Estratégia e Modelo de Negócios do Projeto SHELTER

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Abstract

The growing concern over seismic events and the vulnerability of older buildings has revealed a significant market opportunity. In response, the SHELTER project has been launched as a collaborative initiative between Teixeira Duarte Engenharia e Construção (TDEC) and Instituto Superior Técnico (IST). This project aims to develop and commercialize seismic shelters that can be integrated into existing buildings, thereby increasing the chances of survival in the event of a building collapse. This study aims to identify best practices in formulating business strategies, assess the potential market for seismic shelters, and develop an effective business model to enable their successful commercialization and market penetration. The methodology adopted was a case study based on a qualitative approach. This approach allows for the analysis of the internal and external contexts, and based on this, the formulation of strategies to be implemented and the development of action plans.

Keywords: Seismic Shelter; Project SHELTER; Strategic Analysis; Business Model Canvas, SWOT Analysis

1. Introduction

This dissertation focuses on the strategic analysis of an innovative seismic shelter, examining the factors that influence its feasibility and market potential. The introduction provides an overview of the problem context, study objectives and scope, methodology, and organization of the dissertation. The problem context highlights the urgent need for effective solutions to protect against natural disasters, particularly earthquakes, which cause significant infrastructure damage and loss of life. The lack of efficient and affordable seismic products necessitates the research and development of new solutions to mitigate these devastating effects. The creation of an innovative seismic shelter aims to offer a robust solution that can be adopted in vulnerable regions, providing safety and protection to affected populations. This dissertation encompasses a detailed analysis of the development of a seismic shelter, from creating a business model to its strategic implementation. The primary objectives are to identify best practices in formulating business strategies, assess the potential market for the seismic shelter, and develop an effective business model for successful commercialization. This approach aims to evaluate the feasibility of marketing the SHELTER and outline strategies for its market success. The methodology adopted for this dissertation was based on a qualitative approach, involving data collection through a literature review and analysis of documents provided by the project team. The literature review contextualized the problem and helped understand the circumstances motivating the development of the seismic shelter. Benchmarking was conducted by researching similar existing products, while the Business Model Canvas and SWOT analysis were employed to assess the strategic potential of the seismic shelter. This qualitative approach enabled a detailed and well-founded analysis, providing a comprehensive view of the project. The dissertation is organized to facilitate understanding the development and strategic analysis of the seismic shelter. It begins with an introduction that outlines the problem context, objectives, and methodology. This is followed by a literature review discussing business models and strategic analysis tools, providing a solid theoretical framework. The case study covers the development of the seismic shelter, including the partnership, problem description, objectives, concept, proposal, and product presentation. The

strategic analysis includes detailed benchmarking, implementation of the Business Model Canvas, and a SWOT analysis. The results chapter outlines future strategies for the seismic shelter based on the conducted analyses, followed by a conclusion summarizing the main findings and recommendations of the study. In summary, this dissertation provides a comprehensive and structured analysis of the strategies and feasibility of an innovative seismic shelter, addressing various strategic and market aspects influencing its potential success. By employing a qualitative methodology and applying strategic tools, it aims to offer a solid foundation for future research and developments in this field.

2. Literature Review

The subsequent literature review aims to contextualize the research problem by drawing on theoretical foundations from scientific articles and previously published works.

It delves into the relationship between construction history and seismic events, analysing their impact on the safety of existing structures. Architectural and engineering practices throughout the centuries are examined, shaping buildings behaviour in seismic events. The importance of building regulations and standards in Portugal, ensuring adequate structural resistance, is underscored. Construction strategies aimed at enhancing seismic resilience are discussed, including innovative design approaches and the use of advanced materials. Alternatives for surviving severe earthquakes, such as early warning systems and resilient urban planning measures, are also explored.

Furthermore, various business model approaches and discussions surrounding this topic are also addressed, subsequently relating to strategic analysis tools. This review aims to provide a comprehensive and critical overview of these themes, fostering curiosity for future research in this multidisciplinary field.

2.1. The Budling's Resistance to Earthquakes

Earthquakes are defined as a tremor in the Earth's crust resulting from the violent release of energy within it. They occur when two masses of land overlap, creating a shock at the hypocenter, which is the point below the Earth's surface where the earthquake initiates. The epicenter, directly above the hypocenter on the Earth's surface, is the point where the earthquake has its focus [1].

