile method, which involves the self-organized groups, by introducing the time planning activities in the company and evaluating the current situation in the market. The company should consider its position if it is a leader or a follower and project the launch time accordingly.

3 challenge: Not able to predict and manage technological feasibility barriers.

Theoretical Solution: employ technical team leads (TTL), include TTLs in the meetings.

During the development, many things change constantly. In the previous plan, the technology stack can become not actual due to changed requirements, or the development team can face a problem that was not foreseen. Companies are pushed to think out of the box to prevent getting stuck in one technological solution problem. They try to use different technologies, and it is recommended to foresee the alternative technologies if the current does not succeed. Having a plan and alternatives can save not only time but the valuable resources.

The company might employ experienced technical team leads for the different technologies or platforms (front-end, back-end, DevOps, and other technologies) to evaluate ideas feasibility before the development (Indeed.com, 2021). The team leads can help the developer during the development process too. The meetings with all technical team leads should be introduced if the idea is cross-platform. The meeting would evaluate the feasibility if it is impossible to implement technical team leads that could offer the available alternatives.

4 challenge: Not able to extract the actual needs of the customer.

Theoretical Solution: involve the customer in product development, implement Agile.

Understanding the wrong needs of the customer or lack of knowledge about the field of the customer can impact the product delivery time and its quality. The Agile methodology suggests the constant involvement of the customer during product development (M. N. Hoda et al., 2015). It helps the company and the client be on the same page. The customer's constant involvement will help reveal real needs and help reach mutual satisfaction and high-quality product. The constant involvement of the customer will help to share his knowledge with the software development team, and it will help to handle the social identity diversity and fully understand the requirements.

Figure 9 represents the evaluation of different factors using different methods. The SCRUM is the most popular implementation of Agile. The SCRUM implementation has the highest score in efficiency, accuracy, time management, risk analysis, and product quality compared with the spiral and waterfall models.

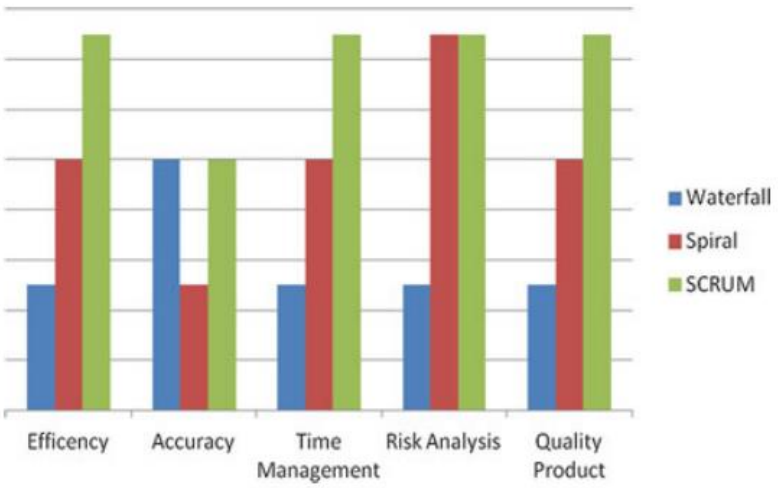

Figure 9 Graphical representation of different factors using different methods (M. N. Hoda et al., 2015)

For the company to successfully implement Agile, it needs to pay attention to the success factors of the Agile methodology implementation. The success and failure factors are in Figure 10. For the Agile strategy to work well, the company needs to create a collaborative culture in the organization, a comfortable and not disturbing work environment. Motivate the employees and promote knowledge sharing and strong relations between team members. The team output should also be monitored. The documentation should be accurate without ambiguities and easy to follow. The technical part should be simple with continuous design across all the projects, and the team should implement the integration testing to make sure everything is working fine. The managers should implement a fluent process flow, and the employees should follow it. Managers should promote good communication in the team and between teams.

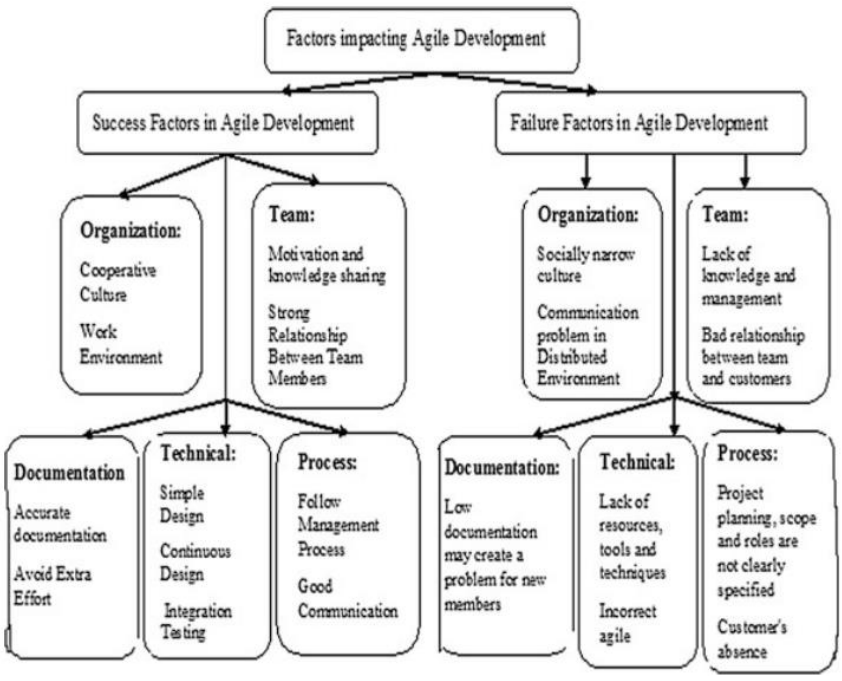

Figure 10 Factors impacting the Agile implementation (M. N. Hoda et al., 2015)

5 challenge: Not able to successfully commercialize the product to the market.

Theoretical Solution: Market research, select the right time for the product launch.

Companies may fail to commercialize their product due to many reasons. The first problem can be the lack of market research. Technology push companies are focused more on their key strengths to create a superior product. Due to the sole focus, the customer can be forgotten and their needs not fulfilled. The company needs to find the time and resources to adapt their product to the customer to be practical and valuable; this approach might increase sales, customer satisfaction and reduce the risk of failing in the commercialization.

Innovation commercialization is an issue shown by the studies. T.Koc and C.Ceylan emphasize the connection between innovation and exploitation – "Innovation and its exploitation should be regarded as an important driver of commercialization" (Koc & Ceylan, 2007). They also have identified the view of Khanil, who states that the new technology needs to be exploited as fast as possible. It will help the company gain customers' acceptance of new technology and define it as a new market's standard. Fast exploitation of the new technology can create a competitive advantage for the company, resulting in becoming the leader in that market.

To cope with the commercialization challenge, the postulate recommends to validate the commercialization in other words to evaluate the overall potential of the idea, the second realistically evaluate the technology the company is planning to work with, take a deep look into the technology that is being to implemented and look at its possibilities. The third is to accurately target the audience and the last one is to initiate the commercial actions. The company can ask for help of the "industrial opinion leaders" to increase the awareness of the customers(Siegel et al., 1995).

6 challenge: Not able to manage large amounts of data necessary for efficient system performance.

Theoretical Solution: Develop scalable applications and use the consistent data format.

SmartSantander platform has noticed the fast growth of the Internet of Things (IoT) applications. It counts over 12 000 diverse IoT devices in Santander city (Lanza et al., 2016). The number consists of fixed and mobile sensors, gateway devices, NFC tags. The devices are spread in the whole city, bus mostly in the center. The number of requests (observations) is listed in Table 3. These requests are coming from various types of devices. There are tendencies for the significant growth of the request in a short period of time.

Table 3 Number of requests generated daily in the SmartSantander testbed (data gathered March 2014)

Service	Daily observations
Environmental Monitoring	139,370
Parks and Gardens Irrigation	8,365
Mobile Environmental Monitoring	82,726
Parking Occupancy	13,489
Traffic Management	54,720
Participatory Sensing	6,352
Augmented Reality	1,489

SmartSantander platform focuses on the scalability of the system, to quickly expand it if a more considerable amount of request will be needed to handle, the second priority is interoperability. It helps to keep the heterogeneity of the data and the consistent data lets to integrate as many various devices as possible and process the data easier. When the company has more consistency in data, it is easier to improve the algorithm and achieve a faster operations rate.

The amounts of data are constantly growing. SmartSantanger platforms approach to pay attention to scalability and interoperability helps process the data easier and on time. Companies might also employ a big-data specialist to help to structure the data and give valuable insights.

7 challenge: Inability to ensure privacy and security of the data from hackers and data breaches.

Theoretical Solution: educate employees, implement security solutions for local network and servers, employ ethical hackers.

Privacy and security are the top values in the current digital age. The company has to educate its employees to behave securely and form good habits in digital security. Educated employees will notice possible scams and potentially malicious software easier when they are well educated. The company might implement constant education and knowledge checks.

The company has to offer a safe environment to work in. The company should have its secure network, save the most critical files in the local network. The company's network should be encrypted and preferably with the demilitarized zone. The guests can access only the public services, but not the local network. IT command should assign the lowest number of privileges for the users in their IT systems. The company might also use other companies' services to evaluate the company's security situation constantly.

The company can employ ethical hackers. They will try to penetrate the company's services and network and try to find possible vulnerabilities. The ethical hacker activity must be discussed in advance with the supervisor of the company. Ethical hackers will not only reveal the possible vulnerabilities but also can offer possible solutions.

To reduce personal data, the companies should anonymize the data to prevent revealing the customer's real identity. The data anonymization approach is the most widely studied approach (Wong et al., 2011). It may help to reduce the possible losses if the company becomes a hacker's target. The losses would be more minor due to data, where the identity cannot be recognized.

8 challenge: Companies are not able to change customer's behavior or are facing difficulties.

Theoretical Solution: Educate and involve the customer using the new product.

Technology-push companies tend to create new inventions; some of them are radical. Not tried inventions before by the customers can lead to confusion or rejection of the product due to lack of customer effort. The manufacturer needs to pay attention, prepare the customer for the new product,

educate, demonstrate how to use it, and let him use the new product—the smoother the transition, the higher the success.

Satisfied customers are more loyal and have a firm grounding for long-term cash flow (Lagrosen, 2005). Despite organizations' best intentions, numerous new product creation programs stall, resulting in products that fail to meet customers' needs. Successful innovative product creation necessitates a thorough analysis of the consumers' needs and desires. This necessitates successful customer interaction in the product development process. It is important to investigate when, to what degree, and how businesses include their consumers in the product development of new products and the outcomes of this participation.

2.4. **Market-pull approach to product development**

This chapter introduces the market-pull approach to product development. It will provide the origin of the idea applying this approach and the importance of the customers. This chapter has two sections the first one analyzes the occurring challenges in the companies that applied the market-pull approach, and the second the possible theoretical solutions to the occurring challenges.

The market-pull model indicates that the stimulus for innovation originates from society's needs or, in other words, the market (Figure 9). The first step is to conduct market research to ensure that the exact need exists and is further developed. It ensures a higher success rate of the product.

Figure 9 The model of the market-pull approach (OpenLearn, 2021b)

This approach focuses on fulfilling the human needs in all industry fields, from safety (airbags) and food (new breeds of plants). The market can dictate their need from all sectors: shopping centers, carriers' service, sport, and executive cars, the need that the car is four-wheeled. The customers can not require the product that could not be conceived yet, but can only create a future need for innovation to emerge (OpenLearn, 2021b). Experts point out that there is no guarantee that the invention will emerge to fulfill that need if there is a critical need.

Some inventions require research and development; on some, they can be skipped. Research and development are more related to radical inventions. Market-pull helps solve the existing problems; for example, when the cameras became more popular, people faced a limited amount of photos taken on the film. The film camera solution was introduced digital camera, where we can store thousands of photographs compared with only 36 on camera with a film roll.

The market-oriented companies have a vast potential and are most are successful in the international context. The study shows that the market-orientation has a positive performance effect in emerging markets. The companies who adopt the market orientation can achieve better results in international and emerging market operations (Gruber-Muecke & Hofer, 2015)

Market-pull innovations are not always successful; for example, while we significantly focus on electric cars, the same interest could not be replicated in electric motorcycles. Market tries to cut the CO2 emissions and create a more environmentally friendly environment, but unfortunately there a gap in technology, to create the motorcycle as good as a petrol one. The electric motorcycle would have slower performance, and the batteries are not enhanced to the level where we can enjoy uninterrupted travels for a minimum cost of effort (Ryan, 2013).

Market-pull/demand-pull/need-pull is a different approach compared to technology-push. It appears when there is a need for the product in the market. It offers a replacement or a substitute. For example, when the cameras appeared, people needed to take and store many photos. The cameras were huge and uncomfortable. The users' needs pulled the technology to evolve into more compact and more

advanced cameras. The source of innovation contains the lacking of customer satisfaction in fulfilling their needs. As a result, a new demand for problem-solving is created.

Market-pull is an approach where the customer needs play a huge role. The needs of the customers are constantly growing and must be fulfilled. Unfortunately, not all needs can be fulfilled due to limiting factors like technological feasibility. The critical part of market orientation is well-made research of market needs. It is important to note that for the idea to come up to the daylight, there must be a well-noted needs related to not too long distance from technology(feasibility). There is a positive connection between market knowledge and market-based innovations(Ozkaya et al., 2015). The knowledge about the market, existing competitors, and customers‘ needs creates a competitive advantage. Focusing on rivals may involve focusing on competitors‘ clients, and focusing on customers may include focusing on market competing products used or desired by the customers. Knowing the customers‘ needs has a positive effect on the company’s performance and customers‘ satisfaction.

Customers are the top priority in this strategy, so businesses should work closely with customers to fulfill their needs. At first glance, it can look quite an easy task to know what a customer wants, but it can be ambiguous sometimes. During the new product creation and development, customers’ insights are crucial. Often customers have difficulties explaining their needs. What leads to confusion and longer product delivery times. Clearly expressed needs significantly impact the company’s absorptive capacity to build up the desired idea. Addressing customers’ needs is a time-consuming task, and it creates a challenge for the firms, which is hard to overcome.

According to Hayes and Wheelwright (in Lubik et al., 2013), the demand-pull strategy or, more often, market-pull tends to imitate products available in the market, suit suitable mainstream market needs, and utilize existing knowledge and infrastructure. It increases customer satisfaction and lead to higher acceptance levels compared to the technology-push strategy, and leads to a faster return on investments (ROI)

Market orientation does not suit best all the companies but mainly has a positive effect (Udriyah et al., 2019). This article emphasizes that the input does not necessarily generate a higher output, which is worth considering before making important decisions. It denotes the correlation between market orientation and competitive advantage.

The market orientation is an essential determinant for the success of the new product development. According to exploratory analysis, there is a link and support that market orientation leads to more excellent product development performance. The market orientation demonstrates the more significant influence on the performance when the product is incremental instead of radical for the customers and the firm (Atuahene-Gima, 1995). The market orientation shows better results in the early stage of the product life cycle, where there is intense competition and the industry’s hostility is high.

2.4.1. Product development challenges of companies applying the market-pull approach

The companies applied market-pull approach receives not only benefits but also challenges. The market-pull approach challenges are mostly related to the customers and the change of the market. The companies are also facing the proper idea potential evaluation challenge. The selection of the low potential idea is not beneficial for the company and customers.

The company is trying to target a too broad market.

The market can be extensive, and the same solution is not applicable for all occasions. The market can be local or global. The companies are failing to target the right customer segment. One type of idea succeeds in one region another in others. The segment selection is crucial because people in different regions, cultures are acting differently. The lack or absence of market segmentation increases the required marketing resources (Tynan & Drayton, 1987). The larger the segment, the higher the expenses, and the expected result can not be guaranteed. The lack of market segmentation and the adaption to specific customers' cultural differences can lead to failure.

Failing to focus on the idea with high potential.

The extraction of the customers' desires and the application is a complex task. The companies are trying to do market research and then develop new products or alternatives to existing ones. The companies can blindly seek the market need, but it might have a low potential. Researchers also have identified the danger of just looking at criteria that can easily be defined with a small potential on the market-pull approach (Brem & Voigt, 2009). The seeking for the idea with low potential can lead to low outcomes and losses compared to what they could do simultaneously with the high potential idea. The selection of the low potential idea is not beneficial for the company and the customers.

Inability to meet frequently changing customers' needs.

The market is constantly changing. The emergence of new technologies encourages the creation of new products, and the older products lose the customers' interest. The constant change of the market means that the customers' needs are also changing. The companies are trying to compensate for the differences and adapt the product to the change of the market. If the change is persistent, the companies might miss the opportunity (Brem & Voigt, 2009). Constant market research is the necessity in meeting the frequently customers' needs in product development.

Another article's different view shares what taking the market-oriented approach without critical assessment can harm the firm's performance in terms of new product development. The author mentioned that the market orientation needs time to build up and mature. It is not a fast process. There not only challenges but pros too. The market orientation is more likely to increase the firm's products' sales, growth, and profitability. Also, it increases cost efficiency and opens up more market opportunities (Atuahene-Gima, 1995).

The frequent change of the customers' needs can cause feasibility problems for the developers. The frequent change during product development can harm the product quality and take much longer. The system structure can have applied not recommended patterns, and it will be tough to maintain. It can also occur due to a lack of technological knowledge, poorly expressed customers' needs, or unrealistic goals in general. The learning limitations of employees can be caused by a lack of knowledge (Scaringella et al., 2017).

Not able to extract the actual needs of the customers.

The customers and the company are usually on different pages. It means that they do not understand the idea in the same way. The ideas extraction of the customers is a complicated and prolonged task. Choi (2018) mentions that customers can not give clear signals, which means they have difficulties expressing their needs. The absence of the lead users who use the products and doing reviews also negatively affects the extraction process. They are helping to retrieve the actual expectations of the customers'. The extraction of the customers' needs is an essential task that needs to be appropriately done.

Table 4 Product development challenges of Market-pull companies

Factor	**Challenges**
Broad market	The company is trying to target a too broad market
The danger of looking at criteria that can easily be defined with a small potential	Failing to focus on the idea with high potential
Frequent change of the needs of the customers	Inability to meet frequently changing customers' needs
Customers' needs Miscommunication with the customers	Not able to extract actual needs of the customers

Table 4 sums up the main challenges occurring in the companies that applied the market-pull-oriented approach. The market-pull approach faces challenges related to customers, extraction of their needs, proper idea potential evaluation, frequent change of the market, and customers' needs.

2.4.2. Solutions to challenges stemming from the adoption of the market-pull approach to product development companies

The market-pull approach brings not only benefits but also challenges. In this chapter, four solutions to product development challenges of the market-pull approach will be discussed. Each challenge has at least or more suggested theoretical solutions.

1 challenge: The company is trying to target a too broad market.

Theoretical Solution: Target the right customer segment.

Market segmentation is the process of grouping large homogeneous markets into smaller, clearly identifiable segments. Segmentation is done based on clearly defined properties of the market. The market can be segmented according to certain similarities or interests of customers. By segmenting the market, it is possible to reach the desired target audience more accurately, reduce marketing costs and gain a competitive advantage (Business Wire, n.d.).

Market segmentation can be differentiated into geographic, psychographic, demographic, and behavioral segmentation. Geographic segmentation is done when the segment is created according to the geographic area. This segmentation type is the most popular. The segmentation can be made in different scopes, countries, states, regions, cities. Psychographic segmentation considers the customers' lifestyle, mindset, interests, hobbies, and other properties to construct a segment. These segments might help to analyze their behavioral patterns of goods purchasing. Demographic segmentation takes into account variables like age, gender, ethnicity, wages, and occupation. This segment, combined with others, can help to reveal real customers' segments. Behavioral segmentation takes into account the customers' behavior, how do they make the decisions. This type of segment allows predicting whether the buyer will buy the goods or not.

The market segmentation helps to identify the trending segments. It may help to prevent marketing to the declining segment and save vast amounts of money. Segmentation might help to detect even changes in customers' preferences over time. Segmentation is a crucial part of marketing strategy (Tynan & Drayton, 1987)

Neither of the segment is more important than other, they work best and have enormous potential when most of them are combined. Segmentation helps to allocate the resources for marketing, plan, set objectives (can be used as guidelines), and even detect customer preferences over time. When the company has clearly defined customer segments, it can use them for marketing strategy.

2 challenge: Failing to focus on the idea with high potential.

Theoretical Solution: evaluate idea potential, evaluate the market situation.

Looking for the criteria with small potential in the market research can be harmful to the company. The idea's checks should be performed constantly from beginning to the product launch to reduce the risk of chasing a not potential idea. The ideas usually are evaluated using four categories: novelty (rarity, originality, paradigm), workability (acceptability, implement ability), relevance (applicability, effectiveness), and specificity (implicational explicitness, completeness, clarity) (Dean et al., 2006).

The company should pay attention to the market situation and evaluate if there is a need for additional market items. What are the strengths and weaknesses? SWOT model can be involved, which describes strengths, weaknesses, opportunities, and threats. Porter's five models could help evaluate the threat of the new entry, suppliers' power, the threat of substitution, buyer power, and competitive rivalry. As a result, a comprehensive view will be built for the specific idea.

3 challenge: Not able to extract the actual needs of the customers.

Theoretical Solution: Communication with customers and extracting their actual needs.

To extract the customers' needs and overcome the miscommunication challenge with the customers, the managers should increase the quality and depth of communication with the customers. It will help to create a robust connection and put their shoes on. After the enhanced communication, the managers should use the benefits from customers' insights for product development and reduce unnecessary information noise. Managers might take the most exciting and relevant ideas for development. The more precise the customers' needs, the more satisfaction the customers will get when the product is launched. The data about the customers can be gathered in many ways: interviews, public pools, and questionnaires (Saplinghr.com, n.d.). A quick and lightweight pool can be suggested after a successful product purchase. Managers can interview experts in that field, what challenges occur, and the customer's expectations, what do they really need. With the combined data, managers can link between blocks of information and extract the customer's closest needs. If the data looks ambiguous, the second interview can be launched to validate the previous findings. All these methods will help to sustain the connection between the market's needs and the management.

4 challenge: Inability to meet frequently changing customers' needs.

Theoretical Solution: implement Agile methodology.

