Business Model: Reducing waiting time for patients through a self-check-in and a waiting time prediction tool for German medical practices.

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I. Abstract

The aim of this thesis is to develop an initial business model and validate the business idea of the start-up, named DOC+. The solution offers the most time efficient way to plan and execute a physician visit for practices and patients though self-check-in and though waiting time predictions.

First, the business idea is described, followed by an analytical and structured approach to create the business model. It is validated through the analysis of an online survey for patients and semi-structured interviews with physicians. The quantitative data is statistically analyzed with regression analyses and the qualitative data according to Mayring's coding scheme.

Ash Maurya's Lean Canvas, a one-page business model, serves as the basis for the thesis. It is designed to serve as a foundation for DOC+ and for the evaluation of strategic plans and projects, which will be refined in future iteration steps. To fill in the key frames of the canvas, different frameworks are used.

Key findings are that physicians have a demand to address root causes that trigger waiting times. This points at the excessive burden of administrative tasks and the need for relief. This also represents the greatest value creation for the paying customer, the physician: Reduction of workload for staff and their use of time for essential tasks. It is also identified that it is more advantageous for DOC+ to collaborate than to compete. The biggest advantage for collaboration with a competitor is the reduction of market entry barriers and having access to their resources.

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II. Resumo

O objetivo desta tese é desenvolver um modelo de negócios e validar a ideia de negócios de uma start-up, DOC+. Esta, entrega a maneira menos dispendiosa e mais eficiente de planear uma visita a um médico, tendo em conta o tempo de check-in e de espera.

Primeiramente a ideia de negócio é descrita, seguida por uma abordagem analítica de como se criou o modelo de negócios. Esta é validada através da análise de dados de um questionário online distribuído por pacientes e de entrevistas semiestruturadas com médicos. Os dados quantitativos são analisados através de regressão linear e a análise qualitativa é feita de acordo com o Mayring's coding scheme. Ash Maurya's Lean Canvas serviu de modelo para a construção desta tese. Foi desenhado para desenvolver o DOC+ e avaliar os planos estratégicos que serão redefinidos em estádios futuros do modelo de negócio. Para preencher os esquemas chave do canvas, diferentes modelos foram utilizados.

Os resultados mostram que os médicos têm procura que é despoletada pelos tempos de espera. Isto deve-se ao fardo de tarefas administrativas e necessidade de alívio. Isto também representa a maior oportunidade de criação de valor para o consumidor, o médico: Redução da quantidade de trabalho de staff e a utilização desse tempo extra para tarefas essenciais. Isto também mostra que o maior vantajoso para o DOC+ é colaborar e não competir. A maior vantagem da colaboração com um "adversário" é a redução de barreiras de entrada no mercado e acesso aos seus recursos.

Título: Modelo de Negócios: Redução do tempo de espera de pacientes através de uma feramente de check-in automático e previsão de tempo de espera para Práticas Médicas Alemãs

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Palavras-Chave: Modelo de Negócios, Machine Learning, Check-in Automático, Previsão de tempo de espera, Lean Canvas, Proposta de Valor Canvas, Orientação de estratégia de negócio, Paciente, Médico, Prática médica, Software de Prática, Startup, Alemanha

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V. List of Abbreviations

API	Application Programming Interface
IT	Information Technology
RQ	Research Question
LC	Lean Canvas
MVP	Minimum Viable Product
VPC	Value Proposition Canvas
TAM	Total Available Market
SAM	Served Available Market
SOM	Share of the Market
ESC	Entrepreneurial Strategy Compass
MVZ	Medizinisches Versorgungszentrum, engl. Medical care center
ML	Machine Learning
NDA	Non-Disclosure Agreement

1 Introduction

1.1 Initial situation and problem description

According to a study by the *National Association of Statutory Health Insurance Physicians* which annually surveyed almost 5,000 insured people since 2006, about 1/4 of all patients experience a waiting time of more than thirty minutes in a German medical practices for their treatment to begin (FGW, 2021). About 1/3 of all patients wait up to half an hour and only 1/3 receives treatment within a quarter of an hour. Since 2008, these numbers have remained largely constant except for a decrease of wait times triggered by the Covid-19 pandemic outbreak. It was also found that with increasing waiting time the confidence level in the physician and his staff decreases. (FGW, 2021) This has been confirmed by the 2018 Vitals study, which found a strong correlation between wait times at the doctor's office and rating of the practice. The shorter the waiting time, the higher the doctor's ratings scored. (Vitals, 2018) As another crucial point that is also related to waiting times identified by the study was the reception. About 50% of patients report to not having sufficient privacy at the reception desk. (FGW, 2021) Furthermore, there are also complaints among practice staff, who are continually highly stressed – at a level twice as high as the general German population. (University Hospital Tübingen, 2019) A third point identified was that a crowded waiting room increases the risk of catching infections from other people waiting, especially for people with a weakened immune system. (Shaw, 2019) This overview shows a possible demand for shorter waiting times and significant potential for improvement. The points described above can be addressed through further digitalization[1]. Digitalization offers the opportunity to reduce waiting time and, by the same means, provides improvements to the negative effects associated with long waiting times. According to physicians, the barrier of ramping up digitalization is described by the following reasons: Transformation efforts (i.e., costs, information and training effort, time requirements), security gaps in the IT systems, an unfavorable cost-benefit ratio and the system's vulnerability to errors are the biggest obstacles to digitization. Around 80 percent of practices assess these as medium to strong hurdles to digitalization. (Albrecht et al., 2020)

[1] Digitalization is defined as the use of digital technologies and of data to create revenue, improve business, replace/transform business processes and create an environment for digital business, whereby digital information is at the core. (De Clerck, 2017)

Conclusively it should be noted that pressure from the healthcare sector and politics is increasing to advance digitization in healthcare. During the reading of the proposed law on the digital modernization of healthcare, former Federal Minister of Health Jens Spahn claimed that the "potential of digitization should be better exploited" (Bundesministerium für Gesundheit, 2021). Heyo Kroemer, CEO of Charité Berlin, confirms this and claims that "a primary goal for the next federal government is to make significant progress in the digitization of the healthcare system" (Deutschlandfunk, 2021).

1.2 Objectives and Problem Statement

To address the problem described in Chapter 1.1. this thesis describes a 2-stage solution. First, the patient will be notified prior to the appointment with the updated actual appointment time. Second, the check-in process at the front desk will be performed digitally by the patient himself. Chapter 2 explains the business idea in detail.

The aim of this thesis is to develop a business model for this solution, named DOC+. The business idea will be validated and a conclusion will be drawn on how to proceed with the business concept. Opportunities and risks will be discussed and the necessary resources for the realization will be estimated. The business model is designed to serve as a basis for the foundation of a company and for the evaluation of strategic plans and projects.

Following research questions (RQ) will be answered:

RQ1) To what extent exists a customer demand[2] for reduced waiting times and the problems they cause?

RQ2) Who will be the paying customer, and in which segment is the early adopter?

RQ3) What value is generated for the stakeholders?

RQ4) To what extent is it advantageous to either develop an own platform and enter the market as a competitor or to collaborate with a medical practice IT system service provider?

1.3 Structure

After describing the initial situation and problem as well as the objectives and the problem statement in the first chapter, the business idea is specified in the second chapter. In the third chapter, the literature review is presented, identifying appropriate scientific tools and methods

[2] Demand refers to the consumers' desire or willingness to use DOC+.

that will be applied throughout this thesis. In the fourth chapter, Methodology, both qualitative and quantitative research methods are presented. The results of the research for each of the two key stakeholders are presented and interpreted in the fifth chapter. In addition, this chapter examines the potential customer and market. Conclusively, the sixth chapter answers the research questions and points out the limitations and future research.

2 Business Idea

2.1 Vision

The goal is to make a doctor´s visit time efficient and resource-saving for doctor and patient. The patient should wait as little as possible for the treatment to begin and the doctor's customer satisfaction should not suffer due to long waiting times. In addition, the physician´s staff should use their time more efficiently and reduce time spent on redundant activities such as the check-in process and thereby freeing up time for other, higher value, tasks.

2.2 Waiting time predictions

The idea is to develop a machine learning algorithm that predicts waiting times in medical practices. The algorithm detects irregularities in the appointment flow that lead to waiting times and calculates the individual appointment delay for the following patients. The prediction tool must be connected to the existing software of the doctor's office. Relevant data, such as information from the appointment calendar, will be exchanged.

The tool is explained with the following example: A patient is scheduled for an appointment at 4:00 pm on a certain day. On this day, irregularities occur at the practice, such as an above-average number of early morning emergencies. Consequently, all appointments scheduled for that day are delayed by 30 minutes. This irregularity is detected by the software which in turn notifies the affected patient in advance via email or text message that the appointment will take place 30 minutes later at 4:30 pm.

2.3 Self-Check-In

Currently, the standard procedure for the patient is to sign in at the reception desk upon entering the practice, with the insurance card being scanned by the reception staff once a quarter. In the case of self-check-in, as the name suggests, this process is to be carried out by the patient himself. The card reader for the insurance card is to be made accessible to the patient for this purpose. A tablet next to the reader could optionally provide the user with instructions and further assistance. The patient must only insert his insurance card into the reader and will then be checked in automatically.

3 Literature Review

In the decision-making process entrepreneurs are facing the specific challenge of how to make rational decisions. The reason for that is the finite information and finite time at their disposal. (Katila and Ahuja, 2002; Leatherbee and Katila, 2020; Schmitt et al., 2018) Much relevant information is missing to make reasoned decisions and filling this information gap requires a substantial amount of time and effort which is usually not available (Leatherbee and Katila, 2020). Early-stage start-ups, especially those with high levels of environmental uncertainty, operating in technology-based industries, are unlikely to decide on an ideal business model at the very beginning of their venture (Contigiani and Levinthal, 2019; Leatherbee and Katila, 2020).

To address this problem and provide a reasonable degree of certainty about the feasibility of the business model, this chapter presents different proven theoretical frameworks that are applied in the analysis. Their contributions to answering the research questions are highlighted.

The Lean Canvas (LC) model provides the basis. To gain detailed insight, different frameworks are used to analyze and answer the various sections of the model. The Value Proposition Canvas (VPC) is primarily used to identify the Value Proposition and Customer segments. Because the sections in the LC interact and are interrelated, insights can be applied to the problem and solution as the VPC is worked through. In the analysis, this framework is an enabler for answering significant parts of the first three research questions. To address the economic model (bottom of the LC), the TAM SAM SOM model is applied to estimate the market size. To elaborate the section of key metrics the framework AARRR is used which provides a guidance to measure success properly. Addressing RQ4, i.e. how the strategic orientation of DOC+ should be, the Entrepreneurial Strategy Compass is described.

3.1 Lean Canvas

In the book "Running Lean" Ash Maurya describes the LC (Maurya, 2012) which is adapted from Alexander Osterwalder's Business Model Canvas (Osterwalder et al., 2010) for early-stage start-ups. The one-page business model describes the basic principle of how a company creates, delivers and captures value (Osterwalder et al., 2010). In this thesis it is employed as a base for a structured approach to the business model and its details are laid out in this section.

Maurya draws inspiration from Steve Blank´s Customer Development approach (Blank, 2007) and Eric Ries´ Lean Start-up idea (Ries, 2011). In addition, Maurya has worked with hundreds of start-ups to test and refine the canvas and the approach. Today, the Running Lean approach and the LC -originally emerged in Silicon Valley- have become established in entrepreneurship literature and practice worldwide (Mollick, 2019).

The LC consists of nine fields that are used to examine the potential of new business ideas in a structured way based on key factors that show a business model at the end (see Figure 1). The left half of the canvas represents the product, while the right half represents the market. In this way, start-ups in the concept phase can find out whether their idea and the direction they are moving toward make sense. It is used to outline a possible problem of a target group, to design a first solution for it, to work out the unique selling proposition and to measure the achievement of the goal. (Maurya, 2012; Moreira, 2017)

The running lean approach has the goal to find a plan that works before running out of resources. Maurya proposes to carry out the theoretical planning and the product design to a level that is well balanced with the available resources and the targeted starting point in time. His credo is to avoid overplanning. However, the so-called success plan A is to be developed and tested based on the following described systematic process. The plan should be agile over time with new tests and findings to create Plan B, C, D or more. (Maurya, 2012) Ash Maurya says: "Life's too short to build something nobody wants." (Maurya, 2017) and hereby refers to the Lean concept. The goal of the lean approach is to eliminate waste. This is achieved by making the entire value creation process lean through continuous improvement. Superfluous work actions are eliminated, inefficient but necessary work actions are optimized. (Ohno, 1988) This is also reflected in the LC that provides the greatest benefit by reducing to the essentials.

The nine fields of the LC are described here and can be seen in Figure 1 (Maurya, 2012):
1. Problem: The problem definition describes the three biggest problems from the customer's point of view. "What problems do the customers have that I want to solve?" Care must be taken to distinguish between customers and users. In addition, existing alternatives are also listed in this step.
2. Customer Segment: Identify different user roles and list possible early adopters. It may be useful to create one LC for each customer segment.

3. Unique Value Proposition: Answer the question: "Why are you different and worth getting attention?" In addition, a short high-concept pitch should be noted here, such as for YouTube: "Flickr for video".
4. Solution: Describe the solution to the problem. It is important in this method to question the interviewees' responses. The problem can be well identified by the methodology, but the solution cannot, because as Steve Jobs says: "People don't know what they want until you show it to them." The entrepreneur must demonstrate creativity in finding a solution.
5. Unfair Advantage: An unfair advantage is something that the competitors cannot easily achieve. This could be the team or network.
6. Revenue Streams: Estimate the earnings and a pricing strategy.
7. Cost Structure: Estimate costs that will occur in the near future. For example, answer the question, how expensive is it to build and launch a Minimum Viable Product[3] (MVP)? Or what are the fixed and the variable costs?
8. Key Metrics: Key Performance Indicators are described here with which success or failure can be measured. An example could be the visit-to-signup rate on a website.
9. Channels: Possible methods of marketing the product to the target customer are listed here. The key is to focus on where the target audience is.

After the first Running Lean step, to document the initial plan in the LC, the second step is to identify the risk parts of the plan. In this step, the risks are to be evaluated and thus it must be determined where the focus should be placed for the next steps. Goals are to find the problem /solution fit, product /market fit and apply scaling of the product. Here the questions arise, "Am I pursuing a problem worth solving with an appropriate solution?", "Will the product be accepted by the potential customer?", "How do I accelerate growth?". Running Lean uses qualitative questioning techniques to best answer the questions and to reduce the risk.
Risks in an early-stage start-up can be divided into the following three categories, listed here, and shown in Figure 1:

- Product risk - getting the product right (blue).
- Customer risk - building a path to customers (green).
- Market risk - building a viable product (yellow).

[3] An MVP has just enough features to satisfy early customers and to provide feedback for future product development (Cerff et al., 2018).

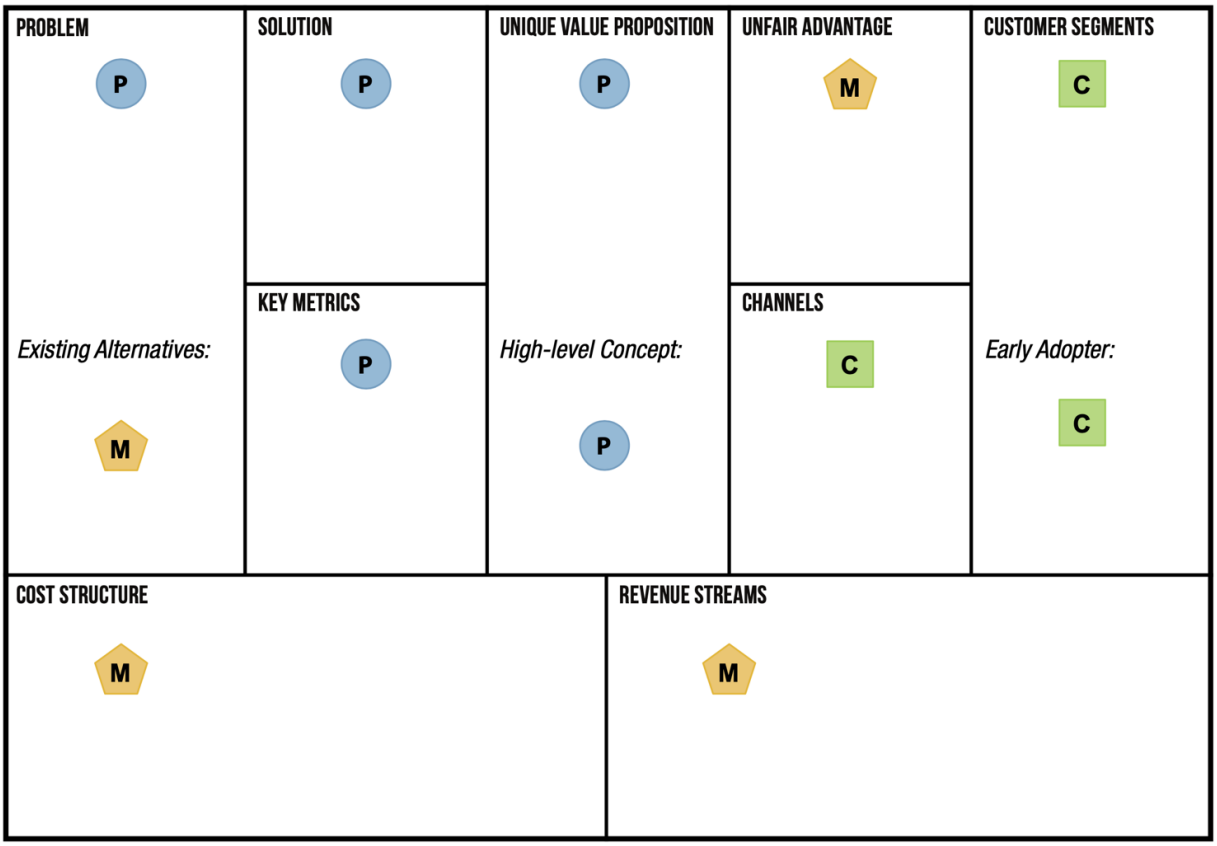


Figure 1 - Lean Canvas: Three risk categories (Maurya, 2012; Strategyzer, 2020)

In the third step, experiments are used to systematically test and improve the most risky plan elements.

Summarized the Running Lean process can be reduced to three basic meta-principles which are modified in an interactive process (Maurya, 2012):

1. Document the initial plan A in the one-page LC;
2. Identify the most risky parts of the plan; and
3. Systematically test the plan.

Critical to the "Running Lean" model is that no systematic approach to risk assessment is presented. Furthermore, no models are presented that could help to fill out individual sections of the LC. Therefore, the use of additional frameworks is required, explained in the following subchapters.

