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Study of Viability of the VASelfCare Project, a Digital Solution for the Healthcare Industry – Case Study.

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Abstract

This work project aims to evaluate the viability of the VASelfCare, a project devoted to help older adults that have type 2 diabetes with their daily self-management. Taking the form of a case study, it begins with a case narrative and then a teaching note. To approach the challenge, I analyse the level of attractiveness of the industry, the internal and external environment, and Porter's generic strategies. In the end, I concluded that the project could generate a viable strategy if it tackles a narrow segment of the market - private health corporations - and by being perceived as credible.

Keywords: healthcare industry, diabetes, self-management, digital transformation, mHealth, software applications, competitive advantage, viability.

The Case Study

1. Introduction

The idea for the project VASelfCare was conceived in January of 2018. An idea centred around the purpose of developing a mobile application to encourage older adults with type 2 diabetes in their daily self-management and promote education about this disease. However, the present project does not have a proper business strategy. Thus, it will not succeed in creating, delivering, and capturing value (Teece, 2010).

During the development of a business strategy, it is important to perform an internal and external analysis. Subsequently, the organization should comprehend how those characteristics can effectively interlink with each other and create a competitive advantage. In the end, the strategy should realistically prove the viability of the business, that can succeed over time in the intended industry environment. (Galai et al., 2016). Therefore, the purpose of this case study is to analyse the viability of the VASelfCare project, by applying the information provided throughout the case narrative and with it, develop a potential competitive advantage. The case narrative is a description of the disease, the trends of digital transformations in the healthcare industry and an illustration of the respective project.

2. The disease

World Health Organization defines diabetes as a chronic disease, it appears either when the pancreas does not produce sufficient insulin or when the body cannot effectively utilize the insulin it generates. Insulin is a hormone that regulates blood sugar. Over time, uncontrolled diabetes can lead to serious consequences for the body's systems, in particularly the nerves and blood vessels (WHO, 2016).

Worldwide, in 2019 there was 463 million adults between 20 between 67 years with diabetes, and it is projected to increase for 700 million in 2045. This disease affects

individuals of all ages, usually with higher prevalence on the age group of 60 to 69 years, with one in five individuals with more than 65 years having diabetes (IDF, 2019). In Portugal, 14,9% of the adults between 20 and 79 years suffer from this disease, representing one in seven. Considered to be one of the biggest values in the European Union (IDF, 2019). Regionally, in 2015, Autonomous Region of the Azores and Alentejo (Portalegre, Évora, Beja and parts of the region of Setúbal) were the regions with higher level of prevalence of diabetes (PND, 2017). Moreover, this disease is responsible for 3,8% of deaths in Portugal contrasting with 1% in Lithuania (Eurostat, 2021).

This medical condition can be divided predominantly by three different types: gestational diabetes, type 1 diabetes, and type 2 diabetes (Centers for Disease Control and Prevention, 2020). However, for the purpose of this case study, the paper will be focused on the last one, as the VASelfCare project proposes to tackle type 2 diabetes. Type 2 diabetes results from the body's ineffective use of insulin. It is most seen in older adults, although it has been increasingly detected in children and younger adults (WHO 2016). Globally, in 2019, this type is the most common type of diabetes, accounting for around 90% of all diabetes worldwide (IDF, 2019).

3. The importance of self-management

There are factors that can intensify the risk of developing diabetes, as the unhealthy diet and physical inactivity, which nowadays have been escalating global concerns (Bi et al., 2012). In 2016, one in three diabetic patients was considered overweight and one in ten suffered from obesity (WHO, 2016). Usually, this disease is not curable but can be prevented (Parka et al., 2020). Empirical evidence proved that self-management is crucial for patients with type 2 diabetes, by developing and maintaining healthy lifestyle behaviours (Eroglua et al., 2021). For older adults, that generally face the disease for a longer period, it becomes important to access information about the disease for an

effective self-management and to avoid severe and permanent complications (Parka et al., 2020).

The components of self-management are characterized by 1) medication management; 2) blood glucose management; 3) physical activity; and 4) diet and nutrition (Jimenez et al., 2019). Yet, self-management is not as straightforward to implement. A recent contribution by Nicola Brew-Sam (2019), identifies some factors in both individual and diabetes care system that can affect the patients to execute, change or maintain self-management behaviours. In an individual dimension that includes the level of health literacy and the adaptability of the patient, such as finding balance and resources to manage diabetes at home. Also, psychological factor as the motivation to follow these practices and physical factor like the presence of other diseases. For the dimension of the care system that includes consistency information and education among the healthcare professionals, and the communication and relationships between professionals and patients. (Nicola, 2019).

4. The digital transformation in the healthcare

The healthcare industry plays a major rule in the global economy, as the health and well-being of populations holds a significant place of importance, by consuming a significant number of resources (Agarwal et al., 2010). From 2017 until 2019, this industry had a total average return of 28% in the European Stock Market, making one of the strongest performing areas in Europe. During the first quarter of 2020, the appearance of the Covid-19 pandemic made this return decrease, yet it is one of the least affected and resilient to downturns (Oliver Wyman, 2020).

At present, the healthcare is entering into a digital transformation (CIO, 2020). This change represents a drastic rethinking of the organizations about the uses of new technology, people, and procedures (Deloitte, 2020). Over the past 10

years, a considerable amount of money has been invested into this industry, with an increase of 400% in investment deals. Most of the venture capital firms have chosen to shape the future of digital healthcare (Safavi et al.,2020). In addition, it is possible to identify major key forces that are promoting technological innovation in this industry. The first is the low levels of productivity and inefficiencies that are causing quality challenges and poor consumer experience. The second force is the high levels of healthcare digitalization investments that are being realized on three main categories, in 1) patient engagement; 2) data and analytics; 3) and new care models. Additionally, the technology giants are avid to earn share in the public organizations and to retain consumer commitment. The last force is the expected regulatory adjustments regarding the entrance of new innovations into the industry (McKinsey and Company, 2020).