The history of seismology is closely tied to Portugal. Following the significant 1755 Lisbon earthquake, which severely impacted Lisbon, seismic phenomena became a vital research topic, spearheaded by the Marquês de Pombal [2]. Their initiative resulted in the widespread distribution of seismological questionnaires to assess the impact of earthquakes on individuals, buildings, and assets, as well as requests for information regarding past seismic events [3]. The built environment represents a distinct urban area, with this category in this study encompassing buildings that have survived either entirely or partially from the great 1755 earthquake and are still standing [4]. Based on their appearance, the following buildings were categorized into main groups: (i) buildings of good quality; (ii) buildings of poor quality; (iii) buildings with sloping floors. Regarding buildings of good quality, these feature well-preserved and layered masonry, with metal stone cladding and arches. As for buildings of poor quality, they exhibit characteristics of poorly maintained masonry [5]. Buildings predating 1755 now constitute a significant portion of Lisbon's old neighbourhoods, primarily urban [6]. The regulatory landscape regarding building safety against seismic events has undergone significant evolution over time. Initiatives such as the Regulamento de Segurança das Construções Contra os Sismos (RSCCS) [7] and the Regulamento de Solicitações em Edifício e Pontes (RSEP) [8] aimed to prevent structural collapse and ensure the safety of individuals and property. The introduction of the Eurocódigo 8 (EC8) [9] in 1998 further refined seismic safety measures, focusing on protecting lives. The EC8 introduced requirements for proving collapse resistance and limiting damage, considering factors like site zoning and soil classification. Additionally, the Programa Nacional da Política de Ordenamento do Território (PNPOT) serves as a strategic instrument for territorial planning in Portugal, providing a framework for national spatial options and cooperation with other EU member states. It plays a crucial role in defining the country's strategic vision and guiding the development of regional strategies up to 2025 [10].

To safeguard buildings against seismic effects, it's crucial to consider both economic and practical factors, ensuring they withstand collapse even during intense earthquakes while minimizing damage in milder tremors. Designing buildings, their specific functions, such as hospitals or nuclear facilities, must be considered to ensure operability post-earthquake. Despite advances in simulations, experimental assessment remains pivotal. Methods like seismic platforms and reaction walls enable detailed analysis of earthquake effects, recording damages and deformations. Strategies like foundation isolation and damage concentration in specific areas have shown to reduce seismic damages. Proper interconnection of walls and anchoring to the ground, known as "box behaviour,"

are also essential to ensure the overall structural strength during earthquakes [11]. In Portugal, a seismic event akin to the one in Benavente could result in an economic impact of approximately €16.6 billion. Despite seismic design standards existing since 1958, enforcement mechanisms for existing buildings remain lacking [12]. The absence of technical retrofitting specifications for existing structures allows projects reducing seismic resilience to proceed legally. Since 2000, the Sociedade Portuguesa de Engenheiros Sismicos (SPES) has been advocating policymakers about urban renewal policy deficiencies, supported by technically robust proposals. SPES's engagement with government officials and civil society has been extensive, highlighting seismic risks to both real estate and public health. Efforts have included structural modelling to establish seismic coefficient relationships, aiding in retrofitting strategies. Beyond structural enhancements, measures like early warning systems, evacuation planning, public education, and the establishment of seismic refuges aim to improve survival rates during earthquakes. However, despite these efforts, the risk of death or injury during seismic events persists [13].

2.2. Business Models and Strategic Approaches

Business models, as a tool to describe organizational operations, have been present since the early days of companies, though it's only been in the last decade that the concept has gained prominence [14]. The most promising research area regarding business models is associated with e-commerce. The information industry has been a subject of debate due to the complexity of information pricing and consumer access. Literature on business models saw significant growth between 1995 and 2010. The dispersion and unique response of each organization to business models give the concept a certain ambiguity [15]. A business model can be understood as the structure, organization, and management of activities aimed at generating value through business capabilities. Essential characteristics include formulating the value proposition, determining market trends, and assessing costs and revenues. Any economically viable entity requires a business model, which is a theory constantly tested by the market. An organization's business model defines how it achieves its objectives and creates value. The concept of a business model encompasses various components and relationships, expressing an organization's business logic. Using a common theoretical framework to describe business models facilitates their understanding, communication, and monitoring over time [16]. While business models simplify analysis, control, and validation of a company's strategic decisions, they themselves do not constitute strategies. Strategy can be defined in various ways: as a model, planning, positioning, or perspective. However, one of the most consistent, identifiable, and adaptable business models is proposed by Gary Hamel. According to this concept, to achieve a revolutionary position in the industry, one must have an instinctive ability to think comprehensively about business models [17]. The elements of a business model can be defined in many ways, prompting Hamel to create a sophisticated yet simple framework consisting of four key elements, each containing a series of components. Hamel's model emphasizes that any competitive advantage is based on the unique resources a company possesses. Customer interaction is crucial, covering aspects such as implementation and support, knowledge and understanding, dynamics of relationships, and pricing. It recognizes the emotional and transactional components in producer-buyer relationships and their impact on different business concepts. These components add value to the final product or solution and can redefine the boundaries between cooperation and competition. In conclusion, an effective business model integrates these elements to create value for customers and stakeholders. It's a theoretical framework that guides strategic decisions and fosters innovation in business planning and execution [18].