The changing customers' needs can be a frustrating part of software development. Software development is a constant process because the clients require new features, the market situation changes, or event bugs appear in already created software. To go out from the chaos in software development, most modern companies use the Agile method to gather the client's needs and software requirements and involve the customer as much as possible.

Figure 11 represents the Agile software development lifecycle. One iteration consists of 6 steps. The first Analysis: the step where all requirements are gathered. This step helps to reduce the ambiguities in the software development requirements. In the second step, Design, the architecture is projected. In the third part, the actual programming begins, the plan is converted to the software. The fourth is testing; this stage ensures that this feature is stable and is ready for production. After the successful testing, the deployment stage is ready. Deployment is the stage where the created feature is pushed to the actual clients in the real working app. To keep the application working, the maintenance is step is used. It takes care to make the product working all way long. After the whole iteration, the managers can evaluate the progress, what is good, what is wrong, and take appropriate actions. Agile is more flexible and friendly to the customer compared with traditional Waterfall methodology, which has only one iteration (Figure 12). Agile is more robust to changes and costs less than Waterfall because the changes are made in the next iteration. The Waterfall methodology involves the customer only in

the analysis stage. The Agile methodology has a backlog where it has all wanted functionality for the software. Every iteration in Agile takes one or few backlog items and processes them in 6 previously mentioned steps: analysis, design, implementation, testing, deployment, and maintenance. To have a successful process, the company might employ the person to manage the whole Agile process.

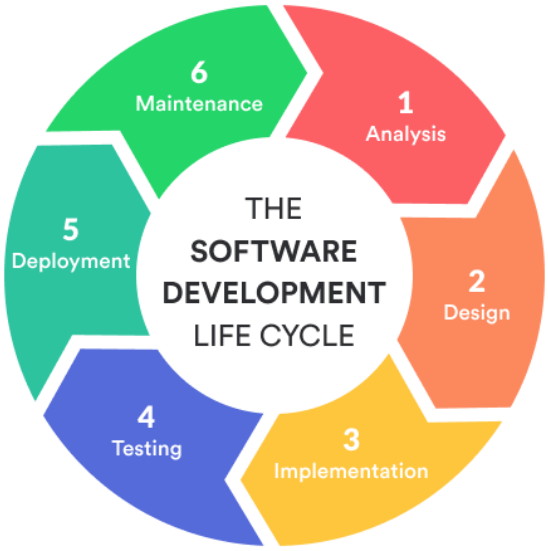

Figure 11 Agile software development life cycle (Anurina, 2021)

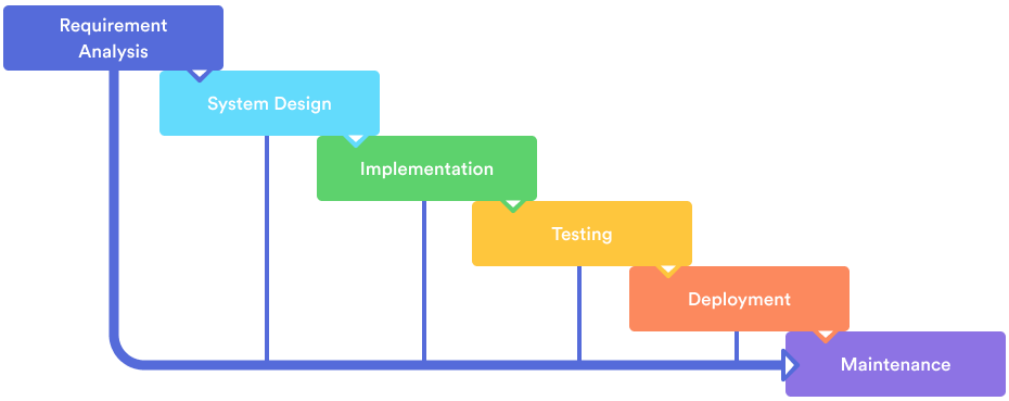

Figure 12 Waterfall method phases (Anurina, 2021)

2.5. Results of theoretical analysis

In the theoretical part the literature analysis was conducted. The literature analysis revealed the occurring challenges in the companies that applied technology-push and market-pull approaches. The literature analysis also revealed the possible theoretical solutions for the occurring challenges. The literature analysis revealed 8 technology-push approach challenges and 22 possible solutions and 4 market-pull approach challenges and possible 12 solutions.

Table 5 summarizes technology-push and market pull challenges and solutions found in the theoretical part. The table is split into technology-push and market-pull parts. Each part consists of the category of the challenges, the challenges, and theoretical solutions for product development challenges. Technology-push companies' challenges are grouped into these categories: technological uncertainty, time to market, intellectual property management, market research, commercialization, management of a large amount of data, ensuring privacy and security of the data, and need for change in customer behavior. The market-pull challenges are grouped into the following categories: market research, marketing, research and development.

Table 5 Product development challenges and theoretical solutions of Technology-push and market-pull companies

Approach to product development		
Technology Push		
Category	Challenges	Theoretical Solutions
Technological uncertainty	Not able to predict and manage technological feasibility barriers	• Have at least a few alternative solutions • Employ technical team leads (TTL) • Include TTLs in the meetings
Time to market	Not able to estimate product launch date accurately	• Introducing time planning activities • Implementing Agile method • Implementing self-organized groups from Agile • Evaluate the current market situation and the company's position (leader or follower)
Intellectual property management	Not able to protect intellectual property	• Implementing patenting • Implementing copyrights
Market research	Not able to extract actual needs of the customer	• Involve the customer • Implementing the Agile method
Commercialization	Not able to successfully commercialize the product to the market	• Conduct market research • Increase the focus on the customers' needs • Fast exploitation

Management of large amounts of data	Not able to manage large amounts of data necessary for efficient system performance	• Employ big data specialists • Improve IT infrastructure
Ensuring privacy and security of the data	Inability to ensure privacy and security of the data from hackers and data breaches	• Educate the employees • Implement constant security checks • Encourage anonymization of data • Secure the network • Buy ethical hackers system's vulnerabilities check service
Need for change in customer behavior	Companies are not able to change customer's behavior or are facing difficulties	• Educate and involve the customer to use the new product
Market Pull		
Category	Challenges	Theoretical Solutions
Market research	Not able to extract the actual needs of the customers	• Strengthen communication • Include customers' insights in the product development process • Interview experts in that field (Person who quite close to your market) • Implement questionnaires and pools.
	Inability to meet frequently changing customers' needs	• Implement Agile methodology • Employ Agile professional
Marketing	The company is trying to target a too broad market	• Customer segmentation. • Selecting the right customer segment
Research and development	Failing to focus on the idea with high potential	• Evaluate an idea using four categories • Evaluate the situation in the market • SWOT analysis • Porter's five model

The theoretical analysis results (see Table 5) will be used as a framework for the empirical research, which will be concentrated on Lithuania's ICT market. The IT sector was selected because it is one of the most dynamic sectors in Lithuania, and the need to identify the occurring challenges while developing products from technology-push and market-pull is highly needed. The research question is to identify the product development challenges of technology-push and market-pull approaches and propose managerial solutions to overcome them in the Lithuanian ICT business. The empirical research will also check if the theoretical part challenges are relevant in the Lithuanian ICT businesses.

3. Research methodology

In this chapter, I will present the research aim, object, and method. In other sections, the research design and analysis of the empirical research data will be discussed. The research design will describe why the qualitative research method was selected; the research sample will describe what companies were interviewed and how the respondents were selected—also, the research instrument and research ethics are described. The analysis of the empirical research will describe the benefits of using MAXQDA software.

The aim of the empirical research is to substantiate the methodology for the identification of preconditions to successfully overcome the challenges in technology-push, and market-pull product development approaches in Lithuanian ICT business companies

Research object: challenges of Lithuanian ICT companies.

Research method: Semi-structured interview was chosen for the empirical part of the thesis as it allows the interviewer to feel accessible throughout the interview, if necessary, to clarify the interview details and analyze the topics discussed in more detail. It helps to saturate the conversation with the necessary information to determine the informant's broader view of the issue at hand.

Selection of respondents: snowball

The respondents were selected from the ICT companies that explicitly expressed technology-push and market-pull approaches. The snowball respondent selection method was selected in this thesis. "This method relies on referrals from initially sampled respondents to other persons believed to have the characteristic of interest" (Johnson, 2014). It helped to get the most relevant interviewees for the empirical research. The first respondent was the owner of the company, which applied the technology-push approach. The respondent recommended the other respondents. The same applied to the market-pull approach.

3.1. Research design

Qualitative research was chosen to reduce subjectivity. When asked closed questions, their answers are usually yes or no or have some value between them. In a qualitative study, by interviewing the survey participants, there is an opportunity to determine the sector's actual situation, problems, assess their relevance, and discuss current, possible, planned, or already implemented solutions to problems. The qualitative interviews will help to reveal the real and actual problems. The collected real problems and possible solutions might be applied practically. It will broaden already collected information in the problem analysis and theoretical parts.

The method of data collection for the study was a semi-structured interview. Based on Gaižauskaitė and Vėlavičienė (2016), the qualitative interviews gather participants' answers that are deeply related to the context and express their opinions, attitudes, knowledge. The essence of the semi-structured interview method used in the research is to interview by asking pre-prepared questions while retaining the possibility to change and supplement the questions list during the interview. This method allows flexibility to adapt to the participant's pace, thus answering as much information as possible. This interview method may change the order of the questions, the wording, and the interviewer (interviewer/taker) may ask clarifying questions not included in the pre-prepared questionnaire. A semi-structured interview allows the interviewer to feel accessible throughout the interview, if

necessary, to clarify the interview details and analyze the topics discussed in more detail. It helps to saturate the conversation with the necessary information to determine the informant's broader view of the issue at hand.

Qualitative research was selected to analyze companies' decisions that are applied to reduce the consequences of these challenges, the losses they cause, and the impact on the company's image. Qualitative research was selected to ensure the respondents' objective opinion about the sector's current state, assess their relevance, discuss live possible, planned, or already implemented solutions to problems. "Qualitative research is an interpretive attitude about the world "(Žydžiūnaitė Vilma & Sabaliauskas Stanislav, 2017). Therefore, when choosing this methodological approach, the research results will be based on the self-reflections of the informants, work experience, saturated with the respondents' opinion.

This master thesis will gather qualitative interviews from experts in the ICT business companies who work with technology-push and market-pull business solutions. The problems found in theory will be validated in the interviews, and the additional not mentioned problems might occur during the research. This research will help get more familiar with the local market's challenges. The research aims to determine the main barriers/challenges faced by technology-push and market-pull businesses and what managerial actions could be applied to overcome these barriers in ICT sector companies.

Qualitative analysis of the research was selected to identify the challenges faced by Lithuanian ICT companies that are applied technology-push and market-pull approaches. This method reveals the company's employees' experience and attitudes and assessing emerging challenges and solutions. The collected qualitative data (information) reveals not the facts and statistics, but experiences and meaning of the processes for the respondents (Žydžiūnaitė Vilma & Sabaliauskas Stanislav, 2017). The ongoing survey interviewed representatives of ICT companies who face these challenges daily, so the responses were based on their examples, opinions, and objective assessments of the problem.

Research sample

The respondents were selected from the ICT companies that explicitly expressed technology-push and market-pull approaches. The snowball respondent selection method was selected in this thesis. "This method relies on referrals from initially sampled respondents to other persons believed to have the characteristic of interest" (Johnson, 2014). It helped to get the most relevant interviewees for the empirical research. The first respondent was the owner of the company, which applied the technology-push approach. The respondent recommended the other respondents. The same applied to the market-pull approach.

The interview flow was semi-structured. The first thing I tried to gather is gathering the information with what product the company is working on and identifying and validating the type of approach: the company applied the technology-push or market-pull approach. Another question was what challenges do the company face. It was an open question to gather as much information as possible and know what part of the questionnaire suits them best. In the end, the respondent was asked to recommend the companies and the respondents to help on this research.

The ICT sector was chosen because both technology-push and market-pull approaches are clearly articulated in the companies of this sector. ICT solutions have a massive impact on the economy and are trending. This research paper will interview technology-push and market-pull companies in order to. The companies will be interviewed anonymously to prevent the loss of sensitive data from interviewed companies. This study will compare the surveyed companies, analyze what problems they face, and discuss the solutions used by technology push and market pull companies to overcome the barriers they face in product development.

According to a TNS LT survey, Lithuania's reputation for information technology is at the top of Europe. At the time of writing, i.e., In 2015, 1017 business enterprises and public institutions were surveyed. The results showed that: The Lithuanian ICT Reputation Index reached 67 points, while the European average was only 56 points (TNS LT, 2015). Neighbor Latvia scored 54 points. The survey shows that individuals and companies trust the information technology services provided.

Information technology was chosen because it occupies an important place in the Lithuanian economy and is one of the fastest-growing sectors. High qualifications of information technology specialists and extensive experience contribute to the rapid growth of the sector. In 2018, this sector generated 682 million Eur value (VšĮ Versli Lietuva, 2020). The ICT sector is one of the most minor compared to other European countries. Small and tiny companies dominate the Lithuanian information technology sector. Of course, there are small companies, but fewer. In 2018, exports of the ICT sector amounted to LTL 476 million. Eur (22 percent more than in 2017). In terms of 2015-2018, the total amount of exports of services in the sector increased by 189 percent or an average of 42.5 percent annually (VšĮ Versli Lietuva, 2020). In 2018, the main export partners were the USA (117 million euros, 8.4 percent of exports), Ireland (69 million euros), and the United Kingdom (49 million euros). These three countries accounted for half of the Lithuanian sector's exports in 2018.

Lithuania's relative investment is one of the largest among European countries (Figure 11). It is measured by the ratio of gross fixed capital formation to value-added). Lithuania is in the 6th position in terms of the number of investments among European countries.

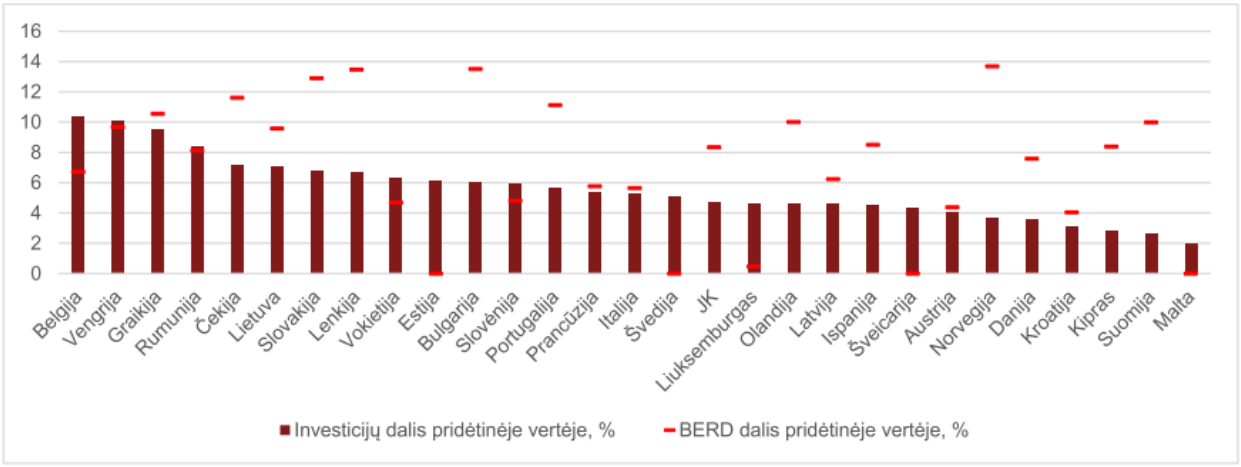

Figure 13 Gross investment intangible fixed assets in the ICT sector and investment in R&D by businesses (VšĮ Versli Lietuva, 2020)

Research ethics

Interviews data were anonymized to prevent possible sensitive data losses. The respondents were informed that information about the interviews would be anonymized, and the data will be used in this master thesis. The titles of the companies were renames to reveal only the name of approach and the number of the respondent like T1 (Technology-push respondent number 1)

Research instrument

The interview will consist of questions with existing challenges in market-oriented and product-oriented markets. Persons will be asked do they have a similar problem, and if yes, how do they solve them. Also, the interview will consist of open questions too, to get more details about the situation.

In Table 6, the interview questions are listed. The table consists of three groups. The first one is the introduction, where the customer is asked about their product and open questions to gather their occurring challenges and possible solutions. Every mentioned challenge is discussed in depth. The second group – product development problems, are devoted to gathering the most actual ICT-related problems. The third part will ask the respondent about the research and development in the company.

Table 6 The interview questions

Group	**Question**	**Meaning of the question**
Introduction	Could you tell me about the product you are developing?	To identify what approach is applied in the company
	What challenges do you face? How do you deal with them?	Open question to gather the all challenges they are facing.
	What contingency plan do you have in case there is a problem with the project with the initially planned technology?	How do they manage occurred challenges?
Product development problems	How do you protect your intellectual property?	The relationship with the theory. Do the companies face the problems mentioned in the theory part.
	What privacy challenges does your company face?	
	What security challenges does your company face?	
	Is your company facing a data management and distribution problem? How do you deal with it?	
	Is your company facing the problem of processing large amounts of data? How do you deal with it?	
	Are you facing a commercialization problem?	
	Are software developers facing technological implementation issues?	

	How do you plan your time? Are you facing time management challenges?	
	Is there a specialization challenge in your company? (relevant for small businesses, a person has to cover many areas, cannot focus on one due to, for example, lack of staff. Tech-debt deteriorates code quality. The faster product preparation with lower code quality.)	
	Do you face challenges in communicating with professionals from other companies?	
	Are you facing changing customer software requirements?	
	Are you facing technological implementation issues in product development?	
	What do you do if you get stuck with the essential feasibility of product functionality?	
	How do you plan your projects? Maybe you are using some model?	
	How is the project launch time is estimated?	
	What are the steps to launch a product?	
	How do you prepare your customer for a new product?	
	Does your product need to change customer behavior? How? For what reasons?	
	Are you facing sales market fluctuations? What affects it? How do you solve this problem?	
Research and development	How do you research the market? What challenges occur during the market analysis?	To reveal the challenges occurring in the development research.
	Are you having trouble identifying your customer?	
	How to refine the real needs of customers?	
	How do you validate and select ideas?	
	What is the duration of R&D, what determines it?	
	Do you involve the customer in the R&D process? How?	

3.2. Analysis of the empirical research data

All interviews were transcribed from the speech to the text. The interviews' transcripts were processed and coded using the MAXQDA software. The data is analyzed and coded separately for the technology-push and market-pull approaches.

MAXQDA software allows the creation of various visualizations of the data. It is a powerful tool used in qualitative data analysis. It offers a visual representation of the coded data. In this case, the code matrix visual option is the most informative. The Columns are the interview files and the rows the codes. MAXQDA software helped to classify the data with codes and manage the data more efficiently. With the aggregated data will be possible to make various analysis. It can help to count the code frequencies, create a code matrix, max maps.

The MAXQDA software allowed to detect frequencies of the challenges occurring in the companies that applied technology-push and market-pull approaches. The frequencies are named as "Code matrix" in the MAXQDA software. The challenges, frequencies, and the respondents are listed in the table. Such a table is used in the fourth section.

Limitations of the research: A more significant amount of interviews and respondents would be needed to enhance this research. The other business groups like startups, traditional companies, international companies could be added and interviewed to enrich the research and get more familiar with the broader scope of the business.

4. Results of the empirical research

In this chapter of the thesis, the occurring challenges in technology-push and market-pull companies in IT companies of Lithuania will be analyzed. It will help to reveal the actual problems and gather or propose possible managerial solutions to overcome the occurring challenges in this sector.

4.1. Research findings

Descriptive data

The interviews are taken anonymously to prevent exposing the persons' identity and prevent possible sensitive data loss. The Interviewed companies list is defined in Table 6. There are interviewed four technology-push companies and three market-pull companies. The table consists of the supposed name of the company, where the first letters of the abbreviation mean the company orientation (T- technology-push and M- market-pull). The interviewed persons‘ education level is also noted in the table.

Table 7 List of interviewed companies

Respondent number	The supposed name of the company	Company focus	Education
1	T1	Technology-push	University education
2	T2	Technology-push	University education
3	T3	Technology-push	University education
4	T4	Technology-push	University education
5	M1	Market-pull	University education
6	M2	Market-pull	University education
7	M3	Market-pull	University education

4.1.1. Managerial solutions for overcoming product development challenges of the Technology-push approach

This section will describe the solutions for the most frequent product development challenges of the companies that applied the technology-push approach. This part will provide the frequency table of product development challenges.

Figure 15 represents challenges occurring in technology-push companies. The most common problem detected in all technology push companies is a data processing and distribution challenge (4/4 companies). The second is commercialization (3/4 companies), The third lack of knowledge (2/4 companies). The fourth is client-related problems (2/4 companies), and the fifth funding challenges(2/4 companies). The numbers in rectangles mean the strength of the challenge (coding frequency) in the respondent interview. The higher the number of the challenge, the more significant it is to the respondent.

