Use of timber in elevator doors

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ABSTRACT

TIMBER TECH, a startup, aims to revolutionize elevator door design by using new material technologies to create timber elevator doors instead of conventional carbon steel doors. These doors will be made from responsibly sourced wood near well-managed forests. The company's primary focus is on designing and selling these timber doors to elevator companies (a B2B business). The adoption of timber doors offers benefits such as reduced carbon footprint, support for the circular economy, energy efficiency and the lighter weight of the door will make it easier for elevator companies to comply with EU OSHA regulations.

The demand of elevators in Europe was 145.400 units in 2022. Being the average numbers of stops or floors in Europe 4.5 per building, means that the specific demand of elevator doors was 654.300 units in 2022. That is the main potential market of timber elevator doors. In addition to this, there are 6.622.000 elevators in use in Europe which represents a potential market of doors replacement of 29.8 Million units [9].

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INTRODUCTION

1.1. Overview

The product I propose refers to the use of new material technologies to produce elevator doors made of timber instead of carbon steel doors.

TIMBER TECH is a start-up specialized in the design and distribution of elevator doors made of timber. The company will be located near responsibly managed forests[1] and wood, which will be the main source of raw materials for the doors. It is therefore a B2B business in the elevator industry.

The use of new material technologies to produce elevator doors made of timber will reduce the carbon footprint of producers by using more sustainable processes and raw materials and will be a more environmentally friendly choice for end customers. The use of lighter materials will also have an impact on energy consumption and significantly affect the building's energy savings. The wood used to produce timber will come from responsibly managed forests that do not contribute to deforestation. Unlike traditional steel doors, elevators doors made of timber will promote the circular economy and the regeneration of nature.

1.2. Scenario

The history of elevator doors for lifts is directly linked with the development of elevators themselves. Elevators have been around for centuries but it wasn't until the mid-19th century that they became a practical means of vertical transportation in buildings [1]. The invention of electric elevators in the late 19th century brought about significant changes. As elevators became more automated, the need for reliable door mechanisms grew [2]. Some of the more notable advancements are linked to safety features that prevent accidents and enhance passenger security [3]. As technology advanced, modern elevator doors became faster and more efficient, necessitating robust and reliable door mechanisms. In summary, the journey from manually operated gates to sophisticated electric doors has transformed vertical transportation, making elevators safer, more efficient and an integral part of our daily lives [4]. Today, elevator doors play a critical role not only in safety, but also in energy consumption and user experience.

1.3. Presentation of the problem

1.3.1. Global warming

Figure 1 shows that 73.2% of greenhouse gas emissions are due to Energy use. More precisely, 24.2% correspond to Energy used in Industry, 17.5% to Energy use in Buildings and 16.2% in Transportation [5]. Understanding that a significant portion of greenhouse gas emissions (73.2%) is attributable to energy use highlights the critical role of transitioning to cleaner and more sustainable energy sources. This data underscores the importance of initiatives such as increasing renewable energy deployment and improve energy efficiency across industry, energy in buildings and transportation.

[1] Spain has 28.3 million hectares of forests and other wooded areas [20]

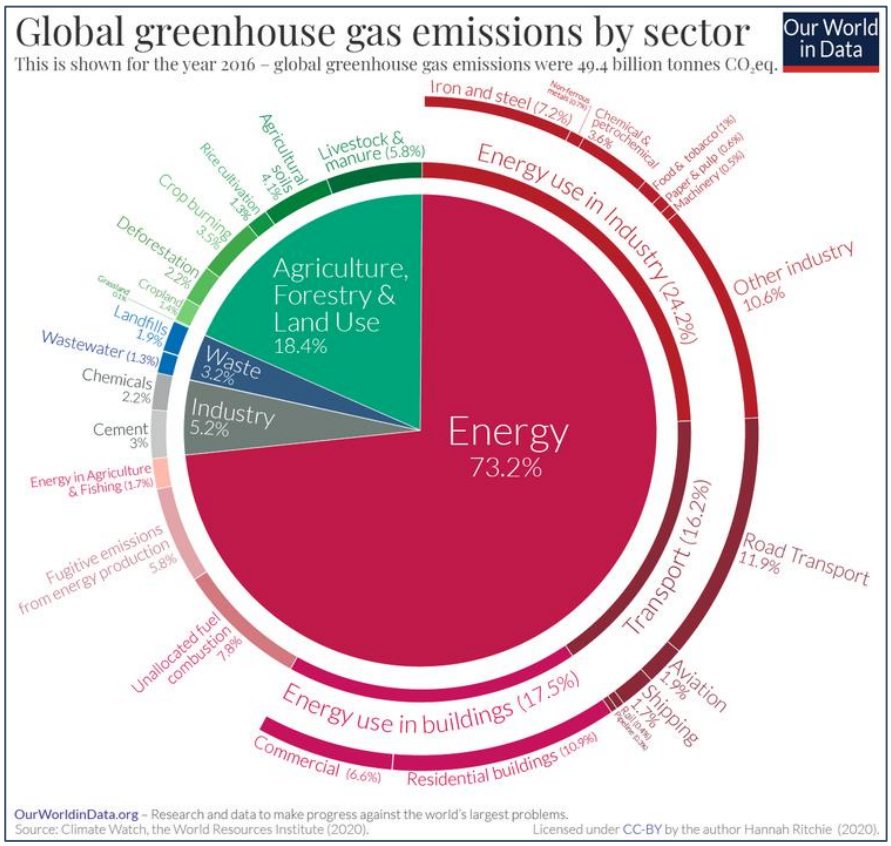


Figure 1: Global greenhouse gas emissions by sector.

Carbon footprint of steel is 1.4 tons per produced ton of steel according to the International Energy Agency, and 1.85 according to Mckinsey and the World Steel Association. Meanwhile, for every dry ton of manufactured timber, around 3.7 tons of CO2 is removed from the atmosphere [6] [7]. In contrast to steel production, the production of timber has a carbon-negative impact, meaning it removes carbon dioxide from the atmosphere. Recognizing that the production of steel results in a significant carbon footprint highlights the importance of reducing emissions associated with steel production.

European forests remove some 400 million tons of CO2 annually – equalling around 10% of EU total emissions [8]. The fact that these forests remove approximately 400 million tons of CO2 annually is significant, as it represents a substantial portion of the EU's total emissions. This natural carbon sequestration process helps offset human-induced emissions and contributes to efforts to combat climate change.

Furthermore, the benefit of CO2 storage in finished wood products adds around another 50 million tons [8]. The additional benefit of storing carbon in finished wood products further enhances the role of forests in carbon mitigation. When timber is used in construction or manufacturing, the carbon stored in the wood remains locked away for the duration of the product's lifespan. This extends the carbon sequestration function of forests beyond their standing biomass.

The combined impact of forest carbon sequestration and carbon storage in wood products not only helps reduce overall emissions but also aligns with the EU's climate goals. By acknowledging the substantial contribution of forests to carbon mitigation efforts, politicians and stakeholders can prioritize forest conservation, sustainable forest management practices and the promotion of timber as a renewable and low-carbon building material. This underscores the potential of using timber as a sustainable building material and encourages the use of sustainably sourced timber in construction projects to help sequester carbon and mitigate climate change.

1.3.2. **Elevator market**

Target customers for elevator doors typically involves multiple parties, being elevator OEMs (Original Equipment Manufacturers) and kit suppliers the largest group of target customers. Additionally, maintenance

elevator companies and third parties like consultants, building owners and architects may have a say and influence the decision of elevator suppliers.

OEMs suppliers design, produce and install elevator systems meanwhile kit suppliers only sell complete elevators, both segments include the doors among their portfolios. They offer a range of door options to suit different building configurations and aesthetic preferences. Elevator manufacturers work closely with building owners and consultants to understand their requirements and provide customized solutions.

There are about 4.000 elevator companies in Europe considering OEMs, kit suppliers and maintenance companies that also provide modernization of existing lifts. OEMs must be prioritised since they control about 65% of the European market, they are the ones who lead the changes. OEMs with leading presence in Europe are:

Schindler (Switzerland) *Source: Schindler website.*	Kone (Finland) *Source: Kone website.*
OTIS (United States) *Source: OTIS website.*	TK Elevator (Germany) *Source: TK Elevator website.*
Orona (Spain) *Source: Orona website.*	

Figure 2: European OEMs.

With regards to kit suppliers, although there are not official figures, some of them relevant ones are:

- Kleemann Lifts (Greece)
- MP Lifts (Spain)
- Raloe (Spain)
- Orona (Spain)

These two segments have specific needs which are:

- High quality products, easy to install and maintain, competitive price, fulfilling Code standards and covering wide range of applications.
- Improve installability by the use of lighter products easy to handle and easy to install.
- Reduce the carbon footprint by using more sustainable processes and raw materials that allow the companies to apply for tax incentives, subventions and exemptions related to the CO2 reduction.

Another segment includes the maintenance companies. Although not directly involved in the initial sale and installation, maintenance companies may be engaged by building owners to provide ongoing servicing and repairs for elevator doors. Regular maintenance is essential for ensuring the smooth operation and safety of elevator systems, including the doors. In some cases, specialized installation companies may be contracted specifically for installing elevator doors. These companies have expertise in handling elevator components and may work in collaboration with elevator manufacturers or contractors to ensure smooth and efficient installation. Building owners normally take into consideration the recommendations and suggestions of such companies, because they can contribute to the reduction of cost of elevator maintenance by reducing breakdowns and use of spare parts.

Building owners, consultants and contractors are another large segment although they are not directly involved in the process to select the elevator door manufacture. Building owners or sometimes property managers and consultants are often the primary decision-makers when it comes to purchasing elevator as complete systems. They are responsible for evaluating proposals, selecting the type of elevator that best fit their building's needs and budgeting for the installation. Contractors on the other hand oversee the physical installation, ensuring that the elevators are properly fitted and integrated into the building according to general plan and safety standards. They all share the same goal of reducing installation time, reducing energy consumption, and ensuring high quality standards over the life cycle of the elevator.

