STRATEGIC ANALYSIS FOR A TRUCK-DRONE HYBRID MODEL IN LAST MILE DELIVERY

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José Francisco Tezei[1]

Claudia Regina de Freitas[2]

Antonio Lombardi Neto[3]

Paulo Cesar Chagas Rodrigues[4]

José Roberto Dale Luche[5]

ABSTRACT

The delivery sector, already on an upward trend prior to the Covid-19 pandemic, experienced a significant boost in demand for its services during the pandemic. However, the most expensive aspect for companies in this domain is the 'last mile' delivery costs, which can account for up to 45% of total logistics expenses. In light of this, our paper presents a study aiming to leverage this market trend to reduce company costs. We propose a hybrid model combining trucks and drones for last-mile delivery and conduct a market analysis for a company interested in developing this model. Drone deliveries are anticipated to grow at an annual rate of approximately 45%, outpacing the overall sector. This market outlook presents a compelling opportunity for entrepreneurs: the market is nascent, with a noticeable upward trend in both demand and investment. The truck-drone hybrid model, being up to 70% faster and 60% less expensive compared to traditional methods, offers dual benefits: enhanced customer satisfaction with lower expenditure, and reduced operational costs for companies while improving service quality. Despite pending regulatory challenges, the prevailing trend in technology advancements and major retailers' interest suggests a favorable outlook for legal approvals. As a novel technology, it naturally encounters some skepticism. Furthermore, drone usage has positive environmental implications, whether through alternative energy sources or traffic reduction, aligning well with the current ESG-driven market trends.

[1] Graduated in Mechanical Engineering, Universidade Estadual Paulista, Guaratinguetá – São Paulo, Brasil, E-mail: jose.tezei@unesp.br
[2] Doctor in Public Health, Faculdade Serra Dourada, Lorena - São Paulo, Brasil, E-mail: psicocrfreitas@gmail.com
[3] Master in Production Engineering, Universidade Estadual Paulista, Guaratinguetá – São Paulo, Brasil, E-mail: antonio.lombardi@unesp.br
[4] Doctor in Mechanical Engineering, Universidade Estadual Paulista, Guaratinguetá – São Paulo, Brasil, E-mail: paulo@paulorodrigues.pro
[5] PhD in Production Engineering, Universidade Estadual Paulista Guaratinguetá – São Paulo, Brasil, E-mail: dale.luche@unesp.br

Keywords: Autonomous Vehicles. Delivery Services. Drone. Last Mile. Strategic Planning.

ANÁLISE ESTRATÉGICA PARA UM MODELO HÍBRIDO CAMINHÃO-DRONE NA ENTREGA DE ÚLTIMA MILHA

RESUMO

O setor de entregas, já em uma tendência ascendente antes da pandemia da Covid-19, experimentou um aumento significativo na demanda por seus serviços durante a pandemia. No entanto, o aspecto mais caro para as empresas neste domínio é o "último quilômetro" custos de entrega, que pode representar até 45% do total das despesas de logística. Diante disso, nosso artigo apresenta um estudo com o objetivo de alavancar essa tendência de mercado para reduzir os custos da empresa. Propomos um modelo híbrido que combina caminhões e drones para entrega na última milha e realizamos uma análise de mercado para uma empresa interessada em desenvolver esse modelo. Prevê-se que as entregas de drones cresçam a uma taxa anual de cerca de 45%, ultrapassando o setor global. Esta perspectiva de mercado apresenta uma oportunidade atraente para os empresários: o mercado é nascente, com uma notável tendência ascendente na procura e no investimento. O modelo híbrido de caminhão-drone, sendo até 70% mais rápido e 60% mais barato em comparação com os métodos tradicionais, oferece dois benefícios: maior satisfação do cliente com menores despesas e custos operacionais reduzidos para as empresas, melhorando a qualidade do serviço. Apesar dos desafios regulatórios pendentes, a tendência predominante nos avanços tecnológicos e o interesse dos grandes varejistas sugerem uma perspectiva favorável para aprovações legais. Como uma nova tecnologia, naturalmente encontra algum ceticismo. Além disso, o uso de drones tem implicações ambientais positivas, seja por meio de fontes de energia alternativas ou redução de tráfego, alinhando-se bem com as atuais tendências de mercado orientadas por ESG.

Palavras-chave: Veículos Autônomos. Serviços de Entrega. Drone. Última Milha. Planejamento Estratégico.

1 INTRODUCTION

Understanding the market position of a new business is crucial for any entrepreneur before launching. This involves identifying what makes the business attractive to consumers, its advantages over competitors, and other key factors. Entrepreneurs must also recognize potential risks or threats and strategize to convert these into strengths or opportunities. Abrams and Kleiner (2003) refer to this as strategic positioning.

Strategic planning is essential for navigating various business scenarios, such as entering a new market, negotiating deals, forming partnerships, or launching new products. Dornellas (2016) highlights that a well-defined strategy guides business decisions and secures a competitive edge by differentiating a company from its competitors and making it more appealing to potential customers.