Besides the forces previously mention, the cultural of people is also changing towards usage of these new technologies, as long it creates real value for the patient (European Commission, 2017). Patients from all age groups are favoured in using digital healthcare information from multiple platforms and devices (McKinsey and Company, 2014). Older patients mostly search information about services for severe and chronic diseases, while younger generations seek for health-promotion and prevention services (European Commission, 2013). Moreover, more than 70% of older patients in the United Kingdom and Germany wish to utilize digital healthcare services, and this percentage is even higher in Singapore (McKinsey and Company, 2014).

In addition, the PWC during 2016 revels that patients are more likely to use their mobile for healthcare purposes. As, 60% of healthcare consumers are favoured to have a video visit with a physician and 21% have used a mobile device to request a refill of a prescription (PWC, 2015).

Looking into the case of Portugal, according to the National Statistics Institute (INE), the proportion of individuals using internet have been rising. In 2016, 70,4% of the population had contact with the internet, 28,3% of them were between 65 to 74 years old. Then, giving the newest data of 2020, the percentage of the total population increased to 78,3% and for the respective age group its growth to 39%. By analysing the additional data and trend, it is certainly that these values would expand in the future (INE, 2020).

5. The mHealth in self-management of diabetes

The fast innovation has fuelled the creation of various digital tools for delivering health services (Rivas et al., 2018). Besides, the increases usage of smartphones and internet established an opportunity to use these tools for training people with chronic diseases to self-manage their disease (Lee et al., 2018).

Progressively, the healthcare industry has started to utilize mobile and wireless technologies for health purposes (mHealth). mHealth is typically available on personal mobile (i.e., mobile phone and tablet) and can vary from a simple text message reminder to a software application with a complex clinical decision support algorithm (Rivas et al., 2018). Along with the possibility of connecting the application to other novel technologies, like portable devices for diagnosis (Rivas et al., 2018). The mHealth definition can be confused with the concepts of telehealth and telemedicine. Yet, these terms are interconnected as it integrates all information and communication technologies intending to improve healthcare (Scientific Resource Center Portland, 2018). The potential of mHealth lies in the capability of communicating and connecting with patients and health professionals in real-time, be able to collect and export data, and offer decision support (Goyal et al., 2013).

In 2019, there were more than 300,000 mobile applications accessible in the market, committed to health. They target a diversity of needs from weight loss to management

of chronic diseases, although diabetes is the most targeted (Jimenez et al., 2019). Another contribution from 2019 shows that the market of software applications for diabetes self-management like the control of blood glucose, weight, or/and diet applications was valued at 173.0 million dollars. And it is projected to have a compound annual growth rate (CAGR) of 22.0% over the forecast period, until 2026 (Grand View Research, 2019).

Still, various recognized barriers persist for the patient when using a digital tool for their diabetes self-management: the lack of clinical, especially the benefit of most software applications; the data protection and security, by using a digital tool an enormous amount of data is generate and stored in the system; the socioeconomic circumstance of the patient, as it requires that the user has the resources to afford a mobile or any other equipment (Shah et al., 2015).

6. The project- VASelfCare

In January of 2018, Vânia and Mara meet in the The StartUp Research. It is a Post-Graduation program developed by ITQB NOVA and NOVA SBE with the help of scientists and entrepreneurs aiming to generate awareness about the value of science. Throughout this program, Vânia and Mara form a team, and end up creating the VASelfCare project.

Vânia since a young age has been inspired by a family example of empowerment in diabetes self-management. She holds a PhD in Biotechnology and knowledge in R&D projects. Mara has a PhD degree in Pharmacy, with involvement in R&D projects with focus on digital transformation in the healthcare and experience in leading interdisciplinary teams. So, together they join expertise to create the VASelfCare project. The initiative is based on the mission of developing an intelligent virtual assistant and other novel technologies to empower elder people with type 2 diabetes with their daily self-management but also to promote education about this disease.

Currently, the project is led by the Nursing School of Lisbon. Over the years, the project has merged efforts to create an interdisciplinary team to help managing the research. Involving professional researchers from the Faculty of Sciences of the University of Lisbon, the University of Lisbon Pharmacy School, Rio Maior Sports College and Santarém Polytechnic and with other Health Units of the Portuguese National Health Service. Furthermore, besides, almost 50 graduate and undergraduate students from nursing, pharmacy, sport sciences and computer sciences have been collaborating. The focus areas of expertise are behaviour change theory and behaviour change techniques, clinical communication, medication adherence, physical activity in elder populations, computer graphics and artificial intelligence.

6.1. The software application

A prototype of an application is a software in a preliminary stage, used for testing and validating purposes. Typically, it is expected to have more than one prototype, as a way to adjust and improve versions. The goal of the VASelfCare team is to construct a viable software to support older adults with type 2 diabetes in self-management with focus on the components of nutrition and diet, medication, and physical activity.

The VASelfCare project was divided into two phases. During the first phase, the software prototypes were developed by team members with cooperation of older people with type 2 diabetes, health professionals and other experts. With that, usability tests of the software were performed, and adjustments made. Later, the second phase pertained to software testing over several months by older adults with type 2 diabetes.

Currently, the project has four protypes, three are the mobile application focus on the patient experience by interacting with the virtual assistant, Victoria, promoting a personalized dialog. The difference between them is the improvement of the total days of

intervention. The other protype is for the health professional, it is a web-based dashboard connected to each patient 'data'.

For the prototypes, three types of users were characterized: the patient, the individual with type 2 diabetes and older than 65 years old; the nurse, the healthcare professional that verifies the development of patient's health; administrator, a team member from the project that gathers all the data from all interactions. Table 1 describes the responsibilities for each user in detail. For an optimal usage of the application, there are some prerequisites from the patient side that need to be fulfilled. First, patient must have some literacy to avoid difficulty in reading the information presented throughout the application. Then, patients must suffer from type 2 diabetes, be over 65, cannot be insulin dependent, only take oral medications, able to perform physical activity, and not fully devoted to their own self-care.