A business model should describe the logic of how an organization creates, delivers, and captures value. The Business Model Canvas is particularly notable for its shared language that facilitates easy manipulation and adaptation of strategy across various types of businesses. It is believed that a business model can be described using just nine basic building blocks, outlining the logic a company should follow to generate revenue. These nine blocks (Key Partnerships; Key Activities; Key Resources; Value Proposition; Customer Relationships; Channels; Customer Segments; Cost Structure; Revenue Streams) address the main themes of a business model: customers, offer, infrastructure, and financial viability [19]. Several strategic analysis and planning tools are essential for business models, including SWOT Analysis, Value Chain, Porter’s Five Forces, PEST Analysis, and Benchmarking. Internal analysis evaluates a company’s resources, competencies, and processes, while external analysis considers competition, industry trends, and market dynamics. These analyses underpin the SWOT analysis. Although there is some debate about directly integrating SWOT analysis into business plans, its strategic value. SWOT analysis examines the Strengths, Weaknesses, Opportunities, and Threats

faced by a company, offering a comprehensive view by combining internal assessments with external conditions [20]. This includes evaluating human resources, procedures, technology, costs, strengths, and weaknesses, and adapting them to the specific objectives [21]. Michael Porter's five competitive forces are a widely used tool in the formulation of organizational strategy. Since his early studies in industrial companies, Porter has focused on understanding ways to improve businesses and popularized the concept of the five forces [22]. The PEST analysis is a widely used strategic analysis tool to study an organization's external environment, aiming to address questions about the environmental factors that affect it. Its objective is to identify potential opportunities and threats in the macro environment of an organization, thereby helping it respond to external changes [23]. This comparison technique is known as Benchmarking, a continuous process of measuring products, services, and practices in relation to the best competitors or market-leading companies. This tool assists companies in objectively evaluating their strengths and weaknesses compared to other organizations [24].

3. Methodology

The methodology of this dissertation was designed to qualitatively explore and analyse the development and feasibility of a seismic shelter, from its initial conception to the definition of future strategies for its implementation in the market. The adopted methodological approach is a detailed case study that includes a strategic analysis based on established tools, such as Benchmarking, the Canvas business model, and SWOT analysis.

3.1. Applied Methodology

The case study methodology was chosen due to its suitability as a qualitative research method to investigate contemporary real-life situations thus allowing a holistic view of the study object. This methodology enables detailed and in-depth investigation into a phenomenon, individual, or organization. Case studies are particularly useful for exploring and understanding the underlying principles of an occurrence within its real context, providing a contextualized and detailed analysis that is essential for understanding the studied phenomena. The methodology of this dissertation was designed to qualitatively explore and analyse the feasibility of a seismic shelter, from its initial conception to defining future strategies for its market implementation. The choice of the case study is justified by the complexity and specificity of the seismic shelter as a product and by the need for a detailed analysis of the organizational and market context. The integration of Benchmarking, the Canvas business model, and SWOT analysis allows for a holistic and practical approach, facilitating understanding of the internal and external dynamics influencing the marketing strategy. This methodological combination provides a solid foundation for formulating strategic recommendations and contributes to theoretical and practical development in the field of business studies and disaster management [24].

3.2. Data Collection and Analysis

The use of multiple data sources, referred to by the author as "triangulation," enables the researcher to develop convergent lines of inquiry. This approach increases the likelihood that the data collected, and conclusions drawn from a case study are credible and convincing, as it allows for the validation of results through comparison and correlation of different perspectives and sources of information. The data used in this dissertation were obtained from scientific articles and documents provided by the project team. Data collection was exclusively qualitative, focusing on scientific articles and documents provided by the project team.