The year 2020 saw a surge in online habits, leading to an increased reliance on delivery services. The online selling sector grew by 83.68% year-over-year compared to 2019, as reported by Nielsen (2020). Market analysis reveals that last-mile delivery costs are a significant portion of logistics expenses for e-commerce, accounting for up to 45% of total costs. This presents a technical and commercial development opportunity: proposing an alternative, more efficient and cost-effective delivery method using autonomous vehicles, as discussed by Joerss et al. (2016). This approach could reduce costs and increase profitability for businesses adopting this delivery method.

This paper proposes a strategic and quantitative analysis of the delivery market, aiming to identify potential competitive advantages and the feasibility of implementing the analyzed delivery method.

The methodology for this study involved bibliographic research with exploratory and qualitative characteristics. An online survey targeting the economically active population was conducted to assess the value proposition and perceived market opportunity. The survey, with 344 respondents primarily from São Paulo – Brazil's largest consumer market and the proposed launch location for this new delivery model – tested the acceptance of a theoretical company using a hybrid model of trucks and Unmanned Aerial Vehicles (UAV).

Subsequent chapters will present specific market analyses and findings from these strategic evaluations.

2 MARKET ANALYSIS

As Kuznetsova (2020) notes, a review of modern world literature reveals numerous tools for analyzing external market environments, as summarized in Table 1: PEST / ETPS / STEP, PESTEL, PESTELI, STEEP, STEEPLED, LEPEST, PESTLE, LoNGPESTEL, ETOP, SWOT.

The variety of these tools, as documented in national and international academic studies, suggests the absence of a singular, universal tool for market environment analysis.

Table 1: Summarizing Table of Marketing Analysis Tools

Environment	Shared Instruments	Specific Instruments
Macromarketing Environment	SWOT, ETOP SPACE, Delphi Technique, Lifecycle Model, BCG Matrix	PEST / ETPS / STEP, PESTEL / PESTLE / LEPEST, PESTELI, PESTLIED, SLEPT / STEEP / STEEPLE / STEEPLED, DESTEP, LoNGPESTEL / LONGPESTLE
Micromarketing Environment		SNW, ABC-analysis, Mc Kinsey 7S, 2x2 matrix Ansoff's, PIMS, 5 PORTER'S, SIMALTO, 4P, 5P, 7P, 5C, 15C, 18P, AIDA, SAVE, AIDAS
Internal corporate environment		VRIO, USP, SOSTAC, MOSAIC, SERVQUAL, RATER, mystery shopper

Source: Kuznetsova (2020)

As Wood (2017) highlights, analyzing the market is crucial for understanding its impact on our goals and strategies. This paper aims to explore three interconnected sectors: the drone industry, the delivery market, and specifically, the segment involving delivery through autonomous vehicles. Our primary focus is on the delivery of small objects (up to 12kg) sold by large retailers.

2.1 ANALYSIS OF THE DELIVERY SECTOR THROUGH AUTONOMOUS VEHICLES

The autonomous vehicle market is projected to experience significant growth, with an anticipated annual growth rate (CAGR) of 15.37%, reaching a valuation of USD 47.87 billion by 2025 (Mordor Intelligence, 2023). This market's dynamics are shifting, with a forecasted doubling of equipment sales by 2025. The growth is expected to be more pronounced in commercial sales, whereas individual or leisure sales may see a decline (Schroth et al., 2020). Despite the presence of major players like SZ DJI Technology and Boeing, the high profitability in the drone segment is attracting numerous small companies and startups, fueling competition and technological advancements in autonomous vehicles.

Schroth et al. (2020) categorize the autonomous vehicle market into three segments: Equipment (manufacture of vehicles, platforms, components, etc.), Software (autonomous navigation, computer vision, data analysis, route optimization), and Services (utilization of autonomous vehicles for consumer services, logistics, pilot training, security, and geographic mapping, among others). In this evolving market, service providers are poised to create significant value.

In Brazil, the autonomous vehicle market is still in its infancy but is showing rapid growth. The sector's revenue was estimated at around USD 800 million in 2019, with a 400% increase in the number of companies authorized to operate autonomous vehicles compared to 2017. The São Paulo government's investment of BRL 6.5 million in autonomous vehicle services signals potential for exponential growth. Notably, the market is seeing robust development in the UAV (unmanned aerial vehicle) sector, with UAVs being more operationally ready for commercial use than their land-based counterparts.

In the UAV sector, significant investments are being made in flight control and automation software. Companies like Flytnow, FlytBase, and Measure are key players in this domain, with the presence of open-source software like PX4 (2020) facilitating program development and testing in real-world conditions (García and Molina, 2022). Recent studies like those by Tseng et al. (2017) and Matschulat (2016) have contributed to route optimization and battery recharging for UAVs, as well as hybrid delivery models using both trucks and UAVs. With the UAV market expected to grow by 25% annually until 2027, research and system improvements are likely to continue expanding.