The team was able to positively validate three of the four prototypes with 20 older adults with type 2 diabetes, 10 clinical experts along with 36 primary care physicians and nurses. The last prototype of the mobile application was developed in 2020, and because of the Covid-19 pandemic was not possible to perform usability tests.

6.2. The funding

The VASelfCare team are incurring costs for the development of the software application, as paying for human resources like research internships, meant for students to improve the existed prototypes and in the collection of data in a larger sample. Additionally, assisting in the dissemination of research results and accelerating the transfer of knowledge into practice. To supports these costs, the project requested funds from the programs: *Fundação para Ciência e para a Tecnologia*, *Lisboa2020*, *Alentejo2020*, *Portugal2020*, and the European Union (European Regional Development Fund). A total of

fifty-five thousand euros was provided. This amount covered a period of 26 months, until March 2020. Presently, the project is in the sustainability and exploitation phase.

6.3. IP protection

In addition to these costs, the team is also considering in investing in an intellectual property protection (IP protection) to protect the algorithms of the application. In this dimension of protection, it is important to consider that a software application in the European Union is not protected by patent or any special form of protection. Still, the Directive 91/250/EEC, regarding the legal protection of computer programs in the European Union can be done by a copyright approach, in the same terms as in literature. Yet, the discussion of patentability of software continuous in some countries (Pinto, 2016).

6.4. Customers

For the mobile application, the final consumer are the older adults with type 2 diabetes. However, at the moment, the VASelfCare team does not have any focus regarding the customers, as they still examining the possibility of having intermediaries to reach the final consumer. The intermediaries involve the biggest private healthcare corporations, in Portugal: The United Health Group - Lusíadas; Grupo José de Mello - CUF; Luz Saúde Group - Hospital da Luz; Hospital Privado do Algarve Saúde Group; Trofe Saúde; Fundação Champalimaud. Table 2, 3, 4 and Figure 1, it is possible to find the information about those six companies, namely their locations, their software application with respective features and other offer services. So, currently the project has two customer segments under study: older adults with type 2 diabetes and private health corporations.

6.5. Other Players

Even though the team does not have any type of customer defined, it is possible to identify other players already establish in this industry, since the project is focused on older adults with type 2 diabetes. Table 5 provides a list of the first forty applications

found in the Google Play Store, under the keyword of "diabetes", accessed on the 21st of February of 2021. Most of them offer a free mobile application and in some of them a subscription-based model by starting as free. Table 5, apps are classified by the most effectively components to self-management type 2 diabetes, according to a study previously mentioned. The components include 1) medication management, to insert medication taken and respectively reminders; 2) blood glucose management, to keep track of the level of the blood sugar; 3) physical activities feature, to encourage users to perform physical actives in any type of way; 4) nutrition or diet feature, to inspire users through ideas/recommendations for a healthy diet; 5) weight management, to keep track of their weight; and 6) data export, to download the reports and giving the possibility of sending to a health professional (Jimenez et al., 2019).

7. Infarmed – The medical device

Appraising a mobile application as a digital health solution can turned to be a complex path given the combination of content, user, platform, links, and interface features (Scott et al., 2020). Still, it is essential in healthcare industry to mobile applications attaining a regulatory approval, since they can gain more credibility and access to a larger market share, as it is more likely that a health professional recommend the usage of such application for their patients. Furthermore, throughout the development and commercialization, significant effort is important for the achievement and maintenance of such approval.

In some countries, as in the United States, completing a regulatory approval require an extensive volume of documentation or regularly facing law changes, leading to some projects choosing not to seek for approval (McKinsey and Company, 2021). Although, whether a mobile application has regulatory authorization or not, validation of clinical trial in a large sample should be performed to prove safety and effectiveness in people.

As, real data evidence have been gradually recognized by health professional and regulatory bodies (Fleming et al., 2020).

Currently, in the United States and Europe, mobile applications can be contemplated as medical device, after they fulfil every prerequisite (Fleming et al., 2020). A medical device can be a simple compress to the most sophisticated product that supports human life. It plays a crucial rule in the diagnostic, prevention, control, and treatment of any type of disease but also help improving the quality of life of patients (Alves, 2013).

Globally, there are continuously appearing changes in technologies, therefore it increases the variety and the capacity of innovation in this sector. Yet, these changes represent a challenge for policymakers to pace with it and adjust the respective policies. Subsequently, it has contributed to many notified bodies to not possess enough experience and resources to appraise these new technologies (Freitas, 2014). In 2019, the UK's National Health Service was able to list 13 mobile applications for the management of diabetes. At the moment, it is considered to be only database approved by a regulatory body (Fleming et al., 2020).

In the EU, each country member has the primary responsibility to provide health services and medical care, and additionally own a national pharmaceutical regulatory authority. Moreover, the European Commission operates as a complement of each national policies and guarantee health protection according to the EU policies (Fleming et al., 2020).

In Portugal, the regulatory authority to certify medical devices is the Infarmed - National Authority of Medicines and Health Products. It is the government agency in charge of the evaluation, authorization, regulation, and management of human medicines, medical devices, homeopathic and cosmetics products (Infarmed, 2021). Infarmed defines medical devices as any instrument, appliance, software, or other item, when utilize

alone or in combination. These medical devices should be used for the objective of prevention, diagnosis, control, treatment, or alleviation of disease, injury, or handicap. (Infarmed, 2021a).