3.2 Value Proposition Canvas

Building up on the LC, the VPC was published by Alexander Osterwalder in "Value Proposition Design" (Osterwalder et al., 2014). It serves as a framework that supports the evaluation and development within individual segments of the LC. The details are laid out in the following:
The VPC was originally developed as a framework to ensure that product and market fit together, representing the offered value to the customer (Clark et al., 2012; Osterwalder et al., 2014). It promotes a structured detailed analysis between the two sections of the LC, the value proposition and customer segment, shown in Figure 2. On the right side, the selected customer segment is analyzed. The left side shows how the value proposition addresses the demands of customers. Only one selected customer segment is considered. A separate VPC should be created for each customer group. This helps to connect individual features or services with a particular target group. If the product or service is able to create gains, reduce pains and solve customer jobs, value is created. (Freiling and Harima, 2019; Osterwalder et al., 2014)

Each target group is analyzed from three perspectives (right side):
1. Customer Jobs - what a person wants to achieve in a given situation, from a functional, social and emotional perspective (Christensen et al., 2016).
2. Pains - negative experiences, emotions and risks related to customer jobs.
3. Gains - an outcome or benefit that customers want to achieve and would satisfy them related to customer jobs.

Subsequently, the respective fields should be prioritized:
4. Pain, from moderate to extreme: Rank how extreme they are from the customer's perspective.
5. Gain from nice-to-have to must-have: Rank how essential they are from the customer's perspective.

Hereafter, the value map is systematically developed, which also consists of three elements (left side). The focus should be on those elements that make a positive difference to the customer:
6. Products & Services - creates gain and relieves pain and reinforce value creation for the customer.
7. Pain Relievers - description of how the product or service relieves the customer's problems.
8. Gain Creators - how the product or service creates customer gains and how it adds value to the customer.

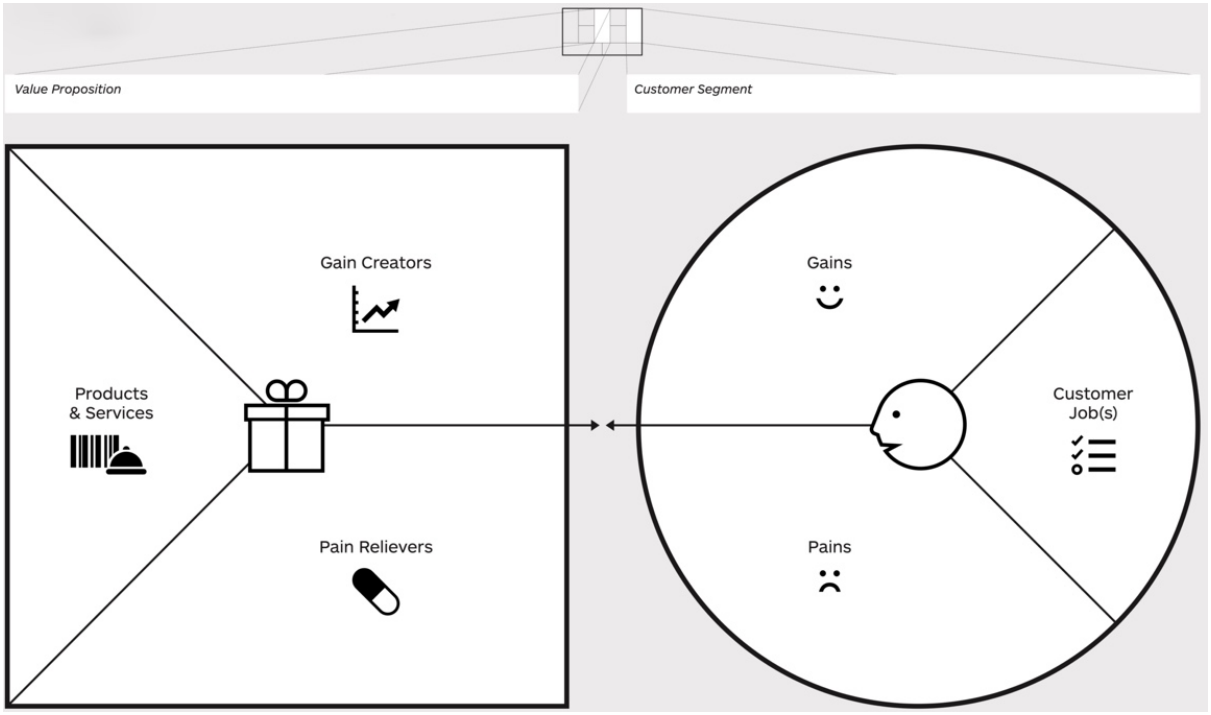


Figure 2 - Value Proposition Canvas (Osterwalder et al., 2014; Strategyzer, 2021)

3.3 Market Size

"Determining the size of a market is a mixture of art and science, and the part that is science isn't particularly accurate." - quotation from Haje-Jan Kamps, author of the book "Pitch Perfect". He maintains that it's okay in the early stage of a start-up to have only a rough estimate of market size. It is important to know roughly what the market dynamics are and whether there is a realistic way to reach the customers. (Kamps, 2020)

One framework to estimate the market size is given by the so called TAM, SAM, SOM (Denault, 2017; Kamps, 2020).

- TAM stands for *total available market* and represents the total demand for a product or service in a specific market on an annual basis. It refers to the combined revenues or unit sales of all the companies in that market.
- SAM stands for *served available market* and represents the share of the total available market that companies offering a particular solution can achieve.
- SOM stands for *share of the market* and represents the share of the served available market that the start-up is planning to achieve within the next years.

  To obtain the most precise assumptions possible, the methodology should be applied not only from top to bottom, but also from bottom to top. In the bottom-up approach, special attention should be paid to the extent to which the future team is able to realistically process sales over the year in order to arrive at the SOM. (Denault, 2017)

3.4 Key Metrics to measure success

The AARRR framework from McClure is used to develop the Key Metrics section of the LC. It is a frequently used framework in the startup world, especially in Silicon Valley, that serves the purpose to measure success (Boller and Peter, 2018; Ripsas et al., 2018). The model consists of the following questions to identify the 5 most important key metrics (McClure, 2007):

- Acquisition: How do customers find DOC+?
- Activation: How many users can DOC+ convince?
- Retention: How often is DOC+ used?
- Referral: How many users recommend the product?
- Revenue: How many are paying?

3.5 Entrepreneurial Strategy Compass

To answer RQ4 the framework developed by Joshua Gans et. al. called "The Entrepreneurial Strategy Compass (ESC)" is used to explore the strategic options of DOC+ (Gans et al., 2021, 2018, 2019). Here the strategic opportunities for early-stage start-ups are categorized along two dimensions, see Figure 3. On the x-axis the attitude toward incumbents is placed from collaborate to compete. On the y-axis the attitude toward the innovation is placed from execution to control. Four distinct strategies result from this that guide a start-ups decision regarding customers, technologies, identity, and competitive space. Each one offers a distinct way to create and capture value. A start-up does not need to go an extreme on any of the axes. It can flexibly position itself strategically on the axes. (Gans et al., 2018).

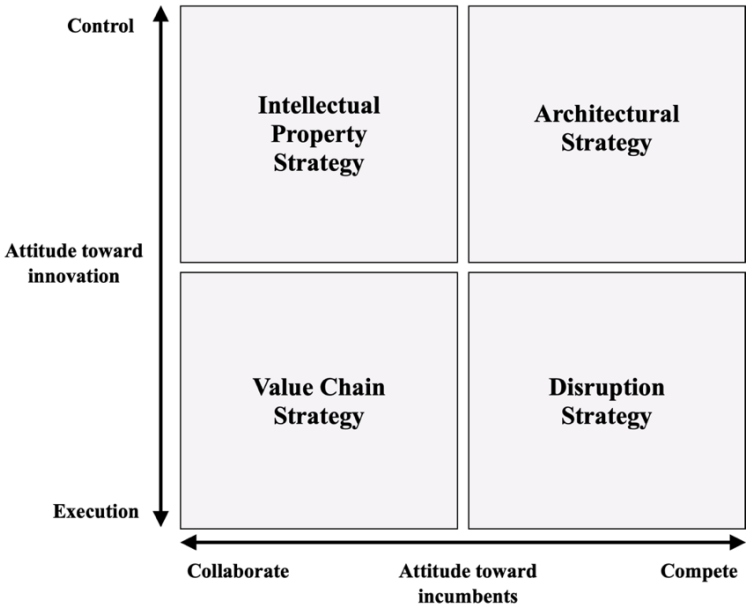


Figure 3 - The Entrepreneurial Strategy Compass, Own table adapted from (Gans et al., 2021)

According to Gans, each start-up must make two specific competitive trade-offs to identify potential strategies. The questions arise to collaborate or compete and to execute or control.

On the one hand, collaborating with established players provides access to resources and a network that can enable the start-up to enter a larger and well-established market more quickly. On the other hand, however, the company may encounter significant delays due to bureaucracy on the part of the partner. In addition, there is a risk that the incumbent has greater bargaining power, especially if it can appropriate key elements of the start-up idea itself.

To compete means the start-up has more freedom to build the value chain it wants. It could collaborate with customers and bring innovations to the market that increase value for customers while displacing other successful products. However, the disadvantage here is that the start-up must compete with rivals that have greater financial resources and an established business infrastructure.

Some companies claim that they have an advantage if they have strong control over a product or technology and can determine its features themselves. They fear that imitations could threaten their success. Therefore, they invest in intellectual property protection. While formal intellectual property protection is expensive, it can enable a technology-driven start-up to exclude competitors from direct competition. It can also generate significant bargaining power when negotiating with a partner. However, focus on control increases transaction costs and challenges in bringing an innovation to the market and as well as collaborating with customers and partners.

Alternatively, young start-ups can focus on rapid market launch execution. Commercialization and development usually arise in close cooperation with partners and customers. Start-ups that choose this path value the ability to test and develop their ideas directly in the marketplace. While a control-focused strategy can delay market entry, start-ups that focus on execution expect competition and use their agility to respond to competitive threats.

In the compass direction of the Intellectual Property Strategy the start-up collaborates with incumbents and retains control over its product or technology. The start-up focuses on further development and avoids costs to gain customers. The core idea must be of value to the

customers of the established company and is chosen as a partner according to this criterion. An example is the sound specialist Dolby.

The Disruption Strategy is the opposite. Here the start-up wants to compete directly with the incumbents and wants to quickly gain market share. If the start-up can serve a niche market, it has an advantage. It can build up a lead before the competition can follow which is difficult to catch up on later. The challenge is to have the ability to move forward quickly and stay in the lead. One example is Netflix.

With the Value Chain Strategy, the start-up invests in commercialization and competitiveness, rather than in controlling the new product and erecting barriers to entry. The goal is to fit into the existing value chain. An example is Foxconn.

When following the Architectural Strategy, the start-up competes and achieves control. This strategy is difficult for most companies to adopt. Successful examples are Facebook and Google. They have managed to create a new value chain and control its key bottlenecks in it. They were able to take the idea to a mass market through careful alignment of customer, technology, and identity choices.

4 Methodology

This chapter provides an overview of the research methods that are used in this thesis to collect data in a systematic way, to answer the stated RQs in Chapter 6. Regarding RQ1, the data will be used to find out how the physician and the patient evaluate the problem described in 1.1 and how great their demand for a solution is. Concerning RQ2, the aim is to find out whether the physician or patient would be willing to pay for such a solution. Regarding RQ3, the aim is to find out what value for the physician and for the patient can be generated. Regarding RQ4, the interviews with physicians are intended to investigate whether they would prefer to purchase DOC+ from their existing IT service provider or from another external provider.

For this purpose, two different methodologies are used for the two user groups, physicians and patients, qualitative and quantitative. The selected qualitative method consists of semi-structured expert interviews with physicians. To collect data from the patients, the quantitative method online survey is chosen. In both methodologies, as described in Chapter 3.2, gains and pains of the two customer groups physicians and patients are identified and then prioritized.

4.1 Physician interviews

The design and execution of the qualitative study is based on the approach of Alan Bryman, published in "Social Research Methods" (Bryman, 2016). In the semi-structured interviews, open-ended questions are asked to examine individual cases more closely and make an interpretative evaluation. The target group of the interviews are physicians practicing in German medical practices. The goal is to get to know independent opinions of individual physicians from different medical specializations. Follow up questions on open questions will be asked at a later moment. An interview guide provides a rough structure to the interview. Depending on how the interview develops, the order of questions may change. In addition, new questions may arise from the interview that are not included in the guide. (Adams, 2015) Hereby the Running Lean approach is used, described in 3.1.

Following the qualitative study, it would be possible to conduct a quantitative study based on these findings. In this way, a larger number of physicians could be surveyed and the results would offer a higher statistical certainty. However, the given framework of this thesis does not allow additionally a quantitative survey which is why the focus here is limited to the qualitative one.

The interview guide was divided into three parts. In the first part, the goal was to find out the current practice process regarding check-in and scheduling. In addition, the aim was to find out

whether the suspected problems exist and to identify other problems in this context. In the second part, the DOC+ solution was presented and the physicians were asked to evaluate the self-check-in and waiting time predictions according to desire as well as the willingness to pay. They were also asked to say what added value this solution offers to them and what they consider critical. In the third part, demographic questions were asked. The interview guide of the semi-structured interviews is presented in the Appendix 2.

The questions were formulated to best answer the research questions from the physician's perspective. For this purpose, hypotheses were formulated, which are listed in Chapter 5.1.1. The answers will be used in the discussion to provide evidence to answer the research questions. To acquire the interview partners, different medical practices in Germany were contacted by email and telephone. Due to the low response rate the author's network of physicians was additionally used to be able to conduct ten interviews.

For the subsequent analysis of the interview material, the qualitative content analysis method according to Philipp Mayring (Mayring, 2015) will be mainly applied. This method was first presented in 1983 (Mayring, 1983) and has long been established in the German-speaking regions and is now in its 12th edition. In addition, the "Coding Manual for Qualitative Researchers" by Johnny Saldaña will be used as a guide (Saldaña, 2013).

This structured method differs from others in particular in being category-based. The categories refer to statements within the interview that concretely express the meaning of these statements. Thus, the interview evaluation is limited to the selected category system. In the beginning the categories are detailed and may be combined at a later stage if useful. The interview content that does not apply to the selected categories is not considered at this point. The categories are selected in order to answer the RQs. (Mayring, 2015, 2014; Saldaña, 2013) In this thesis, they are chosen for the purpose of answering the LC, VPC and Entrepreneurial Strategy Compass, explained in Chapter 3, to answer the RQs later.

The data is recorded in a table, presented in Appendix 5. Here, the categories and statements of the physicians are listed, as well as the information about the interview partner and the frequency of the respective statement.

4.2 Patient survey

In the quantitative study, the goal is to collect as many results as possible and to evaluate them statistically (Laaksonen, 2018), for which a single choice survey is created. The target group of the survey are people who have health insurance and live in Germany. This method was chosen for the patient perspective. Similar to 4.1, it would be possible to conduct additional individual

interviews with patients but are ruled out due to the given scope of the thesis and must be made up at a later date. The disadvantage with surveys is that not all the questions that would need to be asked are known at this point. During an interview it is possible to ask about clarification and explore areas outside the initial understanding (Maurya, 2012). To counteract this problem in the survey, two text fields for comments have been added, which will be explained in more detail later.

To test the questions, procedure and technique before the actual survey, a preliminary survey was completed in the author's presence by five different people from the target group, from different age groups ranging from 18 to 70. The task of the interviewees was to speak out loud all their thoughts during the pre-survey, especially if something was unclear. In addition, the pre-survey was also technically tested on their available devices and browsers. Based on their feedback the questionnaire was revised and can be seen in the Appendix 3 and 4. (Bowden, 2002; Silk, 1990)

Similar to the Physicians interviews, the Patients survey is divided into three parts. The first part examines whether the suspected problems are actually problems for the patients and what other problems they experience in connection with check-in and waiting times. In the second part, the DOC+ solution is presented and asked for their evaluation and whether they would be willing to pay for it. They were also asked in an open text field what they saw as particularly good or critical about the solution. At the end, demographic data was collected.

This survey was advertised in pedestrian zones in downtown Hamburg to collect a sample that is as unbiased as possible and to obtain well analyzable statistical data. For this purpose, the sample should be selected from different population groups, if possible, with evenly divided gender, and evenly divided age groups (Wright, 2005). It should most closely reflect the typical patients in German medical practices. For this purpose, a QR code with the link to the survey was generated and people passing by were encouraged to scan it with their smartphone and fill it out. Due to the scope constrains of this work, this can only be done in the city of Hamburg. Thus, to receive additional responses also distributed in Germany, the convenience sampling method (Etikan, 2016) was used. This method reaches participants that are easily accessible on the internet but not only restricting to people known by the author. The online channels used to promote and forward the survey were social networks like LinkedIn, Facebook, Instagram and messaging services like WhatsApp.

For this purpose, the online survey tool Google-Forms was used. The data analysis is performed using the software RStudio and the R programming language for statistical calculations and graphics.

5 Analysis

5.1 Main findings

5.1.1 Physician interviews

The results of the physicians' interviews are summarized below. The detailed results are shown in Appendix 5. The summary of the interviews is limited to the verification of hypotheses derived from the RQs. Hypotheses (H_1, H_2, ...) are verified exclusively from the perspective of the interviewed physicians. They provide an indication of the later answers to the RQs. Owing to the number of interviews conducted and the rather broad questions asked, in this thesis a hypothesis is confirmed if at least half of the interviewees support it.

In the hypotheses derived from RQ1, it was assumed that the desire for the solution is high, concluded from the listed problems in Chapter 1.

Anticipating that a problem exists for small physician practices and their willingness to pay for the solution, hypothesis for RQ2 are derived. In addition, it can be expected that a group of physicians with one or more specialization will emerge from the interviews where the demand is particularly great and thus become potential early adopters.

The hypotheses developed from RQ3 are also derived from the findings mentioned in Chapter 1. For each problem mentioned, they represent the value creation when the problem is solved. Two exceptions are H_7 and H_{13}, which are conjectured value creations that are additionally created by the automation processes.

For RQ4, two hypotheses were derived for the two options. Develop and market DOC+ either in collaboration with an established company or independently.

The symbol ☑ stands for a confirmed hypothesis and the symbol ☒, for a rejected one.

First, the demographic data of the interview respondents are listed and then the summary of the results.

The interviews were conducted between Nov. 2 and Nov. 15, 2021, via the Software Zoom or by phone. A total number of 10 physicians practicing in Germany were surveyed. Nine of them work in a practice located in or around Hamburg and one doctor is based in Cologne. The physicians practice in six different medical fields, of which the highest number of three are general practitioners. Four physicians are employed and six physicians are practice owners. The physician practices employ between one and five physicians, with a median of two physicians per practice. Three physicians are male and seven are female. The median age is 56,5 years.

RQ1) To what extent exists a customer demand for reduced waiting times and the problems they cause?

- *H_1 Physicians have a great demand to reduce waiting times.* ☒
- *H_2 Physicians have a great demand to reduce problems long waiting times cause.* ☒

Most of the interviewed physicians claim that the waiting times in their practices for patients with an appointment are not very long, on average 15 minutes. When waiting times occur, it is mainly due to the reason that unforeseen treatment time for patients is needed. Physicians state that it is difficult to predict the treatment time for an individual patient.

Patients who do not have an appointment must wait significantly longer, up to over an hour. According to physicians, these patients and emergencies disrupt the planned schedule and thus are another main contributor to wait times. However, five physicians also stated that poor practice time management is another factor for waiting times.

Patients in the waiting room are needed to prevent idle time. To work economically, one patient must be treated right after the other, without any time interruptions for the physician.

Eight of the physicians' state that waiting times at the reception desk occur primarily at peak hours, but do not tend to see this as a problem. Compared to waiting times in the waiting room, they feel those are longer and therefore tend to classify them rather as a problem.