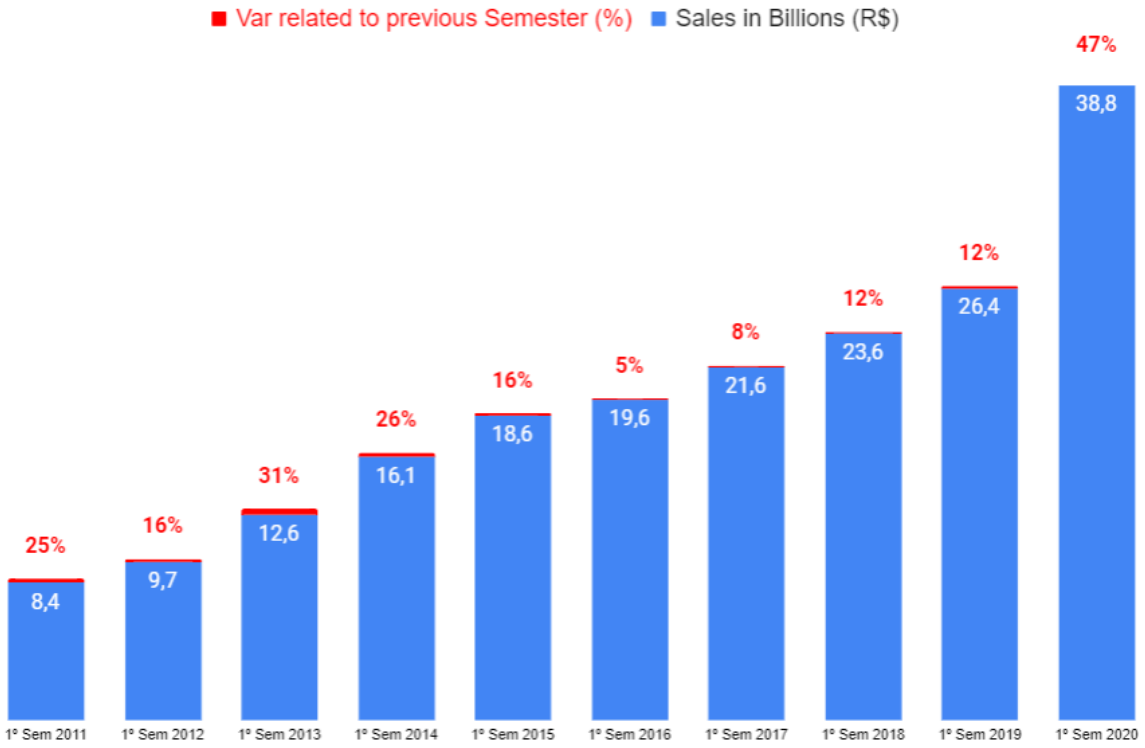
2.2 DELIVERY MARKET ANALYSIS

The logistics sector in Brazil, particularly influenced by the expansion of e-commerce, represents a significant and growing market. Despite the challenges of 2020 due to the COVID-19 pandemic, the logistics sector saw a 9% increase in revenue in the latter half of the year compared to the same period in 2019 (Nielsen, 2020). E-commerce sales alone surged by 47% in the first half of 2020, reaching R$38.8 billion, indicating an acceleration in growth trends.

This study specifically focuses on the transportation aspect of the logistics sector, with a particular emphasis on home delivery services. The delivery market has experienced continuous

growth, further amplified during the pandemic when 72% of consumers increased their usage of delivery services, notably via mobile apps (Nielsen, 2020). The trend towards digital retail and delivery services is not just a temporary shift but is likely to become a staple in retail practices. Figure 1 illustrates the growth of the e-commerce market from 2011 to 2020.

Figure. 1: E-commerce Market growth –



Source: Adapted from Ebit-Nielsen (2020)

The structural challenges of the country's mobility infrastructure significantly impact transport and delivery operations, which are already complex due to supply chain intricacies. Souza et al. (2020) identify the primary hindrances in urban distribution as stemming from land vehicle issues like traffic and parking difficulties. The reliance on a predominantly road-based network creates logistical bottlenecks, limiting operational efficiency (Davila and Epstein, 2014).

To circumvent these limitations, there has been a shift towards integrating technology with traditional logistics processes, including logistics management, delivery, reverse logistics, and inventory or freight marketplaces. Companies applying technological solutions in logistics, often

referred to as 'Logitech,' are predominantly startups specializing in this sector. Notably, over 50% of Logitech companies were established between 2015 and 2020.

This sector can be divided into two categories for analysis purposes: door-to-door delivery (encompassing the entire delivery process and representing 4.2% of the market) and last-mile delivery solutions (focusing on the final stage of delivery to the customer, accounting for 15.2% of the market). Last-mile logistics companies possess significant potential for expansion, as evidenced by their receipt of around 53% of all third-party capital investments, mainly directed towards managing deliveries (Chamola et al., 2020).

The most prevalent technologies in last-mile solutions include vehicle monitoring, routing, Transport Management Systems (TMS), Radio Frequency Identifiers (RFID), IoT sensors, machine learning, and drone/robotic delivery (Kostrzewski et al., 2022). The latter three, although holding immense potential, are still underutilized in the Brazilian logistics sector, representing untapped opportunities. The economic landscape of this market has seen substantial investment since 2011, with Logitech companies raising approximately USD 1.3 billion across around 100 investment rounds. The delivery solutions category received the bulk of these funds, totaling USD 911.1 million, or 74% of the total investment in this segment. This suggests a hypothesis of significant technological advancements aligning with market expansion in the short to medium term (next five years).