3.3. Strategic Approach

The choice of Benchmarking, the Canvas business model, and SWOT analysis tools over other strategic tools was grounded in several specific and complementary reasons, aligning with the project's objectives. Benchmarking allows comparing the performance of the seismic shelter with the best products and practices existing in the market, facilitating the adaptation and penetration of the product in the market by identifying best practices from other products. The Canvas business model provides a comprehensive and integrated view of all key components of the business model, ensuring alignment and coherence among various aspects of the business, while its visual simplicity facilitates communication and strategic planning among stakeholders. Additionally, the SWOT analysis offers a detailed assessment of internal strengths and weaknesses, as well as external opportunities and threats, crucial for identifying factors impacting the shelter's success in the market and developing corresponding strategies to maximize opportunities and mitigate threats.

4. Case Study: SHELTER

This chapter provides a detailed analysis of the SHELTER project case study, offering a comprehensive understanding of its context, established partnership, identified problem, defined objectives, developed concept, and proposed solution. Throughout this chapter, the comprehensive scope of the SHELTER project will be

explored, laying the foundation for subsequent strategic analysis of the resulting product. The presentation of this case study will offer a clear overview of the process, proposed solution, culminating with Benchmarking, Canvas business model implementation, and SWOT analysis of SHELTER.

4.1. Contextualization of the Case Study

The Portuguese territory, located between the Eurasian, African, and North American plates, faces significant seismic risk, exacerbated by the presence of old buildings vulnerable to earthquakes due to lack of refurbishment over the years. In response, the SHELTER project, a joint initiative of Teixeira Duarte Engineering and Construction (TDEC) and Instituto Superior Técnico (IST), aims to develop seismic shelters integrated into existing constructions, preserving lives rapidly and economically without extensive structural interventions. The project, submitted under Portugal 2020 funding, was approved with a 4.6 out of 5 rating for non-repayable financing, driven by the cause of improving survival odds during partial or total building collapses in severe earthquakes. TDEC seeks to enhance its seismic construction competencies through this project, simultaneously addressing the noble challenge of social responsibility by safeguarding human lives, positioning the company as an innovative builder capable of tackling complex engineering challenges. The project's strategy encompasses a multidisciplinary approach, addressing structural, mechanical, construction, architectural integration, design, and ergonomic aspects, with experimental tests and numerical simulations ensuring shelter mechanical strength and functionality. Operational readiness includes estimating shelter arrival time and possible seismic alarm integration. SHELTER's innovation lies in architecturally integrating shelters into existing buildings, providing an effective, low-cost, aesthetically pleasing solution to overcome financial limitations hindering complete structural building rehabilitation, thereby significantly contributing to population safety and well-being during seismic events and representing a valuable innovation in seismic construction.

4.2. Presentation of the Partnership

To carry out the project, it was necessary to assemble a set of very specific skills, considering that it is an innovative project in the seismic field. Deep knowledge about the technologies and materials to be used in the construction of the seismic shelter is required. Teixeira Duarte is a company with a vast and prestigious track record in construction. Instituto Superior Técnico, one of the most reputable engineering schools in Portugal, has extensive experience in Seismic Engineering, Seismology, structural modelling, and analysis, contributing expertise in structural design, advanced materials usage, and architectural requalification. Regarding subcontracted institutions, Laboratório Nacional Engenharia Civil and IADE were part of the project, with LNEC providing expertise in conducting tests on a seismic table and IADE contributing knowledge in industrial design, ergonomics, virtual reality analysis, and aesthetic framing. Project management was handled by TDEC and IST, ensuring harmony and complementarity among all project entities to achieve the set objectives. In the following chapters, the history of the entities involved in this project will be discussed, as well as their proven skills to effectively perform the assigned roles in the project.

4.3. Description of the Problem

In areas with moderate to high seismic risk, buildings erected before the implementation of modern regulations for seismic construction, including the most recent ones in countries that do not follow these construction principles, show a notable structural vulnerability when face with seismic shocks. This scenario is evident in Portugal, with prominence in the central and southern regions.

The widespread vulnerability of the building stock is a significant challenge, as seismic events can result in the collapse of many of these buildings, causing many casualties. This is a pronounced issue in countries like Portugal, where many old buildings, without rehabilitation or reinforcement for several decades, face substantial structural vulnerability.