1.3.3. **Positioning on TIMBER TECH**

As commented before, timber elevator doors are a sustainable solution because its contribution to carbon footprint reduction. Timber is a renewable resource, and its production involves less energy compared to carbon steel. By choosing timber, we reduce the reliance on energy-intensive materials thus minimizing the overall carbon footprint of elevator systems. Timber is part of a circular economy, and it can be harvested sustainably. Responsible timber management ensures that forests are regenerated, supporting biodiversity and ecosystem health. Timber doors are lightweight, which positively impacts elevator energy consumption.

In this context, TIMBER TECH's product stands out due to its disruptive technology and environmental benefits. Currently, no other timber-based elevator doors exist in the market, placing TIMBER TECH in a category like a monopoly[2] for this specific product. This differentiation gives TIMBER TECH a competitive advantage over other sellers of steel-based doors. The company's focus on sustainability and natural materials resonates with environmentally conscious customers.

Moreover, TIMBER TECH can eventually achieve some control over pricing within a specific range. The distinctiveness of its product allows for flexibility in pricing, even within the context of monopolistic competition. However, to successfully commercialize this innovative product, an accurate Business Plan must consider raw material costs, transformation expenses, operational costs, profit forecasts and effective marketing strategies.

[2] See point 3.2.5. Substitutes.

TIMBER TECH could use the advantages of blockchain in terms of Supply Chain Management. Blockchain can be used to track the movement of goods from origin to destination, ensuring transparency and efficiency. Therefore, we could guarantee that wood used to produce timber doors comes responsibly managed forests. That would give a seal of authenticity to the product, reinforcing the message of CO2 footprint reduction. This is not only the key marketing argument for the product, but it also ensures that customers can access the tax benefits linked to such innovation.

The main threat of the use of blockchain is that records of movement of goods are faked and that wood used is not coming from responsibly managed forests. Blockchain however has some relevant features:

- Decentralized: there's no single authority controlling the information. A network of computers maintains the record book together.
- Distributed: copies of the blockchain are stored on multiple computers across the network. This makes it very secure and resistant to hacking or data loss.
- Immutable: once a record is added to a block, it cannot be changed or deleted. This ensures the accuracy and trustworthiness of the data.

To address the aforementioned threat, TIMBER TECH should implement regular audits of its timber suppliers. These audits would verify the source of the wood and ensure compliance with agreements with forest owners, guaranteeing sustainability throughout the entire process. Implementing such technology strengthens some of its key arguments. This reinforcement ultimately contributes to the overall strength of the Business Model itself.

1.4. Main difficulties of the feasibility study

1.4.1. External technical advisors

One key risk identified in the feasibility study is the potential lack of sufficient evidence on the compliance of timber doors with European standards, based on current research on timber and fire retardants. If this is the case, significant additional R&D investment would be required to investigate the project's viability. These costs could be substantial, exceeding the estimates in a potential Business Case and potentially jeopardizing the project's ROI and overall viability. In such a scenario, incorporating a "technological advisor" could be a valuable strategy. This advisor could function similarly to an accelerator, helping us overcome the aforementioned technical challenges. Here's a specific example of such a company:

- CETEM: https://cetem.es/quienes-somos/
- CETEMAS: https://www.cetemas.es/cetemas/
- HUB FORESTAL: https://www.ctfc.cat/

1.4.2. Main aspects to assess

It is crucial to analyse and collect data on the specific reduction in carbon emissions of timber elevator doors compared to steel ones and how fire retardants can be applied in the process of producing timber doors. This will not only provide marketing arguments for the promotion of products but will also be used as a disruptive argument for door producers to adopt the use of new material technologies.

Carbon emissions: Cross-Laminated Timber or CLT, is a lightweight material made by cross-crossing sections of wood and bonding them with glue. However, CLT has a strength-to-weight ratio comparable to concrete, making it suitable for various types of construction. As trees grow, they absorb carbon dioxide (approximately 1 tonne CO_2/m^3) from the air and when CLT is used in buildings [21], the carbon stored in the wood remains locked up for decades or even centuries. A review of 27 studies found that CLT could lower carbon emissions in large buildings by roughly 40 percent compared to traditional materials [11].

By replacing steel and concrete with timber products, embodied carbon can be reduced by up to 75% [12]. A study comparing the CO_2 intensity (tons of CO_2 emissions per dollar of output) found that [13]:

- Lumber production has about 20% less CO_2 intensity than fabricated metal products (such as steel).
- It is under 50% of the CO_2 intensity of iron and steel.
- It is under 25% of the CO_2 intensity of cement.

Fire retardants: Fire retardants play a crucial role in enhancing the fire resistance of timber doors. Some of the already established methods for applying fire retardants during the production process are:

- Coating application by means of chemicals that can be sprayed or brushed onto the wood surface. The coating is allowed to dry over multiple days or can be placed in a drying machine [14] [15]. This method is effective and maintains the original qualities of the substrate.
- Pressure impregnation is a process in which the fire retardant is forced into the wood fibers under pressure. The wood absorbs the chemical, providing long-lasting protection. Pressure impregnation ensures uniform distribution of the fire retardant throughout the timber [14] [15].
- Nano-Scale fire retardants consists of coatings containing fire retardant nanoparticles which enhance the material's fire resistance without compromising its appearance or properties [16].
- Intumescent coatings expand when exposed to heat, forming a protective char layer. These coatings are commonly used for interior applications where aesthetics matter. They provide passive fire protection by delaying ignition and slowing flame spread [17].

Today, there are already treatments for timber that improve fire safety in accordance with European standards [10]. Because of wood's inherent flammability, elevator companies may be hesitant to introduce such a product to their customers (building owners, contractors and architects). Therefore, it's crucial to directly approach this segment to promote the product's benefits and highlight the compliance of the product to the European Lift standards.

2. BUSINESS ORGANIZATION

2.1. Description of the business

The proposed name of the company is TIMBER TECH, while the product's name is ESSENTIA. The activity is the design, manufacture, and sale timber doors to elevator companies.

2.2. Ownership & Principals

- Owner: To create a new legal entity through a joint venture with an existing elevator door manufacturer. The reason for this is that part of the concept of manufacturing elevator doors from timber is disruptive and completely different from the current process of manufacturing steel doors for elevators. Another part relates to certification, regulatory compliance, promotion and sales,

where knowledge and experience will help the new company overcome difficulties that are not obvious or known at the beginning of the process.

- Ownership: Both shareholders will keep equal rights over the control and financial interest in the business.
- Responsibilities: Establish a competent executive management with a strategic vision, delegate responsibilities to a group of managers with high knowledge and capabilities and ensure that the company becomes more effective and efficient. This professionalization must allow TIMBER TECH to act rationally in the face of external risks or internal risks that may eventually lead to a rethinking of the organizational model. It must also help the company to face opportunities such as potential new business, sudden changes in demand, needs to outsource or automate processes. The target must be to create and implement a flexible organization that brings added value to the processes and is transparent for all parties including employees, customers, and owners.
- Principals:
  - CEO: responsible for strategy, operations, and financial goals.
  - Product Manager: defining product vision and success criteria based on customer needs and objectives.
  - Sales & Marketing Manager: responsible for marketing opportunities, sales plans and maintaining client relationships.
  - Operations Manager: manages labour, productivity, quality control and safety in the Operations.

2.3. Legal Form

Company's main organigram showing the principals and the secondary activities' responsible parties.

Established in Spain, a "Sociedad Limitada" with two shareholders, myself and the manufacturer of the doors with 50% of the share capital. The initial capital should be on the level of 50.000€ because although there is no relevant investment in machinery or stock, we need to think about operating costs such as rent, salaries and equipment. This should be analysed and detailed in a further Financial plan.

2.4. Organizational chart

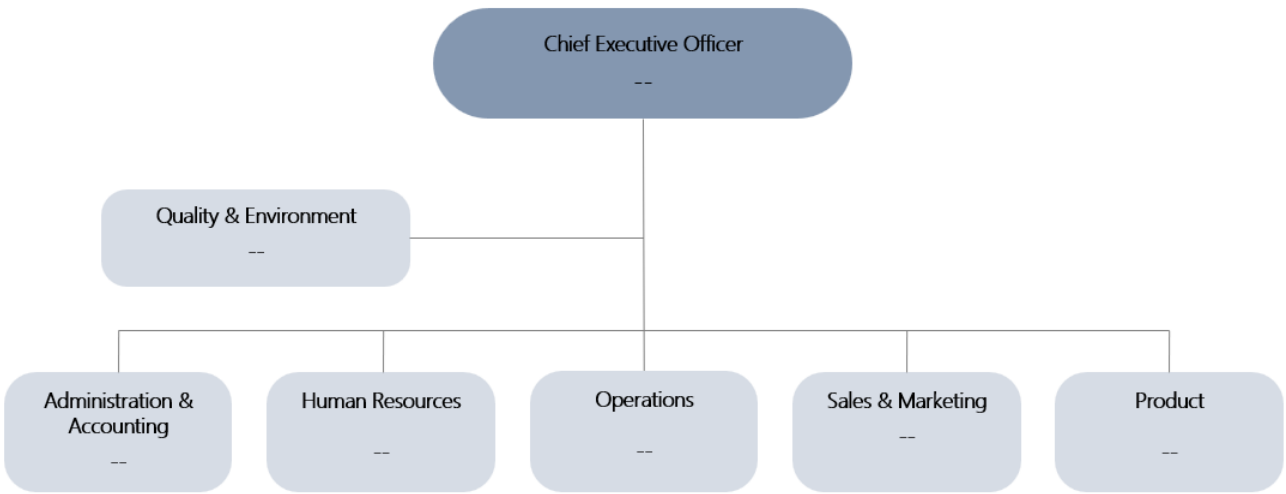


Figure 3: Company's main organigram.

Non-key activities such as Administration & Accounting, Human Resources, and Quality assessments will be outsourced, and the expenses are included in the Financial analysis (Point 7).