2.3 MARKET SEGMENT DESCRIPTION - DELIVERY WITH DRONES

The UAV market, similar to the broader delivery market, is in an early stage of development, presenting as a 'blue ocean' ripe for exploration. Combining the technological advancements of UAVs with the potential to reduce costs and delivery times offers an attractive market entry opportunity. This paper proposes the creation of a company specializing in last-mile delivery using a hybrid model of trucks and UAVs. Studies by Joerss et al. (2016) suggest that drone usage can reduce delivery costs by up to 40%, potentially increasing company margins by 15% to 20% and similarly decreasing prices for consumers.

Drones offer a faster delivery alternative by bypassing most traffic congestion. They are also capable of reaching complex and remote locations, making them suitable for delivering

essentials like food and medicine in disaster scenarios or to isolated communities. This versatility allows the proposed company to engage in general deliveries as well as humanitarian efforts.

The growth potential for drone delivery services exceeds that of the autonomous vehicle sector as a whole, with an anticipated annual growth of 53.8%, reaching a market value of USD 39.0 billion by 2030 (Markets and Markets, 2021). The primary challenge in adopting this model is the limited autonomy of current UAVs, which justifies the proposed hybrid truck/UAV model. In this system, trucks would handle the longer and more physically demanding portions of delivery, with UAVs managing the final stage. This model envisions a distribution process that starts from large centers to smaller units, then to trucks, and finally to UAVs for delivery to the end customer.

Major companies like Google, Amazon, DHL, and iFood in Brazil are influencing regulatory developments concerning UAV circulation. Their investment and testing activities in this market indicate a push towards regulatory adaptation and reduced barriers in the short to medium term.

3 STRATEGIC ANALYSIS

For strategic analysis, an assessment of both external and internal environments was conducted. This started with a PEST Analysis, a tool derived from Strategic Management, followed by Aidar and Burmester (2017) VRIO Analysis, to understand resource and capability utilization. Additionally, Porter’s Five Forces analysis was employed, a widely accepted method in strategic assessment. The insights from these analyses were synthesized in a SWOT Matrix, outlining strategies to leverage strengths and opportunities while addressing weaknesses and threats. The goal is not to innovate in strategic assessment methods but to use those with broad academic acceptance.

3.1 PEST ANALYSIS

PEST Analysis examines Political, Economic, Social, and Technological factors. These external environments are beyond the company's direct control, but it can prepare for and anticipate changes. Ribeiro (2012) delineates the factors in each dimension as follows:

• Political Factors: Regulatory issues, legal aspects (patents, copyrights), political environment;

• Economic Factors: Financial forces, unemployment rates, inflation, interest rates, population income, etc;

• Social Factors: Demographic groups, culture, trends;

• Technological factors: Technological changes and advancements, support technologies, ongoing research.

Utilizing these tools to analyze the marketing environment is crucial for developing strategies that enable companies to anticipate market changes and ensure their longevity. The outcome of the PEST analysis for this project is presented in Table 2.

Table 2: PEST Analysis for a theoretical drone delivery company

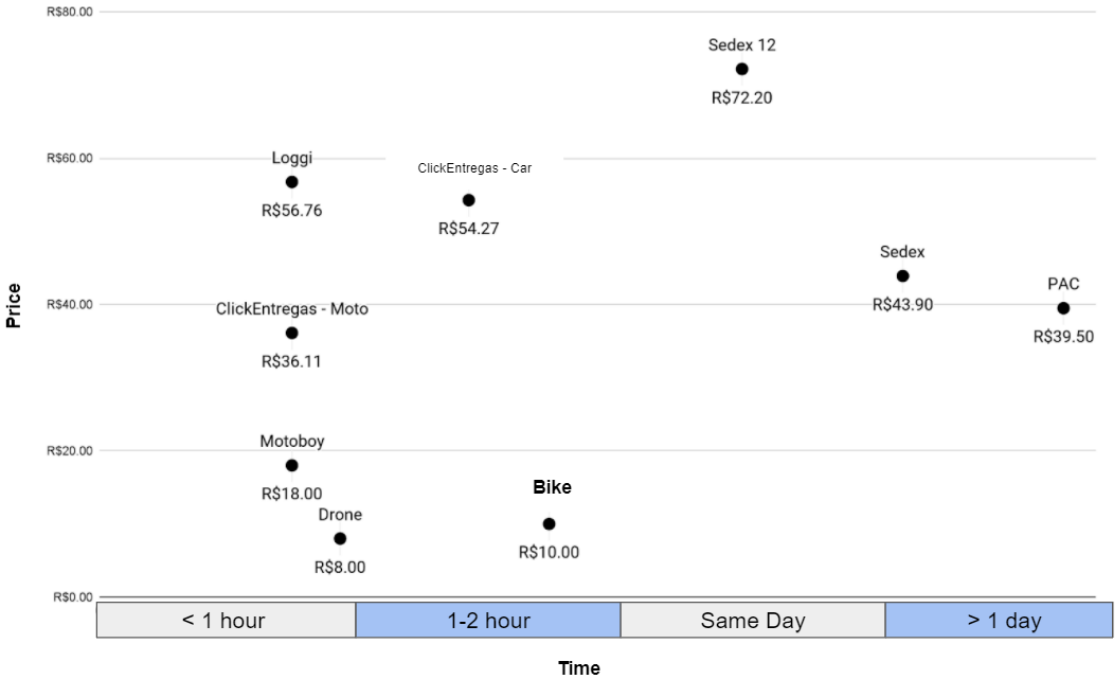
PEST	
Political Factors	Incipient regulation. UAV operation within the operator's field of vision; companies already get authorization for out-of-sight testing. Technological development and market pressure for regulation.
Economic Factors	Possibility of growing above the market (53.8%). Increase in deliveries during the pandemic (57.4%). Market potential predates the pandemic. Deliverymen fear unemployment, but do not assess the possibility of qualification for this new market.
Social Factors	Increase in purchases by delivery (72.5%)1, concept accepted with little resistance (82.2%)1, positive environmental impact, positive impact on traffic in large centers. Fears regarding noise pollution, security from theft and accidents and concerns about privacy
Technological factors:	Equipment and operating systems in the initial phase, a lot of research in the area, low battery life leads to low autonomy, inaccuracy of location systems, market operators investing to optimize systems and equipment