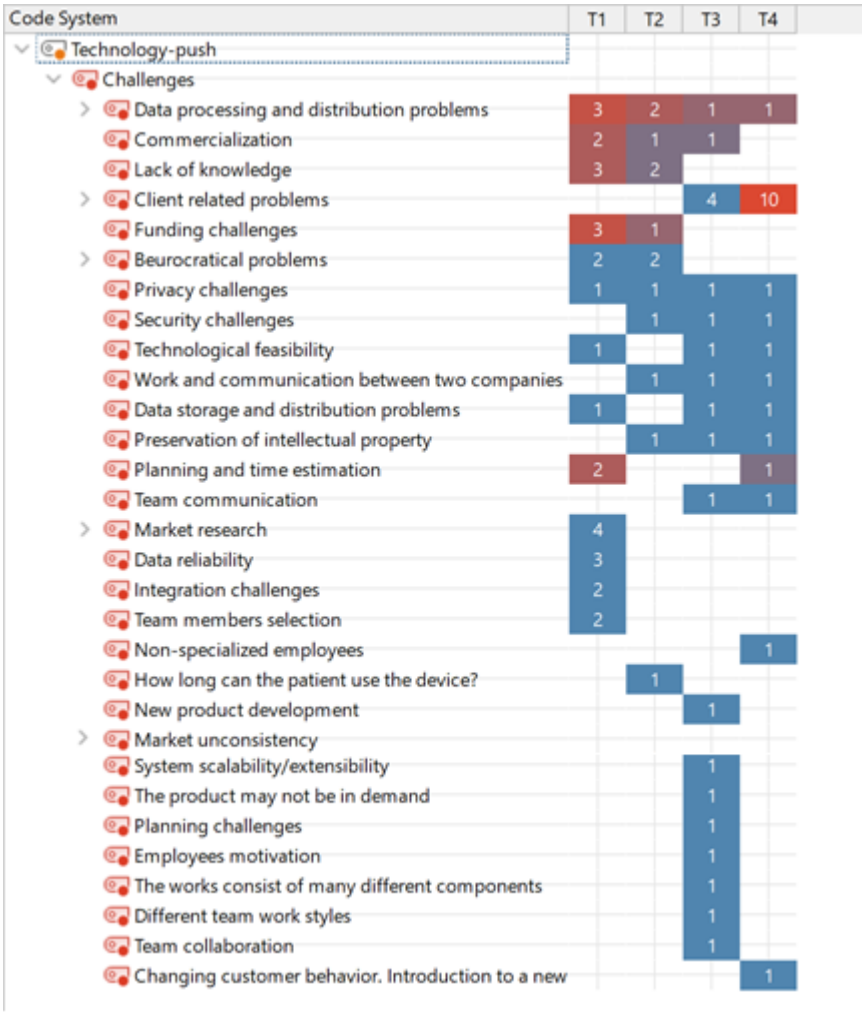

Figure 14 The product development challenges‘ intensity of companies applied technology-push approach

The data processing and distribution challenge was expressed highly in all companies that applied technology-push approach. T1 respondent mentioned that „For us as artificial intelligence startup the data is very important“ so data processing challenge occurs on the go.

Figure 15 represents the frequency of the coded Technology-push challenges. The weight of the line represents the strength of the frequency. The higher the weight, the more occurrences are in the interview text.

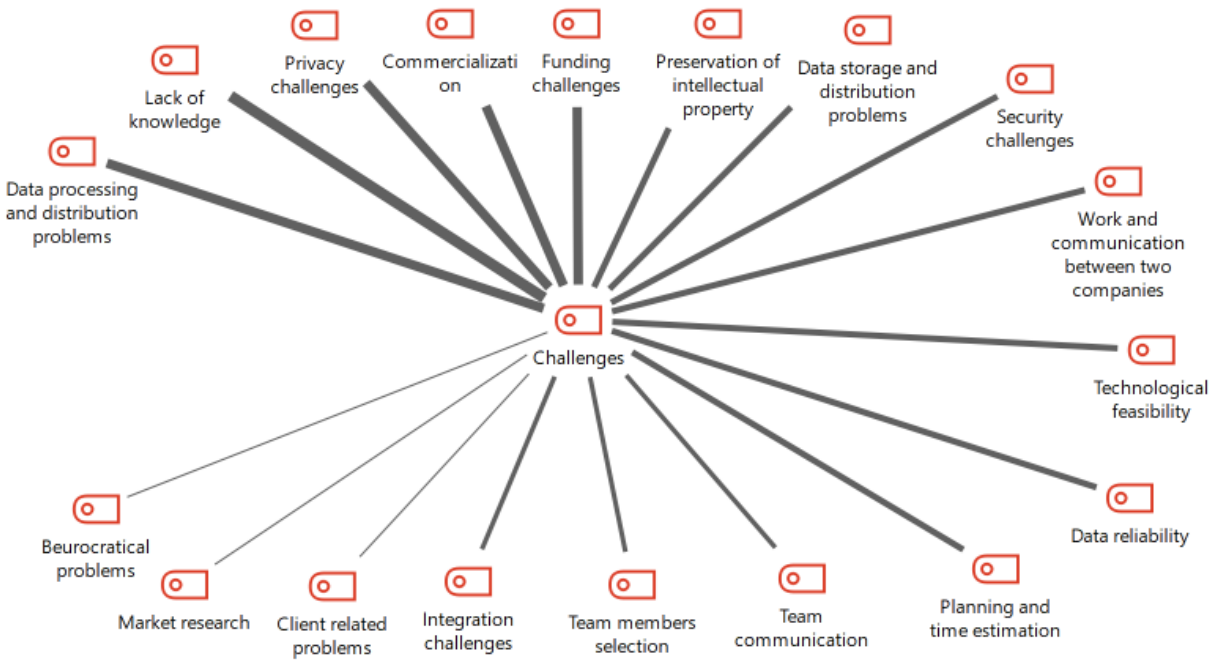

Figure 15 Product development challenges listed by frequency of the companies applied technology-push approach

The highest intensity is in data processing and distribution, because the all 4 interviewed companies that applied technology-push approach faces this challenge. The IT companies are gathering the large amounts of data and are having difficulties to manage and process the data. The second is the lack of knowledge. The technology-push companies are the first companies who solves the unsolved problem, so they are frequently facing lack of knowledge challenge.

Solution for challenge: not able to manage large amounts of data necessary for efficient system performance (data processing and distribution)

The most relevant challenge for all interview technology-push companies is data processing and distribution. 4/4 technology-push companies faced this challenge. The data processing and distribution challenge occurs when the big amount of data are generated and the company is not able to able to process them on time or properly as they should be processed. With the emergence of new devices, the amount of generated data also increased accordingly.

T1 company, which analyzes x-ray photos of animals and tries to find various pathologies, has mentioned how they solve this data processing and distribution problem

„For us as artificial intelligence startup the data is very important" mentions T1. When data is one of the top values of the companies the company can react to the changes in the consistency and the processing speed very sensitively. This artificial intelligence startup processes a lot of images, the processing must be fast and accurate to provide the accurate name of the pathology for doctors and other users.

T1 company uses cloud services to scale and process large amounts of data efficiently. There are many cloud providers, but the „Google Cloud" was used in this case. „Google Cloud" provides various services according to the customers' needs. The supply is enormous. They use „Google Cloud" for hosting and processing image data. The T1 company also improves the local servers' hardware to work well. The respondent mentioned that they had enhanced their GPU (graphic processing unit) card to process the images faster.

T1 company faces problems with artificial intelligence models. The company can not always trust the results and accuracy. The models require constant development and many photos of pathologies.

"We are facing problems with artificial intelligence model reliability. It needs to be developed constantly what is complicated task" says T1. The model helps to analyze the data and propose the pathologies suggestions. The pathology is showed with the best match. The company has "... full stack vets, who works with the x-ray photos their tagging and segmentation". – T1

The full stack vet doctors write the comments on the photos and learn the model. The model is learned by uploading the photo to the system. If the system suggests the wrong diagnosis the doctor corrects it. The constant work enhances the model's accuracy. This constant work is expensive.

The T1 company mentioned that the development is costly. The company has to develop the model, invest in the research, and purchase the photos and pay for the doctors to enter them into the system name the pathology appropriately.

"We are purchasing photos from the clinics and they are quite expensive. It is not surprising that artificial intelligence solutions are so expensive." – T1

T2 company emphasized that their device constantly needs to analyze much information. They are analyzing the body movements as the many of us can guess the people makes ton of the during the day. T2 respondent mentions that

„Whereas, our own product only receives data from sensor data. The challenge is how to properly fit those data, how to segment them, and how to classify them. Because there are so many human movements, that is why the problem arises as to how detailed we want to analyze them. This results in a data processing problem and their distribution.“ – T2

Currently, the product does not have any connection with the internet, but it is planned to implement it in the future. The data needs to be saved locally. The microcontrollers have limited space and resources, so the algorithm must be written appropriately and lightweight. The respondent mentions that the data distribution challenge also occurs because the company is not sure what is the best way to classify and store data.

T3 company does not face the data processing challenge in terms of speed, but they face the problem in terms of price.

„We don't really have performance issues, but they do come at a price. When large amounts of data need to be processed. We can process terabytes of data per day through Cloud servers, but it is very expensive. Well the problem of price and quantity is getting (scalability)“.– T3

The large amounts of data cost a lot to be processed appropriately. The company uses cloud services to process the data and store them, but the quotas are expensive in data processing. The limiting factor for T3 company to analyze data constantly is the enormous amounts of data and accumulated price.

Figure 16 represents the data **processing and storage challenges and the solution that could be used to overcome them .** These two challenges has the another related connection, the larger the amounts of the data, the larger the price to process that data. The available solution for both challenges are cloud solutions. Not appropriately created storage can cause the slow system performance and the data processing will get slow. The storage of large amounts of data and the processing of the costs a lot of money. The company needs to decide is it worth it or prioritize some sections of the data analysis. For both challenges inability to process data and inability to store data the cloud solutions implementation can help. The cloud solutions offer the scalability when you can enlarge the processing power on the demand, also you can shrink it too. The cloud servers are very accessible and is lower chance that your server gets out of the service and not responsive

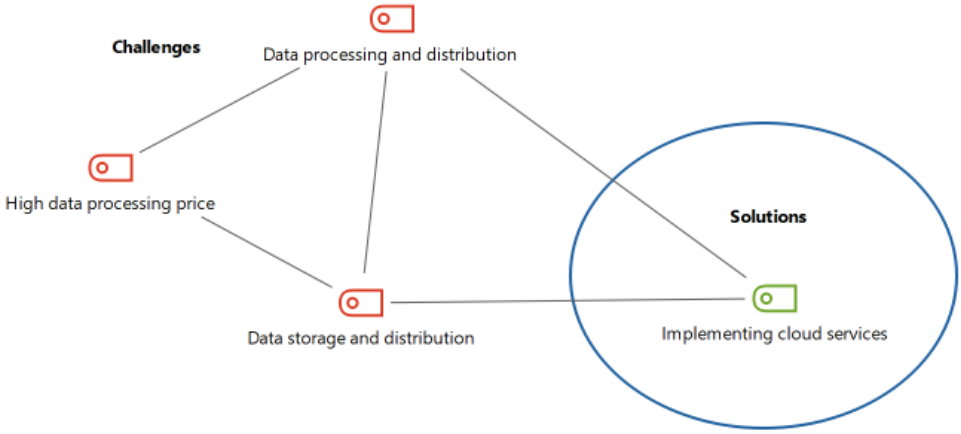

Figure 16. The solution to data processing and storage challenge for the companies applied technology-push approach

All technology-push companies that have participated in the research have faced data processing and distribution challenges. The challenge occurs when external devices or services generate large amounts of data. Companies use various cloud services to solve the data processing challenge. There is mentioned „Google Cloud“ platform, but there are other alternatives like „Amazon AWS“, „Microsoft Azure“. The cloud services let to analyze data faster and offer storage. Cloud services can be extended and scaled very quickly. Some companies also need graphic processing power. The cloud computing platforms offer various packages for various use cases; in this case, they could offer the GPU (graphic processing unit) computation power. The cloud services are accessible all the time, 24/7.

Solution for challenge: not able to successfully commercialize the product to the market (commercialization)

Three of four companies are facing commercialization challenges. Commercialization is a process when the created product is hard to sell. T1 company is a startup that analyzes the animals' x-ray photos and warns the user if the pathology is detected.

"Our product needs more functionality, more convenience. And then we will be able to commercialize it. Because on the business side, we have a team that educates a lot about this project and writes various posts and contacts the clinics themselves. However, the product itself is still missing. So we can really trust those products to integrate and sell them" -T1

Currently, they are focused on the joins. T1 struggles with the commercialization problem because they do not know a lot about selling the product because the selling is not even started.

The respondent mentioned that it is tough to forecast the possible demand and the number of purchases. T1 mentions that they need to develop further their product to fulfill the needs of the customer. The application is lacking trust in calculations. The T1 respondent mentioned that they could commercialize the product only then the product is more accurate in the pathologies predictions. T1 already has contracts with medical institutions worldwide, but at the current stage, they can not ask the clients for the money because the product does not deliver all customers' needs. They are trying to get as many contracts as possible and increase the number of integrations.

T2 company is also in the start-up stage. The product is in development.

"At the moment, our product is not for sale, however, I see that there will most likely be a problem with the sale, namely from the point of view of quantity. The price of the product is expected to be high, it would be around € 5,000 per unit so automatically want to assume some people will not be able to buy it for that price. We plan to contact the health insurance funds for funding on this issue. In the future, I see potential bureaucratic problems in working with public bodies, as it is not very easy to talk to them."- T2

The problem of commercialization comes from the unfinished product and the high predicted price. One kit to help to reduce unconscious muscle movements will cost around 5000€. This price is high and not easily affordable for everyone. T2 company is planning to ask the government health institution (in Lithuanian "Valstybinė ligonių kasa") for possible funding or partial compensation. The compensation will make the product more affordable for more significant amounts of people.

T3 company faced the commercialization problem only at the beginning of the business. The respondent emphasizes the benefits of the startup - „I think that the success came from here. The respondent means that their state as a startup helped them dominate the market and get a considerable market share and reduce the competitors. The startup companies are small but very flexible. The flexibility helps to deliver a product or features faster than corporates. This competitive advantage helped the company to became the market leader and became corporate. ". Also, they were one of the first companies offering this service in the market. T3 company collected as many positive reviews as possible on Amazon and other websites. It helped them to make the brand more recognizable and trustable. Currently, the company tries to save the existing market share and to increase it.

Figure 17 represents the extracted solutions of the experts‘ interviews for the commercialization problem. Companies should be flexible and able to adapt to the change of the customers‘ in a short period of time. It might help to dominate the market. The startup stage of the company has a positive effect on performance. The startups are more agile and flexible compare with the corporates. The companies which need the additional funding may ask the government‘s help. The government might help reduce the price for the customers and increase the benefit for the company (VLK). The companies should seek to get the best reviews and feedback from the customer and deliver high-quality customer support service.

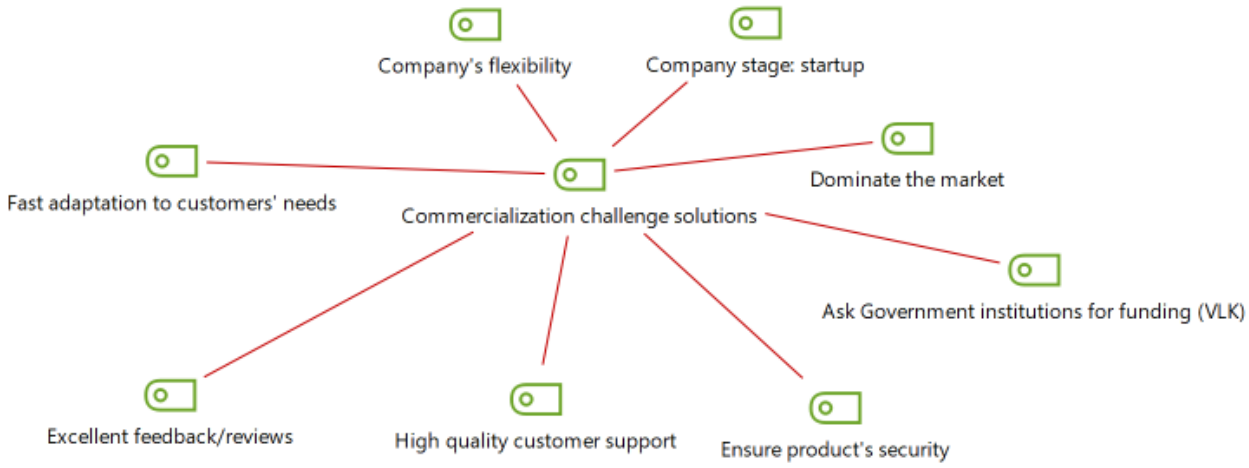

Figure 17 The solutions of commercialization challenge for companies applied technology-push approach

The commercialization problem is primarily relevant for young companies. Three of four technology-push companies faced the commercialization challenge. 2/3 companies have not even started commercializing the product due to a lack of completeness of the product. One company mentioned the positive connection between commercialization and business startup. The companies are trying to overcome the commercialization problem by increasing the number of contracts, asking the government for compensation for expensive medical devices, increasing brand awareness, and creating the product's trust.

Solution for challenge: The companies are lacking of knowledge

Two of four technology-push companies have to face the lack of knowledge challenge. The new product development requires much information and new unseen technological solutions. The companies that work with emerging technologies are lacking documentation and articles. T1 respondent emphasizes that there is a challenge to refine the data and choose the one and ensure its validity.

“It’s always hard to find that data and refine exactly what you need. This needs to be done every time it is re-applied. Add and fix something. You always want to base everything on some scientific articles or statistics, but you don’t always manage to do that. You need to calculate quality denominators yourself and the like. Then you get that data taken from Eurostat because you can't get it other than you do. But from this, perhaps, there is also the problem that those data are not completely reliable. But you still have to get them and rely on them.” - T1

The respondent mentions that the data and researches are conducted inside the company if the external data is not found or the validity is grounded. T1 company solves the lack of knowledge challenge by having high qualification specialists in IT, vets, and media.

"We have four IT people, we have full stack veterinarians who work with photos, their tagging, segmentation. We still have a media team that also does business development work" – T1

The T3 respondent of the technology-push company emphasizes the importance of occurring challenges. The interviewed person emphasizes that one of the biggest challenges is to create a brand-new product in the whole market. We are the persons who must solve the occurred problems first, without any examples and guidance. "There is no reference point" - mentions the T3 representative. It is a good challenge but requires a lot of effort and knowledge. We make impossible – possible.

"One of the biggest challenges in general is producing what is not yet on the market when there is no starting point. Let's call it an innovation problem where innovation is needed. It's such a challenge, but it's a good challenge. When you ask people, you can sometimes say that your idea is impossible or too difficult to implement or not valid, but implement it afterwards. Such a challenge is the implementation of the impossible" -T3

The company T2 creates a product that helps to reduce the unconscious movements of the human muscles. The challenge appears from the technological and medical sides. The human body is susceptible, and every electric impulse must be under control. The company T2 lacks medical knowledge.

"Sometimes there is a miscommunication about terminology because as far as I have come across in medicine there is very strict terminology and one word can change the whole point. There have been problems with doctors when it comes to problems with terminology, and I would like to communicate in a language we understand. For that reason, I had picked up a module on human anatomy and physiology, which helped me talk to doctors and understand their terminology" – T2

They lack a doctor or person who understands the medicine very well. They are communicating with doctors, but it is pretty slow. The doctors cost a lot, so the startup does not have enough money for them. The Owner of T2 has taken a few courses in the medical school (LSMU) to get more familiar with the medical terminology of the medicine, understand the human body, and ease communication with the medical staff. The T2 also faces a lack of bureaucratic knowledge. It is hard to communicate with government companies and fulfill their requirements. The lack of knowledge extends the duration of the product delivery.

"In the future, I see potential bureaucratic problems in working with public bodies, as it is not very easy to talk to them." – T2

The T4 did not emphasize the lack of knowledge significant in their company but have told few solutions they are applying. The T4 company implements very specialized teams. The team members usually have only one field where they focus and are professionals.

"Our teams are platformed. There are sales people who are responsible for sales, communication with customers. Next are programmers, project managers, testers, designers. Specialists are specialized in their technology such as websites, mobile apps, cross-platform systems, back-end. There are specialized people everywhere." – T4

Figure 18 represents the relationship between the lack of knowledge challenge and other challenges. Lack of knowledge challenge has an impact from and on communication, privacy, funding, commercialization.

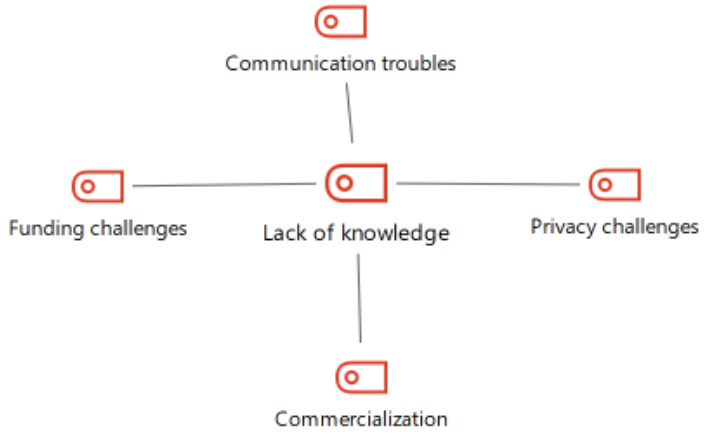

Figure 18 Lack of knowledge challenge‘s relationship with other challenges in product development of the companies applying technology-push approach

Figure 19 represents the possible solutions for the lack of knowledge challenge. The available solutions are employing the specialist the team of the desired profession, consultations with specialists, specializing the teams, enrolling in various courses online or in the university to learn new skills.

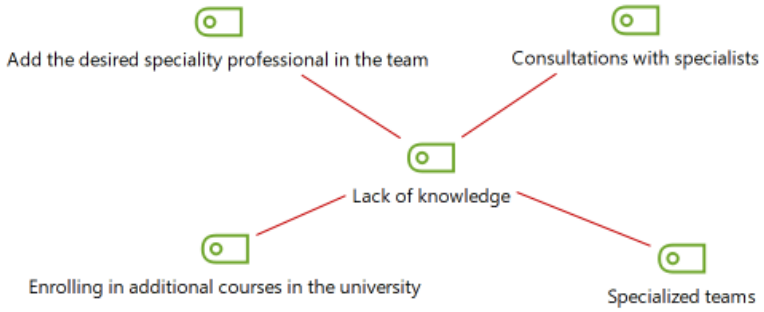

Figure 19 Solutions to lack of knowledge challenge for the companies applied technology-push approach

Without the knowledge, new product development is not possible. The knowledge can be accumulated in the company and transferred from one to another. The search for new technological or other data is challenging. The companies use various sources of the data and are sometimes struggling with the trust and validity of the data. The companies are using various solutions to overcome the lack of knowledge challenge. The most common is to employ professional employees, ensuring their specialization, because broad scope can reduce the quality of the product and increase

the delivery time. One company has noted the challenge in understanding the bureaucratic, medical fields. The appropriate consultations are purchased to get more familiar with the field.

Solution for challenge: improper communication and collaboration within teams

Technology push companies are facing the communication and collaboration challenge. The communication related with the customers are expressed in 2 of 4 companies; work and communication between two companies are expressed in 3 of 4 technology-push companies. The communication is an essential part of the proper functioning company and high performance.