The risk of patients catching an infection in the waiting room is not perceived as a problem by most physicians. It was claimed that the risk is not higher than in everyday life. All physicians say that the risk of infection has been significantly reduced by the measures introduced through Covid-19 but will rise again after the pandemic. Half of the physicians interviewed claim that in times of Covid-19 the waiting times in general and their related problems are reduced due to less patient traffic in the practice. Also, six of the physicians say that patients continue to come to the physician even with long wait times.

Regarding online ratings, six physicians claim that they hardly ever or never view their ratings online and thus cannot make any statement about the content of their ratings regarding waiting times. The reason for this are critical reviews, which the physicians do not want to look at. Although two of them emphasize that online reviews are important for the practice. One physician claims that in general negative online reviews put pressure on physicians. However, four physicians state that waiting times are a reason for bad reviews.

Based on the interviews, these physicians in general claim that a reduction in wait times is not evaluated as a great demand, nor are the problems caused by them. They know some of the

weaknesses of the practice that cause wait times but do not perceive an urgency to reduce them. Thus, hypotheses H_1 and H_2 are rejected.

RQ2) Who will be the paying customer, and in which segment is the early adopter?

- *H_3 Physicians are willing to pay for the DOC+ solution.* ☑
- *H_4 Small medical practices are potential early adopters.* ☒

Nine physicians indicated that they would be willing to spend money for DOC+, if the price is appropriate. Two of them indicated that they would pay money for the solution if there was an adjusted price for low usage. One physician clarified that it must be evident that the benefits have to clearly commensurate with cost and installation effort. Only one physician does not see a need, as no problem exists for him.

For the self-check-in, nine of the ten physicians indicated that it is between a nice-to-have to must-have tool. For the waiting time prediction tool, five physicians indicated that this is a nice-to-have to must-have, the other five indicated that there is rather no need or absolutely no need for the tool.

Eight of the physicians suggested that the solution will most likely encounter high demand in large group practices or medical care centers (in German, Medizinische Versorgungszentren, MVZ). They claim that they would have a much greater interest in reducing costs on their side and increasing patient satisfaction on the other. Moreover, they have their own management that can take care of process optimization and digitalization matters. In contrast to the physicians interviewed, they do this themselves in their practices in addition to their day-to-day business and have hardly any additional capacity for further digitization topics that are not absolutely necessary.

In addition, four of the physicians pointed out that there is currently a shift happening from traditional small practices to large medical care centers. They claim that this trend will continue and in the long run a large part of the small medical practices will be bought out.

In summary, from the physicians' responses, hypothesis H_3 is confirmed. Predominantly physicians are willing to pay for the DOC+ solution. When the solution works well and gives a positive return on investment, small medical practices are willing to pay for the DOC+ solutions.

Hypothesis H_4 is rejected, as they do not have the capacity to manage such a pilot project alongside their day-to-day business. In addition, the desire is not great enough to solve the problem of waiting times as quickly as possible and to accept initial IT problems for this.

Physicians refer to medical health centers as potential customers for DOC+ with a greater desire to solve the problem of wait times.

RQ3) What value is generated for the stakeholders?

- *H_5 Workload for the reception staff is reduced.* ☑
- *H_6 The reception staff is less stressed.* ☑
- *H_7 Practice saves costs and increases profit by automating processes.* ☒
- *H_8 Patients tend to give the practice better online ratings.* ☒
- *H_9 Patients have more time available for other activities.* ☑
- *H_{10} Privacy at the reception increases for the patient.* ☒
- *H_{11} Risk of infection among patients in the waiting room decreases.* ☒
- *H_{12} The quality of the patient's stay in the practice is increased.* ☒
- *H_{13} The waiting time transparency is increased.* ☒

The majority of the interviewed physicians expect that the solutions, if implemented at their practice, would save time for the patient as well as time and workload for the reception staff. Apparently, the workload of reception staff is a big problem, as seven physicians claim that the workload is high and therefore suffer from stress. All state that the reception staff continually multitasks to handle the work, managing patients and physicians needs at the same time. In addition, eight of the physicians say that complaints, including those regarding waiting times, are directed to the reception staff and that the physician rarely notices direct patient complaints. With this mentioned information, hypothesis H_5, H_6 and H_9 are confirmed.

Two physicians claim that they could increase the quality of treatment with the implementation of DOC+. Since only two physicians, and thus the minority, made these statements, hypothesis H_{12} is rejected.

Other possible improvements such as saving costs, better online ratings, increased privacy for patients at the front desk, increased wait time transparency or reduced risk of infection in the waiting room were not mentioned, when physicians were asked what value would be generated for the practice if they implemented the DOC+ solution. Thus, hypotheses H_7, H_8, H_{10}, H_{11} and H_{13} were rejected temporarily due to a lack of data. To test these hypotheses in more detail, the physicians would have to be consulted with questions specifically designed to validate these hypotheses. Due to the defined scope limits of this work, the results of these queries will arrive after completion and thus not be included in this work.

In summary, it can be concluded from the interviews that value can be generated on the practice side by reducing the workload and stress of the reception staff, and on the patient side by the reduction in waiting time and therefore providing them with more time for other activities, confirming H_5, H_6 and H_9.

RQ4) To what extent is it advantageous to either develop an own platform and enter the market as a competitor or to collaborate with a medical practice IT system service provider?

- *H_{14} Physicians prefer to purchase the DOC+ tool through their current software provider.* ☑
- *H_{15} Physicians prefer to purchase the DOC+ tool from an additional software provider.* ☒

During the interview, physicians were asked if they would prefer to purchase the tools described in Chapter 2 from their current practice software provider, from an additional external provider, or if they were indifferent.

Six of the physicians responded that they would prefer to purchase the tool from their current provider, three physicians are indifferent and one physician prefers an additional external provider. The advantage of the current provider was justified with the lower planning and implementation effort. All contacts of the company are known for the practice, such as service or payment. The hurdle to book the two tools with the current provider would be the lowest.

It was also said that the negative experiences with software problems prevent physicians from bringing more work and more problems into their practice with further digitalization projects. They say that they already have enough workload with their current provider.

The statements about their current practice software provider are predominantly negative. Disturbances with the software are reported to occur regularly, especially with updates, which disrupt the workflow, bad customer service consequently presents challenges to the physicians. At the same time, however, half of the physicians say they appreciate the benefits of the software, even if it sometimes does not work smoothly.

From the information given, H14 is confirmed and H15 rejected. Most physicians prefer the existing software provider, although they are not always satisfied with them.

5.1.2 Patient survey

This section presents the results of the online survey for patients. All information is based on the .csv file of the interview responses as well as the analysis in the RMarkdown file in Appendix 16 and 17. All variables are categorical variables due to the design of the survey. All analyzed subgroups have a size equal or larger to 30 respondents. This is the minimum population number used in this thesis, which is also commonly used in the literature to be able to draw statistical conclusions (Adam, 2020; Hill, 1998; Knofczynski and Mundfrom, 2008). When referring to relations among variables, the coefficients are statistically different from zero and at least significant at the 90% significance level since its p-values are lower than 10%. The R-squared are not discussed in the analysis since they are not of great importance in this research. The primary goal of the study is to identify factors influencing the dependent variable and not to explain the dependent variable as best as possible with different independent variables. The descriptive statistics from the demographic variables are described in the Appendix 7 and 16. These variables were analyzed for relationships with additional respondents' answers, which are data in the Likert-scale- (1-5) or dummy- (0-1) format.
To test for relationships between two or multiple variables, while holding other variables constant, several different regression models were performed. The preconditions, such as normal distribution or homoscedasticity for meaningful regression models were tested and corrected if necessary (Wooldridge, 2015).
To answer the research questions in the discussion, in the statistical analysis they were divided into sub-questions and reframed to the patient's perspective:

RQ1A) To what extent exists a patient demand for reduced waiting times in waiting rooms and waiting times at receptions?

The majority of nearly 60% of respondents are not satisfied with the waiting times in the waiting rooms. In contrast, about 60% of patients are satisfied with the waiting times at the reception desks. In addition, nearly 76% would prefer a practice that uses DOC+. Almost 88% stated desiring a waiting time prediction tool. 67% report desiring the self-check-in. It can therefore be concluded from the descriptive statistics, that the sample rates waiting times in the waiting rooms is more of a problem for patients than waiting times at the receptions. These numbers in detail can be found in Appendix 7.

To measure demand, it is first examined whether and to what extent each problem exists. Afterwards, it is examined whether and to what extent a demand exists to fix the identified problems. To find relationships between the variables and to highlight individual groups, regression analyses were conducted with multiple regression models, see Appendix 9. Two separate dependent variables were used to represent the problems. The first is satisfaction with waiting times in the waiting rooms and the second is satisfaction with waiting times at receptions. Then, in each model, the variables assessing the desirability of the two tools and whether a practice that uses DOC+ is preferred were added as independent variables. All other independent variables are demographic variables described in the Appendix 8 and 9.

The findings are that desirability for the waiting time prediction tool, insurance status and age have an influence on satisfaction of waiting times in the waiting room as dependent (see model 3). Patients who are more dissatisfied with waiting times in the waiting room also tend to prefer the waiting time prediction tool. In addition, there is a tendency for older patients to be more satisfied with the waiting time in the waiting room than younger patients. Respondents with public health insurance are more likely to be dissatisfied with the waiting time in the waiting room than those with private insurance (see model 4). Analyzing the subgroup of patients who are also responsible for other appointments, it emerged that this group is more dissatisfied with waiting times when the number of doctor visits increases (see model 5).
In the regression analysis of the satisfaction of waiting times at the reception as a dependent variable, no significant relationships could be identified, not even among subgroups (see model 6). Thus, there is no specific group that influences the satisfaction of waiting times at the reception and the information from the descriptive statistics can be used in general.

According to the above definition of demand, it can be summarized to answer the sub-question that only the waiting time prediction tool has a measurable demand for one specific group. Only here the dissatisfaction of waiting times in the waiting room and the desirability of the waiting time prediction tool do show a relationship for the demographic age and insurance status. In the case of satisfaction of waiting times at the reception and self-check-in, this cannot be proven for one specific subgroup.

RQ1B) To what extent exists a patient demand for reduced problems waiting times cause, like privacy at the reception or risk of infection?

Figure 4 shows that the satisfaction of privacy at the reception is rather low for most patients. About 48% state they are rather to fully dissatisfied. 25% are rather satisfied to fully satisfied. About 27% are neither satisfied nor dissatisfied.

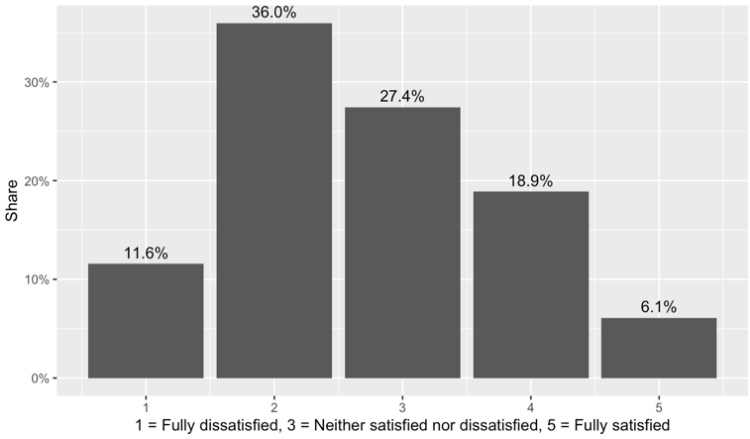


Figure 4 - Satisfaction of privacy at the reception (The Author)

Regarding the perceived risk of infection in the waiting room of patients, see Figure 5, about 54% perceive a rather high to very high risk. About 15% perceive the risk as rather low. 30.5% state that it is neither high nor low.

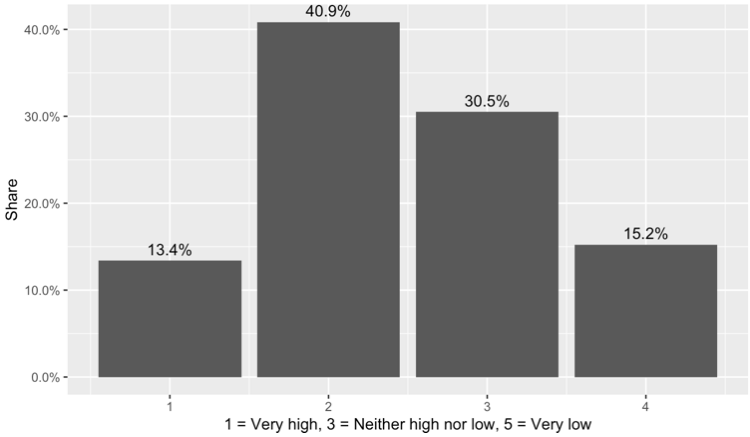


Figure 5 - Perceived risk of infection in the waiting room (The Author)

The descriptive statistics indicate that the two mentioned problems are rated as a dissatisfaction by the majority.

After the descriptive statistics, the regression analysis follows, see Appendix 10. To answer RQ1B, the satisfaction or problem was chosen as dependent variable, similar to the previous

regressions. In this case, the satisfaction of privacy at the reception and the perceived risk of infection in the waiting room were chosen. The independent variables remained the same.

In model 2, with privacy at the reception as dependent variable, it is observed that older patients tend to be less satisfied with the privacy at the reception. Also, publicly insured patients tend to be rather dissatisfied with the privacy at the reception than privately insured patients. Finally, gender also shows a slight difference, with women tending to be more dissatisfied with privacy at the reception than men. Other demographic variables have no effect.

By analyzing the subgroups in more detail, model 3 shows that publicly insured patients have a slightly higher desire for improvement than privately insured patients, since the coefficient of "privacy at the reception" and "if that patient prefers a practice using that tool", is bigger and more significant.

The subgroup of patients who are only responsible for their own doctor's appointments and have private insurance, tend to be more satisfied with the privacy at the reception than those with public insurance who are solely responsible for their appointments (see model 4).

Models 1 to 4, with privacy at the reception as dependent variable, show a preference for a practice that uses DOC+, but not a specific tool. Therefore, a certain demand exists for both tools, but cannot be assigned to a specific subgroup.

In the models 5 and 6 with the dependent, perceived risk of infection in waiting rooms, show for the whole sample no significant relationships with other variables, except that they prefer a practice that uses DOC+. However, with a more detailed analysis of subgroups, publicly insured patients highlight that the older the patient, the higher the perceived risk of infection is. In addition, it shows that if people are responsible for other people’s appointments (e.g. parents), they are more likely to be dissatisfied with the risk of infection. The subgroup with these two characteristics tends to show a preference or demand for the waiting time prediction tool.

RQ2A) Who will be the paying customer?

Figure 6 shows the descriptive statistics if respondents would be willing to pay for DOC+. About 62% claim they would not pay anything for DOC+. 22% are undecided and about 16% could imagine paying something for using the tools.

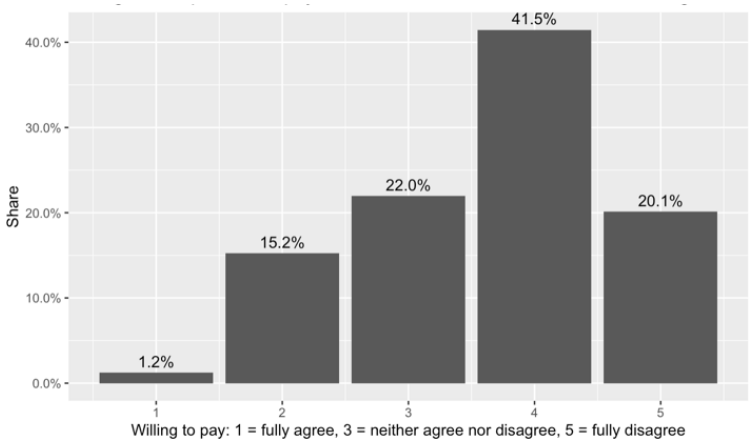


Figure 6 - Willingness of patients to pay for DOC+ (The Author)

The regression analysis, see Appendix 11, has the goal to identify subgroups with specific characteristics that are willing to pay for the solution. The dependent variable is, if patients are willing to pay for the DOC+ service to reduce their waiting time.

The different regression models gave following results:
The less satisfied a patient is with the waiting times at the reception, the more likely that patient is willing to pay for DOC+. Patients that rather desire a waiting time prediction tool are more likely to pay for that. This is not the case with the self-check-in.
Privately insured patients rather pay for the solution when the dissatisfaction for privacy at reception is high. Also, they prefer the waiting time prediction tool over the self-check-in.
Publicly insured patients that rather pay for the solution and prefer a practice that uses DOC+ are dissatisfied with the waiting times at the reception, tend to be rather younger patients and responsible for other people's appointments.

In summary, it can be concluded that patients are generally not willing to pay anything for the DOC+ service. However, after analysis of the subgroups it was observed that especially privately insured patients who are dissatisfied with the privacy at the reception desk desire a waiting time prediction tool and are willing to pay for that service. Publicly insured people who

are younger, responsible for other people's appointments and dissatisfied with waiting times at receptions are also more likely to pay something for the DOC+ service.

RQ2B) In which segment is the early adopter?

Figure 7 shows the descriptive statistics if respondents would prefer a practice that uses DOC+. Nearly 76% of respondents claimed to prefer a practice that uses DOC+. About 19% neither agree nor disagree and only 5.5% would not favor such a practice.

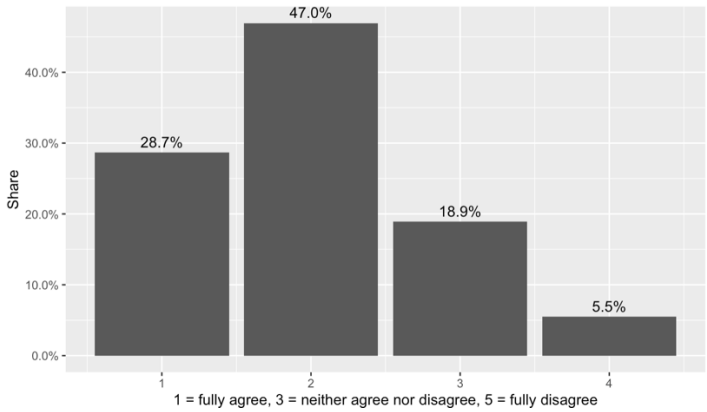


Figure 7 - Preference for a practice that uses DOC+ (The Author)

To identify early adopter subgroups, regression analyses were conducted, see Appendix 12. Goal is to determine characteristics of a patient group that prefer practices that offer DOC+. Several distinct groups of potential early adopters for DOC+ were identified:

Patients who go to the doctor more often and are younger are more likely to prefer DOC+. Also, patients who would likely use a self-check-in are also more likely to prefer a practice with DOC+, especially the publicly insured. Patients who perceive the risk of infection in medical practices as high, are also more likely to prefer a practice that offers DOC+, especially the privately insured and with a lower significance publicly insured.

Patients that are responsible for other people's appointments tend to prefer a practice that uses DOC+ and are dissatisfied with the waiting times at the waiting room. Additionally, this subgroup tends to go more often to a physician and is male. Patients that visit the physician on their own behalf prefer a practice that uses DOC+, perceive a higher risk of infection and tend to be younger. In addition, this subgroup prefers the self-check-in tool.