Source: Author's production

3.2 VRIO ANALYSIS

UAV delivery presents significant value in terms of cost savings for both the company and the consumer. In the context of medical supply delivery, UAVs offer a substantial advantage, being 70% faster and 60% cheaper compared to traditional delivery methods – these figures are based on data from the American market (Unmanned Airspace, 2019). Comparable efficiencies are observed when evaluating the estimated costs for deliveries using a hybrid model (combining trucks and UAVs). This efficiency extends beyond medical supplies, as illustrated when comparing UAV delivery to other modes of transport such as motorcycle couriers, Sedex, and Loggi. These comparisons are detailed in Figure 2, demonstrating the cost-effectiveness and speed of UAV delivery across various scenarios.

Fig. 2: Delivery Cost using Drones x Conventional Models



Source: Author's production

Data for our analysis were derived from the websites of the respective delivery services under consideration. We focused on deliveries weighing up to 10kg over a distance of approximately 15km. Drawing on the research by Sudbury and Hutchinson (2016), which compares the costs of van and UAV deliveries, we obtained an average UAV cost estimated at USD 4,000.00. We also factored in the average maintenance cost, estimated to be 10% of the UAV's value, and its average lifespan of 5 years. For simplicity, a fixed exchange rate of USD/BRL = 5 was used.

To estimate the number of UAVs required for the initial operation of the proposed company, we utilized data from Mercado Livre (Salomão, 2020). According to this source, there were 157 million items delivered in the second quarter of 2020, with half of these passing through the company's warehouse. We annualized this volume to represent the total number of deliveries managed by the company. From this, we calculated the number of deliveries per inhabitant per day across Brazil.

Considering that 86% of deliveries weigh less than 12 kg and assuming a UAV can complete 2.4 deliveries per hour, we estimated the number of UAVs needed to service 14% of the

market. These calculations allowed us to determine the cost per delivery for each package over a five-year operation period, as shown in Table 3.

Table 3: Delivery cost per package with UAVs (Monetary values expressed in BRL)

Cost per UAV	#UAVs	Energy Cost	Total Delivered Packagers	Cost per package
20000	455	10000	9,462,960	1.44

Source: Author's production

To ascertain the costs associated with using trucks for delivery, we obtained a quote from one of Brazil's largest vehicle rental companies for the monthly rental of a van. The estimate considers that the van would travel an average of 125km per day. We also took into account the average fuel consumption per kilometer and the prevailing fuel prices in São Paulo.

The number of packages that could be transported was estimated based on the van's cargo capacity. To ensure accuracy in our cost calculations, we calculated the cost per package. This method avoids any potential bias that might arise from the need to use more than one vehicle for deliveries. The detailed breakdown of these costs, including all the variables considered, is presented in Table 4.

Table 4: Cost per package by road (Monetary values expressed in BRL)

Km/month	km/l	Needed fuel	BRL/L	Total fuels Cost	Car Rent	Total Cost with Van
3000	10.7	280.37	3.96	1,109.44	2,598.00	3,707.44
Total working hours	Price per hour	Worked Hours/day	# of Packages	Cost per Package		
288	12.87	12	100	1.54		

Source: Author's production

Beyond the monthly costs associated with vehicle rental and operation, we factored in several other expenses crucial to the delivery service's operation. These include salaries for employees, costs for personal and logistics management software, marketing expenses, office overheads, insurance premiums, and investments in innovation and technological advancements. These components collectively contribute to the operational cost structure of the delivery service.

To provide a complete financial overview, we meticulously calculated these costs and aggregated them to determine the final cost per package delivered. This detailed financial breakdown, encompassing all the mentioned expenses, is presented in Table 5.