T3 company faces communication and collaboration challenges in the teams. The representative mentions four teams in our company, and there are difficulties in guiding the appropriate communication. The working styles of the teams are different, and it is pretty hard to find the middle. It takes time to put everything in its place, organize and optimize.

"Team communication or collaboration is a difficult thing especially when many components are involved in the implementation of the whole project. The styles of each team are different, different responsibilities to coordinate it all, optimizing it to work optimally for both sprinting and product delivery is quite a challenge" – T3

T3 mentions that he needs to calm down the various fluctuation in his team life as a manager. The rule of thumb does not to overpromise things, so there will not be feasibility problems and be honest with the customers. This combination will help to prevent many occurring challenges. It can be called expectation management.

T3 company solves communication and collaboration problems by managing the meetings and using the software programs to have a platform to communicate and track the existing tasks.

"One solution is to build more responsible communication channels between teams because there are two things: either you invite too many people to the meeting, half of whom are listening passively and to no avail, or you include only a few people who really need it in the meeting. Work planning involving people who really need it and such responsible planning (approach)" – T3

T3 only invites the required people in meetings, so the communication becomes more effective. The meetings take less time, and any inactive persons do not participate in the conversation. The not necessary people for the meeting can work on their work and do not waste their time. This company uses the software "Slack" for internal communication. It allows the creation of various channels for various teams. It is easy to use and very extensible. For tasks management, the "Jira" is used.

This company, as a startup, grow very fast, eliminated the competitors, and became a corporation. The startups are flexible and agile, which helps to grow faster than big companies.

4.1.2. Managerial solutions to product development challenges of Market-pull approach

The conducted interviews with the experts of ICT companies revealed the most frequent problems occurring in the ICT field. Data processing and systematization using MAXQDA software helped to reveal the mostly expressed problems occurring in companies what applied market-oriented approach. Figure 16 represents the most frequent challenges occurring in the market-pull approach, the challenges are listed by the frequency. The higher the frequency of the product development challenge in the companies and the larger amount of the companies faced the problem - the higher is the significance of the challenge. For example, the M1 company has expressed the client related challenges with very high significance and other two companies also have faced the problem, it means that overall significance is high because all the companies are facing the same challenge and it is highly expressed. This chapter analyzes the most frequent challenges and suggests the solutions extracted from the experts interviews.

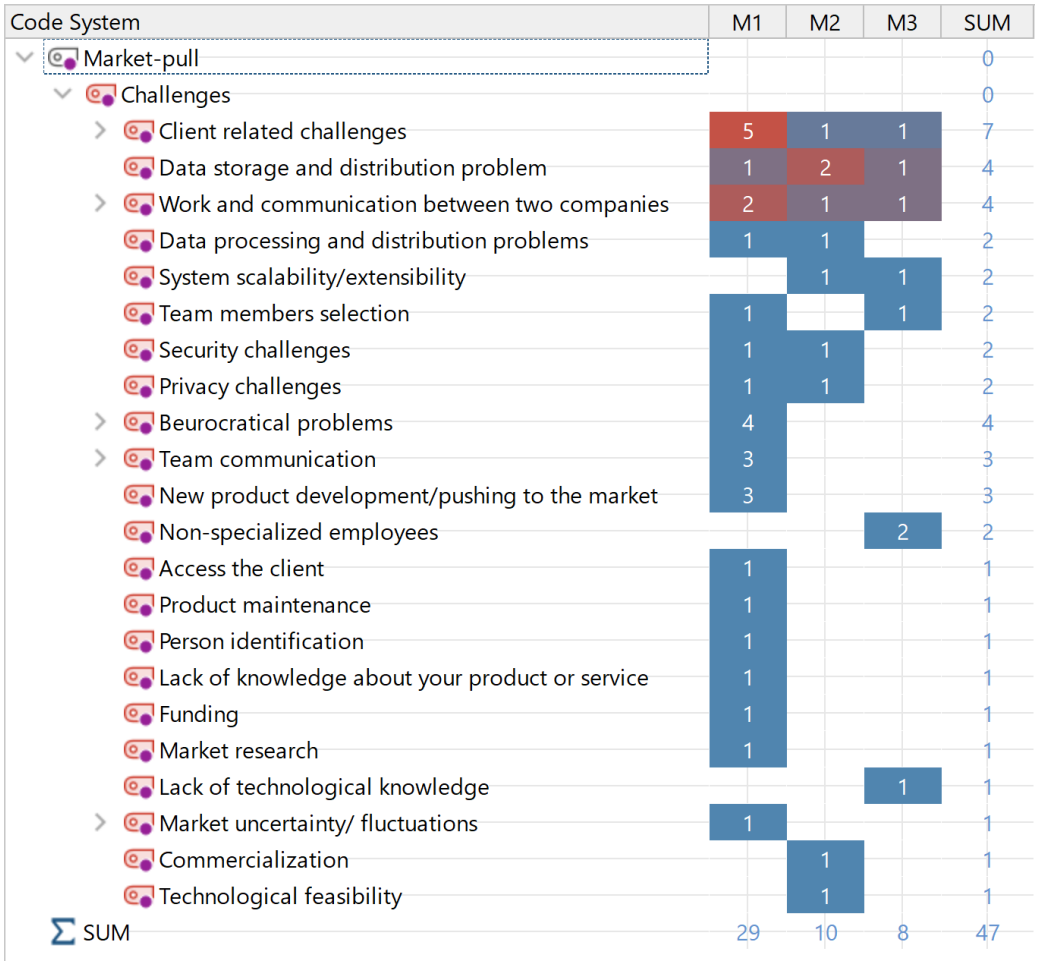

Figure 20 The product development challenges‘ intensity of companies applied market-pull approach

Figure 16 represents the challenges faced by market-pull companies. The most significant challenge is to deal with clients (3/3 companies). The second challenge is to store data and distribute it (3/3 companies) properly. The third work and communication between two companies (3/3 companies). The fourth data processing and distribution, system scalability, team members selection, security, privacy challenges (2/3). The M1 company showed high significance in bureaucracy and government

regulations, also in team communication. The M3 company emphasized the problem of non-specialized professionals in small companies.

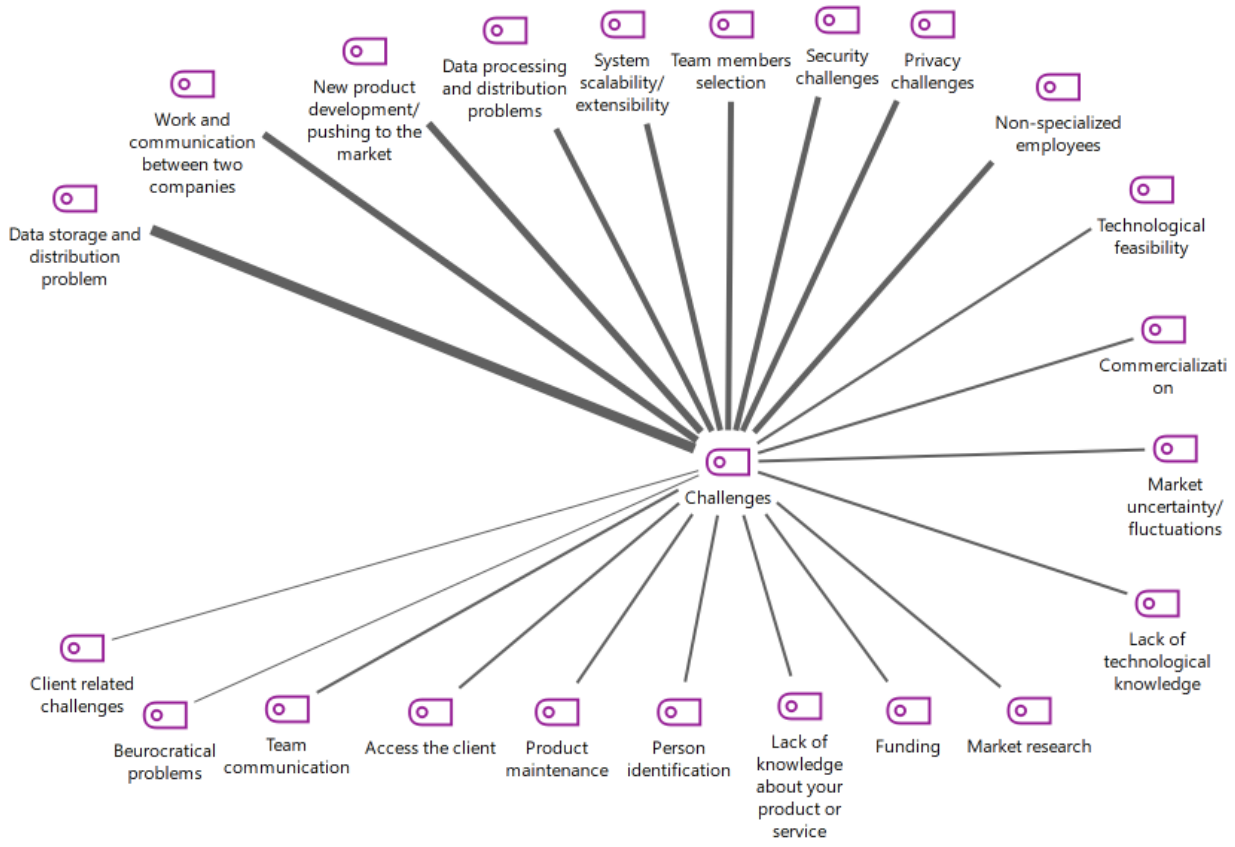

Figure 21 Market-pull challenges listed by frequency.

Figure 17 represents the market-pull challenges by frequency. The line weight represents the frequency. The wider the line the higher the frequency. The most frequent was data storage and distribution challenge. It was because the ICT companies are generating large amounts of data and there occurs difficulty to store and manage the data.

Solution for the challenge: inability to deal with clients: extract their needs and communicate

All market-pull companies have faced various challenges with customers (3/3 companies). The most significant challenge of these is frequently changing customer's needs and requirements. The market is constantly changing, new trends are emerging, the customers dictate new requirements. On the one hand, the client is the value of the company. On the other hand, the challenge. Companies have to work with various age groups, and the marketing, design, the message must be different compared to other groups. The challenge is occurring from the different understanding of the customers. It means that different age groups interpret and understand the products differently, so every product should have its target audience. The older the people, the more conservative they tend to be. They are evaluating the word by their previous experiences.

M1 mentions that they face various client-related problems: frequently changing customer's needs, conservatism, different interpretation of the products, avoidance of complex solutions. M1 company

is working in the IT gambling sector. They face various clients, their needs and behavior change constantly. The representative mentions that people have their preferences and usually chooses the most comfortable one. In most cases, that is the most similar to the environment they have grown in.

"As for the gambling sector, there are certain traditions in certain regions: e.g. a middle-aged or older profile gambler by age group, he is more conservative. As a result, classic slot machines are always more attractive and much easier to understand, which means that they are more popular than modern and state-of-the-art slot machines." – M1

Older people would like to choose the older and more straightforward than a new and modern slot machine. Here comes the role of conservatism too. The clients are afraid of things they do not understand. The older people are based on logic and the youth on the visuals.

"Young people are not focused on the logical side, but on the visual side. Young people basically see with their eyes because he had no experience from before or didn't have any practical examples with whom he grew up, so he's basically focused on what you saw growing up. And so an attitude towards a particular service or product is formed." – M1

M1 mentions that there is a constant change in the market. The Lithuanian automotive market previously was on demand because people did not have proper conditions to buy a car on leasing. The situation today is different. The leasing companies are on-demand, the used car market is declining. The salary, the conditions of the banks are forming new possibilities for the customers and the change of these factors reflects on the client needs. The company adapts the slot machines to the current demands of various age groups, educates the customers, how to use the slot machines, and increases the trust.

M1 also notices the opportunity. The companies who fill the market gap or reduce the complexity are more successful and marked as innovative than others. The respondent, in this case, had a banking app, „Revolut, " which has brought the risk capital investments in cryptocurrencies and gold in a more simplified and affordable way. The people are investing indirectly, and the mirror effect is generated. The „Revolut" creates a possibility to feel how investing feels like and how it works. It simplified the complex investing to understandable to almost everyone.

M2 company mentions that customer's needs change over time. When the software is completed, but the user interface is not convenient, or additional functionality is missing, the new demand originates. The clients' needs, in this case, are incremental or gradual. The company collects the new requirements and tries to implement them on the go.

"We are partially confronted with the changing software requirements of our customers. When the customer sees the finished product, additional requirements for user convenience appear " – M2

M3 mentions that all the systems are based on the customer's needs. Various users have different user interfaces to work more efficiently and effectively. The challenge occurs when the customers' new requirements are given, and the system needs to be extended/scaled. If the customers' needs are collected not accurately initially, it is not easy to extend the existing software architecture.

"In this way, we adapt all systems to the needs of our customers. Managers have a different user interface designed to make it easier to see a variety of statistics, while employees have something else to make it convenient and easy to work with. Hmm, customer needs are changing and this poses

challenges to how to add additional functionality to the existing system architecture without removing the old functionality.“ - M3

All interviewed companies have to face the challenges related to the customers. The most significant challenges are frequently changing customer’s needs, conservatism, different interpretation of the products, avoidance of complex solutions. The customers‘ needs are usually determined by the environment in which they grew. The older people are based on their logic and the youth on the visuals. All companies have noticed the change of customers‘ needs over time. The companies are constantly adapting to the customers, launching new products, and simplifying the existing products in the market to make it more understandable and affordable. The companies are gathering the requirements constantly and launching new features.

Solution to challenge: not able to store data and distribute it

All interview companies have faced data storage and distribution challenge (3/3 companies). All the companies had difficulties implementing and following the regulation launched by European Union – General data protection regulation (GDPR).

The M1 company has mentioned that the company had faced by implementing the GDPR. The company did not have any violations, but the respondent mentions that it is a challenge to ensure proper data storage, security, and accessibility. All data is anonymous, so it is almost impossible or impossible to identify the persons. GDPR is also related to another challenge in the IT financing sector – person identification. The companies have to identify the client before providing services. The company is using this party service to handle the persons’ identification process.

M2 company faces data storage and distribution problems because they lack system scalability. The company collects many data and is not sure how to properly save and classify them. The GDPR made this problem even more acute.

“We are facing a system scalability problem. Architectural problems make it difficult to develop code. The general data protection regulation, which we had to follow was also quite a challenge.” – M2

The main challenges related to data storage in this company are due to incorrect software. There is a linkage between data storage and system architecture. The company tries to classify data by its branches and customers’ roles. The company is planning to shift to the cloud in the next few years.

A large amount of various devices and large amounts of users creates extensive amounts of data. The data needs to be stored, classified, and anonymized to protect the persons’ privacy. The companies have faced GDPR in some terms. The GDPR regulates the proper use and storage of private data of the customer. Companies are facing the data distribution challenge when a large amount of data between servers are generated. Companies can use cloud services to scale and extend the current system quickly. The data storage challenge is related to inappropriate system architecture. If the system is not correctly built, there is a high chance that the company will face data management problems in the future.

Solution for challenge: difficult to work and communicate between two companies

Communication is not an easy task. The communication challenge is noticeable in the companies background also. The companies that focus on their main activity and uses offshoring services are pushed to communicate with the third-party companies and communicate their desired requirements. The relationship between the companies became client and provider. The communication between the client and the seller (in this case provider) is complicated from the previously researched data. A similar process can be applied in this communication too.

M1 company mentioned that they depend on the government institutions' regulations. Communication with them is crucial. All the products and services are created according to the regulations. The discussion between the government and institutions should be introduced if needed.

"Depending on the regulation, you choose the product or service you want to introduce and then see what challenges await you on the regulatory side. This is one of those challenges from the regulatory environment and you checking do you meet their requirements" – M1

M2 company faces the communication challenge between two companies, but it is more concentrated on the solutions. They are applying self-control checks to validate the gathered data. The other company is listened to and asked questions to ensure they are on the same page.

"We do, self-control, listen, describe how we understood and checked with the client, whether we understood the task correctly." – M2

M3 company faced communication challenges when the developers had too many responsibilities. The developers were responsible for creating the product on various platforms, communicating with the customers, and sketching the designs. M3 company emphasized that the difficulty was to gather their requirements. They lacked time, and it could be the factor that might affect the communication.

Communication is an essential part of the business to success. Communication between companies is as challenging as communication with customers. The factors of gathering clients' needs apply here too. The companies are trying to validate the collected requirements by asking open questions, introducing self-checks. The companies have to have a person devoted to communicating between the two or more companies. The M3 example has shown the example of adding to multiple responsibilities from coding to requirements gathering and design sketching.

"We were two Android programmers and one back-end programmer. The guide for Android programmers said well, you made the app on the Android platform, now do it on iOS. And of course, we needed to learn that technology and as a result, we didn't do the job as well as a specialized iOS programmer would have done. Well we couldn't specialize in one area. We had to cover many areas including testing, design and communication with customers. Very little time was devoted to programming, as it was necessary to communicate with customers, refine their requirements, communicate how the program works. In other words, a lot of responsibilities." – M3

The employees should be specified, and experts in their fields and the responsibilities should be evaluated. Too high responsibilities can cause the employees' burnout what would damage the health of the person and overall productivity.

4.2. **Discussion**

Technology-push and market-pull companies are facing the similar challenges, but they are expressed in different strengths. The empirical research has provided two not discussed challenges in the theory. Lack of knowledge and communication and collaboration. The empirical research suggest to solve the lack of knowledge by employing the specialist where the knowledge gap is and to specialize the employees to more narrow specializations. For communication and collaboration it is recommended to involve only the required persons in the meetings. In the research there was not found any new challenges for the market-pull approach. The research suggested only new solutions: like age differentiation and differentiation by the factors and the environment the customers grow in. Based on the both approaches it is recommended to implement the Agile methodology to extract the customers' needs and adapt to the changes easier.

Table 8 sums up all the challenges collected in the theory section and in empirical research. The table consists of challenges and theoretical and empirical solutions. Some companies did not had the challenge in the theoretical or empirical part, so it is market with dashes ---

Table 8 Results of the empirical research

Approach to product development			
Technology Push			
Category	Challenges	Theoretical Solutions	Empirical solutions
Technological uncertainty	Not able to predict and manage technological feasibility barriers	• Have at least a few alternative solutions • Employ technical team leads (TTL) • Include TTLs in the meetings	• Employ technical team lead
Time to market	Not able to estimate product launch date accurately	• Introducing time planning activities • Implementing Agile method • Implementing self-organized groups from Agile • Evaluate the current market situation and the company's position (leader or follower)	• Implementing Agile method
Intellectual property management	Not able to protect intellectual property	• Implementing patenting • Implementing copyrights	• Implementing licensing • Intellectual agreement
Market research	Not able to extract actual needs of the customer	• Involve the customer	• Implement Agile method

		• Implementing the Agile method	
Commercialization	Not able to successfully commercialize the product to the market	• Conduct market research • Increase the focus on the customers' needs • Fast exploitation	• Collaborate with government institutions for funding • Seek for great reviews of the customers • Implement startup method to gain flexibility
Management of large amounts of data	Not able to manage large amounts of data necessary for efficient system performance	• Employ big data specialists • Improve IT infrastructure	• Implement cloud solutions • Improve software algorithm
Ensuring privacy and security of the data	Inability to ensure privacy and security of the data from hackers and data breaches	• Educate the employees • Implement constant security checks • Encourage anonymization of data • Secure the network • Buy ethical hackers system's vulnerabilities check service	• Anonymize data • Implement "Cloudflare" security
Need for change in customer behavior	Companies are not able to change customer's behavior or are facing difficulties	• Educate and involve the customer to use the new product	• Creating user friendly interface
Lack of knowledge	Lack of knowledge	---	• Employ specialists where the knowledge gap is • Enroll to university modules • Specialize in the specific field
Communication and collaboration	Improper communication and collaboration	---	• Invite only required people in the meetings • Install communication and collaboration applications for internal communication

Market Pull			
Category	Challenges	Theoretical Solutions	
Market research	Not able to extract the actual needs of the customers	• Strengthen communication • Include customers' insights in the product development process • Interview experts in that field (Person who quite close to your market) • Implement questionnaires and pools.	• Implement agile methodology
	Inability to meet frequently changing customers' needs	• Implement Agile methodology • Employ Agile professional	• Encourage openness with the client • Ensure that the customer expectation is realistic
Marketing	The company is trying to target a too broad market	• Customer segmentation. • Selecting the right customer segment	• Differentiate customers by age groups • Differentiate customers by the environment and the situation they grow up
Research and development	Failing to focus on the idea with high potential	• Evaluate an idea using four categories • Evaluate the situation in the market • SWOT analysis • Porter's five model	• Implement Agile methodology • Seek for Minimum viable product (MVP)

The most expressed challenges in technology-push companies are data processing and their distribution, commercialization, lack of knowledge and challenges related to the customer (communication, expressing the needs). The technology-push companies tends to have difficulties with the funding compared to market-pull companies. The companies are struggling with the deficit of money because the companies are constantly researching the fields and trying to solve problems that have never been solved.

The most expressed challenges in market-pull companies are the challenges related to the customers (communication, extracting their needs, adapting the product for different age groups), data storage

and distribution problem, work and communication between two companies, and data processing and distribution challenges. Market pull companies are facing the system scalability more than technology push. It is caused by technological factor. Technology-push companies tend to have more scalable and robust applications compared to market pull.

Both technology-push and market-pull companies are facing IT challenges. The IT challenges are related with data processing and storing, the data privacy and security. The technology-push companies are facing data processing challenge more frequently compared with the market-pull. But market-pull also faces the processing challenge, but it is in 4 place while in technology push in the second place. The respondents use various solutions to store and process the data. The most common solution is using cloud services like „Google Cloud“. The companies can improve their algorithm and to classify the data to reduce the occupying space. The rapid growth of the number of IoT and other IT devices generates massive amounts of data, which must be processed and stored appropriately. The companies should employ the big data specialists to help to analyze the data and transfer the system to the cloud or make it more scalable.