2.5. Products and services

The main activity will involve designing, manufacturing, and selling timber doors to elevator companies. In new elevators installed within new buildings, the level of service required for elevator doors is less time-consuming. Building and elevator companies typically use standard drawings based on elevator capacity and type (e.g., 630 kg, 8 persons, 1.0 m/s, Machine Room Less). In such elevators, door types and dimensions are standardized, and elevator companies already possess the necessary information to provide quotes to their customers, including all data related to elevator doors.

However, there exists a substantial potential market for replacing elevator doors in existing elevators to adapt them to current norm requirements, because of malfunction of existing doors or because of aesthetic reasons. As previously mentioned, this potential market comprises 29.8 million units. For these existing elevators, the level of service required will be significantly higher. This is because these elevator doors will be installed in old buildings that employed different construction techniques and protocols. Replacing the existing doors with new timber doors may prove challenging. Therefore, providing expert services will be crucial to facilitate the replacement process beyond the inherent advantages of timber doors.

3. MARKET ANALYSIS

3.1. PESTLE analysis

3.1.1. Political Factors

- Government stability: in Spain and generally across Europe, there exists political stability that inspire confidence in business investments. All countries, with the exemption of Ukraine due to the invasion by Russian Federation, operate under democratic electoral systems, ensuring political stability.
- Trade: well-established and regulated domestic sales, imports, and exports of products and services exist. International business transactions are also well-managed.
- Labour: EU countries have labour laws in place to ensure stability in employment regulations and workforce management.
- Corporate taxation: the standard corporate income tax rate in Spain is 25%. Newly created companies can benefit from a reduced tax rate of 15% for the first two years of taxable profits.

3.1.2. Economic Factors

- Market potential: in addition to the previously mentioned market potential, Europe's level of urbanization is expected to increase to approximately 83.7% by 2050 [23]. Trends in the total population of the EU27 and the UK from 1961 to 2018 reveal a decline in the share of the population living in rural areas relative to the total population. Meanwhile, towns and cities have experienced a smooth and constant increase [23]. This urbanization trend benefits the potential sale of elevators due to the vertical growth of cities.
- The installation of new elevators is closely linked to the construction of new buildings, so market variations directly impact the potential sale of elevator doors. On the other hand, the modernization of existing elevators is often unavoidable due to their age and specific plans to upgrade safety and/or reduce energy consumption in buildings will further promote the adoption of timber doors for existing elevators.

- GDP Growth Rate: The real GDP growth rate in percentage of the EU27 from 2007 to 2022 has been consistent at around 1-3%, except for two major negative peaks. In 2009, the rate dropped to -4% due to the financial crisis, and in 2020, it fell to -6% because of the COVID-19 pandemic. These declines led to a rebound effect in 2021, with an increase to a 6% real GDP growth rate [28].
- Inflation rate: the average inflation rate in Spain from 2007 to 2022 was approximately 1.80%. There were two major negative peaks of -0.3% in 2009 and 2020, which led to a rebound on the positive side [28].
- Interest rate: as of 2024, the Main Refinancing Operations interest rate for Spain, as set by the European Central Bank (ECB), is 4.50% [29].
- Unemployment rate Spain 2007-2022:
    - 2007: 8.3%
    - 2013: peak at 26.1% due to the financial crises.
    - 2019: decreased to 13.8% during economic recovery.
    - 2020: increased to 15.5% due to the COVID-19 pandemic.
    - 2022: decreased to around 12.9% as the economy recovered post-pandemic [28].

3.1.3. **Social Factors**

- Change in customer attitudes: there has been an increase in climate change awareness among the population, particularly among the final users of elevators. Consequently, it is crucial for elevator manufacturers and suppliers to align their product values with customer preferences.
- Challenging installation jobs: elevator installation jobs can be demanding due to the working conditions in building construction, tight elevator shafts and the handling of heavy metal components. Timber doors offer a solution to this problem because doors are significantly lighter than traditional carbon steel doors, making them easier to handle during installation. Reduced weight minimizes strain on workers, improving the overall installation experience.
- Aesthetics: timber doors enhance the overall look of an elevator, creating a more pleasant ambiance for passengers and evoke a sense of being close to nature. Passengers can appreciate the natural warmth and beauty of timber, enhancing their overall elevator experience.

3.1.4. **Technological Factors**

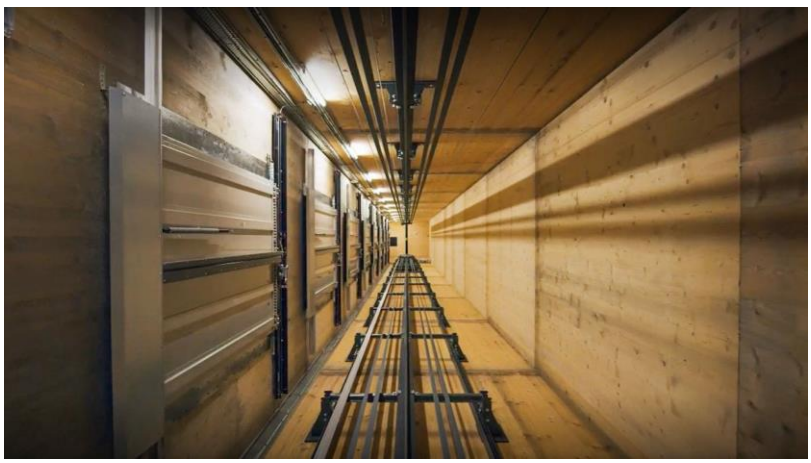
- Design engineering and 3D CAD modelling software: the uses of latest technologies in the design and modelling can represent a relevant saving in terms of cost of tests by better simulating the performance of the designed doors before running a complete set of mechanical and/or fire tests.
- Manufacturing technology: several technologies have evolved with the purpose of adapting and customizing wood's characteristics to the demands of modern design and construction. From thermal modification to engineered wood or versatile particle boards, these methods not only enhance wood's suitability for the rigors of contemporary architecture but also expand the usability of this sustainable material [24].
- Blockchain: proper implementation and functioning of blockchain technology will allow the company to guarantee that the wood used for timber doors comes from near-by responsibly managed forests. This authenticity seal reinforces the message of reducing the product's CO2 footprint.

3.1.5. **Legal Factors**

- Regulatory compliance: adhering to EU regulations and safety standards is essential. Timber doors must comply with specific norms such as Directive 2014/33/EU related to lifts and safety components [18], as well as the Elevator Standards EN 81-20/50:2014 [19]. Timber doors must ensure sufficient fire protection according to EN 81-58:2022, which addresses fire resistance tests.
- Emissions trading system: the EU already established Emissions Trading System (ETS) on CO2 emissions. There are taxes on emissions, as well as tax incentives, subventions and exemptions related to the CO2 reduction [30].

3.1.6. **Environmental Factors**

- Environmental regulations: EU citizens benefit from some of the highest environmental standards globally. The EU, along with national governments, has set clear objectives for European environmental policy until 2020 and envisions a greener, resource-efficient, and low-carbon economy by 2050. These goals receive support through dedicated research programs, legislation, and funding. The EU's proactive environmental policies create a favourable framework for companies promoting green products, such as timber doors.
- Sustainability: elevator components manufacturers must focus on sustainable practices and reduce their environmental impact and CO2 footprint.
- Supply chain: the COVID-19 pandemic and the global supply chain crisis highlighted the need for resilient supply chains and domestic production capabilities to reduce dependency from long-distance suppliers.



Picture 4: elevator shaft made of timber. Source: Schindler's website.

3.2. **Porter's 5 Forces**

3.2.1. **Suppliers**

- Key suppliers are the ones of timber and the fire retardants on a second level.
- Competent suppliers: according to the AEIM (La Asociación Española del Comercio e Industria de la Madera), there are around 140 companies in Spain involved in the distribution, manufacture and representation of wood products [25].
- Alternative suppliers: as the company focuses on using wood from nearby, responsibly managed forests, the alternative suppliers are included in the list of available suppliers of wood products in Spain.

- Change of suppliers: I don't foresee any relevant costs for changing timber suppliers, as they are all geographically located in Spain and their working methods and culture should not be very different. The fact that wood products must comply with EN standards depending on their use makes it easier to obtain data sheets and compare product characteristics of different suppliers.

3.2.2. **Customers**

- Potential buyers in the elevator industry: There are about 4.000 elevator companies in Europe considering OEMs, kit suppliers and maintenance companies that also provide modernization of existing lifts.
- Turnover concentration: Elevator OEMs control about 65% of the European market and they are the ones who lead the changes. This 65% is in Europe controlled by five companies: Schindler (CH), Kone (FI), OTIS (US), TK Elevator (DE) and Orona (ES). If one of these companies would implement timber doors in their portfolio, the revenue would significantly increase.
- Size of the orders: the standard order of elevator doors in Europe comprises 1 door for the cabin and 4/5 doors for the landings or floors.
- Change of seller: as far as there are no timber elevator doors producers, there is no alternative to TIMBER TECH. However, there are substitute products[3].

3.2.3. **Competitive Rivalry**

- Number of competitors: non in terms of timber elevator doors. However, there are substitute products[4].
- Product positioning: The use of timber to produce elevator doors.
- Elevator industry growth: The urbanization growth in towns and cities benefits the potential sale of elevators due to the vertical growth of cities.

3.2.4. **New Entrants**

- New competitor or startup in the market: entering the elevator door market would likely involve significant initial investment in research, development, marketing analyses, test and qualification, and compliance testing to ensure that the timber doors meet regulatory standards such as Directive 2014/33/EU, EN 81-20/50:2014 and EN 81-58:2022. Additionally, establishing manufacturing facilities and distribution channels would require further investment. The time to enter the market would depend on various factors such as:
    - Financial resources.
    - Complexity of design of the doors.
    - Compliance approval.
    - Manufacturing setup.
    - Stablishing a competent team.

  It could take several years (5 to 10 years) for a new competitor or startup without previous experience in the elevator door market, to develop and launch a competitive product. In the meantime, it could take much less time (2-4 years) for an existing elevator company to introduce

[3] See point 3.2.5. Substitutes.