Table 5: Total cost per package (Monetary values expressed in BRL)

Anual Total Costs(Year 5)	Monthly Costs	Months	Total Cost
Fixed	262.779,93	12	3.153.359,12
Variable	311.578,39	12	3.738.940,69
Total	**574.358,32**	**12**	**6.892.299,82**

Source: Author's production

An arbitrary markup price of 2.5 times the costs was selected, in line with general retail practices. This pricing strategy aims to achieve an EBITDA similar to that in the logistics sector, allowing profitability for the company utilizing this model. Consequently, delivery via the hybrid system (truck + UAV) could be up to 55% cheaper than the least expensive traditional model currently available in the market.

Rarity - The rarity of resources stems from early market entry, enabling exclusive partnerships and market consolidation while competitors are still in their nascent stages. Although access to operating systems and equipment is not restrictive, the development of a safe and efficient logistics system necessitates high-quality professionals, crucial for the company's initial hiring.

Imitability - The company's pioneer status in the segment can create a unique sense of security and trust, hard to replicate. This depends on the adopted communication strategies. Moreover, an optimized and bespoke logistic system is difficult to imitate, especially when established partners are unlikely to switch to new, untested systems.

Organization - A competent staff, predominantly engineers with market experience, guided by clear mission, vision, and values, would allow optimal use of resources and capabilities.

3.3 PORTER'S FIVE FORCES ANALYSIS

Threat of Substitute Products/Services: The existing delivery sector, featuring major players like Correios, Jadlog, and Loggi, presents a significant threat. These established companies could potentially offer similar UAV services or use their influence to impede necessary regulatory changes. Their easier access to capital could enable them to develop competing services rapidly,

which could hinder the growth of new entrants like the proposed company. The lower operational costs of UAVs, if adopted by financially stronger companies, could also be a challenge for new market entrants.

Potential of New Entrants: The entry into the UAV delivery market is currently hampered by regulatory barriers, making early entry a significant advantage. Early movers not only stand to gain quicker regulatory approvals but also have the opportunity to leverage the best, already tested technologies.

Power of Customers: The cost of freight has been identified as a primary factor in customer purchase decisions (ROCKCONTENT, 2018). Offering a more affordable freight option could therefore be a substantial advantage. The current lack of UAV delivery services further underscores this opportunity.

Power of Suppliers: The supply market for UAV equipment and operational software is diverse, with numerous players involved. This diversity suggests that supplier power is likely not a significant concern, as there are multiple options available for sourcing these components.

Competition in the Industry: The proposed business model's competitive edge lies in its pricing and faster delivery times. Another distinctive feature could be the introduction of a return system, a service currently not widely offered in the sector, except by Correios, which requires consumers to physically go to an agency. The delivery market is segmented with various operational companies, but the lack of a collection service, which companies like Amazon offer in other markets, presents an opportunity for differentiation and potential market capture.

3.4 SWOT ANALYSIS

Based on the internal and external scenarios of the sector, a SWOT analysis, as suggested by Teoli et al. (2019), was conducted. This analysis identifies the strengths and weaknesses (internal factors) and the opportunities and threats (external factors) faced by the proposed company. The results of this analysis will guide the formulation of strategic objectives, correlating each element in the SWOT matrix with necessary actions for achieving the company's goals.

3.4.1 Strengths

- Faster and cheaper delivery model: The UAV-based model promises up to 70%

faster deliveries at 60% lower costs, enhancing the company's margins and reducing consumer costs.

- Economies of scale: The growing delivery sector indicates a larger demand, enabling economies of scale.
- Lower operating costs: UAVs incur lower operational expenses compared to trucks or vans, leading to reduced personnel costs.
- Adaptability: The versatility of UAVs allows for service expansion into various market segments beyond traditional delivery.

3.4.2 Weaknesses

- Outdated technology: Current UAV technology has limitations, particularly in battery autonomy and location systems.
- Specialized labor requirements: The nascent UAV sector lacks a large pool of qualified personnel, potentially slowing the expansion of the business, especially given the regulatory landscape overseen by ANAC (National Civil Aviation Agency).