The technology-push companies have faced the communication challenge in the teams and between the other companies. T1 company uses „Jira“ application to manage ant track the priorities and progress in the „Kanban“ boards. The tasks are split to the different “Kanban” board queues (like “Backlog” (the list of all brainstormed functionality to the product), “To do”, “Development”, “Testing”, “Deployment” and “Done”. The yellow sticky note represents the formulated task. The team lead, and the team members are always able to be on the same page and track the changes.

Teamhood.com emphasizes the benefits of the Kanban board (Teamhood.com, 2020). It helps to save time; when the task is moved to the other stage or completed, all related persons are informed automatically. The creation of a virtual task takes seconds compared with the physical on the real board. Kanban board helps manage the remote teams that are trending in the current moment on the COVID-19 pandemic. The manager can assign tasks for specific persons and monitor the progress. This board is accessible 24/7, so no matter what, managers can check the board and track the changes. Also, it comes with beneficial functions like context. Workers can add comments, documents, descriptions to the task, so nothing gets lost. Most of the Kanban providers offer prioritizing task options and integrations with other platforms. It is a great tool, and it can be event used for free with essential functionality. Tools like “Kanban” boards are helping not only in communication, but their primary focus is planning, so the benefits in the planning is also noticeable.

Both technology-push and market-pull approaches faces the product development challenges with customers and extracting their needs. The theory has suggested several models to solve it. The clarification can be accomplished in the new product development where Figure 3 or Figure 4 can be used to narrow customers’ needs to more precise and company goals oriented objective. The company also can use the common solution in the IT industry – Agile methodology. The Agile methodology (Figure 11) has a constant loop of 6 steps. Every time the requirements are collected. The requirements are the formal form of the customer’s needs.

Conclusions and recommendations

1. The problem analysis of the fast-changing and demanding ICT sector of has revealed the challenges companies face in product development when applying tech push or market pull approaches. The growth of the number of devices connected to the internet increase the amounts of generated data that needs to be processed and stored. It causes data processing and data storing challenges for both business orientations. ICT companies are frequently facing security and privacy challenges. In this digital age, security and privacy are the top values in the digital world.
2. Analysis of the scientific literature distinguished the challenges of the companies that applied technology-push and market-pull approaches. Technology-push companies face challenges in the product development such as intellectual property, how to sustain the intellectual property; product launch date estimation; having difficulties to overcome technological feasibility barriers; extracting actual needs of the customers; having difficulties in product commercialization; having difficulties educating and involving the customers to use a newly created product; managing and processing large amounts of data; ensuring privacy and security of the data. The market-pull companies are facing challenges like targeting the right customers' segment; evaluating the idea potential; communicating with the customers and extracting their needs; frequently changing customers' needs. The market-pull companies face also some technology push problems (data management challenges) but at the same time have a more significant impact on the customers, the frequent change of their needs, market research, and ensuring the validity of the research, by selecting the approved data. These all challenges as an effect on an overall product development. Most of the ICT companies related problems could be solved by implementing Agile method in the company that applied technology-push or market-pull approach.
3. The qualitative approach was selected for empirical research in order to identify the key barriers in both approaches and how those barriers / challenges could be overcome by applying appropriate management practices. The respondents were interviewed with semi-structured interviews. 7 experts of the field were interviewer: 4 representatives of companies that applied technology-push approach to product development and 3 representatives of the companies that applied market-pull approach. The interview questions were developed based on the theoretical analysis it was structured in the 3 parts. The interviews were anonymous. The interviews were recorded, then transcribed, and analyzed with MAXQDA software.
4. The recommendations of combined theoretical and empirical results are:
    a. The companies that are facing challenges related to the data management and storage should implement cloud solutions. Cloud solutions are easily scalable and can be expanded on demand. Also, the developers should create extensible system architecture, for easier implementation of new features and develop the algorithm.
    b. The companies what are facing difficulties with customers' needs extraction and frequent change of them; difficulties with planning should implement the Agile method in the company. The companies that implemented Agile methodology more easily deal with changing requirements and customers' needs. The small iterations of 6 steps helps to gather the requirements or react on their change and overall delivery the high-quality software.
    c. The companies facing technological barriers in product development should consider employing technical team lead in include it in the meetings.

d. The companies struggling with the launch time should consider what position do they take. Are they the market leader or the follower. The followers should launch the product later compared to the market leader position.
e. The companies who do not have implemented any segmentation should consider about the segmentation implementation and defining the target audience. The segmentation by the customer age and the factors they grow in could be used for more accurate segmentation.
f. The companies facing communication and collaboration challenges should install in the company the communication and collaboration platforms to enhance the communication. The company should include only necessary people in the meetings, to reduce the distractions and increase the focus.
g. The companies facing inability to sustain intellectual property should consider implementing patenting, copyrights, licensing.
h. The companies that are not able to successfully commercialize the product to the market should collaborate with the government institutions to get funding, seek for great reviews of the customers, implement startup business model to gain more flexibility.

List of references

Aaron, S. (2017). *Americans and Cybersecurity | Pew Research Center*. https://www.pewresearch.org/internet/2017/01/26/americans-and-cybersecurity/

Ameka, I., & Dhewanto, W. (2013). Technology Push vs. Market Pull in Technology University Innovation Commercialization Case Study: ITB. In *Information Management and Business Review* (Vol. 5, Issue 7).

Anurina, O. (2021). *Agile SDLC: How Your Project Can Benefit From This Model*. https://mlsdev.com/blog/agile-sdlc

Atuahene-Gima, K. (1995). An exploratory analysis of the impact of market orientation on new product performance a contingency approach. *The Journal of Product Innovation Management*, *12*(4), 275–293. https://doi.org/10.1016/0737-6782(95)00027-Q

Brem, A., & Voigt, K. I. (2009). Integration of market pull and technology push in the corporate front end and innovation management-Insights from the German software industry. *Technovation*, *29*(5), 351–367. https://doi.org/10.1016/j.technovation.2008.06.003

Business Wire. (n.d.). *Choosing the Right Type of Market Segmentation to Suit Your Marketing Goals | Read Infiniti's Latest Blog for More Insights | Business Wire*. Retrieved February 27, 2021, from https://www.businesswire.com/news/home/20191120005637/en/Choosing-the-Right-Type-of-Market-Segmentation-to-Suit-Your-Marketing-Goals-Read-Infiniti's-Latest-Blog-for-More-Insights

Businesswire.com. (2021). *Global IoT Market & Technology Forecast 2020-2029 - Growth in Support Infrastructure, Expanded Internet Connectivity & High Mobile Adoption and Cellular IoT - ResearchAndMarkets.com | Business Wire*. https://www.businesswire.com/news/home/20210111005848/en/Global-IoT-Market-Technology-Forecast-2020-2029---Growth-in-Support-Infrastructure-Expanded-Internet-Connectivity-High-Mobile-Adoption-and-Cellular-IoT---ResearchAndMarkets.com

Choi, H. (2018). Technology-push and demand-pull factors in emerging sectors: evidence from the electric vehicle market. *Industry and Innovation*, *25*(7), 655–674. https://doi.org/10.1080/13662716.2017.1346502

Dean, D., Hender, J., Rodgers, T., & Santanen, E. (2006). Identifying Quality, Novel, and Creative Ideas: Constructs and Scales for Idea Evaluation. *Journal of the Association for Information Systems*, *7*(10), 646–699. https://doi.org/10.17705/1jais.00106

Design Technology. (n.d.). *Technology Push & Market Pull - Design Technology*. Retrieved April 17, 2021, from http://designkmg.weebly.com/technology-push--market-pull.html

Di Stefano, G., Gambardella, A., & Verona, G. (2012). Technology push and demand pull perspectives in innovation studies: Current findings and future research directions. *Research Policy*, *41*(8), 1283–1295. https://doi.org/10.1016/j.respol.2012.03.021

Gruber-Muecke, T., & Hofer, K. M. (2015). Market orientation, entrepreneurial orientation and performance in emerging markets. *International Journal of Emerging Markets*, *10*(3), 560–571. https://doi.org/10.1108/IJoEM-05-2013-0076

Herstatt, C., & Lettl, C. (2004). Management of "technology push" development projects. *International Journal of Technology Management*, *27*(2–3), 155–175. https://doi.org/10.1504/ijtm.2004.003950

Hoda, M. N., Quadri, N. C. S. M. K., & Srivastava, P. R. (2015). Software engineering. In *Software Engineering Proceedings of CSI 2015* (Vol. 731, Issue 1). Springer. https://doi.org/10.1109/6.738332

Hoda, R., Noble, J., & Marshall, S. (2013). Self-organizing roles on agile software development teams. *IEEE Transactions on Software Engineering*, *39*(3), 422–444. https://doi.org/10.1109/TSE.2012.30

Indeed.com. (2021). *A Guide to Technical Leads: What They Do and How to Become One | Indeed.com*. https://www.indeed.com/career-advice/finding-a-job/technical-lead

Inga Gaižauskaitė, & Valavičienė, N. (2016). *Socialini tyrimų metodai -kokybinis interviu*.

https://repository.mruni.eu/bitstream/handle/007/16209/12_Socialini tyrim metodai-Kokybinis-interviu.pdf?sequence=1
Johnson, T. P. (2014). Snowball Sampling: Introduction. In *Wiley StatsRef: Statistics Reference Online*. John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118445112.stat05720
Kess Pekka. (2011). *Technology push vs. Market pull (adapted from Martin, [19]). | Download Scientific Diagram*. https://www.researchgate.net/figure/Technology-push-vs-Market-pull-adapted-from-Martin-19_fig1_228526548
Khalil Zadeh, N., Khalilzadeh, M., Mozafari, M., Vasei, M., & Amoei Ojaki, A. (2017). Challenges and difficulties of technology commercialization − a mixed-methods study of an industrial development organization. *Management Research Review*, *40*(7), 745–767. https://doi.org/10.1108/MRR-08-2016-0192
Koc, T., & Ceylan, C. (2007). Factors impacting the innovative capacity in large-scale companies. *Technovation*, *27*(3), 105–114. https://doi.org/10.1016/j.technovation.2005.10.002
Kohli, A. K. (2017). Market Orientation in a Digital World. *Global Business Review*, *18*(3_suppl), S203–S205. https://doi.org/10.1177/0972150917700769
Krakul.eu. (2020). *IoT trends to expect in 2021 | Krakul*. https://krakul.eu/iot-trends-to-expect/
Krebs, T., & Ranze, C. (2015). Market-oriented variant management (position paper). *CEUR Workshop Proceedings*, *1453*(November), 1–4.
Lagrosen, S. (2005). Customer involvement in new product development: A relationship marketing perspective. *European Journal of Innovation Management*, *8*(4), 424–436. https://doi.org/10.1108/14601060510627803
Lang Marissa. (2017). *There is No Such Thing as True Privacy in the Digital Age*. https://www.govtech.com/security/There-is-No-Such-Thing-as-True-Privacy-in-the-Digital-Age.html
Lanza, J., Sotres, P., Sánchez, L., Galache, J. A., Santana, J. R., Gutiérrez, V., & Muñoz, L. (2016). Managing large amounts of data generated by a Smart City internet of things deployment. *International Journal on Semantic Web and Information Systems*, *12*(4), 22–42. https://doi.org/10.4018/IJSWIS.2016100102
Lee, I., & Lee, K. (2015). The Internet of Things (IoT): Applications, investments, and challenges for enterprises. *Business Horizons*, *58*(4), 431–440. https://doi.org/10.1016/j.bushor.2015.03.008
Liuiza, A., & Stirbys, K. (2008). *Studentu mokslines konferencijos pranesimu medziaga: KOMPIUTERIO PROGRAMŲ TEISINĖ APSAUGA: AUTORIŲ TEISĖS AR PATENTINĖ TEISĖ?* 1–38.
Lubik, S., Lim, S., Platts, K., & Minshall, T. (2013). Market-pull and technology-push in manufacturing start-ups in emerging industries. *Journal of Manufacturing Technology Management*, *24*(1), 10–27. https://doi.org/10.1108/17410381311287463
MacCord, A. (2016). A successful software patent [Patent Reviews]. In *IEEE Power Electronics Magazine* (Vol. 3, Issue 3, pp. 12–13). Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/MPEL.2016.2585471
Masa'deh, R., Al-Henzab, J., Tarhini, A., & Obeidat, B. Y. (2018). The associations among market orientation, technology orientation, entrepreneurial orientation and organizational performance. *Benchmarking*, *25*(8), 3117–3142. https://doi.org/10.1108/BIJ-02-2017-0024
OpenLearn. (2021a). *Invention and innovation: an introduction: 12.2 Technology push*. https://www.open.edu/openlearn/science-maths-technology/design-innovation/invention-and-innovation-introduction/content-section-11.6.2
OpenLearn. (2021b). *Invention and innovation: an introduction: 12.3 Market pull*. https://www.open.edu/openlearn/science-maths-technology/design-innovation/invention-and-innovation-introduction/content-section-11.6.3
Ozkaya, H. E., Droge, C., Hult, G. T. M., Calantone, R., & Ozkaya, E. (2015). Market orientation, knowledge competence, and innovation. *International Journal of Research in Marketing*, *32*(3), 309–318. https://doi.org/10.1016/j.ijresmar.2014.10.004
Ryan, V. (2013). *WHAT IS MARKET PULL?*

https://technologystudent.com/prddes1/marketpull1.html
Sampera Ernest. (2019). *5 Challenges Facing IoT and How to Overcome Them*. https://www.vxchnge.com/blog/iot-challenges-and-solutions
Saplinghr.com. (n.d.). *Sapling - 8 Ways to Collect Employee Feedback*. Retrieved March 31, 2021, from https://www.saplinghr.com/blog/8-ways-to-collect-employee-feedback
Scaringella, L., Miles, R. E., & Truong, Y. (2017). Customers involvement and firm absorptive capacity in radical innovation: The case of technological spin-offs. *Technological Forecasting and Social Change*, *120*, 144–162. https://doi.org/10.1016/j.techfore.2017.01.005
Siegel, R. A., Hansen, S. O., & Pellas, L. H. (1995). Accelerating the Commercialization of Technology: Commercialization Through Co-operation. *Industrial Management & Data Systems*, *95*(1), 18–26. https://doi.org/10.1108/02635579510079425
Su, M., & Rao, V. R. (2011). Timing decisions of new product preannouncement and launch with competition. *International Journal of Production Economics*, *129*(1), 51–64. https://doi.org/10.1016/j.ijpe.2010.09.001
Teamhood.com. (2020). *Kanban Board Online | Digital Kanban | Virtual Kanban |Teamhood*. https://teamhood.com/kanban/physical-to-digital-kanban-board-in-2020/
TNS LT. (2015). *TNS LT: Lietuvos IT sektoriaus reputacija – viena geriausių Europoje | Invest Lithuania*. https://investlithuania.com/lt/naujienos/tns-lt-lietuvos-it-sektoriaus-reputacija-viena-geriausiu-europoje/
Tynan, A. C., & Drayton, J. (1987). Market segmentation. *Journal of Marketing Management*, *2*(3), 301–335. https://doi.org/10.1080/0267257X.1987.9964020
Udriyah, Tham, J., & Ferdous Azam, S. M. (2019). The effects of market orientation and innovation on competitive advantage and business performance of textile smes. *Management Science Letters*, *9*(9), 1419–1428. https://doi.org/10.5267/j.msl.2019.5.009
Van Den Ende, J., & Dolfsma, W. (2005). Technology-push, demand-pull and the shaping of technological paradigms - Patterns in the development of computing technology. *Journal of Evolutionary Economics*, *15*(1), 83–99. https://doi.org/10.1007/s00191-004-0220-1
VšĮ Versli Lietuva. (2020). *Lietuvos informacinių technologijų sektoriaus eksporto plėtros tikslinėse rinkose strateginis dokumentas*.
Wong, R. C. W., Fu, A. W. C., Wang, K., Yu, P. S., & Pei, J. (2011). Can the utility of anonymized data be used for privacy breaches? *ACM Transactions on Knowledge Discovery from Data*, *5*(3), 1–24. https://doi.org/10.1145/1993077.1993080
Žydžiūnaitė Vilma, & Sabaliauskas Stanislav. (2017). *Kokybiniai tyrimai: principai ir metodai : vadovėlis socialinių mokslų studijų programų studentams*. https://www.vdu.lt/cris/handle/20.500.12259/57984

Appendices

Appendix 1. Technology-push interview No. 1

Interviu data
Interviu trukmė

Lukas: Ką šiuo metu darote ?
Apklausiamas asmuo: Šiuo metu esu komandos vadovas IT įmonėje

Lukas: Papasakokite apie savo produktą.
Apklausiamas asmuo: Produktas prie kurio dirbame yra įrankis skirtas valdyti prieigą prie interneto puslapių, panašu į "parental control", kai gali uždėti limitus, kurių puslapių vartotojas negali pasiekti, pvz. vaikai. Tėvai gali matyti, kiek laiko vaikas praleido, kokioje nors programėlėje ar tinklalapyje. Gali valdyti kiek laiko gali ten būti.

Lukas: Su kokiais iššūkiais susiduriate vystydami šį produktą ? Ir galbūt kažkokius sprendimus taikote?
Apklausiamas asmuo: Vienas iš didžiausių iššūkių apskritai yra gaminimas to ko dar nėra rinkoje, kai nėra atskaitos taško. Vadinkim tokia inovacijos problema, kur reikia kurti inovacijas. Tai yra toks iššūkis, tačiau jis yra geras iššūkis. Kai žmonių paklausi, kartais gali pasakyti, kad tavo idėja yra neįmanoma arba per sunkiai įgyvendinama ar nevalidi, bet įgyvendini ją po to. Toks vat iššūkis neįmano įgyvendinimas.

Toks kitas tarp komandinė komunikacija arba kolaboracija yra sunkus dalykas ypač kai daug komponentų įeina į viso to projekto įgyvendinimą. Kiekvienos komandos stiliai yra skirtingi, skirtingos atsakomybės tai viską sukordinuoti, optimizuoti, kad optimaliai veiktų tiek sprintai, tiek produkto "delivery" yra gan didelis iššūkis.

Toliau iššūkiai, tai tiesiog problemų sprendimai, "kylančių gaisrų gesinimai" (šypteli).Viskas atsiremia į planavimą ir komunikaciją atsiremia. Arba gerai arba blogai suplanuotas darbas. Kai gera koordinacija tada lengva ir nenumatytas problemas spręsti ir "deliverint" produktą laiku. Nes pas mus vėlavimų buvo anksčiau nemažai

Lukas: Kaip sprendžiate iššūkius susijusius su planavimu su komunikacija ? Galbūt kažkokį modelį naudojate ar kažkokį esamą naudojate ?
Apklausiamas asmuo: Mes tą baisiąja fazę jau praėjome. Kažkokios tai "Sidabrinės" kulkos nebuvo, tiesiog atsirado daugiau vertybių, kurias pradėjome puoselėti. Vienas iš dalykų tai "ne-overpromissint" klientui niekada, geriau "overdeliverint" negu "overpromisint". Tai šitai įteigėm savo komandai. Expectation'ų managementas.

Antras dalykas tai atsakingiau nutiesti komunikacijų kanalai tarp komandų, nes yra du dalykai: arba per daug žmonių pakvieti į susirinkimą, iš kurių pusė pasyviai klausosi ir jokios naudos nėra, arba tu įtrauki tik kelius žmones, kurių tikrai reikia tam susirinkime. Darbų planavimas įtraukiant asmenis, kurių tikrai reikia ir toks atsakingas planavimas (požiūris).

Lukas: O kiek komandų jūs turite ?
Apklausiamas asmuo: prie mano "feature", yra developerių komanda, firmware komanda, delivery komanda ir laboratorijų komanda. Na, 4 komandos mažiausiai.

Lukas: Galbūt naudojate kažkokias tai taikomąsias programas ar kitas priemones komunikacijai ? Ypač šiuo metu, kai yra karantinas

Apklausiamas asmuo: Kažko naujo per karantiną iš komunikacijos programų neįsidiegėme. Naudojame "Slack", "Microsoft Teams", o toliau naudojame bilietų valdymo sistemą "Jira", "Confluence". Tai yra pagrindiniai tools'ai daugiau nieko ypatingo neturime.

Lukas: Ką darote tokiu atveju, jei ką nors nusimatote padaryti ir neišeina įgyvendinti ? Galbūt turite kažkokį atsarginį planą ?
Apklausiamas asmuo: Atsarginio kelio dažniausiai neturime, bet čia vėl atsiremia į tai t.y. neprižadėti to ko neišeina įgyvendinti, kartu su tuo ateina atvirumas su klientu. Vadinkime, kai jie kažko paprašo ir tu užtikrintai atsakai, kad taip viskas bus (įgyvendinta) arba jei tu nesi užtikrintas, tai pasakai, na pirma reikia pasižiūrėti ir neprižadi. Taip ir išvengiame to tokio "nedeliverinimo", kai tu neprisižadi kažko, kiek įmanoma, žinoma. Dažniausiai plano B nelabai būna. Na bent jau mano komandoj darbo specifika ne tokia, kad mes turime kažkam kažką pristatyti tą pačią dieną. Pas mus nekritiniai "delivery", jei nesuspėsim, mums niekas per galvą tikrai neduos, mums tik svarbu pranešti, kad nusikelia į kitą savaitę tarkim. Mes užsitarnavom pasitikėjimą, nes galim pavėluoti, galim nesuspėti, svarbu atvirai pasakyti ir nebepyksta.

Lukas: Kokia daro jūsų komanda ?
Apklausiamas asmuo: Mūsų komanda yra pagrinde susifokusavusi į analitiką ir inovacijas. Mes developeriams pasakome kaip tai turėtų atrodyti, tada jie suprogramuoja. Idėja ir funkcionalumas pirmiausiai kyla iš mūsų pusės.

Lukas: Iš kur kyla idėjos ?
Apklausiamas asmuo: Idėjos kyla ne visada iš mūsų, kartais jos ateina iš projektų vadovų. Pro mus praeina pati pirma iteracija. Užregistruoja, kažkokią idėją, tai mes turime "research“ padaryti, kaip galima padaryti tą ir tą, kad klientas galbūt tai pirktų. Laboratorijose įsivertiname ko turime, ko neturime ir ką reiktų turėti. Po to daug komandų įjungia į bendrą darbą.