The most suitable solution would involve comprehensive intervention to enhance the seismic resistance of all susceptible buildings. However, due to economic constraints, this approach is impractical and not expected to be adopted in many countries with seismic risk and vulnerable buildings in the coming decades. Faced with this scenario, it becomes imperative to develop a solution that effectively addresses this serious and widespread problem, ensuring the safety of residents in vulnerable buildings in seismic areas, without incurring significant costs and with the possibility of realistic implementation within a short timeframe.

4.4. Objectives

The main objective of this project is to develop a seismic shelter solution for apartments in old buildings (residential or commercial) that is technically effective, economically viable, and

integrated into the architecture, allowing for immediate implementation, and saving the lives of thousands of people in the event of partial or total building collapse.

The proposed solution aims to meet five main objectives: mechanical resistance to seismic actions, ensuring a high probability of survival, providing physical and psychological comfort for at least 7 days after an earthquake, limited installation time of two weeks under standard conditions, minimal intervention in existing space, and estimated costs much lower than those of overall structural rehabilitation of buildings. These criteria aim to create an efficient, affordable, and quickly implementable shelter, contributing to safety in seismic situations without significantly compromising existing space.

4.5. Concept and Proposed Solution

The seismic shelter solution development entails a thorough analysis of mechanical and structural behaviour, construction aspects, architectural integration, operability, design, and ergonomics. A multidisciplinary team was formed to tackle the project's challenges. The shelters are designed for installation in sections of old buildings where comprehensive structural interventions are unfeasible due to financial constraints, owner disagreements, or technical reasons. They reinforce a specific compartment with a system resistant to various forces, creating an ultra-resistant zone. Equipped with devices for protection and survival, they target buildings prone to collapse during earthquakes. Initially focused on structures with concrete slabs and masonry walls, the shelters are adaptable to any architectural type. They are intended for placement in central, easily accessible locations like corridors. The project drew inspiration from various contexts like war shelters, underground mines, and vehicle cockpits. Mechanical behaviour was assessed through experimental tests and numerical simulations, including dynamic free fall tests, building demolition tests, and seismic table tests. Integration into existing buildings prioritized compatibility with regular space usage while preserving structural integrity. Early warning systems and a training program for occupants enhance safety measures. Design and ergonomics ensure physical and psychological well-being during earthquakes. The solution offers cost-effective implementation compared to structural rehabilitation, with minimal intervention required for installation. Overall, the proposed shelter solution prioritizes mechanical resistance, occupant comfort, architectural integration, cost-effectiveness, and ease of installation in existing buildings.

4.6. Product Presentation

The project called SHELTER is a construction product whose main objective is to significantly reduce the risk of loss of human lives in the event of earthquakes. Designed to increase the survival chances of occupants in buildings vulnerable to earthquakes, SHELTER faces challenges in making buildings structurally safe against seismic action.

The structural safety of buildings against earthquakes is mostly ensured by the ability of structural elements to withstand the vibrations induced by earthquakes. However, older buildings, constructed in times with insufficient or non-existent regulations, are known to be vulnerable to earthquakes. This vulnerability raises concerns about the safety of occupants, as these buildings have a considerable probability of collapse [26].

While there is recognition from the technical-scientific community about this situation, there is no simple solution to the problem. Measures to ensure the seismic performance of older buildings are costly, and the responsible organizations face difficulties in implementing them. In Portugal, the increase in the value of old buildings due to the real estate boom has led owners to improvements in interior architecture, but structural safety measures are often limited by the lack of knowledge about the structural performance and design of old buildings.

It is expected that global solutions, such as seismic certification of buildings, will be introduced to mitigate these problems. However, other difficulties persist, such as the costliness of structural solutions, the unfavourable horizontal property system for renovation, and the false sense of security due to the periodicity of destructive earthquakes [26].

The complexity of the problem requires the urgent development of technical solutions that guarantee the protection of human life in the event of earthquakes, regardless of the damage to the buildings at risk. Innovation in civil engineering has been a response to this need, creating solutions considered attractive in the market.

As a product, the SHELTER, like all other solutions of this type, was designed exclusively to meet the survival needs of its users. Once they can establish contact in time, they have a good chance of surviving a partial or total collapse of the building. A solution of this kind should include an early warning system that alerts them to a potential catastrophic earthquake.