Furthermore, the medical devices are classified regarding the level of risk. The risk is established by taking into consideration the duration of contact with the human body (temporary, short-term, and long-term), the invasion in the human body (invasive, non-invasive), the part of the body affected (brain, heart, lower limbs, etc.), and the potential risks evolving technical design and manufacturing. Subsequently, four risk classes were created: class I - low risk; class IIa - medium risk; class IIb - medium risk; class III - high risk (Freitas, 2014). Along with the process of risk classification, it is important for Infarmed to demonstrate clinal evidence (INOFARMA, 2019). Currently, the prerequisites for safety and performance are regulated under the law DL 145/2009 (Directive 2007/24/CE) (INOFARMA, 2019). But as in many other countries, the process of classification has some gaps, regarding mobile application aiming patients to self-management. Thus, it has been considered a barrier by entrepreneurs in this industry. Optimistically, in May of 2021 new rules from the European Union will be released to ensure that these procedures reflect the latest scientific and technological improvements (Infarmed, 2021b).

8. Main Challenge

According to a study of McKinsey, when organizations choose to enter the digital health market, most of them seek to comprehend how to create value by applying technology to tackle an issue. However, the study has defined six interlinked blocks essential to develop a scalable business. It begins with talent and agility as the first block, enabled an agile organizational engine. The second block is characterized by a clear value proposition, to focus on an unsatisfied need and in one or more healthcare stakeholder, then the

third block is to create a better experience, with user-centred. Afterward, the fourth block is to combine healthcare and technical knowledge to create a compliant product, as the fifth is to confirm value by a clinical trial, to attest safety and usefulness. Last, the sixth block is the study of viability by aligning with the business strategy, it is about creating a competitive advantage that will generate a sustainable and scalable model (McKinsey and Company. 2021). The VASelfCare is missing the last block. So, currently the main challenge, is to understand the viability of the project, by analysing if there is space in the market to create a competitive and sustainable advantage.

Teaching Note

1. Case Synopsis

For over the past 10 years, a significant amount of money has been invested into reshaping the future of the healthcare industry, approximately, an increase of 400% of the investments deals in digital transformation. This change represents a drastic rethinking of the businesses about the uses of new technology, people, and procedures.

The VASelfCare project started in 2018, with the mission of developing an intelligent virtual assistant and with the cooperation of other technologies to encourage older people with type 2 diabetes in their daily self-management. The team wants to tackle an escalating global problem, with 463 million people with diabetes in 2019 and with an expected value of 700 million in 2045. This disease can lead to huge risks like the increase of the probability of early death and the failure of body systems. Yet, the odds can be diminished by the adherence to better lifestyle habits by self-management. Herewith, the VASelf cares incorporates the trend of using digital solutions and has created a mobile application to support older adults with type 2 diabetes in effectively perform their self-management, with focus on the components of nutrition and diet, medication, and physical activity.

Additionally, the team has designed a web-based dashboard for the health professionals to access each patient data.

However, the path for to achieve regulation approval is full of uncertainty, as it is a challenge for governments to adjust policies manage along with the quick changes in innovation. Moreover, the VASelfCare currently does not have any focus regarding which customers to tackle, as it is under study the possibility of having intermediaries, private health corporations to reach the final consumer, older adults with type 2 diabetes.

2. Case Objectives

The objective of this case study is to understand if there is space in the market to develop a competitive and sustainable advantage for the VASelfCare project. When implementing a solution into the market it is not only about the problem to tackle or the idea behind the solution, yet it is also about establish a well structure strategy plan. It is essential to analyse the respective environment, internal and external. After that, the VASelfCare team must realize how those characteristics can successfully interlink with each other and create a competitive advantage that proves the viability of their project (Galai et al., 2016).

The teaching objectives of this case study focus on teaching fields of Digital Transformation and Strategy, Entrepreneurship and Business Model Innovation.

3. Discussion Questions

To answer the objective question "How viable and sustainable is the VASelfCare project?", this case study will be sub-divided into three questions:

3.1   Analyse the level of attractiveness of the industry?

In 1979, Michael Porter described the strongest competitive forces that establish the attractiveness and profitability of an industry, and with the greatest value in strategy design. The level of attractiveness is not demonstrated only by other players. Instead, the

model encouraged to consider beyond the actions of other players and assess what other forces might impact the business environment. The forces are: Supplier Power; Buyer Power; Threat of Substitution; Threat of New Entry; Competitive Rivalry (Porter, 1979).

The combined intensity of these forces determines the potential of an industry and respective profit. An industry with high level of attractiveness leads to low levels of returns on investment. For this case study, the industry are the software applications with a target market of older adults with type 2 diabetes to support with their self-management. Based on previous information given in the case study, in 2045 it is projected to have 700 million adults around the world suffering from diabetes with 90% of these cases being type 2 diabetes. Globally, it is estimated that one in five individuals with more than 65 years old have this disease. For the case of Portugal, 14,9% of the adults, between 20 and 79 years old, suffer from diabetes. Besides, in 2020, 78,3% of the population have contact with the internet and 39% of them were between 65 to 74 years old, which might indicate some potential autonomy when utilizing an application. Thus, applying the Porter's five forces into this industry:

• <u>Supplier Power</u>: currently, there are two major mobile platforms: iOS and Android. However, the software applications developed are mostly platform - specific. So, it depends on if the VASelfCare team wants to be present in one platform or in many. The inputs required are software developers and hardware that nowadays are easily available in the market and with a reasonably price. At the moment, according to Statista there were 26,4 million software developers in 2019 (Statista. 2020).

• <u>Buyer Power</u>: in 2019, there were 463 million adults with diabetes, and it is expected to grow to 700 million in 2045. Consumers are looking for an application that can fully meet their needs, the ones with more features to their self-management. With that, in 2019, it was available in the market more than 300,000 mobile applications,

devoted to health and diabetes being the most targeted. The cost to switch applications mostly depend on if the consumer has the necessary hardware and if it meets the application requirement. Moreover, unless the application is indicated by a healthcare professional, the customers have low levels of loyalty on an application.