Lukas: Kaip apsaugote savo intelektinė nuosavybę ?
Apklausiamas asmuo: Vienas iš tų iššūkių, kaip paskatinti darbuotojus ar komandos narius, aplikuoti patentams. Intelektinė nuosavybė saugoma patentais. Tačiau yra gan nemažas darbas pasiruošti patento pateikimui. Nemažai, dokumentacijos, "followup'o", ir apskritai laiko trunka, tai sunku paskatinti. Dažnai darbuotojams tai skamba bauginančiai.

Tai sprendžiame turėdami įmonėje atsakingus žmones būtent dėl intelektinės nuosavybės, kurie viska pataria, identifikuoja ar tavo idėja yra tinkama bandyti aplikuoti patentuoti. Ir žinoma padeda su dokumentacija.

Lukas: Ar jie yra teisininkai ?
Apklausiamas asmuo: Nežinau ar jie tiksliai teisininkai. Aš nežinau tiksliai titulo. Jie pateikia prašymus į patentų ofisus. Na o, teisininkai kažkuriame žingsnyje peržiūri ar visi dokumentai yra tvarkoje.

Lukas: Ar kyla privatumo iššūkiai? Kaip suprantu jūsų produktas glaudžiai susijęs su privačiais duomenimis.
Apklausiamas asmuo: Taip kyla. Tai labiau persikelia ant mūsų klientų, kurie siūlo paslaugą galutiniams klientams. Tai būtent tas tarpininkas surenka sutikimus, kad jie sutinka jo teikiama privatumo politika. Mes vadovaujamės visų valstybių, kuriose esame įstatymais. Mes turime anonimizuoti duomenis, jei darome kokį tyrimą, bei pas mus nuolat daromi auditai ir atitinkame ISO standartus.

Lukas: Ar kyla saugumo iššūkiai ?

Apklausiamas asmuo: Mūsų viena iš pagrindinių paslaugų yra užtikrinti žmonių saugumą ir privatumą internete. Turime įvairių funkcijų, kurios gali blokuoti kenkėjiškus puslapius, tuo pačiu turime ir funkcionalumą t.y. blokatorių įvairiems duomenų rinktuvams. Na yra didelis spektras ką teikiame. Yra nes visas saugumo padalinys. Atitinkame ISO standartus ir jų laikomės. O iš development'o pusės yra daromi pastovūs vulnerability skenavimai, samdomos įmonės testuoti mus.

Lukas: Ar jums kyla duomenų saugojimo ir paskirstymo problemos ?
Apklausiamas asmuo: Kyla. Dėl didelio įrenginių kiekio, bei didelio duomenų kiekio. Turim problemą labiau iš scalability.

Lukas: Galbūt kyla problemų dėl našumo ?
Apklausiamas asmuo: Na dėl našumo problemų tikrai nekyla, tačiau kyla dėl kainos. Kai reikia apdoroti didelius kiekius duomenų. Galime apdoroti per Cloud serverius terabaitus duomenų per dieną, tačiau tai yra labai brangu. Na kainos ir kiekio problema gaunasi (scalabiity).

Lukas: Ar susiduriate su komercializacijos problema?
Apklausiamas asmuo: Hmm, kaip tik manau, kad mūsų sėkmė pro čia net atėjo. Mūsų įmonė uždominavo tą sritį. Tai labai greitai išsaugome iš startuolio į korporaciją. Problema galbūt yra tame, kad nebeturim likusių didelių žaidėjų. Mūsų iššūkis dabar yra išlikti ant viršaus (užimti didelę rinkos dalį). Šiuo metu nepamenu procentais, kokia rinkos dalį užimame tačiau ji yra labai didelė ir yra likę tik mažesni konkurentai.

Lukas: Kaip jums pavyko užimti tokią didelę rinkos dalį? Galbūt pavyko per kažkokias paslaugas, funkcionalumą, marketingą ar galbūt daugiau niekas neteikė tokios paslaugos ?
Apklausiamas asmuo: Manau tuo metu niekas neteikė tokios paslaugos. Tuo metu dar buvo startuolis, dėl to buvome labai lankstūs palyginti su korporacijomis. Tokio "agility" turėjome, greitai daryti dalykus. Didelė įmonė lėtai juda, o mes buvome maži, greitai prisitaikėme prie kliento.

Mes stipriai dirbome, kad gautume geriausius klientų atsiliepimus. Teikėme "extra-ordinary" klientų aptarnavimą. Taip vystydami projektą gaudavome gerų atsiliepimų įvairiose platformose, kad mums padėjo iškilti. Gavome labai gerus "Amazon" atsiliepimus, tai šita metodika buvo viena iš key selling points, t.y. kad klientų feedbackas geras apie mus. Bei užtikrindavome saugumą, kad ypač aktualu dabar visokie "data breach'ai", mūsų produktas leisdavo to išvengti. Saugumo klausimas tapdavo vis aktualesnis ir aktualesnis, ką mūsų kompanija dabar ir teikia.

Lukas: Kaip išsigryninate tikruosius klientų poreikius ? Galbūt kyla kokių iššūkių?
Apklausiamas asmuo: Su klientais problemų kyla, nes jie nėra pakankamai edukuoti apie produktą kurį jiems siūlome. Na bent man buvo tokia problema, kad buvo *keliami reikalavimai, kurie akivaizdžiai būdavo nevertingi ir ta prasme reikalaudavo daug pastangų ir būdavo abejotinos vertės. Čia atsirasdavo kliento edukavimas, kas tai per produktas, kaip jis veikia, na labiau perteikti savo viziją klientui. Čia atsiveria į atvirumą ir edukaciją.* Čia priklauso ar klientas kreipia dėmesį į tave. Taip pat priklauso ar su tavim bendrauja įmonės žemiausios grandies darbuotojas ir derinasi su tavimi ir apie integraciją sprendžia ar, žinai, yra atskirai sukurta komanda iš kliento pusės, kuri dirbs su būtent dirbs ant integracijos su profesionaliais darbuotojais ir žinančiais ką jie daro. *Atsiranda dviejų įmonių bendro produkto vedimas, t.y. gan sunkus darbas.*

Lukas: Ar daug pastangų reikalauja kliento apmokymas naudotis jūsų produktu ?

Apklausiamas asmuo: Nemažai, na tai pastovus darbas t.y. tu kažką naujo sukuri ar nori padaryti. Kartais išsiskiria požiūriai tarp kliento ir įmonės, jie galvoja, kad tas patobulinimas yra nereikalingas, tad turi klientą įtikinti, kad tas patobulinimas yra naudingas. Turi aiškiai paaiškinti, kas bus jei nedaryti ir kas bus jei padarysi, edukuoti, kaip veikia tas funkcionalumas, kaip jį testuoti. Visame šitame reikia dalyvauti kartu su klientu. Man teko ir būti 1.5 mėnesio komandiruotėje būtent tai edukacijai. Gyvai bendrauti su klientų komandomis, gyvai spręsti problemas, juos apmokyti.

Lukas: Galbūt susiduriate su rinkos nepastovimu?
Apklausiamas asmuo: Pas mus rinka gan pastovi. Na pernai gal kai atėjo COVID-19 sustabdė visus projektus, nes nežinojo kas bus, kas čia keisis rinkoje. Tačiau kai išsiaiškino visus rodiklius su COVID, viskas vėl stojo į savo vėžias. Kažkokių nepastovumo nebuvo. Mums tenka dirbti su dideliais žaidėjais rinkoje, o jie ganėtinai pastovūs, tai pastovumas atsiranda ir pas mus.

Lukas: Galbūt turite pasidalinti iš kasdieninės veiklos ?
Apklausiamas asmuo: Hmm. Manau vienas toks geras dalykas, kuris man patinka. Kartais įjungti ir savo darbuotojus į corporate meetingus, kad pamatytų ką reikia daryti vadovui, su kokiais iššūkiais jam tenka susidurti, nes dauguma galvoja, ką veikia tie vadovai, atrodo, kad nieko neveikia, visą dieną chillina, bet kas verda backgrounde nežino. Vadovui reikia nufiltruoti tą visą chamą vykstantį už durų, prioretizavimą ir kovojimą dėl laiko, resursų , dėl pinigų. Tai tokia nepamatyta vadovo darbo pusė.

Appendix 2. Technology-push interview No. 2

Lukas: Papasakokite apie savo kuriamą produktą
Apklausiamas asmuo: Mūsų sprendžiama problema yra nevalingi judesiai. Žmonės negali atlikti tikslių užduočių dėl to kad jiems pasireiškia nevalingi judesiai ir jie trukdo gyventi žmogui. Mūsų idėja yra sukurti kostiumą, kuris pasitelkiant įvairius sensorius nustatytų nevalingus judesius ir juos sustabdytų. Tam būtų pasitelkiamas dirbtinis intelektas.

Lukas: Kokie iššūkiai kyla vystant, tokį inovatyvų produktą ?
Apklausiamas asmuo: Kyla, kyla, tikrai kyla tų iššūkių. Pagrindinė problema su kuria susiduriame yra būtini įvairūs bioetikos leidimai, kad galėtumėme kurti ir vystyti produktą. Todėl pats kūrimo procesas ganėtinai užsitęsia. Kadangi visa mūsų komanda yra iš technologinės pakraipos, kartais tenka susidurti mes neturime medicininių žinių, know-how. Mes tą sprendžiame konsultuodamiesi su medikais. Mes kol kas nematote prasmės pasikviesti mediko, kadangi šiuo metu jau vyksta medicininiai bandymai.

Pasikvietus mediką į komandą know-how problema sumažėtų arba visai išnyktų.

Lukas: Galbūt kyla iššūkių kaip nuskaityti ar apdoroti duomenis?
Apklausiamas asmuo: Taip, kadangi, mūsų pats produktas gauna duomenis tik iš sensorių duomenų. Kyla iššūkis kaip juos tinkamai tuos duomenis, kaip juos segmentuoti ir kaip juos klasifikuoti. Kadangi žmogaus judesių yra labai daug, būtent todėl dėl to kyla problema kaip smulkiai mes norime juos išanalizuoti. Tai dėl to kyla duomenų apdorojimo problema ir jų paskirstymas.

Lukas: Ar įrenginys saugo duomenis savyje ar kažkur kitur, galbūt internete?
Apklausiamas asmuo: Jis duomenis saugotų viduje. Jei įrenginius būtų visą laiką prijungtas prie interneto tada būtų prasmė pagalvoti apie jų saugojimą internete, tačiau šiuo metu viskas saugoma valdiklyje.

Lukas: Technologijos keičiasi labai greitai. Kaip apsaugote savo intelektinę nuosavybę ?
Apklausiamas asmuo: Po konsultacijos su intelektinės nuosavybės specialistais yra planas ateityje patentuoti patį dirbtinio intelekto modelį, bet ne patį gydymo metodą. Pats gydymo metodas yra nėra naujas.

Lukas: Galbūt susiduriate su kokiais privatumo iššūkiais ?
Apklausiamas asmuo: Bendraujant su žiniasklaida kyla klausimas, kiek verta atskleisti informacijos apie patį produktą. Pačia prototipo esmė. Kuriant produktą norėtųsi, kad ta intelektinė nuosavybė liktų nepastebėta.

Lukas: Na taip, kaip suprantu intelektinė nuosavybė yra pats didžiausias turtas startuolyje
Apklausiamas asmuo: Na,taip

Lukas: Galbūt kyla kažkokių saugumo iššūkių? Vis tik įrenginys leidžia elektros impulsus, manau, kad šioje vietoje saugumas yra labai svarbus.
Apklausiamas asmuo: Kiek yra žinoma ta pastovi elektros srovė žmogų vargina, per laiką prie jos pripranta ir pradeda nebereaguoti. Nebevyksta susitraukimai nuo tam tikros elektros srovės. Pati didžiausia problema yra nuspręsti kiek žmogui galima naudotis įrenginiu per dieną. Mes stengiamės padėti žmogui, o ne pakenkti. Srovė yra ribojama, tai neturėtų sukelti saugumo problemų.

Lukas: Kokiame etape yra šis projektas?
Apklausiamas asmuo: Šis projektas yra startuolio etape

Lukas: Ar susiduriate su komercializacijos problema ar šiš produktas dar nėra parduodamas ?
Apklausiamas asmuo: Kolkas jis nėra parduodamas, tačiau, aš matau, kad greičiausiai bus susiduriama su pardavimu problema, būtent iš kiekio numatymo pusės. Produkto kaina numatoma didelė, tai būtų daugmaž 5000€ už vienetą tai automatiškai norisi daryti prielaidą, kai kurie žmonės negalės nusipirkti jo dėl tos kainos. Mes dėl šio klausimo planuojame kreiptis į ligonių kasas, kad jos skirtų finansavimą. Ateityje įžvelgiu galimas biurokratines problemas bendradarbiaujant su valstybinėmis įstaigomis, nes su jomis nėra labai lengva susikalbėti.

Lukas: Galbūt jūsų programuotojai susiduria su technologinio įgyvendinimo problemomis?
Apklausiamas asmuo: Programuotojai su technologinio įgyvendinimo problemomis nesusiduria, nes aš pats esu vienas iš tų programuotojų, tai kol kas nėra problemų. Vėlgi mes susiduriame su duomenų klasifikacijos problema (duomenų apdorojimo), o ši problema tiesiogiai įtakoja pačia dirbtinio intelekto architektūrą.

Lukas: Ar tiriate klientų poreikius ?
Apklausiamas asmuo: Klientų poreikiai maždaug išlieka stabilūs, kad faktiškai tos ligos su kuriomis mes susiduriame nėra su tokiomis optimistinėmis prognozėmis, tai faktiškai nesikeičia.

Lukas: Koks yra jūsų rinkos dydis ? Ar jis maždaug apibrėžtas ?
Apklausiamas asmuo: Lietuvoje cerebriniu paralyžiumi serga apie 15 tūkstančių asmenų ir dar apie 20 tūkstančių Parkinsono liga. Ir aišku nedidelė dalis dar serga Hantingtono liga. Tai faktiškai viską sudėjus Lietuvoje gaunasi apie 35 tūkstančių žmonių rinka. Bet jeigu mes žiūrėtume į pasaulinę ar Europos rinką skaičiai yra žymiai didesni.

Lukas: Kaip planuojate laiką? Kada bus paleidimas į rinką ?
Apklausiamas asmuo: Mes faktiškai turime nusimatę laiką, kad per metus laiko nuo vasaros mes padarysim jau pilnai veikiantį ir priartintą prie galutinės versijos prototipą. O paleidimą planuojame nuo dar kitų metų pradžioje.

Lukas: Kokia maždaug yra R&D trukmė?
Apklausiamas asmuo: Faktiškai man bent jau atrodo, tyrimų trukmė sąlygojama kiek patys žmonės įdeda savo darbo. Kadangi mes esame studentai, mums ganėtinai ilgai užtruko, nes reikia skirti laiko ir studijoms. Grubiai iki įmonės įkūrimo buvo apie pusę metų (šiuo metu įmonė veikia 2 mėnesius, išviso 7 mėnesiai).

Lukas: Kaip suprantu tikriausiai tenka bendrauti su pačiais medikais ir galbūt kitų sričių specialistais ir ar kyla iššūkių bendraujant su jais ?
Apklausiamas asmuo: Taip. Kartais gaunasi diskomunikacija dėl terminologijos, kadangi, kiek man teko susidurti medicinoje yra labai griežta terminologija ir vienas žodis gali pakeisti visą esmę. Su gydytojais kildavo problemų kalbant apie kylančias problemas dėl terminologijos, o norėtųsi bendrauti mums ir jiems suprantama kalba. Dėl tos priežasties buvau pasiėmęs, modulį apie žmogaus anatomiją ir fiziologija, tai man padėjo susišnekėti su gydytojais ir suprasti jų terminologiją.

Appendix 3. Technology-push interview No. 3

Lukas: Kuo užsiima jūsų įmonė?
Apklausiamas asmuo: Mūsų įmonė kuria įvairius IT projektus, įvairiose platformose.

Lukas: Kokios yra komandos?
Apklausiamas asmuo: Komandos yra platforminės. Yra pardavimų žmonės, kurie yra atsakingi už pardavimus, komunikacija su klientais. Toliau programuotojai, projektų vadovai, testuotojai, dizaineriai. Specialistai yra specializuoti savo technologijoje pavyzdžiui tinklalapiuose, mobiliose programėlėse, daugiaplatformėse sistemos, back-end. Visur yra specializuoti žmonės.

Lukas: Su kokiais iššūkiais susiduriate šioje įmonėje?
Apklausiamas asmuo: Ši įmonė užsiima outsourcinimo paslaugomis, t.y. teikia paslaugas kitoms įmonėms. Tai sakyčiau vienas iš **pagrindinių iššūkių yra darbas su kitos įmonės žmonėmis**, kai jie ne visai žino procesų, kai mes norime palaikyti tvarką. Mes turime savo įmonės požiūrį į tam tikrus dalykus ir norime padaryti taip, kaip darome kituose projektuose, nes mes turime jau sukaupę patirties. Būna, tokių komandų, kai mus prijungia, prie nedidelių komandų su vos keliais žmonėmis, kurios neturi daug patirties, ir klientas nori, kad dirbtumėme pagal jų komandą, nors jų komanda yra maža, nespecializuota ir viską daro savaime. Būna taip, kad jie nori pataupyti ir sako nenorime quality assurance, tegul programuotojai patestuoja ir t.t.. Iš čia kyla pagrindiniai iššūkiai: geras susikalbėjimas su klientu ir išsiaiškinimas, kodėl reikia daryti taip, o ne kitaip, bet aišku klientas moka pinigus ir vis tiek jis taria paskutinį žodį.

Lukas: Kaip suprantu, kai klientas šitokiu būdu nori sutaupyti, tai kenčia ir kokybė?
Apklausiamas asmuo: Taip, taip. Ir aišku dėl to kenčia ir pačios įmonės, kurį kūrė produktą reputacija. Nes tie žmonės bando sutaupyti, o mes vis tiek turime padaryti, padaro blogų, mūsų nerekomenduotinų sprendimų ir tada pavyzdžiui įsikelia programėlę į produkciją netestuotą, atsiranda klaidų ko pasekoje kenčia mūsų kompanijos reputacija. Mūsų įmonės požiūris yra atviras. Galite paklausti mūsų klientų rekomendacijų apie mūsų atliktus darbus. Klientai, tie kurie norėjo sutaupyti, palieka blogus atsi liepimus "prastai čia padarė", nors mes iš tikro dėl net nesame kalti. Ta būna dažniausiai jų kaltė.

Lukas: Ar galima atsisakyti tokių klientų ar galbūt galima derėtis, kad nenukentėtų jūsų reputacija ir klientas būtų patenkintas ?
Apklausiamas asmuo: Kadangi esu programuotojas, netenka tiesiogiai kalbėtis su klientais tačiau pagal mano turimas žinias, klientai ilgainiui pradeda taupyti. Mini, kad apkarpomas biudžetas ir nebegalime tiek mokėti, tai mokame mažiau. Atsisakome to ir to, ir galbūt bus pigiau. Būna, kad atsisakome klientų, kurie ateina su nerealiais lūkesčiais. Pavyzdžiui būna atvejų, klientas sako aš turiu 2000€ ir noriu pilnai veikiančios sistemos, kur atliktų tam tikras funkcijas. Ir už tuos 2000€ tikrai nieko nepadarysi

Lukas: Žiūrint iš kokio konteksto, tačiau mano manymu tie 2000€ gali būti ir vieno žmogaus alga.
Apklausiamas asmuo: Taip, taip. Tai gali būti vieno žmogaus alga ir suprantama per vieną mėnesį pilnai funkcionuojančios sistemos nepadarysi. Nebent su labai minimaliais reikalavimais, tačiau realybė kitokia, ir visi turi didžiulį funkcionalumų backlog'ą. Tokiems klientams yra paaiškinama, kad tas tiek kainuoja, tas tiek, ir būna, kad ir patys susipranta, arba būna ir taip, kad bėga pas konkurentus, kurie pasiūlo pigiau, kur "junior'ai" darbą padaro tik tam kad veiktų. Ir gan dažnai būna taip, kad jie sugrįžta ir galiausiai susimoka tą didesnę sumą, kad mes sutvarkytume.

Lukas: Ar kyla problemų analizuojant rinką ? Identifikuojant savo klientą ?

Apklausiamas asmuo: Mūsų įmonė labiausiai orientuojasi į rekomendacijas. Mes padarome gerai ir kokybiškai, klientai lieka patenkinti ir jie parekomenduoja mums kitiems. Ir kiek žinau, dauguma mūsų klientų taip ir ateina. Būna, net ir taip, kad mūsų klientų įmonėje aukštose pareigose dirbęs žmogus pereina į kitą įmonę ir sako, kad mes dirbome su tokia įmone, man labai patiko kaip jie kokybiškai dirba, tai mes ir šioje įmonėje dirbsime su Jūsų įmone. Ir tada mūsų įmonė jau turi du klientus, vien dėl to, kad kažkuris vienas žmogus perėjo į kitą įmonę.

Lukas: Ar kyla iššūkių bendraujant su klientais? Kaip jie išsisprendžia?
Apklausiamas asmuo: Klientai duoda reikalavimus ir eigoje reikalavimai pasikeičia iš čia kyla nemažas iššūkis. Tai aišku dėl to dirbame Agile metodu, kad parodytume įvairius demo. Padirbam ir parodom, kas pasikeitė ir tada klientai gali reaguoti iš karto, jo jie iš tikro nori. Gali patarti ką daryti kitaip. Nuo to priklauso ir projekto kokybė, nes jeigu klientas yra labai neįsitraukęs ir atmestinai žiūri, ką tu jam rodai kas kažkiek laiko. Ir tik pabaigus projektą rimčiau pasižiūri, kas padarytą ir sako, kad čia ne taip padaryta, o tada mes sakome, kad jūs prieš tai rašėte, kad viskas tinka. Jei klientas yra labai įsitraukęs, tai jis ir gaus pilnai kokybišką produktą, kokio jis ir nori, bet jei atmestinai žiūrės, tada gali pasitaikyti ir taip, kad mes ne taip suprasime reikalavimus. Tai iš esmės bandome spręsti Agile metodu.