For residential buildings, this means that it is important for the SHELTER to be in a central part of the building, accessible quickly both day and night if

needed. This detail is so important that it should be assumed from the start that the SHELTER is intended for exclusive domestic use, meaning it has limited capacity and is intended only for the occupants of a house, as a typical solution is designed for four people [26]. The SHELTER solution was designed to minimize the impact of disasters, occupying a portion of the available space in the house, typically in the corridor or central part of the dwelling. The structure consists of small and mobile components that adapt to the available space. Initial protection from the SHELTER does not guarantee safety against earthquakes, especially in tall buildings, but includes safety seats that are activated upon entry, along with training on the use and maintenance of the equipment.

To protect against falls from elevated floors, retractable seats are designed to deploy when the alarm is triggered, reducing impact, and limiting occupant movement. Other devices, such as airbags, were rejected due to potential hazards. The chosen solution for the seats provides an optimal balance between occupation time and passenger safety, simulating a collision scenario.

This design significantly reduces the force of impact on the human body, keeping it within tolerable limits and facilitating exit. The SHELTER is also equipped with security doors to block debris and provisions for up to a 7-day stay, ensuring the well-being of occupants until rescue is possible. Additionally, it can be customized with additional packages as needed.

4.7. Strategic Approach

The partnership described in Chapter 4.2 aims to launch the SHELTER in the market. For this, a strategic analysis is necessary to visualize all the steps clearly and concisely, thus facilitating product communication and analysis. To begin this chapter, a benchmarking analysis will be conducted to identify the strengths and weaknesses of competing solutions, as well as the environment in which the product will be launched. Following this, the chosen model for this case study is the Canvas business model, due to its versatility and ease of implementation. Finally, to complement this, a SWOT analysis provides a solid foundation for strategic decision-making and continuous improvement of the business model.

4.8.1. Benchmarking

Currently, old buildings have a high probability of being damaged or collapsing during an earthquake, resulting in enormous intervention costs. Various earthquake protection solutions have been developed, but many are ineffective, only protecting against falling debris and not against the building collapse. Exterior shelters are a common alternative but are inadequate for indoor environments and generally unfeasible in urban areas due to limited space and reduced access time. In 2010, Artur Brutter presented in Israel a protective table against falling debris, designed to withstand impact. This table, lightweight and mobile, can be used for daily activities in classrooms. Another solution is a bed that detects seismic tremors and activates a mechanism that splits the bed's base, protecting the occupant in a steel chamber. The company Safe-T-Shelter developed shelters originally designed for storms but also suitable for seismic disasters, available in residential and commercial models, accommodating from 5 to over 500 people. These shelters have a sophisticated external appearance and conceal a robust steel structure, equipped with essential items for survival until rescue services arrive. The benchmarking analysis conducted in this chapter focuses on products developed for earthquake protection, comparing different market solutions, and evaluating their characteristics and performance within the context of civil engineering.

4.8.2. Implementation of the Business Model Canvas

The seismic shelter, designed to provide a safe refuge during and after an earthquake, represents not only a response to safety requirements but also a business opportunity addressing an urgent societal need. Exploring the key elements of the Canvas business model applied to this product, we highlight its relevance, feasibility, and potential impact on mitigating the effects of natural disasters. Identifying the Customer Segments is essential, considering the central purpose of the shelter. The primary focus is on populations residing in vulnerable buildings in seismic zones. These include Owners of Old Buildings, Public Administration entities responsible for safety, Engineering and Construction Companies, and Insurers seeking to reduce earthquake-related risks. The Value Proposition of the shelter extends beyond providing temporary physical protection; it represents a commitment to preserving life and reducing the devastating impacts of catastrophic events. This proposition includes High Seismic Resistance, Survival Guarantee, Post-Earthquake Comfort, Quick Installation, Non-Intrusive Integration, and Competitive Costs. Efficient Channel definition aligns the company's operations strategically. Initial impactful dissemination to the target audience is through industry events, fairs, and lectures. Partnerships play a crucial role in expanding operations. Collaborations with construction companies and simulation sessions for vulnerable

communities facilitate effective integration and awareness. Customer Relationships are vital for building trust and safety during emergencies. Awareness programs and evacuation simulations ensure community readiness and brand advocacy. Revenue Streams ensure project sustainability and continuous investment in research and development. These streams include the sale of integrated units, maintenance subscriptions, and user training. Key Activities encompass development, manufacturing, distribution, community training, and maintenance, leveraging Teixeira Duarte's expertise in construction. Key Resources include Teixeira Duarte's facilities, equipment, and personnel, essential for shelter development and installation. Key Partnerships with academic institutions, research organizations, and construction companies ensure project success and innovation. The Cost Structure comprises development, production, distribution, and marketing expenses, essential for strategic decision-making and project sustainability. This comprehensive approach to the business model Canvas outlines the strategic framework for successfully introducing and sustaining the seismic shelter, addressing critical societal needs while ensuring business viability.