[4] See point 3.2.5. Substitutes.

timber doors to replace the existing steel doors. Established companies may, additionally, have brand recognition and existing customer relationships that provide them with a competitive advantage. TIMBER TECH, due to the partnership with an elevator door manufacturer, would be within the range of 2-4 years to develop timber doors as described in the project.

- Customer loyalty: customer loyalty in the elevator industry is strong due to factors such as reliability, safety and long-term relationships with established elevator companies. The fact that elevator doors are part of a larger system (elevator) and that liability for the entire system rests with the elevator company and its maintenance teams makes it difficult for competitors to introduce their products. However, if a new competitor can offer significant benefits such as lower cost, higher performance or sustainability, it may be able to lure customers away from existing products.
- Additional barriers: several barriers to entry exist in the elevator door market, including regulatory compliance requirements, intellectual property protection on various components, access to distribution channels and establishing credibility and trust with customers. A failure in the elevator door system can lead to major accidents resulting in the deaths of its users.
- Elevator industry structure: the European elevator industry is formed by various stakeholders involved in the design, manufacturing, installation, maintenance, and servicing of elevators and related equipment.
    - Industry Structure:
        - Manufacturers: companies engaged in designing and producing elevators and their components (wholly or partially).
        - Installation and maintenance firms: these entities install elevators in buildings and provide ongoing maintenance and repair services. Their workforce are service technicians which are skilled professionals responsible for maintaining, inspecting, and repairing elevators.
        - Consultants: experts who offer advice on elevator design, safety, installation requirements, environment and sustainability, durability, and compliance with regulations.
        - Regulatory bodies: government agencies and industry associations that establish safety standards, codes, and regulations.
        - Building owners and property managers: they play a critical role in deciding the elevator brand, thus the safety and compliance within their properties by selecting reliable and well-established elevator companies.
    - Regulation and safety standards:
        - Lifts Directive (2014/33/EU): This directive ensures the free circulation of lifts and safety components within the EU market while maintaining a high level of safety for users and maintenance staff. It governs the design, manufacture, and installation of lifts [18].
    - European Harmonized Standards (EN 81-20 and EN 81-50):
        - These standards aim to enhance accessibility, safety, and comfort for lift passengers and maintenance personnel. They also stipulate requirements related to building design and interface. The European Committee for Standardization (CEN) regulates both EN 81-20 and EN 81-50 [19].
    - Safety Focus: European regulations emphasize safety features such as door detection systems, car door locking mechanisms, fire classification for elevator door materials, and strength requirements. Compliance with these standards ensures reliable and efficient elevator systems across Europe.

- Protection of key technology: the protection of key technology (timber doors) would be critical to protect the innovation from a new entrant in the elevator door market. This could involve securing patents for innovative designs and/or manufacturing processes. Additionally, ensuring the authenticity of responsibly sourced wood through blockchain technology could be a key differentiator and a form of intellectual property.

3.2.5. **Substitutes**

- Substitute products: timber elevator doors intend to replace traditional elevator doors made of steel. The timber doors will then act as a substitute for the existing products. Besides steel doors, sometimes glass doors are used, specially in high-end buildings.
- Products similarity: from a functional point of view, there are no significant differences between carbon steel doors and timber doors. However, timber is lighter, which reduces the moving mass and thus the energy required to open/close the doors, which ultimately reduces the energy consumption of the building. The density of carbon steel is 7.85 gr/cm³, while the density of timber is around 0.60 gr/cm³ [26], depending on the type of wood (pine, hemlock, spruce or chestnut) and specific batch. The final design of the timber door and the thickness of the timber boards will define its final weight.
- Product positioning: wooden doors enhance the overall appearance of an elevator, create a more pleasant ambience for passengers and convey a feeling of closeness to nature. Timber has a natural warmth and beauty that enhances the passenger experience.
- Product cost: cost of carbon steel is 0,65 €/Kg in April 2024. Considering that the weight of steel door is about 75 Kg, the cost of steel per door is about 59 €, including 20% of scrap [Source: Tecnolama S.A.]. Cost of timber LTC is 540 $/1000 board feet on April 6th 2024 [27]. That is :
    - 540 USD → 0,9396 USD/EUR → 507,38 EUR

  I now calculate the weight of a board feet in Kg:
    - 1 bord feet equal to,
    - 144 cubic inches → 365,76 cubic centimeters → 0,00036576 cubic meters
    - 600 Kg/m³ density timer
    - 1,42 Kg

  So the cost of a board foot is:
    - 507,38 EUR / 1.000 board foot → 0,51 EUR

  And the cost per kg is:
    - 0,51 EUR x 1,42 Kg → 0,36 EUR/Kg

  This means a saving of about 80% of the raw material cost compared to the steel used for an elevator door. However, the cost comparison must be based on the final weight of the door, as the material thickness of wooden doors is significantly greater than that of steel doors in order to achieve the same mechanical strength and fire resistance. Normally, the thickness of a steel door is about 1 to 1.5 mm steel. Therefore, make the following assumptions to compare the weight and cost of timber doors with steel doors:



Picture 5: parts of an elevator door. Source: Tecnolama, S.A.

- Assumption 1: The thickness of timber is **20** times that of steel:

Panels

Height (m)	2,1						
Opening (m)	1	2,1	m2	Weight		Cost	
Thickness (m)	0,02	0,042	m3	25,2	Kg	9,03	€

Jamb x 2

Height (m)	2,3						
Opening (m)	0,35	0,805	m2	Weight		Cost	
Thickness (m)	0,02	0,0161	m3	9,66	Kg	3,46	€

Header

Height (m)	0,2						
Opening (m)	1	0,2	m2				
Thickness (m)	0,02	0,004	m3	2,4	Kg	0,86	€
Total				37,26	Kg	13,35	€
Comparison				-50%		-77%	

- Assumption 2: The thickness of timber is **40** times that of steel:

Panels

Height (m)	2,1						
Opening (m)	1	2,1	m2	Weight		Cost	
Thickness (m)	0,04	0,084	m3	50,4	Kg	18,06	€

Jambs

Height (m)	2,3						
Opening (m)	0,35	0,805	m2	Weight		Cost	
Thickness (m)	0,04	0,0322	m3	19,32	Kg	6,92	€

Header

Height (m)	0,2						
Opening (m)	1	0,2	m2				
Thickness (m)	0,04	0,008	m3	4,8	Kg	1,72	€
Total				74,52	Kg	26,70	€
Comparison				-1%		-55%	

- Assumption 3: The thickness of timber is **50** times that of steel:

Panels

Height (m)	2,1						
Opening (m)	1	2,1	m2	Weight		Cost	
Thickness (m)	0,05	0,105	m3	63	Kg	22,57	€

Jambs

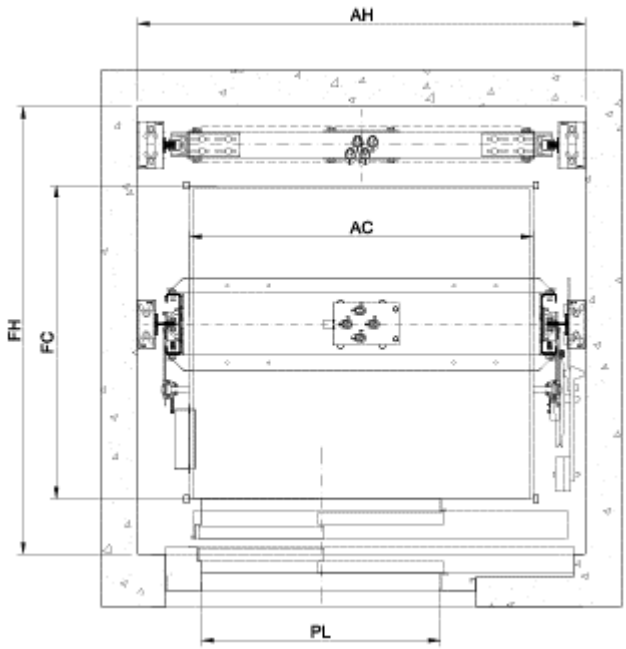
Height (m)	2,3						
Opening (m)	0,35	0,805	m2	Weight		Cost	
Thickness (m)	0,05	0,04025	m3	24,15	Kg	8,65	€

Header

Height (m)	0,2						
Opening (m)	1	0,2	m2				
Thickness (m)	0,05	0,01	m3	6	Kg	2,15	€
Total				93,15	Kg	33,38	€
Comparison				24%		-43%	

According to the assumptions made, the thickness of timber panels would have to be just under 4 cm (40 times the thickness of steel sheets used in the construction of steel elevator doors) for wooden doors to meet the requirements of being lighter than steel while providing the required mechanical strength and being a comparable solution in terms of cost for elevator companies.

- Cost of switching to a substitute product: the cost of switching from steel doors to timber doors depends on several factors, such as:
  - Overall door dimensions: as doors must fit into standardised shaft dimensions, an important aspect of timber door design is to maintain the overall dimensions of steel doors as much as possible. If timber doors are larger (overall height, width or depth), elevator companies are forced to change the floor plans, which means additional costs for them.
  - Standards: as elevator doors are subject to different standards, wooden elevator doors must comply with the same standards so that the elevator company does not have to change the technical specifications of the elevator when applying for the EU Declaration of Conformity. That would represent an extra-cost for the elevator company.



Picture 6: layout of an elevator. Source: Raloe Mediterráneo, S.L.

  - Project specifications: One of the documents an elevator company must provide to the building owner or contractor upon acceptance of an elevator is a bill of materials of the components, which lists the raw materials used, manufacturers, technical specifications and

other relevant information. Switching from carbon steel doors to timber doors has a corresponding impact and forces elevator companies to change their project specifications. These costs are unavoidable.

- Cost: these costs are related to the labour costs of updating documentation, which are relatively low compared to the selling price of an elevator. Estimate:

Cost of changing product for an elevator company.