3.4.3 Opportunities

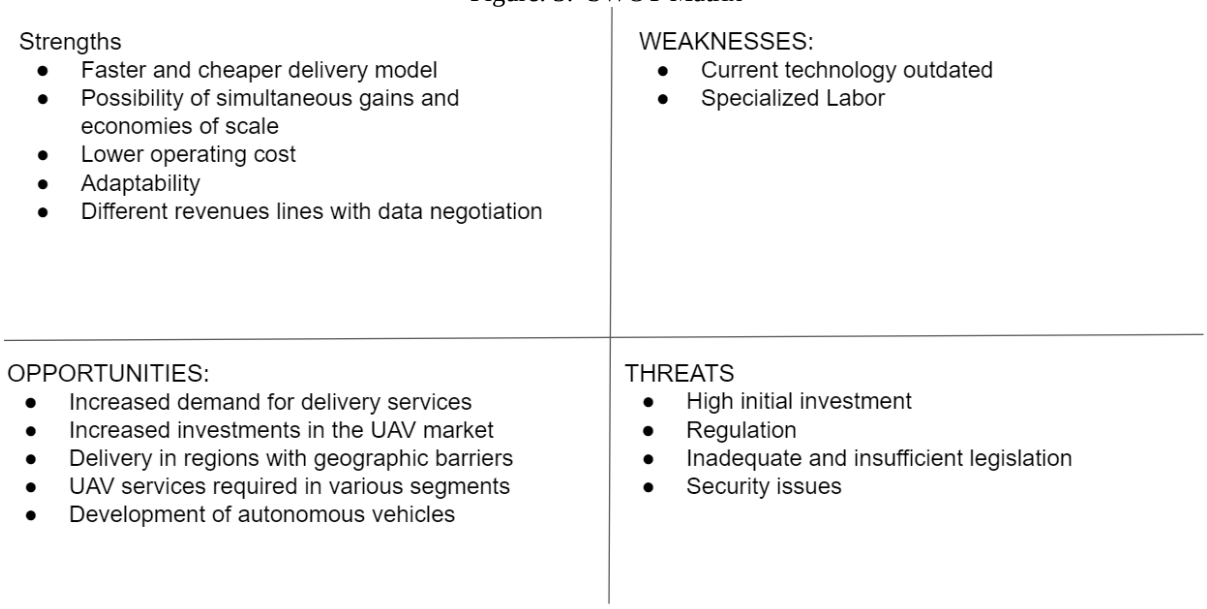
- Growing delivery demand: Increasing orders in various sectors point towards potential investments in new delivery technologies and modalities.
- Expanding UAV Market: Additional investments in the UAV market are likely to lead to technological advancements and new service opportunities.
- Geographical Reach: UAVs can facilitate deliveries in challenging terrains or during calamities, offering quick and efficient service.
- Diverse Applications: UAVs have potential uses in agriculture, mining, government services, and public safety, providing alternative revenue streams if regulatory delays occur.
- Autonomous Vehicle Development: The integration of UAVs with autonomous ground vehicles could further optimize logistics operations and reduce costs.

3.4.4 Threats

- High initial investment: The cost of purchasing UAVs and operating systems, along with maintenance and extensive pre-operational testing, signifies a substantial initial investment. This includes the effort and resources needed to develop an efficient, reliable system with optimized routes, and the selection of the best suppliers. These factors contribute to a delay between the company's inception and its actual market entry. Only after these investments and preparations can the company form its first commercial partnerships and comply with ANAC's regulations.
- Regulation: Current ANAC regulations limit UAV operations to a radius of 2.5 km from the takeoff point. This restriction can significantly limit the operational scope and effectiveness of the UAV delivery model, impacting the potential service area and efficiency.
- Inadequate and insufficient legislation: The existing legal framework for UAV operations is not clearly defined, lacking specific permissions or prohibitions. This ambiguity creates uncertainty and does not provide the necessary legal security for confidently operating a UAV-based delivery service.
- Security issues: There are considerable security concerns regarding both the UAVs and the merchandise they transport. Risks include potential damage to or theft of the UAVs and cargo, as well as safety hazards to the public in the event of an accident or system failure. Addressing these security issues is crucial for the safe and reliable operation of UAV delivery services.

Figure 3 presents the detailed SWOT Matrix.

Figure. 3: SWOT Matrix



Source: Author's production

3.4.5 Leveraging strengths and 0pportunities

Marketing and Communication: To capitalize on the company's strengths and market opportunities, a strong focus on marketing and communication is essential. This will help in quickly establishing the brand as a cost-effective and speedy delivery option.

Scaling and Financial Management: With the low operational costs of UAV delivery, the company should prioritize scaling its operations. Simultaneously, prudent financial management in the initial years is crucial to control cash burn.

Market Monitoring and Technological Advancements: Keeping a close eye on market trends and investing in cutting-edge technology will help the company stand out and maintain a competitive edge.

3.4.6 Addressing Weaknesses and Mitigating Threats

Cost Optimization and Market Monitoring: Continuous market surveillance and cost optimization strategies are vital to address inherent weaknesses and external threats.

Staggered Investment Approach: Investments should be made progressively, starting with a Minimum Viable Product (MVP) and gradually scaling up UAV purchases as demand grows.