5.2 Value Proposition Canvas

The goal of this chapter is to design DOC+ with the aim to attract specific customer segments. In addition, RQ3 is answered to some extent, listing the created values. The VPCs are completed using the information taken from Chapter 1 and 5.1. In addition, the author discussed Jobs, Pains, and Gains with 10 representatives of each of the two customer groups, physicians and patients. The pains and gains are ranked according to intensity from the customers perspective. Intensity is measured by the number of times the statements were mentioned. The results of the discussions are listed in Appendix 6, created based on Mayring's coding scheme described in Subchapter 4.1. A description of the VPC is given in Chapter 3.2.

Theoretically, a VPC could be designed for a variety of physicians who have different characteristics such as specialization or size of medical practice. This also applies to patients for whom a distinction could be made between characteristics of, for example, age or insurance status. For simplicity, only two customer segments are chosen here, physicians in small medical practices and patients in general.

The VPC of physicians is shown in Figure 8, followed by the VPC of patients shown in Figure 9. Details and further explanations are given for Figure 8 in Appendix 13 and for Figure 9 in Appendix 14.

The colors are added after Osterwalder et al., 2014 to add another visual dimension to the VPCs. On the left side yellow represents the DOC+ product and on the right side the customer jobs. Positive represents green: on the left side the gain creators and pain relievers, and on the right side the desired gains. Red represents the pains.

The customer segments, physicians and patients, are described in detail on the right side of the framework and listed according to prioritized gains and pains. On the left side of the framework the value map describes how DOC+ intends to create value for each of the customer segments.

A fit between DOC+ and physicians as well as DOC+ and patients is successfully created, leading to the creation of value. The gain creators and pain relievers of DOC+ meet the desired gains and pains of the customer segments. Here, the customer groups can identify the benefits

they can expect from DOC+. The VPCs confirm the results of the patient survey and physician interviews, that value can be created for both customer segments.

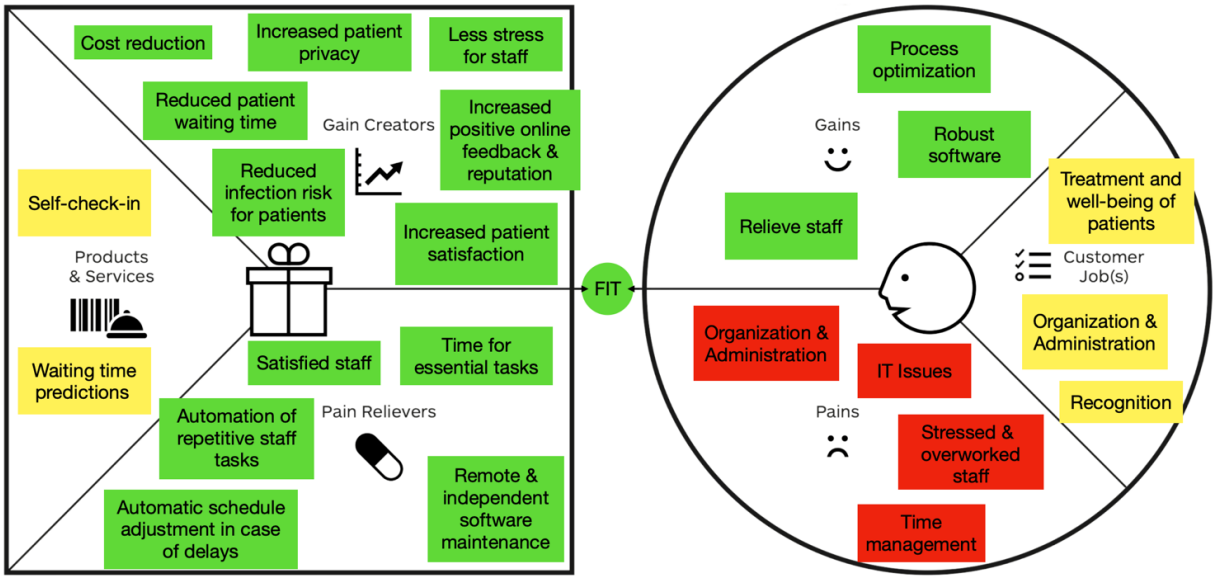


Figure 8 - Resulting Value Proposition Canvas with physicians on the customer side (Strategyzer, 2021, The Author)

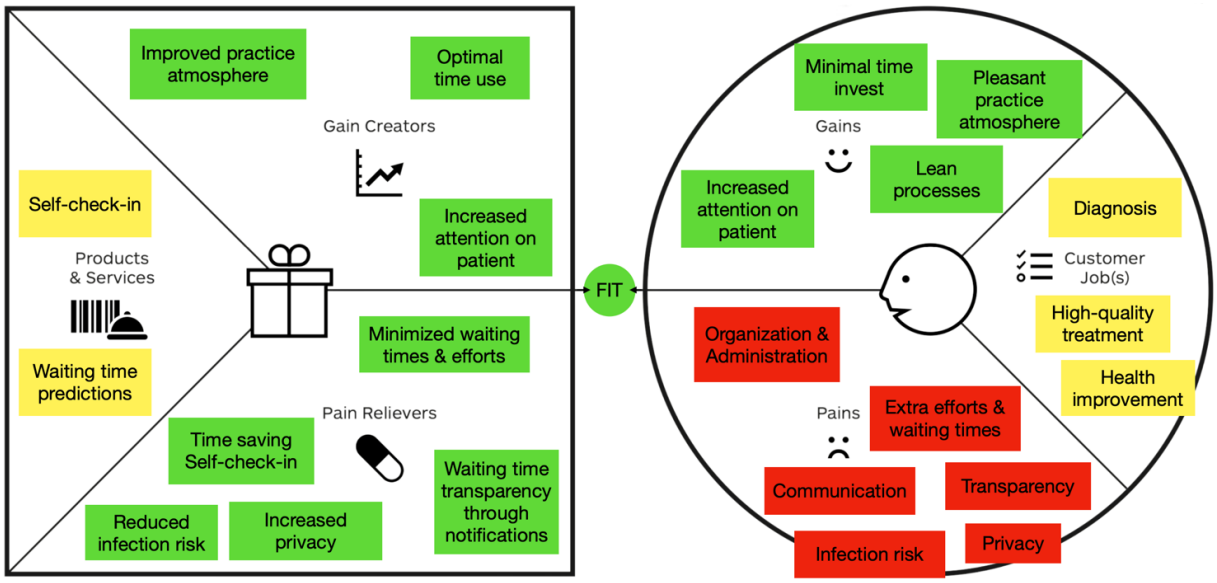


Figure 9 - Resulting Value Proposition Canvas with patients on the customer side (Strategyzer, 2021, The Author)

As indicated at the beginning of the chapter, it must be critically stated that more than two customers exist. Another VPC should be created for the customer group of practices. In this case, the customer group should be the immediate beneficiaries and users of DOC+, the reception staff. The VPC for physicians should be used to identify higher-level Jobs, Pains and Gains of practices. However, the Jobs, Gains and Pains that are at lower levels of the hierarchy, i.e. the reception staff, are also important to consider. After all, these will be the individuals

who would use and directly benefit from DOC+. In the physician interviews, this was also confirmed with the statement that the reception staff has to endure complaints, extra work and stress, of which the physicians are usually barely aware nor directly affected. Due to the given scope of the work, these additional VPCs are not included in this work.

5.3 Entrepreneurial Strategy Compass

To answer RQ4, the Entrepreneurial Strategy Compass is used to provide thoughtful strategic direction at this early stage of the start-up. According to Gans framework, see Chapter 3.5, two fundamental questions must be answered, namely, to collaborate or compete and to execute or control.

To answer the question, collaborate or compete, an overview of the practice software market must be made. An initial indication that individual providers may have significant market shares emerged from the analysis of the physician interviews. Five of the ten interviewed physicians use the software of the provider CGM, see Appendix 5.
Data from the National Association of Statutory Health Insurance was evaluated for a detailed analysis. The association provides statistics on the number of practices that have processed invoices using an approved software system, excluding dentists and orthodontists. (KBV, 2021) The data analysis identified 134 providers in use for the first quarter of 2021. Three providers have a market share of nearly 60%. The analysis of the data for dentists and orthodontists showed similar results (KZBV, 2021). Consequently, three dominant software providers have an oligopoly and share the market with various small providers.

CompuGroup Medical (CGM), with a German market share of almost 28% in the first quarter of 2021, stood out during the research. The German-based company sells medical software solutions in 50 countries and has been growing steadily for years, with further growth predicted (CompuGroup Medical, 2021). In addition, the company is one of the most innovative software companies in Germany and benefits additionally from government funding for digitization. (CompuGroup Medical, 2021; FOCUS, 2021; IMWF, 2021; Presse Portal, n.d.) This qualifies CGM as a potential collaboration partner.

Collaboration advantages / Competing disadvantages:

- Market is dominated by a few providers whose dominance is constantly expanding.
- CGM emerges as an attractive partner after initial research.

- Six of the ten physicians interviewed stated to prefer to use the DOC+ service through their current provider (see Appendix 5).
- Market entry barriers are high according to interview partners, as practices are reluctant to change their software due to the high effort involved.
- DOC+ only offers partial solutions and not an entire practice system. If DOC+ were to be expanded into a practice software of its own and were to be a direct competitor in the market additional significant challenges and risks would be added.
- Shared risk.
- Use of resources e.g. know-how, financial support, marketing and network.
- Benefits for customers: Uncomplicated accessibility to tools, possible lower usage costs, one contact for billing and service.

Competing advantages / Collaboration disadvantages:

- Delays due to bureaucracy on the part of the partner.
- Risk that the partner has greater bargaining power, may have the ability to utilize and market key elements of the start-up idea itself.
- More freedom to build own value chain.
- Possibility to collaborate with physicians and bring innovations to the market that increase value for customers while displacing competitors.

Execution advantages / Control disadvantages:

- Collaborating with customers and partners is unbureaucratic and fast.
- Intellectual property protection requires a significant quantity of resources including money.
- Difficult to acquire patents on software.
- Rapid market launch execution with tests and development in marketplace.
- Use agility to respond to competitive threats from competitors.

Control advantages / Execution disadvantages:

- Intellectual property protection to exclude competitors from direct competition.
- Increased bargaining power when negotiating with a partner.
- Legally prepared against imitations that could threaten success.

To answer RQ4, the author comes to the conclusion that the above advantages for execution and collaboration outweigh the disadvantages. Thus, the Value Chain Strategy will be perused with the goal to fit in an existing value chain. The biggest advantage for collaboration with an established partner is the reduction of market entry barriers. In the oligopoly market, in which a few companies are leaders and continue to expand their market power, customers prefer solutions from a single source and very rarely change their software, therefor market entry is very difficult. In addition, collaborating would also simplify scaling in the future, as some of the market leaders are already present in other countries. The degree of "attitude towards innovation" depends strongly on the future partner and its procedures. To a certain degree, the author is willing to shift towards control. Resources of the partner could be used to secure intellectual property protection of key elements, but without losing the agility and speed to market launch. Figure 10 shows the desired position of DOC+ in the ESC.

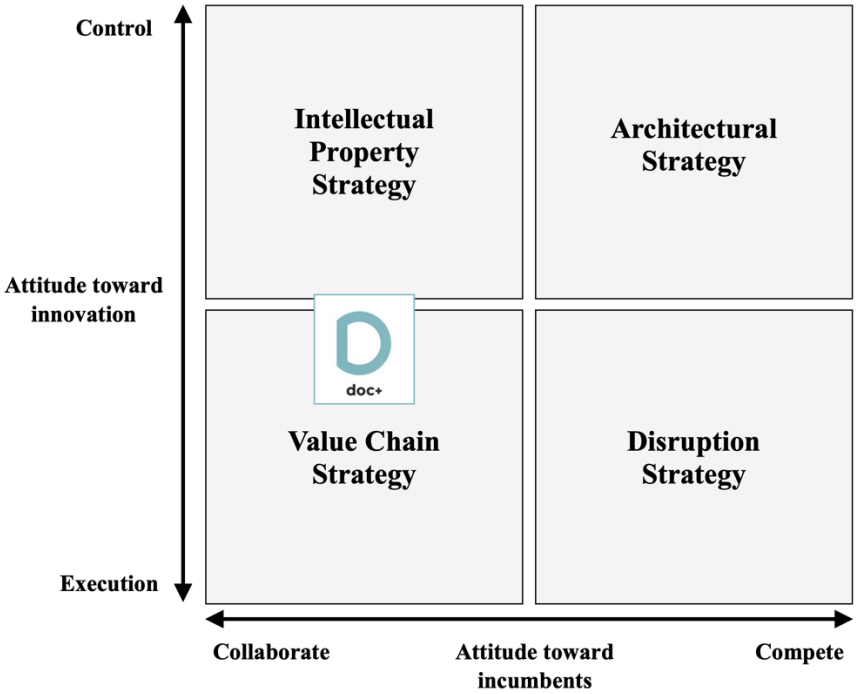


Figure 10 - DOC+ Entrepreneurial Strategy Compass (Gans et al., 2021, The Author)

5.4 Market Size

In the following, the framework TAM SAM SOM described in Chapter 3.3 is applied to DOC+ to roughly estimate the market size in case of collaboration with CGM.

TAM stands for *total available market* and represents the theoretical total demand for DOC+ in the German practice management system market on an annual basis. The figure represents

the total number of medical practices in Germany, 117.240. The figures are taken from the Federal Statistical Office published in 2018 (Statistisches Bundesamt, 2018).

SAM stands for *served available market* and represents the share of the total available market that the CGM company offers practice management systems to. For this purpose, the market share of CGM is chosen, which is 28%. Thus, the SAM of about 32.800 medical practices is given.

117.240 total practices * 0,28 market share of CGM = 32.827,2 ≈ 32.800 practices that CGM has as customers

SOM stands for *share of the market* and represents the share of the served available market that DOC+ is planning to achieve within the next years.

This must be differentiated for each of the tools. The self-check-in can be developed and marketed independently of the physicians' specialties. The waiting time prediction tool is more complex to introduce to the market and is strongly dependent on the specific data. Therefore, the physician group of general practitioners is chosen for the market entry of the waiting time prediction tool. The reason is that this is the largest subgroup of physician practices with 25% share, or of about 29,300 practices (Statista, 2018; Statistisches Bundesamt, 2018). This would represent a general practice market share for CGM of 8.200 practices. No exact figures of the market share for general practices from CGM are published; CGM was not willing to share these numbers upon the author's request. When the product is fully developed for this subgroup of physicians, it can be extended to others.

32.800 of practices that CGM has as customers * 0,25 share of general practices = 8.200 general practices that CGM has as customers

Based on the interviews, 9/10 physicians desire the self-check-in and 5/10 the waiting time prediction tool. As asserted earlier, a larger number of physicians need to be interviewed for increased statistical confidence. For now, however, as an approximation, these numbers are used.

This corresponds to a SOM of about 4.100 general practices that are CGM clients demanding the waiting time prediction tool. The SOM of 29.500 medical practices that are CGM clients would demand the self-check-in.

8.200 of general practices that CGM has as customers * 0,5 share of medical practices that demand waiting time prediction tool = 4.100 general practices that are CGM customers demanding the waiting time prediction tool 32.800 of practices that CGM has as customers * 0,9 share of medical practices that demand self-check-in = 29.520 ≈ 29.500 medical practices that are CGM clients demanding self-check-in

Figure 11 gives an overview of the numbers described above:

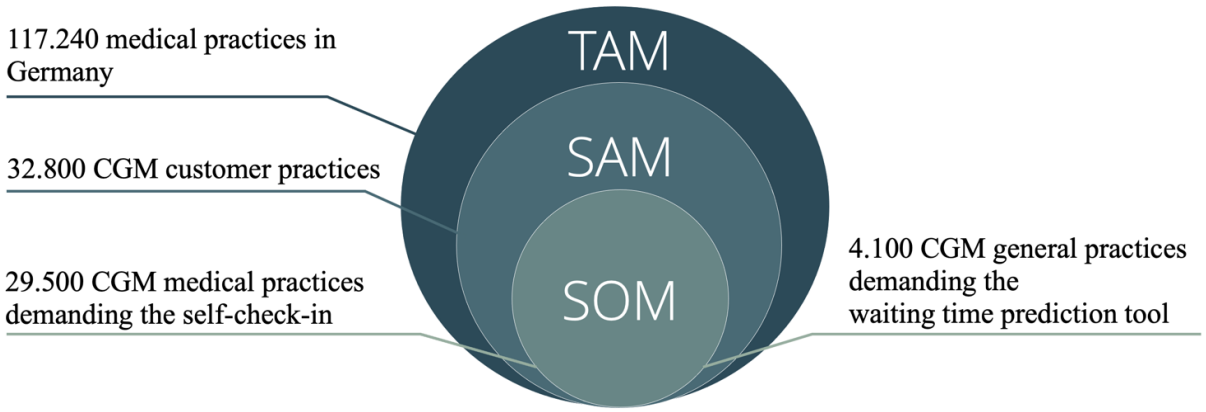


Figure 11 - TAM SAM SOM (The Author)

5.5 Lean Canvas

In the following, the first LC is completed, based on this, the next iteration steps will be made. This canvas serves as the first business model for further development. Problem, Solution, Value Proposition and Customer Segment is derived from the VPCs, which in turn is based on the findings of the survey and interviews. For existing alternatives, responses were taken from the physician interviews explaining how they currently perform the process. Key metrics were identified using the AARRR framework. To check the unfair advantage, a competitor analysis was performed to highlight the stand-alone feature, see Appendix 15. The cost structure and revenue streams were not the focus of the thesis. This is not yet of interest in detail, as a

collaboration will be conducted and such details will be agreed with the future collaboration partner. The Revenue Structure is roughly estimated but will change significantly. To get a rough idea of the Revenue Structure the market share of the potential collaboration partner CGM was taken, which was divided by the TAM SAM SOM model, and an exemplary subscription fee of 20€ per tool was chosen. The cost structure is based on assumptions for the first year of development and will also change significantly.

Problem	Solution	Unique Value Proposition	Unfair Advantage	Customer Segments
• High organizational and administrative effort • IT issues • Stressed & overworked staff	• Waiting time prediction tool • Self-check-in • Remote and independent software maintenance	The most time efficient way to plan and execute a physician visit for practices and patients though a self-check-in and waiting time predictions. The reliable software relieves not only the staff significantly but is also autonomously serviced ensuring a stable workflow.	• Close network of physicians who are willing to test and co-develop an MVP. • No precise calculation tool exists on the market to predict the waiting time for patients and actual appointment time.	• Medical practices • Medical health centers
Existing Alternatives	**Key Metrics**	**High-Level Concept**	**Channels**	**Early Adopters**
• Practice management systems • Medical appointment scheduling software • Reduced pacing of appointments	A: Number of website visits & origin analysis. A: Number requesting the newsletter or consultation. R: Number of patient users per practice. R: Number of referral codes sent by customers. R: Number of paying customers per tool.	Amazon Forecast for medical appointment waiting times. Airport Self-check-in for medical practices.	• Collaboration partner network • Personal visits to physicians • Promotions at conferences • Online information sessions promoted via medical platforms and LinkedIn • Word of mouth	• Large medical practices with an individual in charge, who deals exclusively with management activities. • Medical health centers. • Technology savvy, change-minded physicians who have a young patient base.