	Door dimensions	Standards	Project specifications
1. Engineer cost (25€/hour)	20 hours	10 hours	4 hours
2. Cost of the change	500 €	250 €	100 €
3. Average selling price elevator residential	12.500 €		
4. Cost impact on one elevator	4%	2%	0.8%
5. Possibility to use the modifications on multiples sales	Yes	Yes	Yes

Table 7. Source: Orona elevator and Tecnolama, S.A.

Based on the analysis of costs, it can be stated that the costs to switch from carbon steel to timber doors and vice versa, are not significantly high.

- Became a substitute product: the most used door for elevators nowadays and at worldwide level is the carbon steel door. Here a comparison of both products:

Comparison table of steel and timber doors.

Criteria	Steel doors	Timber doors
1. Material	Carbon steel	Timber
2. Carbon footprint	Higher	Lower
3. Circular economy	Not specifically mentioned	Supported
4. Weight	Higher density. Total weight 70 Kg	Lower density. Total weight will depend on its design
5. Compliance with EU OSHA regulations	Compliance may require additional measures like increasing number of technicians to handle parts on site	Likely compliant due to lighter weight.
6. Fire protection	Typically fire-rated	Must ensure sufficient fire protection
7. Energy efficiency	Depends on insulation properties. Steel has very low thermal insulation properties if compared to wood.	Likely energy-efficient due to lighter weight and the natural thermal insulation of wood.
8. Cost	0,65 €/Kg	0,36 €/Kg
9. Market potential in Europe	Replacement market: 29.8 Million units	Same

10. Compliance with Industry norms	Generally compliant	Must pass mechanical tests and meet industry norms
11. Verification of responsibly sourced raw material	Not applicable	Important for authenticity seal, supported by blockchain technology

Table 8. Source: Tecnolama, S.A. and own data.

3.3. S.W.O.T. analysis

3.3.1. Strengths

- Environmental sustainability: significant reduction of the carbon footprint associated with steel doors construction and operation. The use of timber from responsibly managed forests promotes environmental handling and supports the circular economy.
- Innovation: the use of new material technologies in producing timber elevator doors positions the company as a pioneer in the elevator industry. The incorporation of blockchain technology for supply chain management enhances transparency and authenticity in sourcing raw materials.
- Differentiation: TIMBER TECH's unique product offering fills a gap in the market for sustainable elevator doors. By leveraging the environmental benefits of timber and addressing the increasing demand for eco-friendly building materials, the company can differentiate itself from competitors and attract environmentally conscious customers.

3.3.2. Weaknesses

- Market awareness: Lack of knowledge among key players about the benefits of timber elevator doors. Lack of confidence, scepticism, and the impression that timber doors are mechanically less stable and compliant with regulations compared to steel doors.
- Supply chain: strong dependence on suppliers for timber and fire retardants introduces risks related to supply chain disruptions, cost fluctuations and quality level.

3.3.3. Opportunities

- Market demand: Utilizing the demand for environmentally friendly building materials due to the increasing importance of sustainability and environmental responsibility in the construction industry.
- Partnerships: Strategic partnerships can facilitate product adoption, drive sales growth and open new business opportunities.
- Policy support: government initiatives such as tax incentives, subsidies, and regulations promoting the use of sustainable materials and carbon reduction can create a favourable business environment for TIMBER TECH.

3.3.4. Threats

- Competition: from well-established elevator door manufacturers that offers steel or other alternative materials.
- Code compliance: meeting regulatory requirements for safety and fire resistance can incur significant costs and time investment.

- Market scepticism: scepticism or resistance from stakeholders, including elevator manufacturers, building owners, and regulatory authorities, regarding the suitability and safety of timber elevator doors.

3.4. CAME analysis

3.4.1. Correct

- Market awareness: TIMBER TECH needs to educate the market about the benefits of timber elevator doors and overcome scepticism, build trust, and change the perception of stakeholders.
- Supply chain: ensuring reliable and sustainable sources of raw materials will be essential for maintaining production consistency and meeting customer demand while maintaining the differentiation attributes.

3.4.2. Adapt

- Competition: TIMBER TECH must focus on distribution channels, value propositions and brand awareness to leverage its market position against existing competitors.
- Code compliance: The experience of the elevator partner as well as the expertise of the suppliers and the collaboration of a multidisciplinary team will be crucial to achieve the goal.
- Market scepticism: Overcoming perceptions of risk and addressing concerns about strength, durability, fire safety, sustainability, and long-term performance.

3.4.3. Maintain

- Environmental sustainability: Development of a sustainability report with real and specific data on the reduction of CO2 emissions and the origin of the wood.
- Innovation: Implementing blockchain technology to prove the use of wood from responsibly managed forests.
- Differentiation: Reinforce the message through marketing campaigns about the benefits of using environmentally friendly building materials and improving the quality perception of timber versus steel.

3.4.4. Explore

- Market demand: By offering a solution that reduces carbon emissions and promotes responsible forest management.
- Partnerships: To work with elevator manufacturers, architects, builders and government agencies to expand the market for timber doors and gain credibility.
- Policy support: Engaging with policymakers and advocating for policies that incentivize the adoption of timber elevator doors can further support market penetration and growth.

4. CANVAS analysis

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segments
Joint Venture with an existing elevator door manufacturer.	*Design and distribution of elevator doors made of timber.*	*Reduce the carbon footprint by using more sustainable processes and raw materials.*	*My partner enjoys established brand reputation, immediate credibility among existing customers and access to promotion channels and distribution networks all over the world.*	*Elevator manufacturers, kit suppliers and elevator maintenance companies which provide modernization services (about 4.000 elevator companies in Europe).*
The partner contributes operational know-how, market knowledge and industry experience.	*Implementation of the blockchain to ensure that the wood used comes from responsibly managed forests.*	*Reduce energy consumption of the buildings by using lighter materials.*		
The partner's established market presence can help me to introduce the disruptive technology to a wider audience.	*Developing lighter timber doors compared to the weight of steel doors.*	*Reduce deforestation by using wood used from responsibly managed forests.*	*Promoting a sustainable product in addition to existing traditional steel doors is a differentiator between products that adds value to the established brand.*	*OEM's control about 65% of the European market: TKE (DE), Schindler (CH), OTIS (US), Kone (FI) and Orona (ES).*
Clear definition of the type of JV among Contractual/Objective/Capital-based/Corporate.	*Analyse the mechanical properties of timber to ensure that at least doors considered as complete systems have the same mechanical strength as steel doors.*	*Promote the circular economy and the regeneration of nature.*		*The demand of new elevator doors was 654.300 units in 2022. Potential market of doors replacement of 29.8 Million units in installed elevators.*
Suppliers of timber and the fire retardants. Their expertise and quality products are crucial to ensure success.	*Check which fire retardants and which application method can ensure that the product complies with the EN81-58 fire safety standards.*	*Improving installability by using lighter products that are easy to handle and easy to install. The lighter weight will make it easier for elevator companies to comply with EU OSHA regulations.*		
	Key Resources	*Helping customers achieve their sustainability goals by reducing CO2 in raw materials, transportation and building energy consumption.*	**Channels**	
	Partner's R&D / Engineering human resources because of the operational know-how, market knowledge and industry experience.		*Dedicated magazines on sustainable architecture, zero-emissions buildings and sustainable elevators.*	
	Partner's Marketing resources to promote the product among existing customers, established promotion channels and distribution networks.	*Supporting customers in applying for tax incentives, subsidies and exemptions related to CO2 reduction through the Emissions Trading Scheme (ETS) for CO2 emissions introduced by the EU.*	*Attend building and elevator trade shows/exhibitions to meet end customers: building owners, large tenants, consultants and architects.*	
	Timber doors must be patented as soon as we have a functional design that meets the different value propositions.		*Social networking sites for business people like Linkedin, XING and Instagram and other trendy networs at the time of promotion.*	

Cost Structure	Revenue
Key expenses will include 1.- R&D/Engineering expenses for product development. 2.- Cost of raw materials (timber) and fire retardants. 3.- Outsourced transformation costs. The assembly along with the remaining components, packing and shipping will be done in-house.	*Revenue is generated by selling the doors to the elevator OEM's, kit suppliers and elevator maintenance companies.*
	This will represent the 100% of revenue income.
Fixed costs will be mainly the ones of R&D/Engineering salaries. Other costs will be relatively low in comparison. Variable costs are raw materials (timber parts and mechanisms), transformation, accessories and packaging.	

5. Marketing Plan

4.1. Core Operating Principles: Mission, Vision, Values

4.1.1. Mission

The mission is to increase the sustainability of the elevator door manufacturing segment by reducing the carbon footprint, supporting the circular economy, increasing energy efficiency, and improving the working conditions of elevator technicians.

4.1.2. Vision

The vision is to revolutionize the elevator door industry by designing and producing timber elevator doors that are sustainable, responsibly sourced, and compliant with industry standards. The company aims to lead the market in creating environmentally friendly alternatives to conventional carbon steel doors.

4.1.3. Values

The main values are:

- Sustainability: prioritizing the reduction of the carbon footprint and supporting the circular economy using responsibly sourced wood.
- Innovation: revolutionizing elevator door design by integrating new material technologies.
- Compliance and safety: ensuring products meet specific norms and industry standards, including safety and fire protection regulations.
- Quality: commitment to designing, manufacturing, and selling high-quality timber doors.
- Transparency: implementing blockchain technology to guarantee the authenticity sourcing of wood.
- Customer focus: providing elevator companies with products that not only meet regulatory requirements but also offer operational benefits, such as lighter weight for easier compliance with regulations.

4.2. Business Proposal

4.2.1. Product concept

The product concept of TIMBER TECH revolves around creating innovative, sustainable elevator doors made from responsibly sourced timber instead of conventional carbon steel to create a superior and eco-friendly alternative to traditional elevator doors made of steel.

4.2.2. Insights & Market opportunity

The elevator industry faces three main problems: availability of operators to install elevators on-site, difficulties to comply with local regulations in terms of waste management of packaging, lifecycle of materials, use of recyclable products; and CO2 emissions. The construction industry is also exploring ways to reduce its carbon footprint by shifting to regenerative materials, improving decarbonization of conventional materials and avoiding unnecessary extraction and production. In this context, the use of elevator doors made of timber will address some of above-mentioned issues by significantly reduce CO2 emissions by use of lighter, nearby, natural and regenerative materials.