Lukas: Kaip išgauti klientų poreikius, kad jie būtų kuo mažiau dviprasmiški?
Apklausiamas asmuo: Pirmiausiai viskas prasideda wireframe stadijoje, kurioje yra nubraižoma sąsaja, sudėliojami elementai. Po to seka dizaino fazė, kai wireframe įgauna spalvas ir stilių. Per šiuos žingsnius yra išsigryninama labai daug dalykų. Po šių darbų programuotojai gali susiprojektuoti viską iš savo pusės ir kibti į darbus. Dar kartą pabrėšiu, kad kliento įsitraukimas yra labai svarbus, nes kilus klausimams galime iš kart jų tiesiogiai paklausti ir atitinkamai reaguoti. Iš pradžių tikrai sunku pastebėti visus neatitikimus, tad kad viskas vyktų greičiau ir sklandžiau kliento įsitraukimas yra labai svarbus.

Lukas: Kiek trunka R&D procesas, jei pas jus projektas pradedamas nuo nulio ?
Apklausiamas asmuo: Kiekviena mūsų platforminė komanda turi savo technical team lead'ą, kuris atsakingas už visą platformą. Jis yra daręs kažką panašus, jis gali spėjimo būtų pasakyti prognozuojamą laiką (estimate) t.y. kiek tai gali trukti. Žinoma, tiksliai pasakyti negali, tačiau intervalais. Technical team lead įvertina racionalumą visų jo reikalavimų, kaip kas gali būti išspręsta. Jei eis per kelias platformas visu tų platformų team lead'ai susitenka ir peržiūri. Visas kliento atėjimas iki projekto pasirašymo gali trukti labai ilgai net gal iki metų ar dviejų. Būna tokių atveju, kai klientui visko reikia labai greitai, tai yra gan blogas ženklas. Šiuo atveju klientas norėjo per pandemiją norėjo modernizuoti savo elektroninę parduotuvę. Jie greitai pateikė, ko jiems reikia, jų projektas buvo patvirtintas vos per keletą savaičių. Tada per mėnesį buvo sukurta programinė įranga. Tai buvo vienas iš greičiausių mūsų paleistų projektų.

Lukas: Kokių dar iššūkių kyla dirbant su klientais ?
Apklausiamas asmuo: Na gan problematiška būna, kai klientas ateina jau su savo serveriais, ir jie lūžta. Dėl to mūsų programinė įranga atrodo ne tokia stabili nors problema buvo jų serveriuose. Mes buvome labai glaudžiai susiję su jų serveriais. Dėl to kentėjo ir mūsų vardas.

Lukas: Ar kyla kažkokių technologinių iššūkių įgyvendinant produktus ?
Apklausiamas asmuo: Tai atsitinka labai retai, nes prieš tai viską būna įvertinęs technical team lead. Jie jau turi patirtį ir žinias, jei reikia pasitaria su kitais kolegomis.

Lukas: Kaip planuojate laiką ? Galbūt naudojate kažkokias tai diagramas, nusistatyti produkto paleidimo laikui ?

Apklausiamas asmuo: Mes labai retai naudojame kažkokias diagramas, nu bent jau prie mano dirbtų projektų. Kartais būna kokia GANTT diagrama, tačiau į nėra skiriamas didžiulis dėmesys. Kadangi dirbame su Agile metodu, dažniausiai sistema yra parodoma klientui ir klientas įvertina: pvz. prie šito dar reikėtų padirbėti, bet šitas jau gerai arba ooo viskas gerai, galime judėti toliau. Tai priklauso ar reikia kažką keisti ar nereikia. Tai gan gerai veikia, kai klientai turi besikeičiančių reikalavimų, o jie visada jų turi. Niekada negali tiksliai nustatyti laiko (estimate), net negali iš tikro ir užsimesti laiko, nes tada būna tie prognozavimo paradoksai (estimate paradox), kad jei užsimesi laiko, tai projektas išsitęs tiek laiko, bet ir tikrai nesibaigs anksčiau, nes žmonės sugalvos kam išnaudoti tą laiką, pavyzdžiui patobulinti vieną dalyką ar kitą. Geriau papildomai neuždėti papildomai laiko. Mes naudojame MVP - minimum viable product. Mes į jį orientuojamės, bandom padaryti kuo greičiau ir tada išleidžiame veikianti produktą, tada papildome dar kažką ko nori klientas ir tada vėl išleidžiame.

Lukas: Ar dėl jūsų produkto turi keistis kliento elgsena ?
Apklausiamas asmuo: Hmm, klientai turi daug alternatyvų. Tai jie gali rinktis arba mus arba alternatyvą. Kad klientas būtų patenkintas, mes turi įvairių specialistų su įvairia patirtimi, kuri padeda, numatyti galimus kliento lūkesčius. Tai padeda padaryti produktą, kuris būtų patogus klientui, viskas būtų aišku, sąsaja neperkrauta.

Lukas: Kaip apsaugote savo intelektinę nuosavybę?
Apklausiamas asmuo: Naudojame konfidencialumo sutartis, su klientais sudaromos sutartys. Kodas atitenka klientu, tai automatiškai jis ir yra intelektinės nuosavybės savininkas. Darbuotojai negali dalintis kodu, nei jo fragmentais be kliento sutikimo.

Lukas: Ar kyla privatumo iššūkių ?
Apklausiamas asmuo: Tai priklauso nuo projekto tipo. Kai kuriuose reikia nuasmeninti duomenis, papildomai apdoroti, prieš kažką darant.

Lukas: Ar kyla saugumo iššūkių ?
Apklausiamas asmuo: Norint apsaugoti sistemas nuo išorės grėsmių mes naudojame VPN. Duomenys yra šifruojami, šifruojamos duomenų bazės. Naudojame HTTPS protokolą. Turime saugumo komandą, kuri rūpinasi šiuo klausimu.

Lukas: Ar susiduriate su duomenų paskirstymo problemą?
Apklausiamas asmuo: Na tai priklauso nuo kliento. Duomenis jis gali saugoti pats arba galime tuo rūpintis mes. Tai susitarimo klausimas. Kažkokių iššūkių nekyla mūsų devops komanda pilnai susitvarko.

Lukas: Ar susiduriate su didelių duomenų kiekių apdorojimo problema ?
Apklausiamas asmuo: Taip ši problema yra aktuali. Mūsų programuotojai nuolatos optimizuoja programinį kodą, kad jis reikalautų mažiau skaičiavimų ir efektyviai apdorotų duomenis, bei žinoma parenkami atitinkami serveriai, kurie sugebėtų pajėgūs apdoroti reikalingą duomenų srautą.

Lukas: Ar susiduriate su komercializacijos problema?
Apklausiamas asmuo: Tai yra marketingo ir pardavimų komandų atsakomybė, jie įvertina priežastis bei galimus sprendimus.

Lukas: Kaip sprendžiate viduje iškilusias problemas?
Apklausiamas asmuo: Pirmiausiai sprendimą bandau susirasti pats, o jei nepavyksta tad komunikuojame su kitais specialistais apie išbandytus variantus bet dar galimus, kurie padėtų išspręsti iškilusią problemą.

Appendix 4. Technology-push interview No. 4

Lukas: Kuo užsiima jūsų įmonė ?
Apklausiamas asmuo: Mūsų įmonė kuria įvairias programines įrangas: mobiliąsias programėles, tinklalapius, prižiūri serverius. Labai platus paslaugų spektras

Lukas: Papasakokite apie produktą prie kurio tenka dirbti.
Apklausiamas asmuo: Įmonė turi programėlę vidiniam darbų valdymui. Programėlė nurodo išsamius duomenis reikalingus darbui atlikti tarp jų atlikimo būsena, eiga, komentarai ir t.t. Programėlėje yra daug įvairių rolių, tiek vadovams, tiek patiems darbuotojams.

Lukas: Ar atsižvelgiate į klientų poreikius ? Ar jie dažnai keičiasi ?
Apklausiamas asmuo: Taip visas sistemas pritaikome pagal klientų poreikius. Vadovams yra sukurta skirtinga vartotojo sąsają, kad galėtų patogiau matyti įvairias statistikas, o darbuotojams dar kita, kad būtų patogu ir lengva dirbti. Hmm, tai tie poreikiai keičiasi ir iš to kyla iššūkių kaip pridėti papildomus funkcionalumus prie esamos sistemos architektūros, nepanaikinant seno funkcionalumo.

Lukas: Su kokiais iššūkiais teko susidurti kuriant projektą ?
Apklausiamas asmuo: Na šioje įmonėje gan prasta situacija. Nes mūsų išviso buvo keturi darbuotojai ir 2 pradedantieji programuotojai dirbome prie mobiliųjų programėlių ir turėjome vieną back-end programuotoją. Visas kodas buvo prastos kokybės, kad tik padarom ir kad veiktų, o ne kad kokybiškai. **Buvo tokie "shot-term solution'ai" ir atsirado "tech-debt"**, t.y. kai yra atliekami greitesni solution'ai o ne daroma pagal geriausias praktikas. Šie greiti sprendimai veikia, tačiau reikės ateiti kažkada ir sutvarkyti tai arba dėl to kils problemų vėliau. Paprasčiau tariant, tai panašų į skolos pasiėmimą, padarai greitai, bet ne kokybiškai ir tada tu vis tiek atsiimsi tą laiką, sugrįši, kad perdaryti nes vėliau atsiras problemų ar tai kuriant naujus funkcionalumus ar išlys kažkokios tai klaidos. Dėl pačių "tech-dept" tampa sunku palaikyti programinę įrangą bei pridėti naujus funkcionalumus. Tai kainuos žymiai daugiau plėsti projektą.

Taip pat buvo iššūkis iš komandos pusės, kad ten nebuvo dedikuoto asmens **iOS** programuotojo. Mes buvome du "Android" programuotojai ir vienas back-end programuotojas. Vadovai "Android" programuotojams sakydavo gerai, padarėte programą ant "Android" platformos, dabar padarykite ant "iOS". Ir aišku, mums reikėdavo išmokti tą technologiją ir dėl to mes neatlikdavome darbo taip gerai, kaip tai būtų padaręs specializuotas iOS programuotojas. Na mes negalėjome specializuotis į vieną sritį. Turėjome apimti daug sričių įskaitant testavimą, dizainą ir bendravimą su klientais. Labai nedaug laiko būdavo skiriama programavimui, nes reikėdavo bendrauti su klientais, išsigryninti jų reikalavimus, iškomunikuoti kaip veikia programa. Kitaip tariant labai daug atsakomybių. Kitaip tariant užsiimu "suvirintojo-kunigo" darbu, darau viską, bet nieko pilnai, be specializacijos normalios. Ši problema buvo aktuali šioje įmonėje, nes ji yra labai maža, turi mažą komandą. Būdavo didelis atsakomybių pasiskirstymas ant mažai žmonių, ko pasekoje kentėdavo daro kokybė. Sakyčiau, kad ši problema yra aktuali kiekvienoje mažoje įmonėje.

Appendix 5. Market-pull interview No. 1

- Trumpai papasakokite apie savo kuriama produktą
- Kuriame programinę įrangą skirtą žirgų radiologijos diagnostikai. Produktą naudoja veterinarijos gydytojai kurie, dirbtinio intelekto pagalba analizuoja žirgų rentgeno nuotraukas. Tai pagrindiniai naudotojai yra veterinarijos gydytojai, jiems skirtas šis produktas
- Kiek laiko vystote šį projektą?
- Jau bus du metai
- O gal kilo kokių nors iššūkių nuo pat pradžios iki dabartinio etapo?
- Žinoma, kitaip nebus. Pradžioje buvo sunkiausia išsigryninti komandą, nes ji keitėsi, jos sudėtis. Iš pradžių dalyvavo vieni žmonės, dabar mes jų turime devynis, kurie jau dirba ilgą laiką. Tai vienas čia iš iššūkių. Tai pirmiausia sudėtinga buvo komandos pritraukimas. Dabar kiti iššūkiai tai finansavimo iššūkiai, kur jį rasti ir kaip geriausi aplikuoti. Šiuo metu mes dirbam su Europiniu projektu vienu. Rašėm kitą, bet tikriausiai nepavyko jo gauti. Realia tai yra fundingo klausimas vienas didžiausiu. Žinoma mums kaip dirbtinio intelekto startuoliui svarbūs yra duomenys, bet juos esme gavę. Todėl `čia problemos kol kas nėra
- O galbūt minėjai, kad tas europinis projektas galbūt nepasisekė. Galbūt ir iš čia galima būtų įžvelgti kažkokį tai iššūkį. Galbūt kažkokia teisinė reguliacija, pati galėtum apie tai papasakoti?
- Turi omeny, kodėl mūsų neatrinko? Na tai dar nėra oficialūs šitie duomenys. Mes aplikavome į tokį projektą *****, jei esi apie tokius girdėjęs. Tai ten labai paprastai buvo nesusikalbėjimas ir pati organizacija mane informavo, kad mes galime dalyvauti pradedančiojo inovatoriaus, o ne brandžiojo inovatoriaus turint statusą. Ir tiesiog ne pačiame projekte buvo problema, bet biurokratinėje sistemoje ir jos išmanyme.
- Na tas nesusišnekėjimas gana dažnai būna tų verslų, kiek teko domėtis. Kaip kilo ši idėja, kaip ją išsigryninote?
- Idėja, tai matai aš pati esu baigusi veterinarinę mediciną ir daug metų buvau su žirgais. Stažavausi daug klinikų visoj Europoj ir tiesiog pati susidūriau su ta problema, kad tos nuotraukos nėra įvertinamos. Ar, kad tas nuotraukos vertinimas daromas ką tik pabaigusių veterinarijos gydytojų, na ir išvažiavus gydytojui į ambulatorinę praktiką, kur jis yra vienas. Jis neturi nei kaip pasitarti su kažkuo ir sprendimus reikia priimti dabar ir reikia gydymus paskirti, reikia tolimesnius diagnostiko būdus paskirti ir pačiam analizuoti. Tai iš tokių problemų ir kilo tokia idėja ir sprendimas
- Tai būtent šis sprendimas buvo tiksliau įvertinti pačią būklę?
- Taip. Tai rentgeno nuotraukos daromos dažniausiai ant sąnarinių paviršių įprastai. Šiuo metu esame sukūrę prototipą vieno sąnario, kuris yra dažniausiai fotografuojamas, nes jis labai dažnai būna pažeidžiamas. Todėl mes jį pasirinkom.
-Tačiau galima analizuoti ne tik tą vieną sąnarį, bet ir kitus kaulus?
- Taip, taip. Ir sąnarius ir kitas kūno vietas.
- O nuo pirmos minties, kad noriu padaryti būtent tokį produktą, galbūt per tą laikotarpį kilo realizacijos problemų. Pavyzdžiui, kaip viską padaryti, gal, ar technologija tinka. Ir gal pakeisti kažkokius dalykus?
- Šiaip pagrinde idėja liko ta pati. Galbūt kas pasikeitė, tai prisidėjo tokių papildomų dalykų, kas galėtų būti tame projekte ir kam jis galėtų būti naudojamas. Tai gydytojai pareiškė norą, kad galėtų būti sistema kaip klasifikuoti tas rentgeno nuotraukas. Ko mes prieš tai nebuvo apmąstę ir supratę, kad čia irgi yra niša. Bet esmė visa kaip ir liko, nekeitėme.
-Supratau. O tikriausiai rinkos analizės nereikėjo daryti? Jūs kaip ir nusistatote, kad jūsų klientai yra gydytojai. Ar galbūt ligonis, gal taip galima pasakyt.
- Taip, rinkos analizę tai žinoma reikia daryt be kalbų ir suprasti ir kokio dydžio ta rinka ir sakykime ir kiek žirgų pasaulyje ir kiek gydytojų ir kiek nuotraukų galima padaryti. Priedo veterinarijos gydytojai yra ""end useriai" Bet mes norime integruoti į tokias softo programas, kurias jau naudoja gydytojai, tam kad palengvinti visą integracija tai mums reikėjo ir čia tuos rinkos tyrimus pasidaryti ir apie tas kompanijas suprasti ir su jomis susisiekti ir panašiai.
- Tai būtent kažkokių problemų tai darant nekilo?

-Būtent atliekant rinkos analizę? Na kaip. Visada yra sunku rasti tuos duomenis ir išgryninti būtent ko tau reikia. Jei ją reikia daryti kiekvieną kartą ją aplikuojant vis iš naujo. Kažką pridėti ir panašiai. O kad kokių bėdų nežinau. Visada norisi viską pagrįsti kažkokiais moksliniais straipsniais ar statistikos duomenimis , bet ne visada tai pavyksta padaryti. Reikia ir pačiam skaičiuoti kokybiškus vardiklius ir panašiai. Tada gaunasi, kad tie duomenys nėra iš Eurostato paimti. Nes neina jų gauti kitaip, nei tu pats padarai. Bet iš čia gal irgi kyla problemos, kad tie duomenys nėra visiškai patikimi. Bet tu vis tiek juos turi gauti ir jais remtis. Nežinau ar atsakiau į klausimą?
- Taip. Nes aš pats buvau išsikėlęs tokį klausimą. Tokią problemą, būtent dėl duomenų validumo. Nes būna, kad tiri rinką, atrodo, kad viskas gerai, bet išties jie nėra visai teisingi tie duomenys. Todėl jei nusistatai neteisingą klientą, gali nebūti gerai.
-Taip žinoma. Tai ir investuotojai klausia kokia čia rinka, todėl reikia to pagrindimo. Tai aišku norisi patiems nesuklysti ir neapsiskaičuoti, nes po to viskas į tai remiasi.
- Ar didelė jūsų rinka? Ar dirbate su gana maža rinka?
- Šiaip čia tikrai yra nišinė rinka tiek iš veterinarijos gydytojų. Sakykime žirgų klinikų Europoje yra virš 600 tai palyginus su smulkiais gyvūnais jų yra žymiai mažiau. Bet pati rinka, žirgų sporto yra auganti ir pakankamai gerus pelnus generuojanti. Tiek su lenktyniniais žirgai tiek su kitom disciplinom.
- O koncentruojatės į viso pasaulio ar pagrinde į Europą?
- Šiaip žinoma sprendimas tarptautinis. Šiuo metu turime sutarimą dėl integarcijos su viena Europos įmone. Viena įmonė iš JAV norėtų mūsų sprendimo.
- O kai dirbate su tais pačiais jūsų klientais. Tai kaip sekasi išsigryninti pačius kliento poreikius?
- Iš pradžių atlikom nemažai interviu, su gydytojais. Ar aplamai jiems įdomu ar tai ne per daug nauja. Kad būtų norima naudotis. Rėmėmės šitais, vėliau atlikome internetines apklausas kai jau kovidas atėjo. Tai iš tikro susidomėjimas didelis. Ir šį mėnesį pradėsime testuoti pačią sistemą su veterinarijos gydytojais ne mūsų, nes vidiniais, o išoriniais. Tai norim išgirsti iš pačių jų ko jie dar tiksliau norėtų. Kaip įsivaizduotų patį interfeicą ir kaip naudoti norėtų.
- Ar tokių nesupratimų būna, kad jūs galvojat taip, o jie įsivaizduoja visai kitaip ir paskui jie turi iš naujo gryninti idėją ir aiškinti?
-Sunku atsakyti, nes produktas dar ne pardavimo būsenoj tai sunku ir pasakyt. Kai jie jau turės mokėt už tai, tai gal bus ir aiškiau. Bet šiaip mes ir su testavimu norime padaryti, kad iš pat pradžių tai atitiktų jų lūkesčius.
- Bandau įžvelgti miskomunikacijos su klientu problemą, bet atrodo, kad čia jos nelabai yra. Ar kol nėra tas pardavimo etapas.
- Taip. Aš teoriškai suprantu, kad tą produkciją tu turi daryti pagal kliento norus, ne pagal tai kaip tau patogiau ar įsivaizduoji. Į šitą klausimą tikiuosi galėsiu atsakyti po mėnesio kai produktas jau bus ištestuotas ir turėsiu konkretesnių atsakymų. Nes dabar tai visiems atrodo laibai įdomu. Ypač kai įsisuki į tokias nišines rinkas kaip veterinarinė medicina ar žirgų medicina, tai visi yra tokie excited.
- Tuomet dar klausimas ir R&D. Ar lengva įvertinti kiek gali trukti naujos idėjos realizavimas. Atrodo gauni idėją ir ją reikia įvertini. Tai ar tas laikas yra koks nors konkretus ar labiau toks labai komplikuotas?
-Būtent jei kokį naują produktą pradėti? Kiek mums viduje reikia apsręsti ar mes imam ir panašiai?
- Na taip.
- Nežinau. Pas mus įmonės viskas ga greit vyksta. Ir dabar esam pradėję vieną naują R&D projektą. Šiek tiek nesusijusį su mūsų veikla. Tai nežinau, jei reikia laiko tai sakyčiau savaitė.
-Bet tai gal labiau susiplanavimas? O pati realizacija ar truputį ilgesnė?
- Na taip, žinoma. Labai priklauso nuo konkretaus dalyko.
- O jei dar kalbat apie tai ar lengva nustatyti tą datą kada jau išeis produktas?
-Mes planuojam produktą išleist dalimis. Ir labai tikimės, kad po metų galėsime daryti pirmąją integraciją daryti. O pilnas produktas kada išeis tai labai sunku pasakyti, bet manau, kad užtruks dar kokius tris metus.
-Galbūt jau teko su kažkuo integruotis? Su kokiais nors servisais?