Cost Structure		Revenue Structure
Fixed costs:	Developer: 5500€ / Month * 3 Developer = 16.500€ / Month Founder: 6000€ / Month Customer Support: 3000€ / Month	Self-check-in: 20€ / Month * 29.500 Practices = 590.000€ / Month Waiting time predictions: 20€ / Month * 4100 Practices = 82.000€ / Month
Variable costs:	Travel, hardware and software purchases: 3000€ / Month	Total: 672.000€ / Month
Total:	28.500€ / Month	

Figure 12 - DOC+ Lean Canvas (Ash Maurya, 2017; Neos Chronos, 2022, The Author)

6 Conclusion

The purpose of this thesis was to create a first business model for DOC+ that is illustrated in Figure 12. After the original idea and vision were described in Chapter 2, an analytical and structured approach was used to create the business model. It was validated through the analysis of survey and interview data from future stakeholders. This first business model is used as a so-called plan A (see page 6) for the launch of DOC+, which will be improved in many further iteration steps. It is designed to serve as a basis for the foundation of the company DOC+ and for the evaluation of strategic plans and projects.

The research questions are answered below, which were used to help fill in key fields of the LC and to answer the question of what the next steps of DOC+ should look like:

RQ1) To what extent exists a customer demand for reduced waiting times and the problems they cause?

The data collected and analyzed through physician interviews and patient online surveys showed that the demand among patients is higher than for physicians to reduce waiting times and the problems they cause. Thus, the author's hypotheses that physicians also have a high demand were initially rejected from the physicians' statements themselves.

However, after a more detailed analysis with the help of the VPC (see Figure 8), it was indeed possible to identify a high demand for DOC+ on the part of physicians. This was proven by examining their strongest pains and the root causes that trigger these pains. DOC+ addresses the root causes of these pains and offers an improvement in all of them.

High organizational and administrative effort is addressed by automating repetitive staff tasks. In addition, automation removes a significant amount of work from the staff, which addresses the problem of stressed and overworked staff. The pain of poor time management is addressed by the waiting time prediction tool, which minimizes the symptoms of poor planning resulting e.g. in waiting times. Furthermore, the pain of IT issues is addressed by a robust DOC+ software that performs remote and autonomous software maintenance.

This confirms the previously mentioned quote from Steve Jobs: "People don't know what they want until you show it to them". Thus, as a next step, an MVP must be developed, demonstrated, and interviews conducted and analyzed again.

In contrast patients express their demand more clearly which is also confirmed in the VPC (see Figure 9). 60% of the patients mainly have a demand in reducing waiting time in the waiting room. In particular, it was observed that young patients as well as patients with public health insurance have a demand in reducing these waiting times and are specifically demanding the waiting time prediction tool.

Lower is the demand from patients to reduce the perceived risk of infection (54%) and to increase the demand for privacy at reception (48%). Specifically, it was identified that elderly patients and individuals responsible for medical appointments of patients other than themselves have an increased demand to reduce the perceived risk of infection and demand the waiting time prediction tool.

In summary, patients have a more obvious demand to reduce waiting times and the problems they cause that physicians do not have. Physicians have a demand to address the root causes that trigger waiting times and the problems they cause.

Critical regarding the answer to RQ1 is that the extent of the demand was not specifically measured for both stakeholders. This was not possible because the methodology in conducting patients and physicians' data was not the same and therefore not directly comparable. In addition, a rating system would have been necessary to define the demand extent with specific criteria. This would have been necessary to answer RQ1 more precisely, but in the context of this thesis it is not of high importance to get a precise answer, but rather a rough estimation whether a demand exists or not.

RQ2) Who will be the paying customer, and in which segment is the early adopter?

The analysis shows that physicians are significantly more willing to pay for DOC+ than patients. 90% of physicians and only 16% of patients state that they are willing to pay an as yet undefined amount for DOC+. Physicians clarified that the benefits must clearly outweigh the

costs and installation efforts. Among physicians, interest for the self-check-in tool is slightly higher than for the waiting time prediction tool.

As an early adopter medical care centers (MVZ) were recommended by the interviewed physicians, as they have personnel capacities for digitization projects, as well as a greater interest in standardizing and reducing costs and increasing patient satisfaction. Small medical practices are overloaded with their daily tasks and do not have the additional capacity to manage such a project. This advice results in a further task of presenting the MVP to larger medical practices and MVZs, analyzing their feedback and adapting the business model accordingly.

Among patients, subgroups could be identified that have a particularly high interest in DOC+ and thus are a target group as patient early adopters. Of interest here are patients who tend to be younger and visit physicians more frequently. Further characteristics for early adopter patients are described in more detail on page 27.

In summary, physicians will be the paying customers. Patients who visit the doctor frequently and are rather young will be early adopters. According to current research, large medical practices and MVZs will be early adopters on the part of physicians, although this must be confirmed in future research.

RQ3) What value is generated for the stakeholders?

Physician interviews confirmed only three of nine hypotheses of value creation (see page 20). Namely, that DOC+ reduces the workload of the reception staff and thus also their stress. In addition, patients would have more time for other activities. The author assumes that the statement made by Steve Jobs on page 7 applies here as well. The DOC+ product is still too abstract for physicians and the value creation must be made clear to physicians in the future through an MVP and use case. In addition, the reception staff should be included in this process, as they will ultimately be the direct beneficiaries.

A more detailed analysis using two VPCs identified several value creations for patients and physicians, which are listed in Figures 8 and 9. The most significant value creation for physicians is the reduction of workload for staff and the use of time for essential tasks. For patients, it is their opportunity for optimal time use and increased service quality in the practice.

RQ4) To what extent is it advantageous to develop an own platform and enter the market as a competitor or to collaborate with an IT system service provider for medical practices?

The results of the analysis of the physician interviews and the market analysis have shown that it is more advantageous to collaborate. The market is highly competitive, has high entry barriers and consists of an oligopoly of three companies and many small ones. Furthermore, no competitor could be identified that offers the waiting time prediction tool.

The biggest advantage for collaboration with an established partner is the reduction of market entry barriers and having access to their resources. In addition, collaborating would also simplify scaling in the future, as some of the market leaders are already present in other countries.

The company CGM was chosen as a potential first collaboration partner due to its large and growing market share as well as its reputation for innovation. As a future task, an NDA should be agreed with CGM and initial collaboration discussions should be started.

The goal of analytically validating the business idea from different perspectives and creating an initial business model as a basis for further development for DOC+ has been achieved. In addition, future research, further tasks and the strategic orientation for DOC+ were formulated.

VI. Appendix

Appendix 1: Physicians' interview guide (German)

1. Welche Software wird in Ihrer Arztpraxis täglich verwendet?

1.1. Sind Sie mit der Software und dem Anbieter zufrieden?

2. Wie beschreiben Sie den Anmeldeprozess am Empfang in Ihrer Praxis?

3. Was sind die Herausforderungen für Ihr Praxispersonal, insbesondere an der Rezeption?

3.1. Wie hoch schätzen Sie deren Arbeitsbelastung ein und welche Aufgabenbereiche nehmen die meiste Zeit in Anspruch?

4. Wie lang sind normalerweise die Wartezeiten für einen Patienten in Ihrer Praxis?

4.1. Was sind die Herausforderungen für Ihr Team, wenn Wartezeiten auftreten?

4.2. Was sind häufige Gründe für Wartezeiten?

5. Wie wichtig sind Ihnen die Bewertungen Ihrer Praxis und wie zufrieden sind Sie mit ihnen?

5.1. Was ist der Hauptgrund für kritische Bewertungen?

6. Kann die Privatsphäre an der Rezeption in der Regel gewährleistet werden?

7. Problembewertung:

Bewerten Sie die folgenden Aussagen, inwiefern diese problematisch für Sie sind:

7.1. Privatsphäre an der Rezeption.

7.2. Ansteckungsgefahr unter den Patienten im Wartezimmer.

7.3. Transparenz der Wartezeit.

7.4. Wartezeiten für Patienten am Empfang.

7.5. Wartezeiten für Patienten im Wartezimmer.

7.6. Anmeldeprozess.

7.7. Praxisbewertungen bezüglich der Wartezeiten.

7.8. Zeiteffizienz Ihres Empfangspersonals.

Lösungsbeschreibung: Zum einen wird der Patient vor dem Termin per SMS über die aktualisierte tatsächliche Terminzeit informiert. Zum anderen wird der Anmeldeprozess an der Rezeption vom Patienten selbst digital durchgeführt.

8. Was wären die Vorteile für Ihre Praxis, wenn Sie eine solche Lösung verwenden würden?

9. Wären Sie bereit für diese Module etwas zu zahlen, um die Wartezeiten in Ihrer Praxis zu verkürzen?

10. Wären Sie eher dazu bereit für ein solches Tool zu zahlen, wenn Ihr derzeitiger IT-Anbieter dieses anbieten würde oder bevorzugt separat von einem anderen Anbieter?

11. Bewertung der Lösung:

Bewerten Sie die folgenden Lösungen auf einer Skala von 1 bis 5 (1= nicht nötig, 3= gut zu haben, 5= unbedingt nötig).

11.1. Die vom Patienten selbst übernommene Anmeldung.

11.2. Ein virtueller Warteraum, in dem man von überall sehen kann, wie voll dieser ist.

11.3. Wartezeitvorhersagen für Patienten über SMS.

12. Demografische Daten:

12.1. Spezialisierung des Arztes:

12.2. Verantwortungsbereiche in der Praxis:

12.3. Eigentümerschaft:

12.4. Anzahl der behandelnden Ärzte in der Praxis:

12.5. Gibt es ein eigenes Praxismanagement:

12.6. Ist der Empfang während der Öffnungszeiten immer besetzt?

12.7. Postleitzahl der Praxis:

12.8. Alter:

12.9. Geschlecht:

13. Fällt Ihnen zum Abschluss des Interviews noch etwas zu den Problemen oder der Lösung ein, worüber wir noch nicht gesprochen haben?

Appendix 2: Physicians' interview guide (English translation)

1. What software in the medical practice is used on a daily basis?

1.1. Are you satisfied with the software and provider?

2. How do you describe the check-in process in your practice?

3. What are challenges for your practice staff, especially at the reception desk?

3.1. How much would you estimate their workload and which areas of responsibilities take up the most time?

4. How long are usually the waiting times for a patient in your practice?

4.1. What are challenges for your team when waiting times occur?

4.2. What is the reason for waiting times?

5. How important to you are the ratings of your practice and how satisfied are you with them?

5.1. What is the main reasoning for critical reviews?

6. Can privacy at the reception be normally guaranteed?

7. Problem ranking:

Rate the following statements in terms of how problematic they are for you:

7.1. Patient's privacy at reception.

7.2. Risk of infection among patients in the waiting room.

7.3. Waiting time transparency.

7.4. Waiting times for patients at reception.

7.5. Waiting times for patients in waiting room.

7.6. Check-in process.

7.7. Practice ratings regarding waiting times.

7.8. Time efficiency of your medical assistants/ receptionists.

Solution description: First, the patient will be notified prior to the appointment with the updated actual appointment time including a likely timeline by text message. Second, the check-in process at the front desk will be performed digitally by the patient himself.

8. What would be the advantage for your practice if you had such a tool in use?

9. Would you be willing to pay for this tool to reduce wait times in your practice?

10. Would you be more likely to buy the service if your current IT provider offered the tool or from a separate provider?

11. Solution evaluation:

Rate the solution on a scale of 1 to 5 (1= no need, 3= nice to have 5= must have).

11.1. Self-check-in.

11.2. Virtual waiting room where you can see how crowded it is from anywhere.

11.3. Waiting time predictions for patients by text message.

12. Demographics:

12.1. Physicians' specialization:

12.2. Responsibilities in practice:

12.3. Ownership:

12.4. Number of operating physicians in practice:

12.5. Is there a own practice management:

12.6. Is the reception always staffed during opening hours?

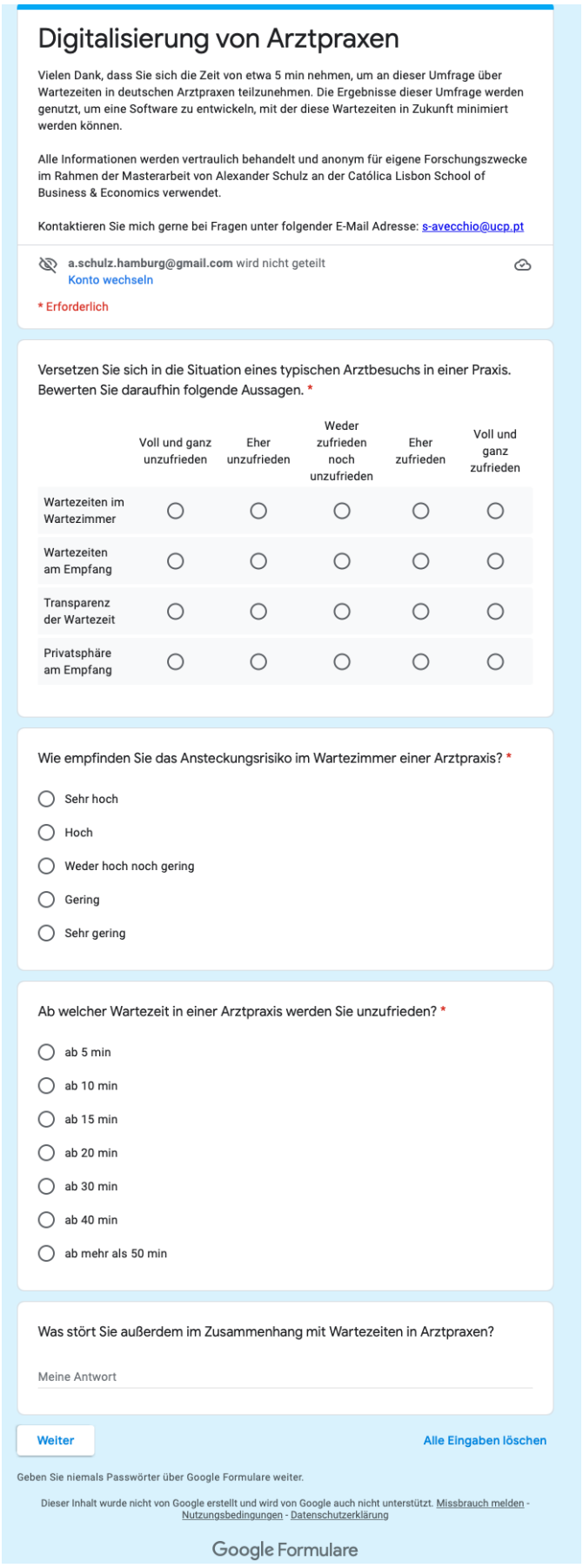
12.7. Practice zip code:

12.8. Age:

12.9. Gender:

13. Can you think of anything else about the problems or the solution that we haven't talked about yet?

Appendix 3: Patients online survey questionnaire (German)



Digitalisierung von Arztpraxen

Vielen Dank, dass Sie sich die Zeit von etwa 5 min nehmen, um an dieser Umfrage über Wartezeiten in deutschen Arztpraxen teilzunehmen. Die Ergebnisse dieser Umfrage werden genutzt, um eine Software zu entwickeln, mit der diese Wartezeiten in Zukunft minimiert werden können.

Alle Informationen werden vertraulich behandelt und anonym für eigene Forschungszwecke im Rahmen der Masterarbeit von Alexander Schulz an der Católica Lisbon School of Business & Economics verwendet.

Kontaktieren Sie mich gerne bei Fragen unter folgender E-Mail Adresse: s-avecchio@ucp.pt

a.schulz.hamburg@gmail.com wird nicht geteilt
Konto wechseln

* Erforderlich

Versetzen Sie sich in die Situation eines typischen Arztbesuchs in einer Praxis. Bewerten Sie daraufhin folgende Aussagen. *

	Voll und ganz unzufrieden	Eher unzufrieden	Weder zufrieden noch unzufrieden	Eher zufrieden	Voll und ganz zufrieden
Wartezeiten im Wartezimmer	○	○	○	○	○
Wartezeiten am Empfang	○	○	○	○	○
Transparenz der Wartezeit	○	○	○	○	○
Privatsphäre am Empfang	○	○	○	○	○

Wie empfinden Sie das Ansteckungsrisiko im Wartezimmer einer Arztpraxis? *

- ○ Sehr hoch
- ○ Hoch
- ○ Weder hoch noch gering
- ○ Gering
- ○ Sehr gering

Ab welcher Wartezeit in einer Arztpraxis werden Sie unzufrieden? *

- ○ ab 5 min
- ○ ab 10 min
- ○ ab 15 min
- ○ ab 20 min
- ○ ab 30 min
- ○ ab 40 min
- ○ ab mehr als 50 min

Was stört Sie außerdem im Zusammenhang mit Wartezeiten in Arztpraxen?

Meine Antwort

Weiter Alle Eingaben löschen

Geben Sie niemals Passwörter über Google Formulare weiter.

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* Erforderlich

Lösungsbeschreibung

(1) Zum einen wird der Patient vor dem Termin mittels SMS über die aktualisierte tatsächliche Terminzeit informiert.
(2) Zum anderen kann der Anmeldeprozess am Empfang bei Bedarf vom Patienten selbst digital durchgeführt werden. Dies geschieht indem der Patient seine Versichertenkarte am Eingang an ein Lesegerät hält.

Bewerten Sie folgende Lösungen *

	Unbedingt erwünscht	Eher erwünscht	Weder erwünscht noch unerwünscht	Eher nicht erwünscht	Überhaupt nicht erwünscht
Wartezeitvorhersagen mittels SMS (siehe Lösungsbeschreibung)	○	○	○	○	○
Optional vom Patienten selbst übernommene Anmeldung (siehe Lösungsbeschreibung)	○	○	○	○	○
Ein virtueller Warteraum, in dem Sie online sehen können, wie voll dieser ist.	○	○	○	○	○

Ich bevorzuge eine Praxis, die einen solchen Service verwendet, vor einer Praxis ohne diesen Service. *

- ○ Stimme voll und ganz zu
- ○ Stimme zu
- ○ Stimme weder zu noch lehne ab
- ○ Stimme nicht zu
- ○ Stimme überhaupt nicht zu

Ich bin bereit für einen solchen Service zu zahlen, um meine Wartezeit zu reduzieren. *

- ○ Stimme voll und ganz zu
- ○ Stimme zu
- ○ Stimme weder zu noch lehne ab
- ○ Stimme nicht zu
- ○ Stimme überhaupt nicht zu

Haben Sie Anmerkungen zu den oben beschriebenen Lösungen?