The initial first impression by consumers is very relevant and elevator doors are often the first element which passengers encounter. The use of natural materials like timber, combined by smooth and quiet operation, creates a positive impression, and adds value to the product. Once consumers demand this product, elevator companies will be able to combine the direct benefits that the products offer to them, with the advantages to their customers.

4.2.3. **Target market**

The demand of elevators in Europe was 145.400 units in 2022, which represents a business of 6.1 Billion € [9]. Being the average numbers of stops or floors in Europe 4.5 per building, means that the specific demand of elevator doors was 654.300 units in 2022. That is the main potential market of timber elevator doors. In addition to this, there are 6.622.000 elevators in use in Europe which represents a potential market of doors replacement of 29.8 Million units. The modernization business of existing elevator in Europe represented 1.7 Billion € in 2022 [9].

4.3. **Marketing Mix**

4.3.1. **Product**

The product's name is Essentia, and the logo of the company is the following:



Picture 9: logo of the company. Source: own design.

4.3.2. **Price**

The selling price of a carbon steel door, like the one analysed in point "3.2.5 Substitutes," is about 300 EUR. The selling price of the timber door must be aligned with the carbon steel doors currently available on the market.
Depending on the direct costs (raw materials, direct personnel costs, and direct general costs for production) and the company structure (indirect costs like office personnel and general costs), we can determine the cost breakdown and thus the profit margin linked to the selling price.

4.3.3. **Place**

The distribution channels are the ones of the elevator partner:

- Direct sales: selling directly to elevator companies (B2B model) through the partner's dedicated sales team.
- Manufacturing license agreements: collaborating with OEMs of elevators to license timber doors for their elevators, ensuring the wood is sourced from nearby managed forests.
- Trade shows and industry events: showcasing the product at relevant events to reach potential clients.

4.3.4. **Promotions**

The promotion will be done through the following points:

- Targeted advertising in journals, magazines, and online platforms that focus on the elevator and construction industries. Also, by applying digital marketing like SEO and social media marketing targeting industry professionals and decision-makers.
- Press releases for announcing new products, technological advancements, and sustainability initiatives. Also, as Case Studies to highlight successful implementations and customer satisfaction stories.
- Technical articles to publishing informative content on the benefits of timber doors, sustainability, and compliance with regulations.
- Workshops to educate potential customers about the technical aspects and advantages of timber elevator doors.
- Samples of products to showcase product quality and benefits.

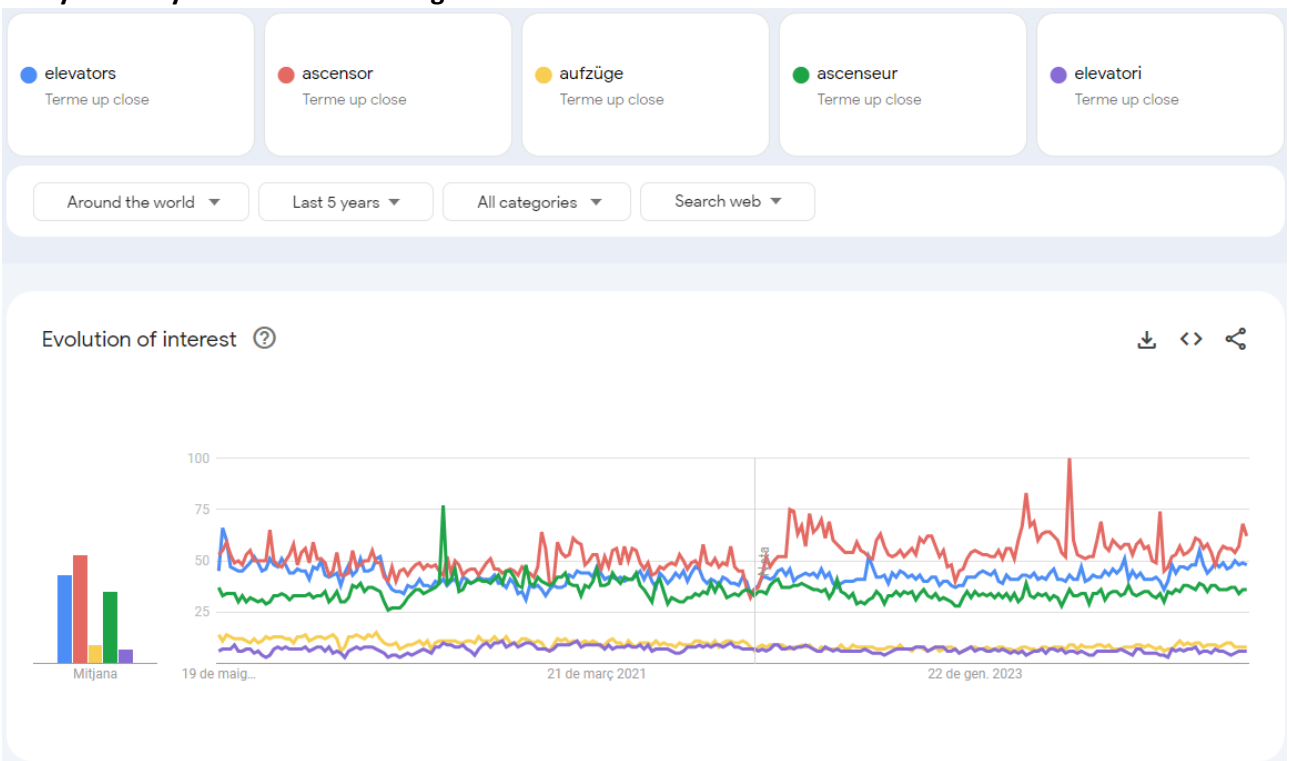
In addition to this, an important marketing activity will be to approach governments and public institutions to promote the use of the product in public tenders and to support the private sector with subsidies.

4.4. **Marketing Strategy**

4.4.1. **Keywords and Search Intent**

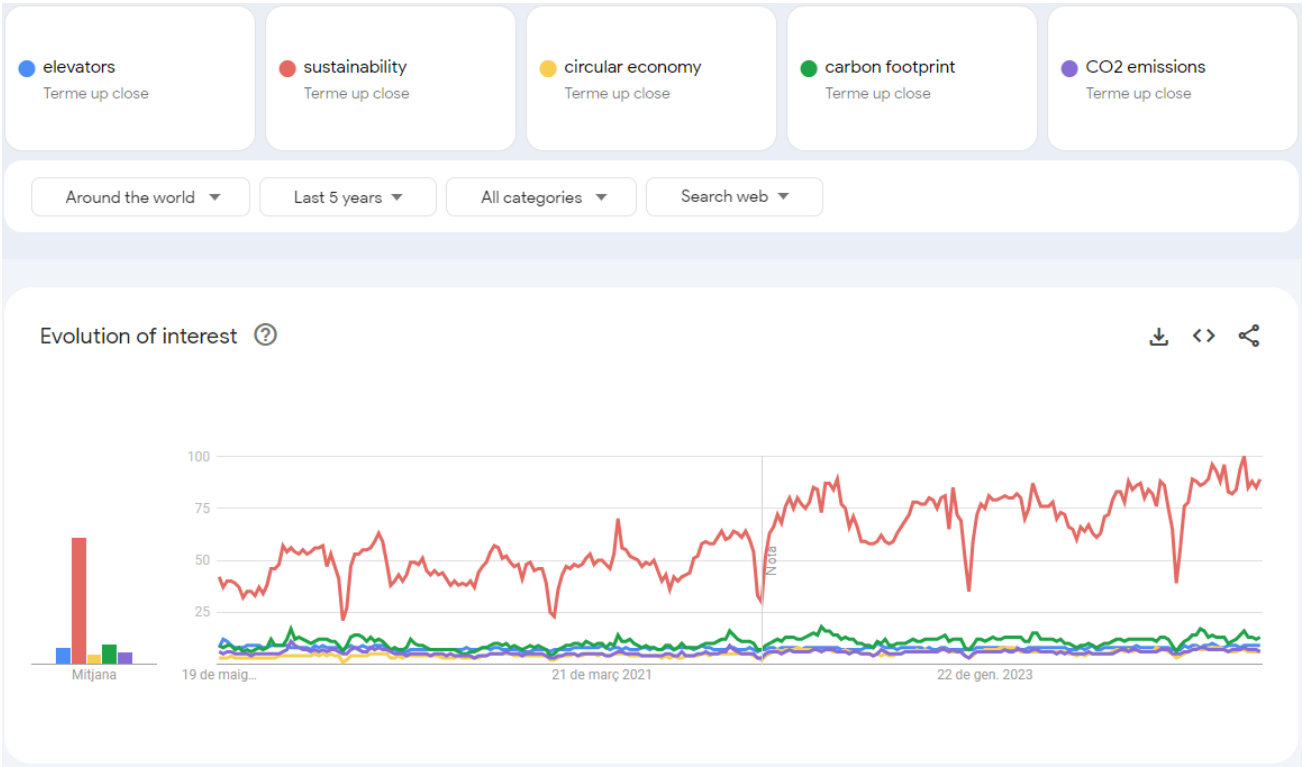
I have analysed the traffic of the keyword "elevator" in English, Spanish, German, French and Italian to get a detailed reference of the search traffic in Europe of the most common word in the industry. After that, I have added some other keywords like sustainability, circular economy, carbon footprint and CO2 emissions to compare the search traffic.

Analysis of keywords search in Google Trends.



Picture 10. Source: Google Trends.

The search traffic trend is very similar except for the Spanish word "ascensor" that shows a higher trend on some specific dates.



Picture 11. Source: Google Trends.

The word "sustainability" shows a growing interest trend compared to other words, reaching values around 90-100 points. On the other hand, the rest of the words analysed show a much lower search interest, although "carbon footprint" shows a higher interest rate than the others.

Based on this analysis and to evaluate the added value and differentiation of elevator doors made of timber, we first need to create a questionnaire to collect consumer data.