4.8.3. SWOT Analysis

The SWOT analysis is a crucial tool to assess the viability of the SHELTER business model. Identifying the strengths, weaknesses, opportunities, and threats associated with it is essential to understand the project's potential and challenges. The strengths of SHELTER include its ability to significantly reduce the risk of death in building collapses, providing a more cost-effective solution compared to widespread interventions, seamlessly integrating with the architecture of homes, and being adjustable to their dimensions. On the other hand, weaknesses involve the need for prior mobilization for installation, the requirement for regular maintenance, and a lack of awareness about the importance of seismic shelters for many homeowners. Regarding opportunities, the potential for geographic expansion of the business in earthquake-prone areas, the opportunity for technological innovation to enhance shelter functionalities, and the chance to position it as a sustainable solution for residential safety are highlighted. However, there are threats to consider, such as instability in raw material costs, potential regulatory changes that could increase production costs, and competition from alternative products in the market. Understanding these aspects is essential to guide strategic decisions and maximize the potential impact of the seismic shelter in saving lives in earthquake-prone areas.

5. Discussion of Results

In this chapter, we present and discuss the results of the strategic analysis conducted for the marketing of SHELTER. Segmenting the discussion of results into three parts, the strategic analysis refers to the adopted methodology, including Benchmarking, implementation of the Canvas business model. The formulation of strategies is based on the SWOT analysis also addressed in the methodology, and finally, the development of action plans related to the implementation of strategies in a practical perspective. These methods provided a comprehensive and detailed view of the opportunities, challenges, and potential strategies for the effective implementation and marketing of the product.

5.1. Strategic Analysis

In this context, the company conducts a comprehensive analysis of its internal resources, competencies, and the external environment, including competition and market dynamics. The process involves SWOT analysis, based on benchmarking to compare existing products and outline strategies for SHELTER. This product stands out for its architectural integration, affordable cost, and ability to preserve lives in collapse situations. The Canvas business model, developed by Osterwalder and Pigneur, is used to map critical aspects of SHELTER's development and commercialization, offering a complete view of the business model.

5.2. Formulation of Strategies

From here, based on the information gathered on Benchmarking analysis and the Canvas business model, internal and external evaluation, resulted in the SWOT analysis. With the conclusions of the SWOT analysis, the conditions are gathered to formulate effective strategies to leverage advantages, overcome limitations, explore opportunities, and address challenges. As previously mentioned in the methodology, this tool is of utmost importance to identify critical success factors, factors that can impact the success of the seismic shelter in the market. Based on the strategic analysis conducted, the following strategies for SHELTER are presented: Research and Development Investment: Prioritize investments in research and development to enhance the product and incorporate technological innovations that increase its effectiveness, safety, and sustainability.

• Market Diversification: Explore new geographical markets with high vulnerability to earthquakes, identifying regions where the demand for seismic

shelters is high and adapting the product and marketing strategy to meet local needs.

• Strategic Partnerships: Establish strategic partnerships with governmental institutions, non-governmental organizations, and technology companies to expand the reach of the seismic shelter, ensure regulatory compliance, and gain access to additional resources for research, distribution, and marketing.

• Education and Awareness: Invest in public education and awareness campaigns about seismic risks and the importance of earthquake preparedness, highlighting the benefits of seismic shelters as an effective protection measure.

• Adaptation to Regulatory Changes: Monitor closely changes in safety regulations and standards and ensure that seismic shelters comply, anticipating market demands and ensuring long-term competitiveness.

• Development of Sustainable Business Models: Integrate sustainable practices at all stages of the product lifecycle, from design to production and distribution, to meet the growing demand for eco-friendly solutions and differentiate in the market.

• Financial Resilience: Implement robust financial management strategies to deal with economic fluctuations, minimize the impacts of increases in raw material costs, and ensure the financial stability of the business in the long term. These strategies provide a roadmap for the future of the seismic shelter, highlighting the importance of adaptation, innovation, and collaboration to address challenges and seize opportunities in the evolving market.

Finally, a potential strategy to be considered is a quick exit through the creation and sale of the seismic shelter patent.