Meine Antwort

Zurück Weiter Alle Eingaben löschen

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* Erforderlich

Angaben für Statistische Zwecke

Sind Sie für die Arzttermine anderer verantwortlich, z. B. für Eltern oder Kinder? *

- ◯ Ja
- ◯ Nein

Wie oft gehen Sie im Durchschnitt pro Quartal zum Arzt? *

- ◯ ≤ 1 mal
- ◯ 2 - 3 mal
- ◯ ≥ 4 mal

In welcher Stadt leben Sie? *

Meine Antwort

Ihr Versichertenstatus: *

- ◯ Gesetzlich Krankenversichert
- ◯ Privat Krankenversichert
- ◯ Sonstiges:

Ihr Alter: *

- ◯ Jünger als 18 Jahre
- ◯ 18 - 24 Jahre
- ◯ 25 - 34 Jahre
- ◯ 35 - 44 Jahre
- ◯ 45 - 54 Jahre
- ◯ 55 - 64 Jahre
- ◯ 65 - 74 Jahre
- ◯ 75 Jahre oder älter

Ihr Geschlecht: *

- ◯ Weiblich
- ◯ Männlich
- ◯ Divers

Zurück Senden Alle Eingaben löschen

Appendix 4: Patients online survey questionnaire (translated to English)

Digitization of medical practices:

Thank you for taking the time of about 5 min to participate in this survey about waiting times in German medical practices. The results of this survey will be used to develop a software to minimize these waiting times in the future. All information will be kept confidential and used anonymously for own research purposes in the context of the master thesis of Alexander Schulz at the Católica Lisbon School of Business & Economics. Feel free to contact me in case of questions at the following e-mail address: s-avecchio@ucp.pt

1. Put yourself in the situation of a typical visit at a physician's practice. Evaluate the following statements and rate them on a scale of 1 to 5. Where 1 represents "fully dissatisfied" and 5 represents "fully satisfied".

1.1. Waiting times in the waiting room

1.2. Waiting times at the reception

1.3. Waiting time transparency

1.4. Privacy at the reception

2. How do you feel about the risk of infection in a doctor's practice waiting room?

Answer options: very high, high, neither high nor low, low, very low

3. At what waiting time in a doctor's office do you become dissatisfied?

Answer options: from 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 50 min

4. What else bothers you about waiting times in medical practices?

Solution Description:

(1) First, the patient is informed of the updated actual appointment time via text message before the appointment.

(2) Second, the check-in process at the reception desk can be carried out digitally by the patient himself, if desired. This is done by the patient holding their insurance card up to a card reader at the entrance.

5. Rate the following solutions on a scale of 1 to 5. Where 1 represents "absolutely desired" and 5 represents "not desired at all".

5.1. Waiting time predictions via text message (see solution description)

5.2. Optional registration performed by the patient himself (see solution description).

6. I prefer a medical practice that uses such a service over one that does not.

Answer options: fully agree, somewhat agree, neither agree nor disagree, somewhat disagree, fully disagree

7. I am willing to pay for such a service to reduce my waiting time.

Answer options: fully agree, somewhat agree, neither agree nor disagree, somewhat disagree, fully disagree

8. Do you have any comments on the solutions described above?

Data for statistical purposes:

9. Are you responsible for the medical appointments of others, such as parents or children?

Answer options: yes, no

10. On average, how often do you go to the doctor per quarter?

Answer options: ≤ 1 time, 2 - 3 times, ≥ 4 times

11. In which city do you live?

12. Your insurance status:

Answer options: legally insured, privately insured, other

13. Your age in years:

Answer options: younger than 18, 18-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75 or older

14. Your gender:

Answer options: Female, Male, Divers

Appendix 5: Physicians interview analysis

Column	Expert	Total mentions	Category	Subcategory	Statement
1			Software		
2				Provider	
3	A	1			Don´t use software
4	B	1			Medisoft
5	C	1			CGM Z1.Pro
6	D,F	2			CGM Medistar
7	E	1			x.isynet
8	G	1			Frey ADV Quincy
9	H	1			CGM Medisoft / Medisoftware for Online booking
10	I	1			Charly by Solutio
11	J	1			CGM Turbomed
12	C,D,F,H,J	5			CGM Group Software
13				Satisfaction	
14	B	1			Rather satisfied
15	H,I,J	4			Neither satisfied nor dissatisfied
16	C,D,E,G	4			Rather unsatisfied
17	F	1			Very unsatisfied
18				Reasons	
19	B	1			Good customer service
20	D,G	2			Long customer service waiting times
21	D,F,G	3			Customer service is very disorganized
22	F,G,I	3			Need to pay additional IT technician to handle problems
23	C,D,E,F,G,I	6			Problems after updates: Interrupts workflow thus annoyed
24	B,C,D,E,G	5			Advantages of the software in general are valued
25			Check-in-process		
26	E,I	2			Process is not a problem for the practice
27	E,F	2			Unfriendly reception staff is a problem
28				Insurance Card	
29	A,B,C,D,E,F,J	7			Some private insured patients don´t have insurance card; Data is transferred manually
30	E,J	2			In case of forgotten or non-functioning insurance card, reception contacts the insurance company and matches data
31	F,G,H,I,J	5			Scan insurance card once in quarter
32				Patient communication	
33	A,B,C,D,F,G,I ,J	8			Ask for Infos about the patient to estimate time with physician
34	A,B,C,D	4			Aks for personal Infos if they have changed
35	H,I,J	3			Note as many information as possible to relieve the doctor of work so that he can focus on the essentials
36	B,C,J	3			Reception knows specialies about certain patiants, for example that they take longer for a special reason
37			Reception		
38				Tasks & Workload	
39	A,B,C,D,E,F,G,H,I,J	10			Multitasking, managing patients and physicians needs at same time
40	A,B,C,D,G,I,J	7			Appointment management by phone takes up most of the time
41	A,B,C,D,F,G,I,J	8			Other administration tasks by phone are time intense (examples G 5:15)
42	C,F,I,J	4			Time-consuming first-time registration process due to: privacy policy, medical history form
43	B,C,F,G,I,J	6			Complex appointment allocation: individually different appointment lengths due to known personal characteristics and/or the length of individual treatment
44	H	1			Online appointment booking problem solving : Wrong doctor booked; wrong treatment booked
45	A,B,F,H	4			Avoid idle time for physician
46	F	1			Lots of paperwork: Manage signed documents, copy, scan, fax
47	A,B,C,D,E,F,H,J	8			All possible complaints are reported to the reception staff and not to the physician
48	A,B,D,E,F,G,I	7			High work load for reception staff; stressed
49	C	1			Medium workload, less stress, due to small practice and a lot of staff

50				Privacy	
51	A,B,C,D,E,F,G,H,I	9			Try to maintain privacy for patients by providing distance and speaking little personal info out loud
52	A,B,C,D,E,F,G,H,I	9			Limited privacy at reception due to the premises
53	C,D,E,J	4			Privacy is rather not considered as a problem
54			Waiting time		
55	A,B,C,D,F	5			Covid helps to reduce waiting times and problems they cause due to less traffic in practice
56				Length	
57	A,C,E,F,G,J	6			Approximately 15 min with an appointment
58	D	1			15-30 min with an appointment
59	B,H	2			15-60 min with an appointment
60	I	1			10-40 min: One day on time, other day whole day behind schedule
61	C,D,E,G,J	5			Significantly longer waiting times for patients without an appointment, up to over 1h
62				Cause	
63	A,B,C,F,H,I,J	7			Hard to predict the duration of an appointment; Unforeseen issues take time
64	C,D,E,F,G,I,J	7			Patients without appointment; emergencies
65	A,C,D,H,I	5			Poor time management
66	C,I,J	3			First visit of a patient takes more time than planned
67	C,I	2			Bad placed appointments: E.g. patient that knowingly takes long, not placed at end of shifts
68	A,B,H	3			Too many scheduled appointments per hour to avoid idling, cause are no shows of patients
69	H	1			System problem: Too little scheduled time per patient, forced to work economically at the cost of treatment quality
70	I	1			Too many patients: Try to help everyone asap and over take myself
71	J	1			Language barriers
72				At Reception	
73	A,B,D,E,F,G,H,I	8			At peak hours high
74	D,H	2			An existing problem
75	A,B,C,D,E,F,I,J	8			Rather no problem, but waiting times in the waiting room are a bigger problem
76				In waiting room	
77	C,E,F,G,J	5			Not a problem, because of good and generous planning
78	B,D	2			Rather a problem
79	H,I	2			Sometimes a problem
80				Transparency	
81	A,B,C,D,E,G,H	7			In general low waiting time transparency
82	E,F,G,I,J	5			Patients are told (sometimes) at the reception desk roughly how long the waiting time will be
83			Waiting times consequences		
84				Risk of infection	
85	A,B,C,D,E,F,G,H,I,J	10			During corona lower than before: Fewer patients in room, more distance, air filter, open windows
86	B,V,E,F,I,J	6			Not completely avoidable; Difficult to separate; Checked in with back pain, actually flu
87	B,D,E,F,I,J	6			Rather not a problem
88	J	1			Different consultation hours for different infection groups.
89				Ratings	
90	A,B,C,H	4			Reason for bad reviews: long waiting times & bad management
91	J	1			Critical reviews cause pressure on the doctor
92	A,B,D,F,G,H	6			Do not look at them at all or rarely; can be fake; Rather unhappy patients rate
93	C,E,I	3			Generally happy; just few reviews
94	D,I	2			Are important for the practice
95			Solution		
96				Advantage	
97	A,B,C,D,H,I,J	7			Saves time for patient
98	D,F,G,H,I,J	6			Saves time & workload for reception staff
99	H,J	2			Increaseses quality of treatment for patient
100	I	1			Better practice overview through more data
101				Criticism	

102	C,D,E,G,H,J	6			Patient comes to the doctor anyway, also with long waiting times
103	A,B,E,F,I	5			Front desk is needed as patients want contact person & for security reasons
104	C,F	2			Data protection concerns
105	D,G	2			Concerns that the upgrade will bring software issues
106	A,B,C,D,F,G,I,J	8			Very good solution rather for large practices and medical care centers (MVZ)
107	E,I	2			Skeptical that the software can compensate for the problem of a poorly managed and overloaded practice
108	F,G,I	3			Optimization package is desired; Online booking must predict more precise time slots
109	F	1			Self-check-in already works because of corona 50% like that
110	F	1			Difficult to assign one patient with new insurance card to his file when he has same personal data as others
111	H	1			Worried that idle time occurs when waiting room is not always full
112	J	1			Needs to be in multiple languages
113				Willing to pay	
114	A,B,C,D,F,G,H,I,J	9			Yes, but depends on price
115	C,F	2			Yes, but only if there is a low price for low usage
116	E	1			No, because there is no problem
117	F	1			Yes, if offered as a whole package with online appointments, paperwork online for massive relieve for front desk
118	J	1			Yes, only if it is evident that the benefits are clearly commensurate with cost and installation effort
119				Provider preference	
120	A,B,E,G,I,J	6			Prefer to buy from current provider
121	H	1			Prefer to buy from extern
122	C,D,F	3			Does not matter
123			Tool rating		
124				Self-check-in	
125	E	1			1 = Absolute no need
126		0			2 = Rather no need
127	B,D,F,G,J	5			3 = Nice to have
128	C,H,I	3			4 = Rather must have
129	A	1			5 = Absolute must have
130				Predictions	
131	E	1			1 = Absolute no need
132	A,F,H,I	4			2 = Rather no need
133	C,D	2			3 = Nice to have
134	G,J	2			4 = Rather must have
135	B	1			5 = Absolute must have
136				Virtual waiting room	
137	A,D,E,G	4			1 = Absolute no need
138	H,J	2			2 = Rather no need
139	F	1			3 = Nice to have
140	B,C,I	3			4 = Rather must have
141		0			5 = Absolute must have
142			Other information		
143	A,C,F	3			Staff is expensive & hard to find
144	D,F,I,J	4			There will be a shift toward more medical care centers (MVZ) and large practices.
145	B,E,H	3			Cycle of patients is reduced to provide better care to patients and have less stress, but less money.
146	F	1			10-15% of patients with appointment did not appear. Now: 25€ fee for no show. Significant improvement after.
147	F	1			Especially old peolple like to spend time in waiting room, read and relax, talk.
148	F	1			Hackers also attack Practices and freeze the systems, dangerourse because of data protection
149	J	1			20% dont have an appointment, depends on area of pratice, cultural background,
150	J	1			In problem neighborhoods, patients don't go to the doctor until absolutely necessary and don't plan ahead.
151	J	1			Psychological problems that occur where more communication is required and takes more time.
152	C	1			Children & Families always take longer
153	C,H	2			Suggestion: Improve services in the waiting room, e.g. by Wifi, to make waiting times more pleasant.

Appendix 6: Physicians Jobs, Pains and Gains

Phisicians' Jobs, Pains and Gains				
Column	**Expert**	**Total mentions**	**Category**	**Statement**
1	What are the main tasks of your job? What do you want to achieve in your job?			
2			Jobs	
3	A,B,C,D,E,F,G,H,I,J	10		Ensure a prompt high-quality treatment and well-beeing of patients.
4	A,B,C,D,E,F,G,H,I,J	10		Investigating, diagnosing and treating the health conditions of patients.
5	A,B,C,D,E,F,G,H,I,J	10		Organizational and administrative work e.g. employee management, modernization, digitalization, documentation, reports, compliance and finances.
6	A,B,C,D,E,F,G,H,I,J	10		Managing the practice as a business and making sure it is secure for the future and profitable.
7	A,B,C,D,E,F,G,H,I,J	10		Recognition of the work
8	What is bothering or troubling that is preventing you from getting your work done?			
9			Pains	
10	A,B,C,D,E,F,G,H,I,J	10		Organizational and administrative work.
11	B,C,D,F,G,H,I,J	8		Digitization and IT-system maintenance that interrupt the daily work and leads to extra efforts and costs.
12	B,C,E,F,G,H,I,J	8		Bureaucratic compliance efforts.
13	B,C,E,F,G,H,J	7		No show of patients that cause a financial loss.
14	B,C,E,F,H,I,J	7		Stressed and overworked staff.
15	C,D,E,F,G,H,I	6		Online feedback and comments that cause a bad reputation.
16	A,C,F,G,H,J	6		Poor time management at reception.
17	B,C,E,F,I,J	6		Too little scheduled time per patient, forced to work economically at the cost of treatment quality.
18	B,F,G,H,I	5		Cybersecurity and data protection.
19	A,C,E,F,H	5		Staff is hard to find and expensive.
20	F,I	2		High operating costs.
21	What would make your life easier getting your work done?			
22			Gains	
23	A,B,C,D,E,F,G,H,I,J	10		Lean practice organization and processes to be able to focus on the essential work and in return to increase patient satisfaction.
24	A,B,C,D,E,F,G,H,I,J	10		Software with increased benefit to effort ratio (less downtime, costs and maintenance problems).
25	B,C,D,E,F,G,H,I,J	9		Relieving the staff from repetitive tasks to focus on the essential and reduce stress.
26	B,C,E,F,G,H,J	7		Minimizing no shows to avoid idle time.
27	C,D,E,F,G,H	6		Increase positive online feedback and thus a better reputation and more patients.
28	A,D,E,H	4		Higher automated cyber security safety.
29	D,F,J	3		Creation of a more attractive workplace for new staff.

Legend:

Expert	Specialisation	Interview Date	Audio File	Zip code	Gender	Year of birth	Ownership	Nr. of physicians	Management	Reception staffed during opening hours:
A	Dermatology	02.11.21	A_02.11.m4a	22391	Female	1965	Owner	1	Doctors	Yes
B	Gynecology and obstetrics	02.11.21	B_02.11.m4a	22359	Female	1958	Owner	2	Doctors	Yes
C	Dentistry, oral and maxillofacial medicine	03.11.21	C_03.11.m4a	22848	Female	1964	Owner	1	Doctors	Yes
D	General practitioner	04.01.21	D_04.11.m4a	22041	Female	1962	Owner	2	Doctors	Yes
E	General practitioner	06.11.21	E_06.11.m41	22949	Female	1959	Employed	5	Doctors	Yes
F	Dermatology	09.11.21	F_09.11.m4a	22041	Male	1965	Owner	3	Doctors	Yes
G	General practitioner	10.11.21	G_10.11.m4a	22111	Female	1964	Owner	3	Doctors	Yes
H	Orthopedics and trauma surgery	13.11.21	H_13.11.m4a	22609	Female	1979	Employed	3	Doctors	Yes
I	Dentistry, oral and maxillofacial medicine	14.11.21	I_14.11.m4a	20355	Male	1994	Employed	2	Doctors	Yes
J	Pediatrician	15.11.21	J_15.11.m4a	51065	Male	1970	Employed	2	Doctors	Yes

Nr. of mentions	Color	Pain Rank	Gain Rank
≥ 8		very strong	must-have
> 5 & < 8		strong	should-have
≤ 5		moderate	nice-to-have

Appendix 7: Descriptive statistics of the online survey

In the period from 05.11.2021 to 20.11.2021, 164 people with a stated residence in Germany participated in the survey. The descriptive statistics are presented below:

• Gender: Is represented approximately to equal proportions (51% female; 48% male) and has little to no correlation with other variables.

• Age: Younger people participated in the survey to a greater extent, 62% are between 18 and 44 years old and 38% are between 45 and 74 years old. The largest group is 25-34 years old with 43%.

• Location: The participants predominantly come from the north of Germany, with 79%, although the city of Hamburg is home to the largest number of respondents overall, at 60%. Investigations of the different places of residence are not conducted due to subgroups smaller than 30.

• Insurance status: 18,29% of the respondents' state that they are privately insured, 81,7% state that they are publicly insured. This sample reflects similar figures to those from the 2015 Federal Statistical Office, which show that about 87% of the German workforce is publicly insured and about 13% privately insured (Statistisches Bundesamt, n.d.).

• Number of physician visits: 68% of respondents' report going to the physician one time or less per quarter, 26% report going to the doctor 2-3 times per quarter, and 6% report going to the doctor more than 3 times per quarter.

• Responsibility for appointments: 18% of survey participants are responsible for appointments of others at physicians, e.g. family. 82% of the participants visit the physician on their own behalf.

• Maximum duration of waiting time for being dissatisfied: About 10% of the respondents are dissatisfied after a waiting time longer than 10 min, about 21% after 15 min, 34% after 20 min, 27% after 30 min, 5% after 40min and 3% after 50min. The median is 20 minutes.

The following Figure A shows the satisfaction of waiting times in waiting rooms of the whole sample. 59.8% of all respondents indicated that they are completely to rather dissatisfied with the waiting times, with the majority of 47.6% indicating rather dissatisfied. Only 21.3% are somewhat to fully satisfied. Nearly 19% are neither satisfied nor dissatisfied.

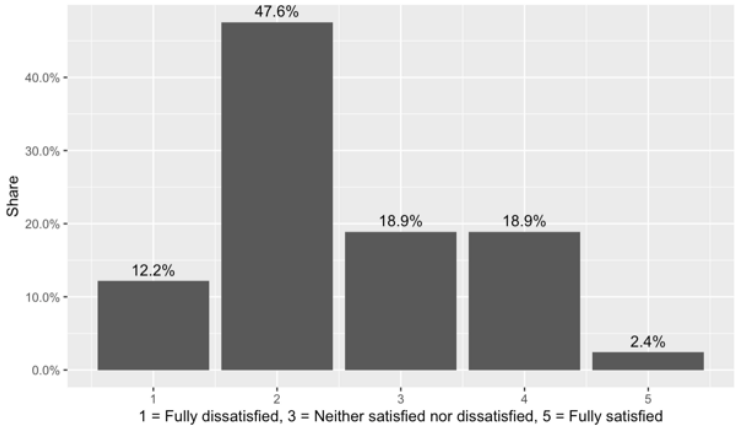

Figure A - Satisfaction of waiting times in waiting rooms of the total sample (The Author)

Figure B shows the satisfaction of waiting times at the reception of the entire sample. The figures here give a contrasting picture to the waiting times in the waiting room. Here, 60.4% are rather to fully satisfied with the waiting times at the reception, 21.4% rather to fully dissatisfied and 18.3% are neither satisfied nor dissatisfied.