Questionnaire

Category	Search question
Question (Product)	How do you feel about our product?
	What would your main reason be for choosing elevator doors made of timber?
	How do you punctuate the CO2 emissions reduction of timber in front of carbon steel?
	In which type of building would you prefer timber elevator doors?
	What features do you look for in a product like this?
	Would you be more likely to recommend timber elevator doors to others? Why or why not?
	What concerns, if any, do you have about using timber for elevator doors?
	Would the availability of customizable timber finishes affect your purchasing decision?
	What are your thoughts on the durability of timber elevator doors?

Table 12. Questionnaire to collect consumer data.

6. Porter's Value Chain

A value chain is a set of activities that an organization carries out to create value for its customers. The value that's created and captured by a company is the profit margin: (Value Created and Captured – Cost of Creating that Value) = Margin. The more value an organization creates, the more profitable it is likely to be.

6.1. Main Business Activities

- Procurement: Conclude supply agreements with high quality timber producers that allow the product to be lighter and mechanically compliant with the Code.
- Operations: Design timber doors lighter than steel doors and compliant with Code requirements.
- Outbound logistics: Delivery of the product in a way that facilitates on-site installation by elevator companies.
- Marketing and sales: to educate stakeholders about the benefits of timber elevator doors and demonstrate the advantages in terms of CO2 emissions, sustainability, and tax incentives.
- Service: Care instructions for the timber and free site visits to new customers to gain credibility and confidence in the new product.

6.2. Support activities

- Firm infrastructure: Create a clean and well-organised factory to encourage customer visits.
- Human resources management: Hiring professionals for the production and processing of timber.
- Technology development: Use specialised 3D software for the design of timber doors and simulation of mechanical tests to improve efficiency and effectiveness in compliance.
- Inbound logistics: Correct tracking of timber in the warehouse to maintain the added value of blockchain.

6.3. Main, Support, and Linking sub activities

Main sub activities		Support sub activities		Links
Procurement	Negotiate price lists with suppliers that are linked to raw material fluctuations to increase price transparency for customers. That will enhance the trust on our brand and the company professionalism.	Firm infrastructure	Implementation of the 5S Lean method to increase efficiency, improve project management, and create a more organized work environment.	To conduct professional negotiations with timber suppliers (Procurement), an experienced team in timber management is needed (Human resources).
Operations	Define quality processes in the factory that can facilitate external audits by customers.	Human resources management	Develop training plans for all employees and managers within the company.	To achieve a smart design that satisfies the values of timber doors (Operations), an investment in specialized 3D software is required (Technology Development).

Outbound logistics	Provide specialised training for the correct installation of timber doors for new customers.	Technology development	Organize workshops with timber and fire-retardant suppliers to stay updated on new market trends.	To deliver products easy to install (Outbound logistics), designers must understand how complete elevators are installed (Human resources training plans).
Marketing and sales	Support elevator companies in applying for tax benefits when using timber doors.	Inbound logistics	Develop an efficient flowchart for the raw material through the various processes in the factory.	To educate stakeholders and support customers on CO2 emissions declarations (Marketing and sales), visits to the factory should be organized to gain customer trust (Firm infrastructure).
Service	Create and stock a comprehensive spare parts list to replace damaged parts on site.			To provide care instructions for timber (Service), workshops with timber and fire-retardant suppliers must be organized (Technology development).

Table 13. Main, Support, and Linking sub activities.

7. Financial Plan

7.1. Description of Assumptions

Because of the company structure of a JV with an existing elevator door manufacturer, the list of initial expenses will be limited to those costs which cannot be avoided. For example, there will not be costs related to the hiring of new personnel because the initial personnel of TIMBER TECH will be transferred from the partner.

7.2. Start-up Expenses

These are the main expenses related to the establishment of the new company:

Start-up Expenses		
Legal Business Registration Fees	EUR	900
Notar	EUR	600
Fiscal authorities	EUR	50
Companies register	EUR	250
Website set-up	EUR	500
Rent Down Payment (3 months)	EUR	1.800
Patent	EUR	1.600
Furniture	EUR	8.900

Computer equipment/peripherals	EUR	2.400
Total	EUR	16.100

Table 14. Start-up expenses.

7.3. Incomes and Expenses Analysis

6.3.1. Expected Incomes

These are the expected incomes based on the experience of the partner in the manufacturing and sale of elevators doors. As commented in the CANVA, the primary activity of TIMBER TECH will be the sale of elevator doors made of timber and 100% of the revenues will originate from this activity.

Year	2026				2027	2028	2029
	Q1	Q2	Q3	Q4			
Doors for home elevators (lift machine directive)							
Units Sold	30	60	90	120	900	2.100	2.700
Unit Price	€ 240	€ 240	€ 240	€ 240	€ 247	€ 256	€ 265
Revenues	€ 7.200	€ 14.400	€ 21.600	€ 28.800	€ 222.480	€ 537.289	€ 714.978
Doors for passenger elevators (lift passenger directive)							
Units Sold	20	50	150	400	2.000	5.000	10.000
Unit Price	€ 310	€ 310	€ 310	€ 310	€ 319	€ 330	€ 342
Revenues	€ 6.200	€ 15.500	€ 46.500	€ 124.000	€ 638.600	€ 1.652.378	€ 3.420.421
Total	€ 13.400	€ 29.900	€ 68.100	€ 152.800	€ 861.080	€ 2.189.667	€ 4.135.399

Table 15. Sales forecast, worst-case scenario.

6.3.2. Expected Expenses

These are the fixed expenses related to current operations of the company:

Fixed Annual Costs	Price	
Website	EUR	1.825
Domain	EUR	25
Hosting services	EUR	1.800
Promotion	EUR	74.300
Journals and magazines	EUR	4.500
Online platforms and SEO	EUR	6.800
Workshops	EUR	45.000
Samples of product	EUR	18.000
Rent	EUR	7.200
Office supplies	EUR	2.400
Overheads	EUR	9.600
Salaries	EUR	160.000
Outsourced services	EUR	2.050
Admin and Accounting	EUR	1.100
HHRR	EUR	950
Total	EUR	257.375

Table 16. Fixed Annual Costs.

These are the variables costs related to the production of timber doors:

Variable Costs		Price
Doors for home elevators		
Timber parts	EUR	26,70
Timber panels (x2)	EUR	18,06
Timber Jambs (x2)	EUR	6,92
Timber Header	EUR	1,72
Production costs outsourced	EUR	37,50
Mechanisms, sill, and fixations	EUR	115,00
Carton boxes	EUR	5,50
Transport incoming material	EUR	8,00
Expedition costs	EUR	2,80
Total	EUR	195,50
Doors for passenger elevators		
Timber parts	EUR	64,70
Timber panels (x2)	EUR	56,06
Timber Jambs (x2)	EUR	6,92
Timber Header	EUR	1,72
Production costs outsourced	EUR	37,50
Mechanisms, sill, and fixations	EUR	115,00
Carton boxes	EUR	5,50
Transport incoming material	EUR	8,00
Expedition costs	EUR	2,80
Total	EUR	233,50

Table 17. Variable Costs.

7.4. Financing the Business

To finance the business, the proposal is to use the Shareholders initial equity of 50.000 EUR and a loan by the Partner of 500.000 EUR to be repaid in 5 years.

Founding sources		
Owner's Equity	EUR	50.000
Loan from the Partner	EUR	300.000
Total	EUR	350.000

Table 18. Founding Sources.

This is the plan to pay back the loan, staring in 2027 after 2 years of cadence with no interest:

Repayment of the loan						
	2025	**2026**	**2027**	**2028**	**2029**	**2030**
Total payment	€ -	€ -	€ 50.000	€ 100.000	€ 150.000	€ 62.124
Interest	€ -	€ -	€ 30.000	€ 16.800	€ 11.808	€ 3.516
Principle	€ -	€ -	€ 20.000	€ 83.200	€ 138.192	€ 58.608
Unpaid Balance	€ 300.000	€ 300.000	€ 280.000	€ 196.800	€ 58.608	€ -

Table 19. Repayment of the loan.

7.5. Sensitivity Analysis

The first step is to calculate the contribution margin to understand the portion of sales revenue that exceeds total variable costs. This margin contributes towards covering the fixed costs of the business and generates profit. It can be calculated in total or on a per-unit basis.

Contribution margin per unit (2025)		
Doors for home elevators		
Selling price	EUR	240,00
Variable cost	EUR	195,50
Contribution margin	EUR	44,50
Doors for passenger elevators		
Selling price	EUR	310,00
Variable cost	EUR	233,50
Contribution margin	EUR	76,50

Table 20. Contribution margin per unit.

Total contribution margin (2025)		
Doors for home elevators		
Total revenues	EUR	72.000
Total units	Units	300
Total contribution margin	EUR	13.349
Doors for passenger elevators		
Selling price	EUR	192.200
Variable cost	Units	620
Contribution margin	EUR	47.429

Table 21. Total contribution margin.

The next step is the calculation of the break-even point (BEP), that is the level of sales at which total revenues equal total costs, resulting in zero profit. It can be calculated in terms of EUR or units:

Break-even Point		
Doors for home elevators		
Fixed costs	EUR	257.375
Selling price per unit	EUR	240,00
Variable cost per unit	EUR	195,50
Break-even point	Units	5.784
Break-even point	EUR	315.956
Doors for passenger elevators		
Fixed costs	EUR	257.375
Selling price per unit	EUR	310,00
Variable cost per unit	EUR	233,50
Break-even point	Units	3.364
Break-even point	EUR	341.694

Table 22. Break-even point calculation.

7.6. Profit & Loss, Balance Sheet, Cash Flow analysis and IRR

The Profit & Loss statement includes several assumptions, such as an initial period of 6 months during 2024 to finalize the design of the products. This short period for product development is considered reasonable due to the long experience of the partner's R&D team in elevator doors. It is assumed that the product will be ready for sale in 2025. The new company will pay 5% of yearly turnover to the partner to compensate for general costs during the assembly of the doors before shipping. For the depreciation of office furniture, computer equipment, and peripherals, a period of 10 years is considered: Depreciation (Annual) = (8,900 + 2,400) / 10 years = 1,130 EUR.