5.3. Formulation of Strategies

From here, based on the information gathered on Benchmarking analysis and the Based on the SWOT analysis conducted, the company can develop specific action plans to leverage its strengths, mitigate weaknesses, explore opportunities, and address identified threats. These action plans are crucial for translating strategic analysis into tangible results and ensuring the success of the seismic shelter in the market. One of the key strategies is to capitalize on the significant risk reduction in case of building collapse. To achieve this, the company can launch targeted marketing campaigns highlighting the safety benefits of the seismic shelter compared to other existing solutions in the market. Through informative and educational promotional materials such as explanatory videos and brochures, customers can be made aware of the protection offered by the product. Another important aspect is reducing installation costs compared to widespread interventions. In this regard, the company can establish strategic partnerships with construction companies and material suppliers to obtain competitive prices and discounts on construction materials. Offering discounted installation packages can encourage customers to adopt the seismic shelter as an affordable and effective safety solution. Furthermore, it's essential to enhance the architectural integration of the product, ensuring it seamlessly integrates with the aesthetics of residences. Investing in research and development to improve the design and aesthetics of the seismic shelter can make it more appealing to customers who value the visual harmony of their living spaces. Customizing the product according to the specific dimensions of each residence is also an important strategy. By offering customizable and adaptable seismic shelters, the company can ensure seamless integration and maximize available space in each dwelling. These strategies aim to explore the opportunities identified in the SWOT analysis, such as business geographical expansion, technological innovation, and sustainability. At the same time, they aim to mitigate potential threats, such as raw material cost instability, regulatory changes, and competition from alternative products. Implemented effectively, these strategies can significantly contribute to the success of the seismic shelter in the market, ensuring the safety and protection of communities in earthquake-prone areas.

6. Limitations and Future Applications

This dissertation, although rich in detail in the qualitative analysis of the business model and marketing strategy of the developed seismic shelter, presents some significant limitations. The lack of concrete quantitative data represents a significant gap, as it hinders empirical validation of the conclusions drawn. While qualitative analysis provides valuable insights, the absence of specific statistics and performance metrics limits the robustness of the conclusions. Furthermore, the failure to conduct an objective sales study prevents a clear understanding of the commercial potential of the seismic shelter. Relying primarily on internal documents may also restrict the objectivity of the analysis, highlighting the need to include external and independent data sources to enrich the research. To overcome these limitations, future research should prioritize the collection of quantitative data, such as market surveys and sales data, and consider mixed approaches that combine

qualitative and quantitative analyses to achieve a more comprehensive and reliable understanding of the subject. This approach will enable a more balanced assessment and provide a solid foundation for strategic decisions and innovations in the field of seismic shelters.

7. Conclusion

This dissertation focused on the comprehensive analysis of the development and viability of an innovative seismic shelter, exploring its conception, implementation strategy, and market potential. Initially, a literature review was conducted to contextualize the importance of seismic shelters, emphasizing the need for effective solutions in natural disaster protection. Subsequently, various business models and strategic tools were examined to understand the most appropriate practices in formulating business strategies, as well as to identify opportunities and threats in the market.

Strategic analysis played a crucial role in this dissertation, enabling a robust and systematic evaluation of the market and the potential of the seismic shelter. Market analysis identified similar products and assessed sector trends, revealing gaps and opportunities that SHELTER could exploit. The implementation of the Canvas business model provided a clear and structured view of the business model. Through SWOT analysis, the strengths, weaknesses, opportunities, and threats associated with the seismic shelter were identified. This tool proved to be fundamental for defining future strategies, highlighting the product's competitive advantages. Based on strategic analysis, several future strategies were outlined for the seismic shelter. One of the main recommendations was the possibility of rapid sale and patenting of the product, enabling quick capitalization of investment and risk mitigation. Another strategy involved establishing strategic partnerships with governmental entities and non-governmental organizations, expanding the product's reach, and reinforcing its credibility and social impact. Despite the significant contributions of this dissertation, its limitations, such as the lack of quantitative data and an objective sales study, need to be recognized. For future research, empirical and quantitative studies are recommended, as well as analysis of real sales data after product implementation in the market.

In summary, this dissertation contributed to a comprehensive understanding of the development and viability of SHELTER through a well-structured and grounded strategic analysis. The recommendations and strategies outlined provide a clear path for the implementation and success of the seismic shelter in the market, offering an innovative and necessary solution for protection against natural disasters.

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