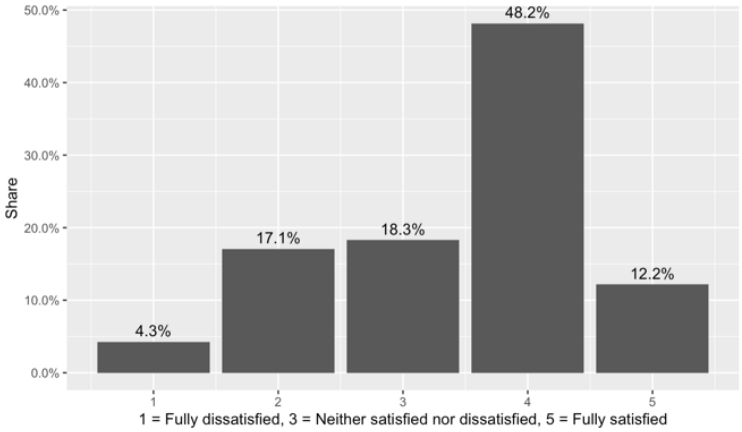

Figure B - Satisfaction of waiting times at the reception of the total sample (The Author)

Figure C and D show the desirability of the respondents, differentiated into the self-check-in, which is intended to reduce waiting times at the reception, and the waiting time prediction tool, which is intended to reduce waiting times in the waiting room. Another indicator of whether there is demand from patients is if patients prefer a practice that uses DOC+, see Figure E.

Figure C shows that 87.8% of respondents desire a wait time prediction tool absolutely to rather. The majority (47.6%) even claims that this tool is absolutely desired. Only just under 5% rather do not desire this tool.

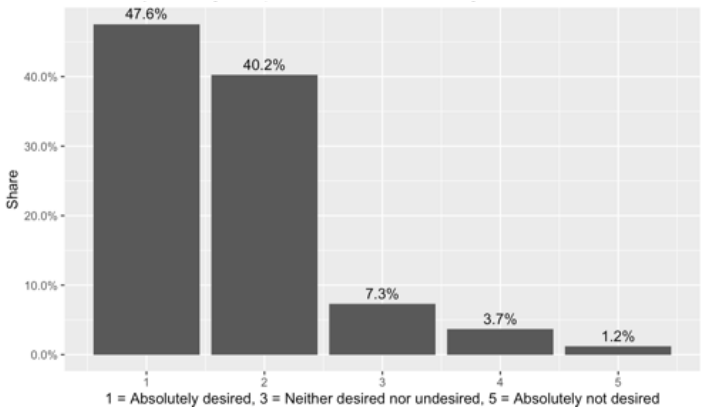

Figure C - Desirability: Waiting time predictions via text message (The Author)

Figure D shows that the self-check-in is somewhat less desired, which is also consistent with the rather lower problem of waiting times at the reception desk for the patients. Nevertheless, almost 67% state that this tool is rather to absolutely desirable. 19.5% state that they rather not to absolutely not desire the tool.

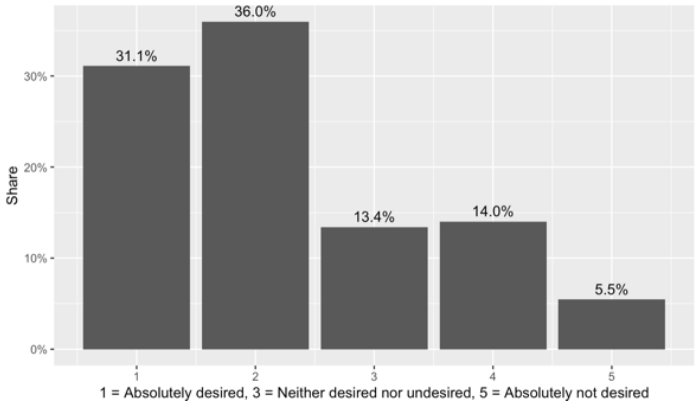

Figure D - Desirability: Self-check-in (The Author)

The high desirability numbers are supported by the following, see Figure E. Nearly 76% claim to prefer a practice that uses DOC+. About 19% do not consider this criterion important and only 5.5% claim to rather not prefer such a practice.

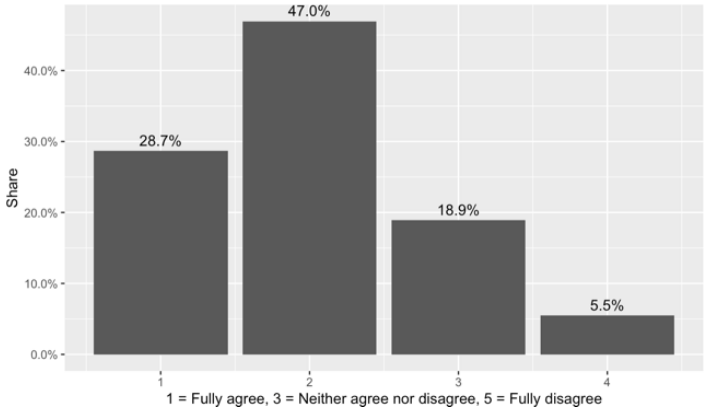

Figure E - Preference for a practice that uses DOC+ (The Author)

Appendix 8: Legend for variables and regression analysis of the patient online survey

Question	Abbreviation	Definition	Scale	Scale description
Put yourself in the situation of a typical visit at a physician's practice. Evaluate the following statements:	wtwr wtar wtt prre	Waiting time in the waiting room Waiting time at reception Waiting time transparency Privacy at the reception	1 2 3 4 5	Fully dissatisfied Rather dissatisfied Neither satisfied nor dissatisfied Rather satisfied Fully satisfied
How do you feel about the risk of infection in a doctor's practice waiting room?	riinf	Perceived risk of infection	1 2 3 4 5	Very high High Neither high nor low Low Very low
At what waiting time in a doctor's office do you become dissatisfied?	wdis	Waiting time dissatisfaction	5 10 15 20 30 40 50	From 5 min From 10 min From 15 min From 20 min From 30 min From 40 min From 50 min
Rate the following solutions:	wpred scheckin	Waiting time predictions Self-check-in	1 2 3 4 5	Absolutely desired Rather desired Neither desired nor undesired Rather desired Fully desired
Do you prefer a practice that uses DOC+ over one that does not?	pref	Prefer DOC+	1 2 3 4 5	Fully agree Somewhat agree Neither agree nor disagree Somewhat disagree Fully disagree
I am willing to pay for such a service to reduce my waiting time:	wpay	Willing to pay for DOC+	1 2 3 4 5	Fully agree Somewhat agree Neither agree nor disagree Somewhat disagree Fully disagree
Are you responsible for the medical appointments of others, such as parents or children?	resp	Responsibility for appointments of others	0 1	Yes No
On average, how often do you go to the	physqua	Physician visits per quarter	1 2 3	≤ 1 time 2 - 3 times ≥ 4 times

physician per quarter.				
In which city do you live?	city	City of residence	1 2 3 ...	Hamburg Pinneberg Ahrensburg ...
Insurance status of respondent:	insstat	Insurance status	0 1	Privately insured Legally insured
Age of respondent:	age	age	1 2 3 4 5 6	18 - 24 years 25 - 34 years 35 - 44 years 45 - 54 years 45 - 64 years 65 - 74 years
Gender of respondent:	gender	gender	0 1	Male Female

Appendix 9: Regression analysis 1 including code

See Appendix 8 for the description of the variables.

```r
# 5.1.3 RQ1A) To what extent exists a patients demand to reduce waiting times in the waiting room (wtwr) and waiting times at the reception (wtar)?
```{r}
lm.wtwr1 <- lm(data = dt.Survey, log_wtwr ~ log_wpred + log_scheckin + log_pref + log_age + insstat + physqua + resp + gender)
# All respondents
lm.wtwr2 <- lm(data = dt.Survey, log_wtwr ~ log_wpred + log_pref) # All respondents
lm.wtwr3 <- lm(data = dt.Survey, log_wtwr ~ log_wpred + log_age + insstat) # All respondents
lm.wtwr4 <- lm(data = dt.Publicly_Insured, log_wtwr ~ log_wpred + log_pref) # Subgroup: Publicly insured
lm.wtwr5 <- lm(data = dt.responsible_others, log_wtwr ~ log_pref + physqua) # Subgroup: Also responsible for other peoples appointments

lm.wtar1 <- lm(data = dt.Survey, wtar ~ log_wpred + log_scheckin + log_pref + log_age + insstat + physqua + resp + gender)
# All respondents including all demographics

stargazer(lm.wtwr1, lm.wtwr2, lm.wtwr3, lm.wtwr4, lm.wtwr5, lm.wtar1, type = "text", no.space = TRUE, title = "Regression analysis 1", omit.stat=c("f"))
```
```

Regression analysis 1

	Dependent variable:					
	log_wtwr					wtar
	(1)	(2)	(3)	(4)	(5)	(6)
log_wpred	0.153**	0.126*	0.169**	0.136*		0.162
	(0.077)	(0.075)	(0.071)	(0.082)		(0.202)
log_scheckin	-0.048					-0.057
	(0.065)					(0.170)
log_pref	0.134*	0.149*		0.147*	0.419**	0.012
	(0.079)	(0.078)		(0.085)	(0.161)	(0.206)
log_age	0.130**		0.150***			-0.024
	(0.061)		(0.056)			(0.160)
insstat	-0.163*		-0.169**			-0.161
	(0.086)		(0.083)			(0.223)
physqua	0.065				0.355***	-0.141
	(0.058)				(0.104)	(0.151)
resp	-0.018					-0.026
	(0.089)					(0.231)
gender	0.029					-0.077
	(0.067)					(0.175)
Constant	0.644***	0.694***	0.761***	0.658***	0.086	3.840***
	(0.168)	(0.060)	(0.099)	(0.064)	(0.234)	(0.439)
Observations	164	164	164	134	30	164
R2	0.125	0.051	0.100	0.057	0.339	0.016
Adjusted R2	0.080	0.039	0.083	0.043	0.290	-0.034
Residual Std. Error	0.408 (df = 155)	0.417 (df = 161)	0.407 (df = 160)	0.412 (df = 131)	0.369 (df = 27)	1.065 (df = 155)

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 10: Regression analysis 2 including code

See Appendix 8 for the description of the variables.

```r
# 5.1.5 To what extent exists a patients demand to reduce problems waiting times cause, like privacy at the reception (prre) or risk of infection (riinf)?
```{r}
lm.prre1 <- lm(data = dt.Survey, log_prre ~ log_wpred + log_scheckin + log_pref + log_age + insstat + physqua + resp + gender)
lm.prre2 <- lm(data = dt.Survey, log_prre ~ log_pref + log_age + insstat + gender)

lm.prre3 <- lm(data = dt.Publicly_Insured, log_prre ~ log_pref + log_age)
lm.prre4 <- lm(data = dt.responsible_themselves, log_prre ~ log_pref + log_age + insstat)

lm.riinf1 <- lm(data = dt.Survey, log_riinf ~ log_wpred + log_scheckin + log_pref + log_age + insstat + physqua + resp + gender)
lm.riinf2 <- lm(data = dt.Publicly_Insured, log_riinf ~ log_wpred + log_age + resp)

stargazer(lm.prre1, lm.prre2, lm.prre3, lm.prre4, lm.riinf1, lm.riinf2, type = "text", no.space = TRUE, title = "Regression analysis 2", omit.stat=c("f"))
```
```

Regression analysis 2

	Dependent variable:					
	log_prre				log_riinf	
	(1)	(2)	(3)	(4)	(5)	(6)
log_wpred	-0.030				0.142*	0.203***
	(0.081)				(0.076)	(0.073)
log_scheckin	0.055				-0.030	
	(0.068)				(0.064)	
log_pref	0.142*	0.143*	0.188**	0.175**	0.218***	
	(0.083)	(0.078)	(0.081)	(0.085)	(0.078)	
log_age	-0.185***	-0.162***	-0.145**	-0.147**	-0.083	-0.125**
	(0.065)	(0.059)	(0.062)	(0.065)	(0.060)	(0.061)
insstat	-0.158*	-0.179**		-0.269***	-0.058	
	(0.090)	(0.086)		(0.098)	(0.084)	
physqua	0.015				-0.009	
	(0.061)				(0.057)	
resp	-0.045				-0.131	-0.203**
	(0.093)				(0.087)	(0.094)
gender	-0.156**	-0.142**			0.061	
	(0.070)	(0.067)			(0.066)	
Constant	1.202***	1.197***	0.901***	1.163***	0.870***	1.015***
	(0.176)	(0.114)	(0.078)	(0.121)	(0.165)	(0.120)
Observations	164	164	134	134	164	134
R2	0.112	0.106	0.068	0.106	0.103	0.103
Adjusted R2	0.066	0.084	0.054	0.085	0.056	0.082
Residual Std. Error	0.428 (df = 155)	0.424 (df = 159)	0.403 (df = 131)	0.417 (df = 130)	0.401 (df = 155)	0.383 (df = 130)
Note:						*p<0.1; **p<0.05; ***p<0.01

Appendix 11: Regression analysis 3 including code

See Appendix 8 for the description of the variables.

```
# 5.2.2 Who will be the paying customer?
```{r}
lm.pay1 <- lm(data = dt.Survey, wpay ~ insstat + log_age +  physqua + resp + gender)
lm.pay2 <- lm(data = dt.Survey, wpay ~ log_pref + wdis + log_riinf + log_prre + log_wtt + wtar + wpred + log_scheckin + log_wtwr +
insstat + log_age + physqua + resp + gender)
lm.pay3 <- lm(data = dt.Survey, wpay ~ log_pref  + wpred + wtar)
lm.pay4 <- lm(data = dt.Privately_Insured, wpay ~ wpred + log_prre)
lm.pay5 <- lm(data = dt.Publicly_Insured, wpay ~ log_age + log_pref + wtar + resp)

stargazer(lm.pay1, lm.pay2, lm.pay3, lm.pay4, lm.pay5, type = "text", no.space = TRUE, title = "Regression analysis 3",
omit.stat=c("f"))
```
```

Regression analysis 3

	Dependent variable:				
			wpay		
	(1)	(2)	(3)	(4)	(5)
log_pref		0.661***	0.591***		0.889***
		(0.190)	(0.174)		(0.186)
wdis		0.001			
		(0.009)			
log_riinf		-0.204			
		(0.200)			
log_prre		0.104		0.788***	
		(0.198)		(0.283)	
log_wtt		0.196			
		(0.195)			
wtar		0.128	0.147**		0.139*
		(0.083)	(0.071)		(0.077)
wpred		0.208**	0.208**	0.600**	
		(0.096)	(0.089)	(0.226)	
log_scheckin		0.040			
		(0.154)			
log_wtwr		-0.037			
		(0.219)			
insstat	-0.253	-0.205			
	(0.206)	(0.202)			
log_age	-0.200	-0.332**			-0.323**
	(0.145)	(0.159)			(0.150)
physqua	0.123	0.167			
	(0.140)	(0.136)			
resp	-0.235	-0.302			-0.473**
	(0.218)	(0.207)			(0.227)
gender	-0.174	-0.013			
	(0.159)	(0.162)			
Constant	4.150***	2.869***	2.416***	2.076***	3.274***
	(0.387)	(0.523)	(0.295)	(0.505)	(0.405)
Observations	164	164	164	30	134
R2	0.035	0.200	0.144	0.340	0.193
Adjusted R2	0.005	0.124	0.128	0.292	0.168
Residual Std. Error	1.006 (df = 158)	0.944 (df = 149)	0.942 (df = 160)	0.819 (df = 27)	0.924 (df = 129)
Note:					*p<0.1; **p<0.05; ***p<0.01

Appendix 12: Regression analysis 4 including code

See Appendix 8 for the description of the variables.

```
# 5.2.5 In which segment is the early adopter?
```{r}
lm.segment1 <- lm(data = dt.Survey, log_pref ~ insstat + log_age +  physqua + resp + gender)
lm.segment2 <- lm(data = dt.Survey, log_pref ~ wpay + wdis + log_riinf + log_prre + log_wtt + wtar + wpred + log_scheckin + log_wtwr + insstat + log_age + physqua + resp + gender)
lm.segment3 <- lm(data = dt.Survey, log_pref ~ log_age + wpay + log_riinf + physqua + log_scheckin)

lm.segment4 <- lm(data = dt.Privately_Insured, log_pref ~ log_riinf)
lm.segment5 <- lm(data = dt.Publicly_Insured, log_pref ~ wpay + log_riinf + log_scheckin)
lm.segment6 <- lm(data = dt.responsible_others, log_pref ~ log_wtwr + physqua + gender)
lm.segment7 <- lm(data = dt.responsible_themselves, log_pref ~ wpay + log_riinf + log_scheckin + log_age)

stargazer(lm.segment1, lm.segment2, lm.segment3, lm.segment4, lm.segment5, lm.segment6, lm.segment7, type = "text", no.space = TRUE, title = "Regression analysis 4", omit.stat=c("f"))
```
```

Regression analysis 4

	Dependent variable:						
	log_pref						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
wpay		0.114***	0.123***		0.141***		0.152***
		(0.033)	(0.031)		(0.034)		(0.034)
wdis		-0.003					
		(0.004)					
log_riinf		0.191**	0.225***	0.525***	0.152*		0.249***
		(0.082)	(0.075)	(0.143)	(0.086)		(0.081)
log_prre		0.053					
		(0.082)					
log_wtt		0.086					
		(0.081)					
wtar		-0.051					
		(0.035)					
wpred		0.045					
		(0.040)					
log_scheckin		0.129**	0.136**		0.208***		0.131*
		(0.063)	(0.060)		(0.067)		(0.066)
log_wtwr		0.061				0.406**	
		(0.091)				(0.177)	
insstat	-0.075	0.007					
	(0.088)	(0.084)					
log_age	0.136**	0.124*	0.126**				0.123**
	(0.062)	(0.066)	(0.057)				(0.061)
physqua	-0.096	-0.118**	-0.113**			-0.333***	
	(0.060)	(0.056)	(0.054)			(0.108)	
resp	0.058	0.100					
	(0.093)	(0.086)					
gender	-0.055	-0.009				-0.295*	
	(0.068)	(0.067)				(0.144)	
Constant	0.654***	-0.084	-0.082	0.213	-0.167	0.947***	-0.330**
	(0.165)	(0.238)	(0.151)	(0.142)	(0.145)	(0.221)	(0.151)
Observations	164	164	164	30	134	30	134
R2	0.052	0.258	0.216	0.324	0.200	0.403	0.251
Adjusted R2	0.022	0.189	0.191	0.300	0.181	0.334	0.227
Residual Std. Error	0.430 (df = 158)	0.392 (df = 149)	0.391 (df = 158)	0.363 (df = 28)	0.394 (df = 130)	0.373 (df = 26)	0.379 (df = 129)
Note:							*p<0.1; **p<0.05; ***p<0.01

Appendix 13: Value Proposition Canvas with physicians on the market side

Physicians VPC:	
Product & Services • Self-check-in, allowing patients to check themselves into the practice on their own. • Waiting time prediction tool that automatically detects delays in the workflow and notifies patients considerably before the appointment about the actual appointment time.	**Customer Jobs** • Ensure a prompt high-quality treatment and well-being of patients. • Investigating, diagnosing and treating the health conditions of patients. • Organizational and administrative work e.g. employee management, modernization, digitalization, documentation, reports, compliance and finances. (Bundesagentur für Arbeit, 2011) • Managing the practice as a business and making sure it is secure for the future and profitable. • Recognition of the work.
Pain Relievers • Significant reduction of organizational and administrative work and stress, through automation of repetitive tasks from reception staff. • Reliable software whose updates, problem detection and problem solving are immediately handled remotely by DOC+, if possible, at non-office hours. • Cost reduction of the reception staff through automation. • Through happier patients, better online reviews, thus more patients and increased revenue. • Minimizing no shows by updating appointment time through text messages.	**Pains** • Organizational and administrative work. • Digitization and IT-system maintenance that interrupts the daily work and leads to extra efforts and costs. • Bureaucratic compliance efforts. • Stressed and overworked staff. • Online feedback and comments that cause a bad reputation. • Poor time management at reception. • Too little scheduled time per patient, forced to work economically at the cost of treatment quality. • No show of patients that cause a financial loss. • Cybersecurity and data protection. • Staff is hard to find and expensive.