- Threat of Substitution: it refers to the likelihood of the customers of finding a different product of doing their self-management without using a software application. Throughout the decade's tools were on development to help diabetes during this process. In 1970, the first blood glucose meter was released and followed by other meters. They were originally intended for the health care professional's office, but later it became accessible for patients to utilize at home. At first, they recorded their blood glucose in paper diaries, then with the entrance of technology, it provided the capability to upload data onto personal computers and with the internet, became possible to share results with healthcare professional electronically. Today, electronic health records can be attained by patients via web portals, cell phone and text messaging interventions. As new technology improves, new opportunities of doing self-management appear. (Ciemins et al., 2010).

- Threat of New Entry: as mentioned in the description of the case study, in 2019, the sector of mobile applications for diabetes self-management was valued at 173.0 million dollars, and it is projected to have a CAGR of 22.0%. This growth is mostly attributed to the rise of unhealthy behaviours that can lead to severe and permanent complications if not well manage, the increase of individuals with diabetes, and the increase in the usage of new technologies. This positive evolution can represent a motivation for the entrances of new players. Also, the uncertainty and complexity of regulation leads to a lot of entrepreneurs in industry to not seek approval, which makes even easier to enter and operate in the market. However, it is essential to mobile applications to attain regulatory approval, since they can gain more credibility and access to a larger market share.

• <u>Competitive Rivalry</u>: another force is the number and strengths of the existed players. In 2019, there were more than 300,000 health applications available in the market, with diabetes being the most targeted. Furthermore, by exploring the data retrieved from the Google App Store and respective features (Table 5). Some important key takeaways can be taken from the Table 5: approximately only 4 of 40 mobile applications have a different consumer target, as for example type 1 diabetes, gestational diabetes and for pets with diabetes, therefore most of the applications target type 2 diabetes; more than 50% have blood glucose management and another 50% have nutrition or diet features; approximately 40-45% of the mobile applications have 4 or more features, as these features translate the most essential characteristics for an effective self-management.

Combining all the forces, it is possible to acknowledge that the VASelfCare project is entering in a competitive environment with a high level of attractiveness. By looking into the supplier viewpoint, currently, the number of software developers and hardware are easily available in the market, in a large scale and affordable leading to a lower supply power.

When exploring the buyer perspective, it is expected that the number of buyers increase, yet the amount of mobile application for self-management is also expected to follow the same tendency, leading to an increase of the range of choices in the market. Also, the switch cost usually is very low except if there is no compatibility regarding the software and hardware. Hence, the level of buyer power is high. Still, if the application be recommended by their own health professional, the trust for an app rise and the respective level of power decrease. It confirms the importance of receiving regulation approval and real-data evidence.

Another force is the threat of substitution, even though along the decades have been built new technologies to help self-management diabetes, the mobile application is

one of the most practicable solution to connect and communicate with individuals in real-time, to be able to collect and export data and to offer a decision support for both patients and health professionals. Still, when combined with other novel technologies for example a blood glucose meter, it increased the probability of answering all the patients' needs in an effective manner. Overall, the level of threat of substitution in this industry is low, which makes enterprises not be afraid of entering and investing this sector.

The other force is the threat of a new entry. As, the healthcare industry had a total average return of 28% in the European Stock Market, becoming one strongest industry. Plus, over the past decade the industry faced an increase of 400% in investment deals, most of them in reshaping the future of digital in this area. This tendency motivates businesses in being part of the growth and possible profitability. Additionally, the uncertainty and complexity of regulation leads to a lot of entrepreneurs in industry to not seek approval, which makes even easier to enter and operate in the market.

The last force is competitive rivalry. The VASelfCare application focus on the components of nutrition and diet, medication, and physical activity, however more than 50% of the applications investigated in the Google Play have blood glucose management. Plus, roughly 40-45% of them have 4 or more of the most important features for an effective self-management. Which makes the competitive rivalry sharp in this industry.

3.2 Analyse the internal and external potential of the VASelfCare project? And effectively interlink those characteristics?

From 1960-1970 a team from the Stanford Research Institute built a framework to help businesses to identify their own core-competencies, planning and structure strategies. This method studies four fields: Strengths, Weaknesses, Opportunities and Threats (SWOT) (Phadermrod et al., 2016). Therefore, by applying this method of study into the project:

- Strengths: the founders have been involved in R&D focus on digital transformation in healthcare; the team counts with an interdisciplinary team with various areas of expertise like behaviour change theory and behaviour change techniques, clinical communication, medication adherence, physical activity in elder populations, computer graphics and artificial intelligence; the project has already four protypes developed, three are the mobile application focus on the patient experience and the other protype is for the professional health staff, a web-based dashboard; the team has already successfully performed a clinical trial with 20 older adults with type 2 diabetes, 10 clinical experts along with 36 primary care physicians and nurses..

- Weaknesses: today, the project is in the sustainability and exploitation phase seeking for more institutions that can provide funds; they do not have any focus regarding the customers to tackle; the purpose of this project is to focus on the components of nutrition and diet, medication, and physical activity excluding the features of blood glucose management; even though they have already performed a clinical trial, the sample was not large enough to prove safety and effectiveness in patients; the mobile application or the web-based dashboard is not yet regulated by any governmental institution- Infarmed.

- Opportunities: in 2019 there was 463 million adults with diabetes, and it is estimated to rise for 700 million in 2045; the proportion of individuals using internet has been rising, the latest data revealed the percentage of the total population increased to 78,3% and between the age group of 65-74 years old its growth to 39%; in 2019, a research reveals that the sector of mobile applications intended for diabetes self-management was valued at 173.0 million dollars in 2019. It is estimated to have a CAGR of 22.0% over the forecast period; most of the mobile application in this industry do not seek for regulation approval; in May of 2021 new regulation from the European Union will be

released to support the process of authorization of the latest scientific and technological improvements; regarding the data from Table 3 none of the big private health corporation in Portugal has a mobile application with any feature regarding diabetes self-management, however, two companies (Luz Saúde Group and HPA Saúde Group) have demonstrated some commitment in monitoring diabetes (Table 4).