The P&L shows a positive result in 2027:

Profit & Loss Statement	**2024**	**2025**	**2026**	**2027**	**2028**
Net Sales		**€ 264.200**	**€ 861.080**	**€ 2.189.667**	**€ 4.135.400**
Material costs	€ 25.000	€ 178.532	€ 566.136	€ 1.394.434	€ 2.557.648
Labor costs outsourced		€ 34.500	€ 108.750	€ 266.250	€ 476.250
Labor costs	€ 80.000	€ 160.000	€ 168.000	€ 216.400	€ 227.220
Rent + Overhead		€ 21.025	€ 21.656	€ 22.305	€ 22.975
Depreciation		€ 1.130	€ 1.130	€ 1.130	€ 1.130
Pre-opening costs					
COGS	**€ 105.000**	**€ 395.187**	**€ 865.672**	**€ 1.900.520**	**€ 3.285.223**
Gross Profit	€ 105.000	€ 130.987	-€ 4.592	€ 289.147	€ 850.177
%Gross Profit	NA	49,58%	-0,53%	13,21%	20,56%
Selling & Marketing Expenses		74.300	44.580	35.664	35.664
Admin., Accounting and HHRR		2.050	2.153	2.260	2.373
Other income		0	0	0	0
Operating Expenses		**€ 76.350**	**€ 46.733**	**€ 37.924**	**€ 38.037**
E.B.I.T.	€ 105.000	€ 207.337	€ 51.325	€ 251.223	€ 812.140
%E.B.I.T.	NA	78,48%	5,96%	11,47%	19,64%
Financial Income					
Financial Expenses				€ 30.000	€ 16.800
E.B.T.	€ 105.000	€ 207.337	€ 51.325	€ 221.223	€ 795.340
%E.B.T.	NA	78,48%	5,96%	10,10%	19,23%
Income Tax (25%)				€ -	€ 163.225
Net Profit	€ 105.000	€ 207.337	€ 51.325	€ 221.223	€ 632.114
%Profit & Loss	NA	78,48%	5,96%	10,10%	15,29%

Table 23: Profit and Loss Statement, 2024-2028

Next, the balance sheet for the initial period of 2024 can be found in Table 24.

Balance sheet	**31/12/2024**
Assets	
Total Assets	**€ 245.000**
Current Assets	€ 230.700
Cash & cash equivalents	€ 228.900
Receivables	€ -
Prepaid expenses	€ 1.800
Inventories & Labor	€ -
Non current Assets	€ 14.300
Property & equipment	€ 11.300
Accumulated depreciation	€ -
Intangible assets	€ 1.600
Other long-term assets	€ 1.400
Liabilities & Equity	
Liabilities	**€ 300.000**
Current liabilities	€ -
Interest payable	€ -
Taxes payable	€ -
Finance Lease	€ -
Obligations due (< 1 year)	€ -
Long term liabilities	€ 300.000
Long term debt	300.000
Equity	**-€ 55.000**
Shareholders equity	€ 50.000
Profit & Loss Statement	-€ 105.000
L+OE	**€ 245.000**

Table 24: Balance Sheet at 31/12/24

A cash flow analysis is relevant because it helps to assess the liquidity and the ability to meet the financial obligations of the company. It shows how cash is generated and used within the business. The forecast shows a positive result in 2027, which is aligned with the result obtained in the forecasted P&L:

Cashflow analysis	**2024**	**2025**	**2026**	**2027**	**2028**
Collections from customers	€ -	€ 264.200	€ 861.080	€ 2.189.667	€ 4.135.400
Payments to suppliers	-€ 41.100	-€ 199.557	-€ 587.792	-€ 1.416.740	-€ 2.580.623
Payments to employees	-€ 80.000	-€ 194.500	-€ 276.750	-€ 482.650	-€ 703.470
Payment for interest	€ -	€ -	-€ 30.000	-€ 16.800	-€ 11.808

Payment for taxes	€ -	€ -	€ -	€ -	-€ 163.225
Cash Flow Operations (CFO)	**-€ 121.100**	**-€ 129.857**	**-€ 33.462**	**€ 273.477**	**€ 676.273**
Equipment purchase	€ -	€ -	€ -	€ -	€ -
Sale of equipment	€ -	€ -	€ -	€ -	€ -
Cash Flow investment (CFI)	**€ -**	**€ -**	**€ -**	**€ -**	**€ -**
Loan repayment	€ -	€ -	-€ 20.000	-€ 83.200	-€ 138.192
New share capital	€ -	€ -	€ -	€ -	€ -
Dividends paid	€ -	€ -	€ -	€ -	€ -
Cash Flow Financial (CFF)	**€ -**	**€ -**	**-€ 20.000**	**-€ 83.200**	**-€ 138.192**

Change in cash=CFO+CFI+CFF	**-€ 121.100**	**-€ 129.857**	**-€ 53.462**	**€ 190.277**	**€ 538.081**
Accumulated change in cash	**€ -**	**-€ 250.957**	**-€ 183.319**	**€ 136.815**	**€ 728.359**
Internal Rate of Return at the end of 2028		**34%**			

An analysis of the cash flow over the period 2024 to 2028 shows that the return of the initial investment is equivalent to an average return of 34% per year. This rate reflects the profitability of the investment, indicating a high rate of return over the specified period.

8. **Conclusions**

Through this business plan, I have demonstrated that using timber from responsibly managed forests for elevator doors minimizes the carbon footprint compared to traditional steel doors (the carbon footprint of steel is 1.4-1.85 tons per produced ton of steel, while for every dry ton of manufactured timber, around 3.7 tons of CO2 is removed from the atmosphere [6] [7]). Timber is a renewable resource that absorbs CO2 as it grows, and responsibly managed forests ensure continuous regeneration (As trees grow, they absorb carbon dioxide, approximately 1 tonne CO_2/m^3, from the air [21]). Emphasizing sustainable production methods reduces environmental impact, aligning with global efforts to combat climate change. By sourcing wood from responsibly managed forests, TIMBER TECH ensures that their operations do not contribute to deforestation, preserving biodiversity and forest ecosystems.

Timber is lighter than steel (the density of carbon steel is 7.85 gr/cm^3, while the density of timber is around 0.60 gr/cm^3 [26]), which can lead to reduced energy consumption in the operation of elevators. This contributes to significant energy savings for buildings, crucial for reducing overall energy demand and costs (73.2% of greenhouse gas emissions are due to energy use, with 17.5% of that figure due to energy use in buildings [5]). Timber doors support the circular economy by facilitating the reuse, recycling, and regeneration of materials. Timber can often be repurposed or biodegraded at the end of its lifecycle, unlike steel, which requires more energy-intensive recycling processes.

There is a growing demand from consumers and businesses for environmentally friendly products (the word "sustainability" shows a continuous growth trend in Google Trends, from about 30 points in 2019 to values around 90-100 points in 2024). Offering elevator doors made of sustainably sourced timber meets this demand and can be a unique selling point. Companies that adopt sustainable practices can enhance their

reputation and appeal to environmentally conscious customers and stakeholders. As environmental regulations become stricter worldwide, companies that use sustainable materials and processes are better positioned to comply with current and future regulations, reducing the risk of penalties and enhancing long-term viability (the EU established the Emissions Trading System (ETS) on CO2 emissions, which includes taxes on emissions as well as tax incentives, subsidies, and exemptions related to CO2 reduction [30]).

There is a potential raw material cost saving of about 80% when using timber instead of steel for elevator doors. The cost of carbon steel is 0.65 EUR/kg as of April 2024, and considering the weight of a steel door is about 75 kg, the cost of steel per door is approximately 59 EUR, meanwhile, the cost of timber (LTC) is 540 $/1000 board feet as of April 6th, 2024 [27], which converts to approximately 507.38 EUR. Calculating the weight of a board foot of timber, which is 1.42 kg, leads to a cost of 0.36 EUR/kg for timber. However, it is crucial to note that this cost comparison must consider the final weight of the door because the material thickness of timber doors needs to be significantly greater than that of steel doors to achieve the same mechanical strength and fire resistance. Typically, the thickness of a steel door is about 1 to 1.5 mm. Therefore, specific assumptions and calculations are necessary to accurately compare the weight and cost of timber doors with steel doors.

In summary, the use of timber doors for elevators supports environmental sustainability, enhances energy efficiency, promotes the circular economy, meets market demands, and ensures regulatory compliance, making it a relevant and strategic choice for the company.

In order for this project to be feasible, several assumptions need validation:

- Timber doors are lighter than carbon steel doors. However, this depends on the final design of the product, which must comply with specific norms such as Directive 2014/33/EU related to lifts and safety components [18], as well as the Elevator Standards EN 81-20/50:2014 [19].
- Timber doors must ensure sufficient fire protection. Most new elevator installations in Europe require compliance with EN 81-58:2022, which addresses fire resistance tests.
- The cost of timber doors cannot exceed that of current carbon steel doors. The final cost will be determined by a design that successfully passes mechanical tests and ensures compliance with industry norms. It is necessary to contact European suppliers to verify the cost assumptions. So far, I haven't found any European index for the selling price of timber in Europe, only an American index for timber.
- Proper implementation and functioning of blockchain technology will allow the company to guarantee that the wood used for timber doors comes from near-by responsibly managed forests. This authenticity seal reinforces the message of reducing the product's CO2 footprint.

From a financial point of view, the Profit & Loss forecast shows material, labour and overhead costs increase proportionally with sales, but gross profit margins improve especially by 2028. The cash flow analysis indicates significant initial outflows for payments to suppliers and employees, resulting in negative cash flows in the initial years (2024 and 2025). By 2028, the company accumulates a significant positive cash flow, with an accumulated change in cash of €756.967, indicating strong liquidity and financial health. The IRR of 39% by the end of 2028 suggests a highly profitable investment, reflecting substantial returns on the initial capital invested.

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