• Optimized scheduling and therefore more time for patients resulting in an increase of treatment quality. • Legally responsible of data protection and use of the highest cyber security standards.	• High operating costs.
Gain Creators • Cost savings. • Reduction of waiting times at the reception and waiting room. • Reduction of the risk of infection in the waiting room. • Increased privacy at the reception. • More satisfied patients. • Increased positive online feedback. • More satisfied employees. • More time for staff to concentrate on essential tasks.	**Gains** • Lean practice organization and processes to be able to focus on the essential work and in return to increase patient satisfaction. • Software with increased benefit to effort ratio (less downtime, costs and maintenance problems). • Relieving the staff from repetitive tasks to focus on the essential and reduce stress. • Minimizing no shows to avoid idle time. • Increase positive online feedback and thus a better reputation and more patients. • Higher automated cyber security safety. • Creation of a more attractive workplace for new staff.

Bullet point colors			
Nr. of mentions	Color	Pain Rank	Gain Rank
≥ 8		very strong	must-have
> 5 & < 8		strong	should-have
≤ 5		moderate	nice-to-have
		No meaning	

Appendix 14: Value Proposition Canvas with patients on the market side

Patients VPC:	
Product & Services • Self-check-in, allowing patients to check themselves into the practice on their own. • Waiting time prediction tool that automatically detects delays in the workflow and notifies patients considerably before the appointment about the actual appointment time.	**Customer Jobs** • Compliance with highest medical and legal standards. • Receiving a prompt high-quality treatment. • Examination, diagnosis and treatment of health conditions by physicians. • Cure and improvement of health. • Open, empathic and understandable communication between practice and patient. • Physician and practice should inspire a sense of trust to patient. • Efficient practice processes. • Transparency of administrative and medical processes. • Positive reputation of physician. • Confidence in physician. • Comfortable practice premises. • Planning: choose doctor, find appointment, plan day of appointment, collect relevant documents. • Punctual presence for the appointment.
Pain Relievers • Self-performed check in that saves time. • Minimized waiting times due to timely notification of wait times and updated actual appointment time. • Transparency and communication increase through automated messages.	**Pains** • Error-prone processes for the disadvantage of patients, e.g. resulting in extra efforts and waiting times. • Barely and poor communication and cooperation of the practices. • Unpleasant premises and conditions in medical practices, including missing privacy at reception and risk of infection.

• Fewer patients in the waiting area resulting in a decreased risk of infection and more privacy. • Friendlier staff who can spend more time with patients.	• Intransparency for administrative and medical processes. • No sense of trust in physicians or practice. • No prompt cure, diagnosis, and improvement in health, specifically due to errors made by the practices. • Non-compliance with medical and legal standards. • Further pains are given in the analysis of the patient survey in the Appendix 16.
Gain Creators • Reduction of waiting times at the reception and waiting room. • Reduction of the risk of infection in the waiting room. • Increased privacy at the reception. • Increased transparency. • Increased attention from friendlier staff. • Improved practice atmosphere.	**Gains** • Process optimizations by the practices, to decrease extra efforts and waiting time, e.g. through digitization. • Increased physician effort and time to understand, diagnose and treat medical conditions. • Reduction of waiting times. • Increasing transparency of administrative and medical procedures. • Pleasant practice atmosphere and premises that also increases trust.

Bullet point colors			
Nr. of mentions	Color	Pain Rank	Gain Rank
≥ 8		very strong	must-have
> 5 & < 8		strong	should-have
≤ 5		moderate	nice-to-have
		No meaning	

Appendix 15: Competitor Analysis

The competitor analysis compares the leading providers of practice software on the German market. The analyzed providers have, among other features, a focus on process optimization in appointment booking in order to relieve practices with repetitive tasks. The information was taken from the respective competitors' websites.

These are on the one hand providers who can be competitors to DOC+, and on the other hand potential partners to collaborate. A significant reason is also that the connection with DOC+ to an online appointment booking system generates a significant value generation. The systems complement each other ideally with the data transfer. Additional features could be added, for example, to automatically allow bookings for additional patients when the waiting time prediction tool predicts negative waiting times. This would offer the potential for a certain number of patients to book additional appointments at that time.

			Competitors								
		doc+	samedi	CGM	Medical	Doctolib	jameda	doctena	Arzttermine.de	TERMED	dubidoc
Features	Online bookings		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Self-check-in	✓	✓	✓							
	Waiting time predictions	✓									

Appendix 16: Patients' online survey analysis

Available digitally upon request to Author: Patients_Survey_Analysis.Rmd

Appendix 17: Patients' online survey data

Available digitally upon request to Author: Patients_Survey_Data.csv

Appendix 18: Audio files of the interviews with the physicians

Available digitally upon request to Author: Audio files of the physicians' interviews

VII. Bibliography

Adam, A.M., 2020. Sample Size Determination in Survey Research. J. Sci. Res. Rep. 90–97. https://doi.org/10.9734/jsrr/2020/v26i530263

Adams, W.C., 2015. Conducting Semi-Structured Interviews, in: Handbook of Practical Program Evaluation. John Wiley & Sons, Ltd, pp. 492–505. https://doi.org/10.1002/9781119171386.ch19

Albrecht, M., Otten, M., Sander, M., Temizdemir, E., 2020. PraxisBarometer: Digitalisierung 2020 52, [WWW Document]. URL https://www.kbv.de/media/sp/IGES_KBV_PraxisBarometer_2020.pdf (accessed 24.9.21).

Blank, S.G., 2007. The four steps to the epiphany: successful strategies for products that win, 3rd ed. ed. S. G. Blank, California, ISBN: 978-0-9764707-0-0.

Boller, A., Peter, L., 2018. Bewertung und Steuerung von Startup-Kollaborationen. Wirtsch. Manag. 10, 44–54. https://doi.org/10.1007/s35764-018-0053-6

Bowden, A., 2002. Methods for pre-testing and piloting survey questions: illustrations from the KENQOL survey of health-related quality of life. Health Policy Plan. 17, 322–330. https://doi.org/10.1093/heapol/17.3.322

Bryman, A., 2016. Social Research Methods. Oxford University Press, ISBN: 978-0-19-968945-3.

Bundesagentur für Arbeit, 2011. Steckbrief Arzt/Ärztin, [WWW Document]. URL https://berufenet.arbeitsagentur.de/berufenet/bkb/58601.pdf (accessed 1.2.22).

Bundesministerium für Gesundheit, 2021. Spahn: “Potenziale der Digitalisierung besser nutzen” [WWW Document]. URL https://www.bundesgesundheitsministerium.de/presse/reden/dvpmg-bundestag-1-lesung.html (accessed 20.10.21).

Cerff, W.S. de, Vegte, J. van de, Boers, R., Brandsma, T., Haij, M. de, Moosel, W. van, Noteboom, J.W., Pagani, G.A., Schrier, G. van der, 2018. Agile Development in Meteorological R&D: Achieving a Minimum Viable Product in a Scrum Work Setting. Bull. Am. Meteorol. Soc. 99, 2507–2518. https://doi.org/10.1175/BAMS-D-17-0273.1

Christensen, C.M., Hall, T., Dillon, K., Duncan, D.S., 2016. Know Your Customers’ “Jobs to Be Done.” Harv. Bus. Rev.

Clark, T., Osterwalder, A., Pigneur, Y., 2012. Business model you: a one-page method for reinventing your career. Wiley, Hoboken, N.J, [WWW Document]. URL https://hbr.org/2016/09/know-your-customers-jobs-to-be-done (accessed 21.10.21).

CompuGroup Medical, 2021. Quartalsmitteilung zum 30. September 202, [WWW Document]. URL https://www.presseportal.de/nr/100921 (accessed 3.2.22).

Contigiani, A., Levinthal, D.A., 2019. Situating the construct of lean start-up: adjacent conversations and possible future directions. Ind. Corp. Change 28, 551–564. https://doi.org/10.1093/icc/dtz013

De Clerck, J., 2017. Digitization, Digitalization and Digital Transformation: The Differences. [WWW Document]. -SCOOP. URL https://www.i-scoop.eu/digital-transformation/digitization-digitalization-digital-transformation-disruption/ (accessed 3.10.21).

Denault, J.-F., 2017. The Handbook of Market Research for Life Science Companies : Finding the Answers You Need to Understand Your Market. Taylor & Francis Group, https://doi.org/10.1201/9781315198606.

Deutschlandfunk, 2021. Interview: Ende der Corona-Notlage - Interview mit Heyo Kroemer, Charité-Vorstandsvorsitz [WWW Document]. URL https://www.deutschlandfunk.de/interview.693.de.html?drbm:date=2021-10-20 (accessed 20.10.21).

Etikan, I., 2016. Comparison of Convenience Sampling and Purposive Sampling. Am. J. Theor. Appl. Stat. 5, 1. https://doi.org/10.11648/j.ajtas.20160501.11

FGW, F.W.T., 2021. Versichertenbefragung der Kassenärztlichen Bundesvereinigung 2021 - Ergebnisse einer repräsentativen Bevölkerungsumfrage 32, [WWW Document]. URL https://www.kbv.de/media/sp/2021_KBV-Versichertenbefragung_Berichtband.pdf (accessed 24.9.21).

FOCUS, 2021. Innovationspreis 2021 - FIT FÜR MORGEN, FOCUS Magazin 25/2021, [WWW Document]. URL https://www.deutschlandtest.de/de/wp-content/uploads/DT-2021-Innovation.pdf (accessed 3.2.22).

Freiling, J., Harima, J., 2019. Entrepreneurship: Gründung und Skalierung von Startups. Springer Fachmedien Wiesbaden, Wiesbaden. https://doi.org/10.1007/978-3-658-26117-7

Gans, J., Scott, E.L., Stern, S., 2021. These Choices Matter Together: Intellectual Property Strategy, Architectural Strategy, Value Chain Strategy, Disruption Strategy [WWW Document]. URL

https://static1.squarespace.com/static/55c4e9aae4b05eaf17ef79ff/t/601376652cfa3536722d7fb8/1611888233760/Entrepreneurial+Strategy+Compass.pdf (accessed 25.20.21).

Gans, J., Scott, E.L., Stern, S., 2018. Strategy for Start-ups. Harv. Bus. Rev. 44–51. [WWW Document]. URL https://hbr.org/2018/05/strategy-for-start-ups (accessed 25.10.21).

Gans, J.S., Stern, S., Wu, J., 2019. Foundations of entrepreneurial strategy. Strateg. Manag. J. 40, 736–756. https://doi.org/10.1002/smj.3010

Hill, Dr.R., 1998. What sample size is "enough" in internet survey research? Interpers. Comput. Technol. J. 6, 11, ISSN: 1064-4326.

IMWF, 2021. Diese Unternehmen sind Innovations Champions [WWW Document]. URL https://www.imwf.de/pressemitteilungen/diese-unternehmen-sind-innovations-champions (accessed 2.3.22).

Kamps, H.J., 2020. Pitch Perfect: Raising Capital for Your Startup. Apress, Berkeley, CA. https://doi.org/10.1007/978-1-4842-6065-4

Katila, R., Ahuja, G., 2002. Something old, something new: A longitudinal study of search behavior and new product intro- duction. Acad. Manage. J., 45(6) 1183–1194.

KBV, 2021. Installationsstatistiken von Softwaresystemen [WWW Document]. Kassenärztliche Bundesver. URL https://www.kbv.de/html/6989.php (accessed 2.3.22).

Knofczynski, G.T., Mundfrom, D., 2008. Sample Sizes When Using Multiple Linear Regression for Prediction. Educ. Psychol. Meas. 68, 431–442. https://doi.org/10.1177/0013164407310131

KZBV, 2021. Kassenzahnärztliche Bundesvereinigung (KZBV): Geschäftsbericht 2020/2021. Köln, [WWW Document] URL https://kzbv.de/static/flips/gb2021_flip/72/ (accessed 3.2.22).

Laaksonen, S., 2018. Survey Methodology and Missing Data. Springer International Publishing, Cham. https://doi.org/10.1007/978-3-319-79011-4

Leatherbee, M., Katila, R., 2020. The lean startup method: Early-stage teams and hypothesis-based probing of business ideas. Strateg. Entrep. J. 14, 570–593. https://doi.org/10.1002/sej.1373

Maurya, A., 2012. Running Lean, Second Edition, 2nd ed, ISBN: 978-1-4493-0517-8

Maurya, A., 2017. Life's too short to build something nobody wants. @ashmaurya. URL https://twitter.com/ashmaurya/status/944992772808937472 (accessed 27.11.21).

Mayring, P., 2015. Qualitative Inhaltsanalyse: Grundlagen und Techniken, 12th ed. Beltz, ISBN: 978-3-407-29393-0.

Mayring, P., 2014. Qualitative content analysis: theoretical foundation, basic procedures and software solution. Klagenfurt 144, [WWW Document]. URL https://www.ssoar.info/ssoar/handle/document/39517 (accessed 11.11.21).

Mayring, P., 1983. Qualitative Inhaltsanalyse: Grundlagen und Techniken. Beltz, Weinheim; Basel, ISBN: 978-3-407-54649-4.

McClure, D., 2007. Startup Metrics for Pirates: AARRR! - Master of 500 Hats [WWW Document]. URL https://500hats.typepad.com/500blogs/2007/09/startup-metrics.html (accessed 15.2.22).

Mollick, E., 2019. What the Lean Startup Method Gets Right and Wrong. Harv. Bus. Rev. [WWW Document]. URL https://hbr.org/2019/10/what-the-lean-startup-method-gets-right-and-wrong (accessed 5.10.21).

Moreira, M.E., 2017. The Agile Enterprise. Apress, Berkeley, CA. https://doi.org/10.1007/978-1-4842-2391-8

Neos Chronos, 2022. Download the Lean Canvas in Word [WWW Document]. Neos Chronos. URL https://neoschronos.com/download/lean-canvas/docx/ (accessed 6.2.22).

Ohno, T., 1988. Toyota Production System: Beyond Large-Scale Production, 1st ed. Productivity Press, ISBN: 978-0-915299-14-0.

Osterwalder, A., Pigneur, Y., Bernarda, G., Smitz, B., 2014. Value Proposition Design. Wiley, ISBN: 978-1-118-96805-5.

Osterwalder, A., Pigneur, Y., Clark, T., 2010. Business model generation: a handbook for visionaries, game changers, and challengers. Wiley, Hoboken, NJ, ISBN: 978-0-470-87641-1.

Presse Portal, n.d. 177 CompuGroup Medical (CGM) News - Pressemeldungen 2022 | Presseportal [WWW Document]. URL https://www.presseportal.de/nr/100921 (accessed 2.3.22).

Ries, E., 2011. The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses. Crown Business, New York, ISBN: 978-0-307-88791-7.

Ripsas, S., Schaper, B., Tröger, S., 2018. A Startup Cockpit for the Proof-of-Concept, in: Faltin, G. (Ed.), Handbuch Entrepreneurship, Springer Reference Wirtschaft. Springer Fachmedien, Wiesbaden, pp. 263–279. https://doi.org/10.1007/978-3-658-04994-2_21

Saldaña, J., 2013. The coding manual for qualitative researchers, 2nd ed. ed. SAGE, Los Angeles, ISBN: 978-1-4462-4736-5.

Schmitt, A., Rosing, K., Zhang, S.X., Leatherbee, M., 2018. A dynamic model of entrepreneurial uncertainty and business opportunity identification: Exploration as a mediator and entrepreneurial self-efficacy as a moderator. Entrep. Theory Pract. 42(6), 835–859, https://doi.org/10.1177/1042258717721482.

Shaw, D., 2019. The hidden risks of the waiting room: confidentiality and cross-infection. Br. J. Gen. Pract. 69, 299–299. https://doi.org/10.3399/bjgp19X703925

Silk, A.J., 1990. Questionnaire Design and Development. Harv. Bus. Sch. Backgr. Note 590–015, 16.

Statista, 2018. Anzahl von Arztpraxen in Deutschland [WWW Document]. Statista. URL https://de.statista.com/statistik/daten/studie/281526/umfrage/anzahl-der-arztpraxen-in-deutschland-nach-facharztbezeichnung/ (accessed 4.2.22).

Statistisches Bundesamt, 2018. Unternehmen und Arbeitsstätten: Kostenstruktur bei Arzt- und Zahnarztpraxen sowie Praxen von psychologischen Psychotherapeuten (No. Fachserie 2 Reihe 1.6.1). Statistisches Bundesamt, Wiesbaden, [WWW Document]. Stat. Bundesamt. URL https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Dienstleistungen/Publikationen/Downloads-Dienstleistungen-Kostenstruktur/kostenstruktur-aerzte-2020161159004.html (accessed 4.2.22).

Statistisches Bundesamt, n.d. Krankenversicherungsschutz [WWW Document]. Stat. Bundesamt. URL https://www.destatis.de/DE/Themen/Arbeit/Arbeitsmarkt/Qualitaet-Arbeit/Dimension-2/krankenversicherungsschutz.html (accessed 2.12.21).

Strategyzer, A., 2021. Value Proposition Canvas [WWW Document]. URL https://www.strategyzer.com/vpc_thank_you (accessed 21.10.21).

Strategyzer, A., 2020. Business Model Canvas – Download the Official Template [WWW Document]. URL https://www.strategyzer.com/canvas/business-model-canvas (accessed 3.2.22).

University Hospital Tübingen, 2019. Arbeitswelt Arztpraxis: Ist die Belastung zu hoch? [WWW Document]. Press Release. URL https://www.medizin.uni-tuebingen.de/de/das-klinikum/pressemeldungen/183?press_str= (accessed 25.9.21).

Vitals, 2018. 9th Annual Vitals Wait Time Report. [WWW Document]. URL www.vitals.com/about/posts/press-center/press-release/9th-annual-vitals-wait-time-report-released (accessed 24.9.21).

Wooldridge, J.M., 2015. Introductory Econometrics - A Modern Approach, 6th ed. Cengage Learning, ISBN: 978-1-305-27010-7.

Wright, K.B., 2005. Researching Internet-Based Populations: Advantages and Disadvantages of Online Survey Research, Online Questionnaire Authoring Software Packages, and Web Survey Services. J. Comput.-Mediat. Commun. 10. https://doi.org/10.1111/j.1083-6101.2005.tb00259.x