• Threats: worldwide, adjustments of regulation are slow, regarding mobile application aiming patients to self-management. It has been considered by many entrepreneurs an identified barrier in this industry; as previously evaluated, question 3.1), this industry suffers a high level of attractiveness, so in the long run approximately no company in the industry will earn extraordinary returns on investments.

After performing the SWOT analysis, it is recommended to perform a Threats, Opportunities, Weaknesses and Strengths, a TOWS analysis, which is an extension of the previous study. This analysis is the conclusion through matching all four together. As, the key strengths and weaknesses in the VASelfCare project, from a strategic perspective can be considered as protection against potential threats or even discover a strategy where the forces in the industry are fragile (Porter, 1979). Considering the most relevant from each field, it is feasible to connect them:

• Strengths to Opportunities: the team has an interdisciplinary team with various areas of expertise and experience, together they have already built four successful prototypes and perform a clinical trial, even if it is small, it shows evidence that can be presented to potential customers, the private health corporations, since none of them has something similar.

• Strengths to Threats: even though Portugal has a complex and unsuitable regulation process regarding software application, one of the prerequisites along the process of risk classification is to show clinical validation. The VASelfCare project has

successfully demonstrated with 20 older adults with type 2 diabetes, 10 clinical experts and 36 primary care physicians and nurses. Even though, it represents a small sample, it is a starting point to prove credibility.

- <u>Weaknesses to Opportunities</u>: the project is in the sustainability and development phase requesting for more institutions to provide funds. As a research reveals that this industry of diabetes self-management is estimated to have a CAGR of 22.0% until 2026. This could be a positive indicator for obtaining funds support since the prospective of the industry value is optimistic. In May of 2021 new regulation from the European Union will be released regarding process of authorization, it represents a signal of hope to gain approval for the mobile application and the web-based dashboard, or at least simplify the process.

- <u>Weaknesses to Threats</u>: as it has been evaluated in the competitive analysis, this industry suffers a high level of attractiveness and the project is focused on the same features that most of other players. So, it is important in this phase to consider expanding the project for an untapped niche in the industry.

3.3 Which strategy should the project adopt, employing Porter's Generic Strategies framework?

The VASelfCare to be effective, it is essential to build a clear strategic plan in how to approach the market. A strategy plan is characterized by being a set of guidelines made in advance to achieve an objective, they should be made consciously and purposefully (Mintzberg, 1987). Hence, Michael Porter created the Generic Competitive Strategies, a model to assist businesses to manage their internal potential and the competitive forces, as previously mentioned, and to outperform other organizations by creating a strong competitive advantage (Porter, 1985). This model depends on the level of competitive advantage (low cost/high cost) and competitive scope (narrow/broad) (Porter, 1985).

The Generic Competitive Strategies includes 'cost leadership', 'differentiation', cost focus' and 'differentiation focus' (Figure 2). It is recommended to firms to follow only one strategy because it would allow the business to ensure a favourable and strong position in industry (Tanwar, 2013). As, approaches that are stuck in the "middle" are only successful in short run, in terms of sustainability in the long term they usually fail (Porter, 1996).

The term "Generic" describes the strategic approach chosen by the firm in the broadest level possible, regardless of industry (Tanwar, 2013). So, even though Porter's model has more than two decades, and digital transformation is a recent phenomenon, the model can still be applicable into the VASelfCare project (Kim, 2004).

As previous analysis, when combining all the five forces, it is possible to recognize that the project is entering in an industry with a high level of attractiveness. Additionally, by acknowledge their key core-competencies and external environment, it was possible to effectively interlink them, as to minimize the threats, take advantage of opportunities, focus on their flaws, and successfully use their core-competences. Therefore, by applying the Porter's model into the VASelfCare project, the most suitable strategy is 'differentiation focus', to tackle a narrow scope of the market, and to be perceived by the customers as unique.

Most of the players in the Table 5, focus on a cost leadership strategy. Since most of them offer a free mobile application or a subscription-based model, as it starts as free and then the consumer pays for additional features. These types of mobile applications want to tackle a very large customer base, to obtain the most extensive distribution of the application. The true winner in this type of strategy, cost leadership, it is the business with the lowest cost but simultaneous offers the basic required features for an effective self-management. They want to be perceived by having the lowest price in the market.

Maintaining this type of strategy involves a constant research around the business in ways to decrease costs.

The VASelfCare by applying a strategy of differentiation focus, it is focusing on a narrow scope of the market, by directing the supply for one customer segment, the private health corporations. To target this segment of the market, the key is to demonstrate a large clinical evidence and/or regulation approval, therefore reflecting into credibility and quality. So, the differentiation strategy is about achieving a perception of integrity from the healthcare professionals, as most entrepreneurs in the industry to not seek approval for their mobile applications. As previously mentioned, none of the big private health corporation in Portugal has a mobile application with a feature dedicated to diabetes self-management (Table 3), however, there are two corporations, Luz Saúde Group and HPA Saúde Group, have demonstrated some commitment in monitoring diabetes (Table 4). Additionally, as mentioned in the description of the case study, Alentejo is one of the regions in Portugal with higher level of prevalence of diabetes. When analysing this region, the Luz Saúde Group, HPA Saúde Group and United Health Group, are the private corporations with more clinics/hospitals there (Figure 1). Yet, the private health corporations are all over Portugal (Figure 1 and Table 2), the Luz Saúde Group are in eleven regions and CUF - Group José de Mello are in eight. Meaning, if the VASelfCare supply to these private groups, more regions of Portugal, therefore more consumers the application is going to reach.