- Tai, mes esame apšnekėję, bet kad pačia integraciją daryti tai dar ne. Esam netoli to, bet reikėtų dar develop, realiai.
- Vadinasi dabartinę integraciją stabdo developas, ar ne?
- Taip.
-Kažkokių technologinio įgyvendinimo problemų jūsų programinės įrangos kūrėjams ar yra kažkokių?
- Žinoma.
- Gal pasidalina jie. Nes kaip suprantu jūs prižiūrit tą visą dalyką, o jie programuoja?
- Taip, turime tų problemų tiek su modelio patikimu, visada jį reikia kelti ir tai yra gana sudėtinga. Anksčiau turėjom iš technologinės pusės tai dėl cloud'ų dėl serverių, bet jas išsisprendėm. Tai iš šitos pusės kol kas problemų nekyla. Nes mes patys bereedinam ir platformas skirtas duomenų apdorojimui ir panašiai. Ir žinoma tų techninių dalykų iššūkių buvo. Bet jei konkrečiai reikia atsakyti tai manyčiau, kad dabar didžiausios problemos yra su pačio modelio treniravimu.
- O kaip suprantu cloud'ą naudojate, kad saugoti savo duomenis?
- Taip, mes dalinai savo serverį turime ant kurio treniruojames su GPU sluoksniu. Tai pirkom visą kompą jai. O cloud'`ą naudojam duomenims saugoti ir aplamai dokumentams, tai Google cloud'ą. Ir postint svetaines ir kitas platformas.
- Supratau. O pavyzdžiui jei jūsų įmonė labai išsiplečia ir gal net šiuo metu net yra, kad kompiuterio skaičiavimo galios reikia. Kaip suprantu šita problema gana aktuali, nes reikia analizuoti gana daug vaizdų. Tai turi būti parinktas labai geras algoritmas?
- Taip, taip.
- Ar reikia daug klientui, kad jis išmoktų naudotis tuo prototipu. Ar jis turi įdėti daug darbo, toks kaip trancision dalykas, ar gal jis galvoja, kad jam per sunku ir galų gale jis gali atmesti šitą dalyką, nes tai jam per sudėtinga? Ar jums kyla tokių dalykų.
-Mes visą kliento naudojimą galvojom nuo pat pradžių, tai ir patį testavimą, pačią platformą padarėm kaip paprasčiau. Kad tiktų ir visi formatai ir visi video, kad kuo paprasčiau daryti. Tai ir mūsų vidiniai veterinarai testuoja ir sako, kas nelabai aišku, ką reikia pakeisti. Svarbiausia, kad jiems užimtų kuo mažiau laiko, neišgąsdintų. O ateity kai integruosimės į kitus softu, darom, kad būtų patogus produktas, kurio nereikės iš naujo atsidarinėti ir kad viskas įeitų į tą usal work-flow. Aš pati kaip gydytoja, žinau, kad gydytojai tikrai nenorės vargti ir viskas jiems turi būti patogu ir greitai.
- O kaip apsaugote savo intelektinę nuosavybę? Vis tiek tai yra idėja kurią vystote, į kurią įdėta daug indėlio
- Būtent iš šitos pusės gal yra šiek tiek lengviau. Patentavę mes dar n kol kas nesame. Ka iš licenzijų pusės, mums yra lengviau dirbant ne su žmonėm, nereikia įvairių sertifikatų. Užtenka minimalių programinės įrangos sertifikato panaudojimo.
- Ar susiduriate su privatumo iššūkiais? Gal su pacientų duomenimis dėl kurių gali skųsti žirgų savininkai?
- Taip tai mes užtikrinam šitą anonimizuodami visus duomenis, pasiekiama ir meta- data ir pixelių lygyje. Taip pat ir jei gydytojam reikia pasirašome konfidencialumo sutartis, kad niekur tai neišeis. Tai kol kas visi tai darom ir problemų nekyla.
-O gal yra kilusių kažkokių tai duomenų saugumo iššūkių?
- Ne, tikrai nebuvo.
-Kaip sprendėte duomenų valdymo ir paskirstymo problemą?
- Naudojame Google Cloud'ą, serveriai. Mes juos laikom įvairiuose vietose.
- Kol produktas nėra parduodamas, dėl ko kyla komercializacija algoritmo?
- Iš jam reikia daugiau funkcionalumo, daugiau patogumo. Ir tada mes galėsim jį komecializuoti. Nes iš verslo pusės turim komnadą, kurie labai edukuoja apie šį projektą ir rašo įvairius postus ir su pačiom klinikom kontaktuoja. Tačiau dar trūksta pačio produkto. Kad galėtume tikrai pasitikėt tais produktais juos integruot ir parduot.
- O kas nustato patikimumą?
- Patį modelį, jo patikimumą tai yra įvairūs mašininių mokymų testai, validacijos su test settais, T-settais, įvairiais tikslumą nurodančiais rodikliais, tai pagal jį vertiname. Bei patys testuojam savo

sistemą ir matom, kad neatpažino kažkokios patologijos ar fasle positive arba false negative rezultatą davė. Todėl už tokį produktą dar negali prašyti pinigų, turį jį išdėlioti, kad pats pasitikėtum.
- Kaip dar planuojate pildyti savo projektą?
- Reikia žinoma finansavimo, tuomet galima judėti toliau. Tiek iš research'o pusės tiek iš development'o pusės. Gal šiek tiek greičiau viskas vyktų
- Kokios tack'as pas, kokios technologijos pas jus naudojamos?
- Daug tų technologijų Python.
- Ar prieš du metus, kai buvo pradėta įgyvendinti ši idėja, gal viskas atrodė šiek tiek paprasčiau nei dabar?
- Ir taip ir ne. Atrodė, kad viskas pasidarys daug greičiau nei iš tikro darosi. Kyla visokių problemų kaip surast, pritraukt komandą. Kaip rast finansavimą ir naujų žmonių, kaip viską suderint
- Ar kolegos prisideda ir prie vadybinės pusės?
- Taip, turim keturis IT žmones, turim full stack veterinarus, kurie dirba su nuotraukomis, jų žymėjimu, segmentacija. Ir toliau turim media komandą, kurie atlieka ir verslo vystymo darbus.
- O iš kur gaunate visus duomenis, nuotraukas pavyzdžiui?
- Jas perkame iš klinikų, kurios išreiškia susidomėjimą, kurios sutinka jas parduoti. O jos pakankamai brangios. Todėl nenuostabu, kad tie dirbtinio intelekto darbai tokie brangūs.
- O iš kur gaunate tokių finansinių dalykų, nes kaip startuoliai nelabai gal nelabai turit kapitalo ar savų investicijų?
- Taip, mes šiuo metu finansuojamės iš Inostarto, iš ten ir finansuojamės.

Appendix 6. Market-pull interview No. 2

Lukas: Papasakokite apie savo produktą
Apklausiamas asmuo: Mes kuriame įvairius Web pagrindu veikiančius sprendimus

Lukas: Su kokiais iššūkiais susiduriate ? Kaip juos sprendžiate?
Apklausiamas asmuo: Susiduriame su sistemos plečiamumo problema. Dėl architektūrinių problemų sunku vystyti kodą. Taip pat gan didelis iššūkis buvo bendrasis duomenų apsaugos reglamentas, kuriuo turėjome vadovautis.

Lukas: Kokį atsarginį planą esate paruošę, jei iškiltų problema realizuojant projektą su iš pradžių numatyta technologija ?
Apklausiamas asmuo: Sistemos projektavimas, kuris leistų nesunkiai integruoti naujas technologijas

Lukas: Kaip apsaugote savo intelektinę nuosavybę?
Apklausiamas asmuo: Pasirašome intelektinės nuosavybės sutartį

Lukas: Su kokiais privatumo iššūkiais susiduria jūsų įmonė ?
Apklausiamas asmuo: Pagrinde problema kyla suteikiant teises prie sistemos. Stengiamasi, kad jų kiekis būtų atitinkamas to žmogaus pareigoms.

Lukas: Su kokiais saugumo iššūkiais susiduria jūsų įmonė ?
Apklausiamas asmuo: Susiduriame su kibernetinėmis atakomis. Jų išvengti naudojame „Cloudflare“ paslaugas prie DDOS atakas

Lukas: Ar jūsų įmonė susiduria su duomenų valdymo ir paskirstymo problema? Kaip ją sprendžiate ?
Apklausiamas asmuo: Didžiausia problema yra jų kiekis ir kur juos patalpinti. Duomenis paskirstome pagal roles ir padalinius ir saugome atitinkamuose serveriuose.

Lukas: Ar jūsų įmonė susiduriate su didelių duomenų kiekių apdorojimo problema ? Kaip ją sprendžiate ?
Apklausiamas asmuo: Taip. Naudojame analitikos (Knime Cloud) sprendimą duomenų apdorojimui

Lukas: Ar susiduriate su komercializacijos problema ?
Apklausiamas asmuo: Jeigu sistemos veikimas lėtas, susiduriame. Tada tenka kodą tobulinti tol kol jis užtikrina greitą sistemos veikimą. Procesas vyksta tol, kol sistema pasiekia optimalų našumą.

Lukas: Ar programinės įrangos kūrėjai susiduria su technologinio įgyvendinimo problemomis ?
Apklausiamas asmuo: Kuriant programinę įrangą, pasitaiko tokių atvejų. Dažniausiai jei prieš tai nebūna viskas tinkamai įvertinta.

Lukas: Kaip planuojate laiką? Ar susiduriate su laiko planavimo iššūkiais ?
Apklausiamas asmuo: Darbus vykdome dviejų savaičių sprintais ir nustatome prioritetus
Lukas: Ar jūsų įmonėje yra specializacijos iššūkių ? (aktualus mažoms įmonėms, asmuo turi aprėpti daug sričių, negali koncentruotis į vieną dėl pvz. darbuotojų stygiaus; atsiranda Tech-debt prastėja kodo kokybė, greitesnis produkto paruošimas, su prastesne kokybe)
Apklausiamas asmuo: Mūsų įmonėje yra įvairių specialistų, kurie yra specializuoti, tad ši problema yra neaktuali.

Lukas: Ar susiduriate su iššūkiais komunikuojat su kitų įmonių specialistais ?
Apklausiamas asmuo: Darome, savikontrolę, išklausome, aprašome kaip supratome ir pasitiksliname pas klientą, ar teisingai supratome užduotį.

Lukas: Ar susiduriate su besikeičiančiais klientų programinės įrangos reikalavimais ?
Apklausiamas asmuo: Iš dalies, matant parengtą produktą atsiranda papildomi vartotojo patogumo reikalavimai

Appendix 7. Market-pull interview No. 3

Lukas: Koks yra jūsų produktas?

Apklausiamas asmuo: Mūsų produktas yra griežtai reguliuojamas valstybinių institucijų. Mūsų produktas labai priklauso nuo reguliacinės aplinkos. Priklausant nuo reguliacijos tu ir pasirenki produktą ar paslaugą, kurią nori įvedinėti ir tada matai, kokie iššūkiai iš reguliacinės pusės laukia.

Lukas: Su kokiais iššūkiais susiduriate ?

Apklausiamas asmuo: Priklausant nuo reguliacijos tu ir pasirenki produktą ar paslaugą, kurią nori įvedinėti ir tada matai, kokie iššūkiai iš reguliacinės pusės laukia. Tai vienas iš tų iššūkių iš reguliacinės aplinkos ar tu atitinki jų reikalavimus. Pavyzdžiui, jei nori vystyti lošimų verslą turi turėti žymiai didesnį įstatinį kapitalą, negu atidaryti rūbų parduotuvę ir kur tau užtektų mažosios bendrijos ar uždarosios akcinės bendrovės. Lošimų sektoriui įstatinis kapitalas yra labai didelis, reikalaujamas kartais net šešiaženklės sumos

Kiti iššūkiai pinigų plovimas reglamentas ir GDPR (duomenų apsauga). Jei tavo paslauga, orientuota į tam tikrą rinką ir tavo paslauga ar tavo produktas turi rinkti tam tikrus duomenis ir turi nustatyti klientų tapatybę, tai kyla didelis reguliacinis iššūkis, taip pat ir duomenų anonimizavimo klausimas. Tapatybės nustatymas yra didelis reguliacinis iššūkis, kuris verčia ne tik įsidiegti naujas technologijas pvz. nustatyti kliento tapatybę ir sekti jo transakcijas ir įsitikinti lėšų kilme, bet ir užtikrinti duomenų apsaugą.

Pagal savo tikslinę paslaugą arba auditoriją yra pritaikomas produktas. Kaip pavyzdys, Kam Lietuvoje prieš dešimt metų geriau sekėsi ar naujų automobilių atstovybėms ar padėvėtų ? Faktas yra, kad padėvėtų. Nors infliacija didėja, darbo užmokestis augo žymiai sparčiau, ypač miestuose, ypač sostinėje, dėl to pasikeitė kliento poreikis ir galimybės, todėl dabar atidaryti atstovybę naujų automobilių negu dėvėtų yra žymiai pelningiau ir lengviau. Na tas jau yra susilyginę. Kalbant apie lošimų sektorių tam tikruose regionuose yra tam tikros tradicijos: pvz. vidutinio amžiaus arba senesnio profilio lošėjas pagal amžiaus grupę, jis labiau yra konservatyvių pažiūrų. Todėl jam klasikiniai lošimų automatai yra visada patrauklesni ir žymiai lengviau suprantami ir tai reiškia, kad yra populiaresni, negu modernūs ir pagal naujausias technologijas sukurti lošimo automatai.

Lukas: Tai čia būtų amžius 30+?

Apklausiamas asmuo: Taip, kitaip tariant su kuo tu užaugai. Jei tu užaugai lankydamasis lošimų automatų salonuose, tu ten matydavai ganėtinai paprastus būgnelių tipo automatus. Jie būdavo mechaniniai, matydavosi tam tikras judėsis, o dabar yra jau skaitmenizuota, su įvairiomis vizualizacijomis. Kai tu užaugai, tu to iš ieškai, kad tau būtų lengva, suprantama ir mažiau įneštų panikos.

Lukas: O kaip jaunimas ?

Apklausiamas asmuo: Jaunimas orientuotas ne į loginę pusę, bet į vizualinę. Jaunimas iš esmės mato akimis, nes jis neturėjo patirties iš anksčiau arba neturėjo kažkokio praktinių pavyzdžių su kuriais augo, todėl jis orientuotas iš esmės į tai ką matei augdamas. Ir taip formuojasi požiūris į tam tikrą paslaugą ar produktą.

Pvz. Jei tu augdamas gyvenai pvz. Kauno rajone ir matydavai, kaip aš norėčiau į Žalgirio rungtynes atvažiuoti. Anksčiau tos realios galimybės nebūdavo, nes daug kas automobilio neturi, sunku ji kur

palikti, svetimas miestas ir t.t. Netgi dabar, kai pats Žalgiris žaidžia, jis pritraukia iš viso Kauno regiono žmones, ne 100 procentų. Kauniečių atvažiuoja pažiūrėti Žalgirio rungtynių, o kažkur apie 35 procentai apskritai atvažiuoja iš aplinkui. Netgi į Vilnių siunčia autobusus, o ką tai iš esmės reiškia, tai reiškia tu gali praplėsti savo paslaugų sfera atsižvelgdamas į poreikį, kuris susiformavo iš esmės anksčiau. Ar kuris kinta nuo trendų. Pvz. jei Žalgiris laimi, tai tuo daugiau žmonių nori atvažiuoti pažiūrėti rungtynes.

Galbūt anksčiau Tau galėjo pasirodyti investavimas į akcijas, galėjo pasirodyti labai sudėtingas procesas. Toks įrankis kaip "Revolut" pasiūlo tau galimybę investuoti į akcijas. Netgi 18 metų asmuo turėdamas paskyrą gali jau investuoti netiesiogiai į akcijas. Taip pat ir nusipirkti kripto valiutų, kodėl tas yra aktualu, nes keičiasi iš esmės poreikis ir tas kas auga, tas iš esmės yra trende. Tai čia su kripto valiutom yra labai geras pavyzdys, kaip netgi rizikinga veikla, kuri prasidėjo nuo noro įgyvendinti necentralizuotą sprendimą. Tai yra Worldwide. Tai pakeitė žmonių požiūrį. Iš centralizuoto t.y. banko perkelti transakcijas į person to person lygį. Kad nebūtų tos vidurinės dalies - banko.

Pirmas žingsnis apsiuostyti reguliacinę aplinką, priklausomai nuo tavo produkto. Tada įsivertinti ar tavo produktas yra rinkoje. Jei yra rinkoje ar kas nors siūlo tą patį produktą ir kokiomis sąlygomis, tada įvertinti ar tu gali pasiūlyti tai geresnėmis sąlygomis, nukenčiant kokybei. Kitas labai svarbus aspektas ar tavo paslauga ar produktas reikalauja palaikymo. Jei reikalauja, kaip tą palaikymą tu galėsi užtikrinti ? Tai yra ar tu būsi gabus ir išgalėsi samdyti žmones, Lietuva dabar galima pavadinti yra toks hotspot'as darbuotojų kalvės srityje. Nes ji iš esmės, didžioji dalis paslaugų yra susijusi su IT. O paslaugą nusipirkti gal tik 20 procentų pigiau negu Australijoje, nors Australijoje vidutinis darbo užmokestis yra 4 kartus didesnis, nei Lietuvoje. Ką tai lemia ? Lietuva, kaip tokia tikslinė rinka, ypač IT, Fintech yra darbuotojų kalvė, lygis labai didėja. Jei tavo paslauga ar produktas su kurio tu ateini į rinką labai greitai ir ženkliai išaugs tu turi įsivertinti ar tu galėsi rasti darbuotojų, jo palaikymui. Jeigu ne, tada turi visą laiką turėti planą B, kur tu darbuotojų ieškosi ir surasi. Lietuvoje tu gali susirasti 40 procentų brangesnes IT paslaugas negu kokioje Ukrainoje ar Baltarusijoje. Jei kokias vizualizacijas darysiesi tai sumokėsi kokius 70 procentų daugiau nei kokioje Indijoje.

Lukas: O kaip viską susiderinti juk mentalitetas juk skiriasi ?

Apklausiamas asmuo: Mentalitetas taip yra kitoks, bet kokybė darbo negaliu pasakyti, kad yra prastesnė. Tiesiog tai supratimas, kad tu susiduri su tam tikrai iššūkiais: komunikacinis iššūkis (į ką įeina kalbos barjeras), kultūrinis aspektas, laiko zonos skirtumas. Jei tuos visus dalykus puikiai įgyvendini ir susirandi tą gerą komandą, darbas ar paslaugos įsigijimas iš trečiosios valstybės jis gali būti tik privalumas finansine prasme

Tai kas dar reguliacija, produktas, konkurencinė aplinka, plėtros vizija.

Lukas: Ar yra kokių nors iššūkių su klientais ? Kaip sekasi išsigryninti ko jie iš tikro nori ?

Apklausiamas asmuo: Aš visą laiką, sakau, tas kas pradeda verslą, turi žinoti su kokiu produktu ar paslauga įeina. Didžiausia klaida, kuri yra daroma, mano galva, kai tu pats nesupranti savo produkto arba kokią pridėtinę vertę kuria. Nes jei tu suprasi savo produktą ir kokią pridėtinę vertę kuria, tu tada visą laiką gali pats patapti vartotoju. Jeigu būdamas iš vartotojo perspektyvos tu visą laiką žinai, kam tas produktas ar paslauga gali būti taikytina. Aš visą laiką būčiau orientuotas pradėti verslą tada, kada atsirakina tam tikros galimybės, na pavyzdžiui, buvo pradėti 2017 liepos mėnesį pinigų plovimo direktyva. Lietuva buvo irgi įpareigota, perkelti ją į savo sektorius. Įsigaliojo privalomi tapatybės nustatymai nuotoliniu būdu, daugelyje sektorių: finansų ir kitiems sektoriams. Visi suprato poreikį, kad tapatybės nustatymas naudojant tokią programėlę kaip Skype ar kita, kuri

suteikia tiesioginį vaizdo perdavimą yra nepatogu. Turi būti įsidiegęs programėlę, turi palaikyti 24/7 supportą. Todėl, kas buvo padaryta. Buvo pagal tam tikrus reikalavimus, įsigilinta į produktą, kuris galėtų analizuoti ir ieškoti tam tikros procentinės atitikties tarp užfiksuoto veido atvaizdo ir tapatybės kortelės nuotraukos. Tikslinė rinka, tiksliniai pavadinkime klientai, t.y. finansų sektorius, lošimų sektorius, na ir visas sektorius, kuriame yra reikalaujama nustatyti tapatybę prieš teikti paslaugas. Įsivertini paklausa ir konkurencinį iššūkį ar tu turi konkurentų, tai vat, šitoje vietoje aš kaip sakau tikslinė auditorija, privalomumas ieškoti produkto ir konkurencinės aplinkos nebuvimas, būtent vat paskatino tam tikra vieną Lietuvišką startuolį labai gerai sustartuoti, okupuoti 90 procentų rinkos su savo produktu per ateinančius kelius metus.

Lukas: Tikriausiai turite omeny startuolį "iDenfy" ?

Apklausiamas asmuo: Taip.

Toliau kas. Jei tai yra reguliuojama rinka, tai turi atkreipti labai daug dėmesio į reguliacinę aplinką, turiu omeny į jos pastovumą, ar ji yra stabili ir pastovi ar ne. Nes vat, jei norėtum pradėti lošimų verslą, tu turi įsivertinti reguliacinius, tiek finansinius iššūkius. Vėlgi, turi pasižiūrėti, koks yra požiūris tam tikrinėje rinkoje į reguliatorių į tavo veiklą. Jei tai yra nereguliuojama veikla, tu tada turi labiau orientuotis į savo konkurencinę aplinką ir ką tu gali naujo, kitokio, geresnio, pigesnio, inovatyvesnio pamatyti. Trendai ir kultūriniai aspektai yra numeris vienas, nes žiūrint, jei Lietuvoje reikėtų pradėti, na nežinau, atidaryti dar vieną kirpyklą, tai eitum pagal senus metodus ir tiesiog ieškotum, kur srautą didžiausią pamatytum, reklaminę iškabą, SEO dalis. Bet jei tu tuo tapu norėtum atidaryti nežinau, dažnai gali pamatyti, kaip į Lietuvą yra įvedami maisto produktai tokie kaip "Buble waffle", nuvažiavo į Amerika, pamatė, kad yra tokie "Bubble waffle". Nusipirko prietaisus jiems kepti, ir iš esmės viskas. Tu turi išsiaiškinti, kur yra tavo tikslinė auditorija. Tai yra ten kur yra ne tik vaikai, bet ir daug jaunimo ar ne, tai yra automatiškai Palanga arba pajūris. Taip tu paimi didžiausiai įmanoma auditoriją, ne investuodamas į plėtrą t.y. įsteigdamas fizinę vietą, bet tiesiog tu būdamas, kažkur pastatydamas savo vagonėlį gatvėje ir tu pritrauki labai didelį dėmesį, visiškai be jokios reklamos ir tada kitą sezoną tu jau gali atidaryti savo pavadinkime šitą (fizinę vietą). Tai čia yra ta sakykim tikslinė auditoriją ir tikslinė vieta ir tikslinė rinka.