Summarizing, by being perceived as distinctive and by gaining the support of a narrow segment of the market, subsequently more health professionals from those private health corporations are going to recommend the usage of the software application. Therefore, it is going to create a sense of trustworthiness in the final consumers, older adults with type 2 diabetes.

4.   Conclusion

The VASelfCare project is entering a competitive environment with a high level of attractiveness. However, one of the identified opportunities is that most entrepreneurs in the industry do not seek approval for their mobile application and none of the mobile applications from the private health corporations in Portugal have a feature concerning diabetes self-management, yet two organizations have demonstrated commitment in monitoring diabetes. So, when applying Michael Porter's Generic Strategy framework, a potential competitive advantage could be attained by implementing a differentiation focus strategy. By tackling some of the private health corporations and by being perceived as reliable and credible, more health professionals from the respective organizations are going to recommend the usage of the software application, and consequently generate a sense of trustworthiness to the final consumers.

In conclusion, when merging the analysis from all three discussion questions, to respond to the main question: "How viable and sustainable is this project?", the study reaches an optimistic answer, but it is highly recommended to follow an approach of obtaining regulation approval or investing in a large sample of clinical evidence to prove credibility. In the future, the VASelfCare project should focus on a financial analysis, to help finding a suitable manner to fund the collection of data in a larger sample and/or costs concerning the approval process, and later supporting the implementation into the market.

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Appendices:

Type of user in the Software Application of the VASelf care	
Patient	use the application to improve their healthcare.
Nurse	register patients; explains and demonstrates to the patients the mode of interaction, making sure that he understands the importance of its use for data collection; verify the development of patient's health; clarify doubts and problems that the patient might have; synchronizes and allocate the collected data on the server. verify the development of patient's health; clarify doubts and problems that the patient might have; synchronizes and allocate the collected data on the server.
Administrator	register nurses; gathers all the data from all interactions; contact patients to ensure that they use the application frequently

Table 1- Type of user and respective functions in the Software Application of the VASelf care

Private Health Corporations in Portugal			
Clients Name	Nº of Hospitals and Clinics	Nº of regions	
United Health Group-Lusíadas	12	5	
CUF - Grupo José de Mello	18	8	
Luz Saúde Group - Hospital da Luz	25	11	
HPA Saúde Group	18	4	
Trofe Saúde	17	3	
Fundação Champalimaud	1	1	

Table 2- Private Corporations in Portugal (United Health Group-Lusíadas, 2021) (CUF- Grupo José de Mello, 2021) (Luz Saúde Group - Hospital da Luz, 2021) (HPA Saúde Group,2021) (Trofe Saúde, 2021) (Fundação Champalimaud, 2021)
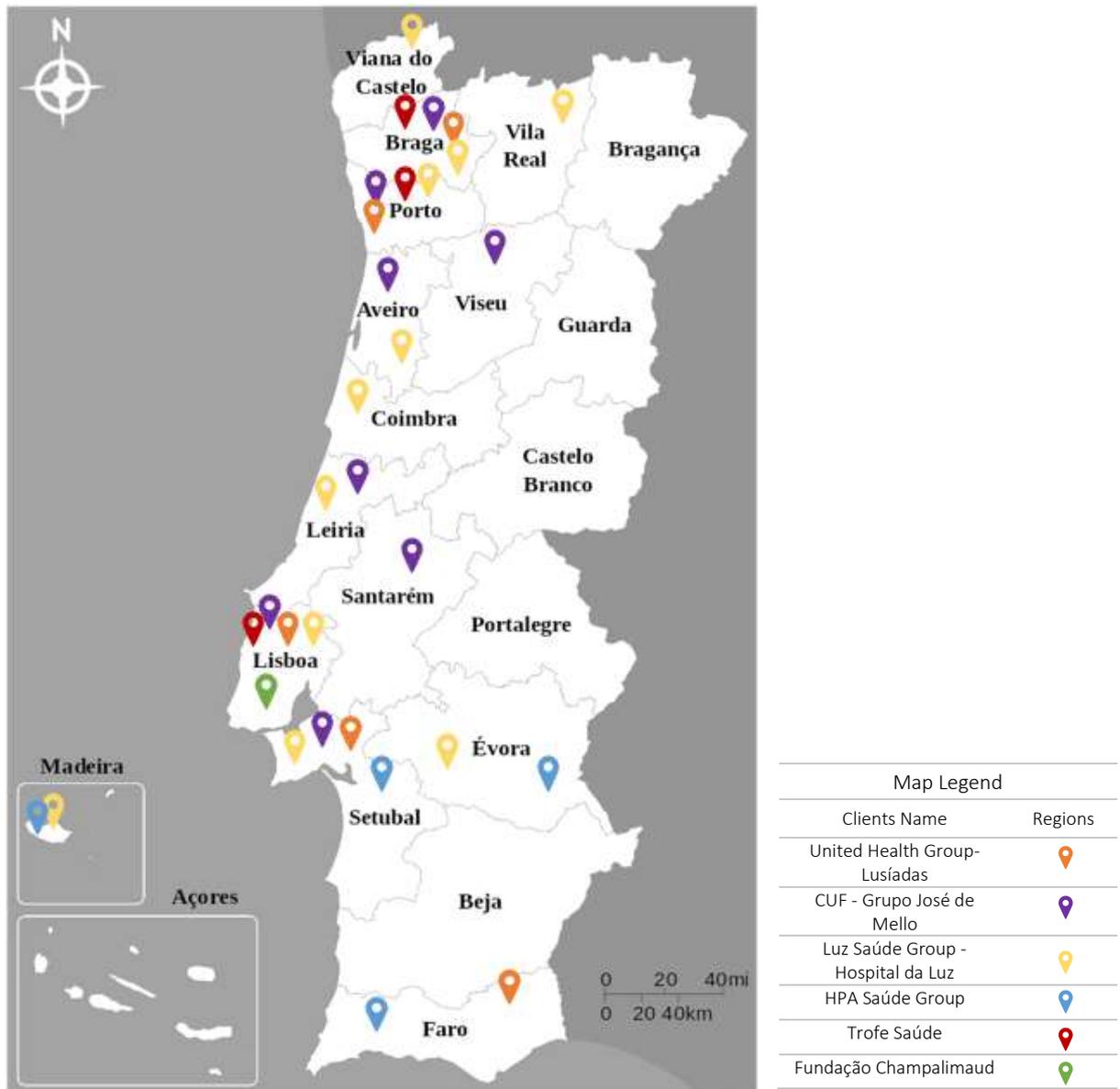
Figure 1 – Distribution of the Private Corporations across Portugal (United Health Group-Lusíadas, 2021) (CUF- Grupo José de Mello, 2021) (Luz Saúde Group - Hospital da Luz, 2021) (HPA Saúde Group,2021) (Trofe Saúde, 2021) (Fundação Champalimaud, 2021)

Mobile Applications of The Private Health Corporations								
Clients Name	Nº of downloads	Ranking	Scheduling appointments	Consulting exam reports and prescriptions	Informations of follow-up	Clinical history	Management of the healthcare of the family	Teleconsultation
United Health Group-Lusíadas	10mil	3.2/5 de 75	1	1	1	1	1	
CUF - Grupo José de Mello	100 mil	2.4/5 de 1mil	1	1		1	1	
Luz Saúde Group - Hospital da Luz	100 mil	3.7/5 de 617	1	1		1	1	1
HPA Saúde Group	10mil	3.3/5 de 617	1	1			1	
Trofe Saúde	100mil	3.8/5 de 617	1	1			1	
Fundação Champalimaud	5mi	4.4/5 de 65	1	1				

Table 3- Mobile Applications of the Private Health Corporations in Portugal; 1 - the mobile application has that feature. (United Health Group-Lusíadas, 2021) (CUF- Grupo José de Mello, 2021) (Luz Saúde Group - Hospital da Luz, 2021) (HPA Saúde Group,2021) (Trofe Saúde, 2021) (Fundação Champalimaud, 2021)

Additional Services of the Private Health Corporations					
Clients Name	24/7 support line	Triage phone	Teleconsultations/video consultations	Monitoring chronic diseases	Monitoring diabetes
United Health Group-Lusíadas	1		1		
CUF - Grupo José de Mello	1		1		
Luz Saúde Group - Hospital da Luz	1	1	1	1	1
HPA Saúde Group	1		1		1
Trofe Saúde	1	1	1	1	
Fundação Champalimaud			1	1	

Table 4- Additional Services of the Private Health Corporations in Portugal; 1- they provide that service (United Health Group-Lusíadas, 2021) (CUF- Grupo José de Mello, 2021) (Luz Saúde Group - Hospital da Luz, 2021) (HPA Saúde Group,2021) (Trofe Saúde, 2021) (Fundação Champalimaud, 2021)

Other Players and Respective Features

App Name	Medication Management	Blood Glucose Management	Physical Activities Features	Nutrition or Diet Features	Weight Management	Data Export	Total of Features
Diabetes-Blood Sugar		1					1
mySugr-App de Gestão da Diabetes e Glicemia	1	1	1	1		1	5
Diabetes M -Management & Blood Sugar Tracker App	1	1	1	1		1	5
Diabete - Diário Glucose		1			1	1	3
Diabetes Controle - Diário Diabetes		1		1		1	3
forDiabetes: Aplicativo de Diabetes	1	1	1	1	1	1	6
Beat Diabetes			1	1			2
Receitas para Diabéticos				1			1
Açúcar no Sangue: Insulina e Diabetes Controle	1	1		1	1	1	5
Social Diabetes. Take Control of your Diabetes	1	1	1	1	1	1	6
A Minha Glycemia		1				1	2
Dieta para Diabéticos			1	1			2
Contour Diabetes (PT)	1	1	1	1		1	5
Blood Glucose Tracker	1	1				1	3
Diabetic Diet Recipes: Control Diabetes & Sugar				1			1
American Association Standards of Care							0
Diabéticos Receitas				1			1
Dieta para Diabéticos		1	1	1			3
Diabetes Connect	1	1		1		1	4
Teste de Diabetes							0
Diabetes Control APP	1	1	1			1	4
Receitas para Diabéticos-Diabetes				1			1
My Diabetes-Personal Diabetes Reversing Assistant		1	1	1	1		4
Controle Glicose	1	1		1		1	4
Aplicativo para Dieta Diabética		1	1	1	1		4
Diabetes Ginástica		1	1				2
Dieta para Diabéticos		1		1			2
Glucose Buddy Diabetes Tracker	1	1	1	1	1		5
Diário Diabetes		1			1	1	3
Blood Sugar Loag - Diabetes Tracker	1	1			1	1	4
Beyond Type 1 Diabetes							0
Insluin Dose Calculator and Timer for Diabetes		1					1
Type 2 Diabetes Healthy Eating		1		1	1		3
RVC Pet Diabetes App							0
Diabetes Tracker	1	1	1	1			4
Freedom from Diabetes		1	1	1	1		4
Pet Diabetes Tracker							0
Gadge Diabetes Care							0
Pregnant with diabetes							0
Diabetes & Diet Tracker	1	1	1	1	1	1	6
Total	14	27	16	24	12	16	

Table 5- Other Players and respective features; 1- the mobile application has that feature. (Google Play Store, 2021).

STRATEGIC ADVANTAGE

Uniqueness Perceived by the Customer | Low Cost Position

STRATEGIC TARGET

Industrywide — DIFFERENTIATION | OVERALL COST LEADERSHIP

STUCK IN THE MIDDLE

Particular Segment Only — FOCUS

Figure 2 -Porter's Generic Strategies