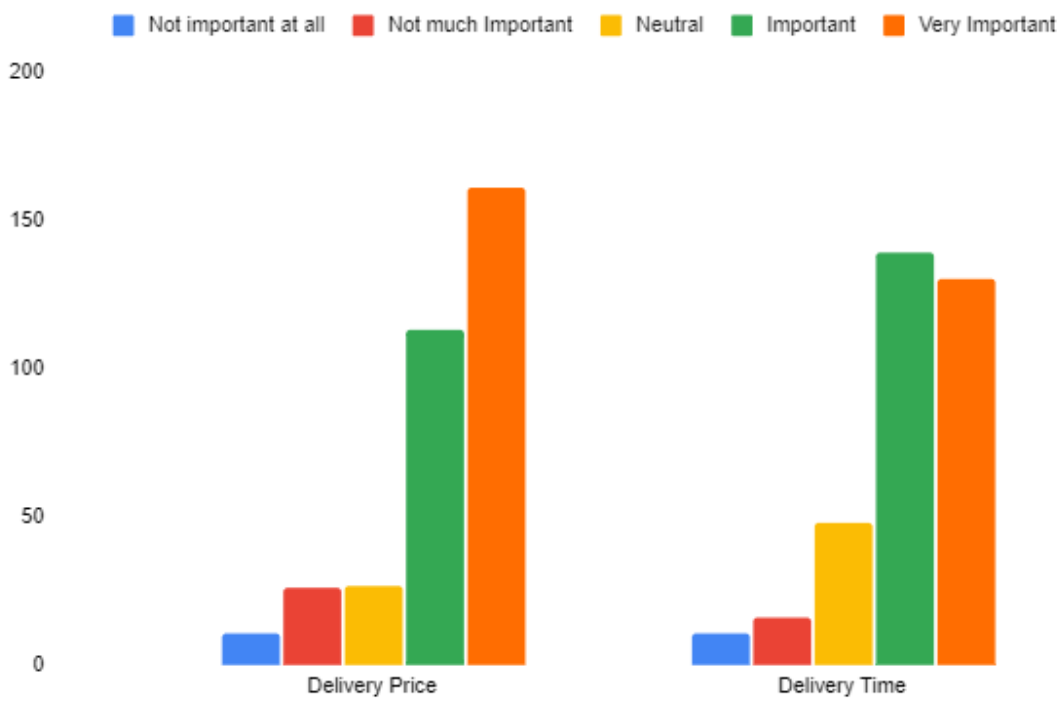
Workforce Training and Recruitment: Investing in training and recruiting a specialized workforce, including enthusiastic UAV pilots, is key. Being a pioneer in this sector, the company has the potential to lead in building a skilled and safe team.

Regulatory Engagement: Navigating regulatory challenges requires patience and direct engagement with governmental bodies. Support from key industry players and the public, garnered through effective sales and marketing, will aid in overcoming these obstacles in the long term.

4 CONCLUSION

This study has explored an innovative approach to delivery, focusing on a hybrid model combining UAVs and trucks. It identifies significant competitive advantages, such as time savings and cost reduction, beneficial for both consumers and the company. The increase in online sales and delivery services, accelerated by the Covid-19 pandemic, highlights the importance of delivery time and cost to consumers. Surveys indicate these factors as critical pain points, with 78% and 81% of respondents respectively rating them as important. Figure 4 illustrates the significance of various characteristics in the context of delivery orders.

Figure. 4: Importance of characteristics when ordering by delivery



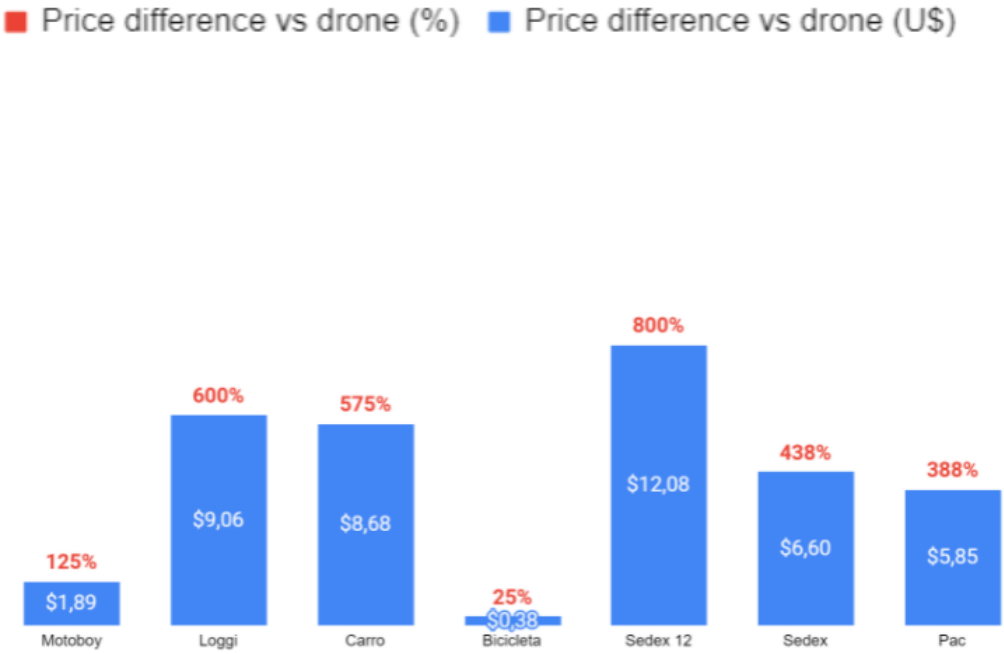
Source: Author's production

The analysis and research conducted in this study strongly support the value proposition of incorporating UAVs into delivery services. This approach is not only likely to be well-received by end consumers but also brings a significant degree of innovation to the delivery industry. Our comparative analysis suggests that the use of UAVs can result in up to an 80% reduction in freight costs, offering a considerably cheaper option for clients. Additionally, the study demonstrates a potential gain of up to 70% in delivery speed, effectively addressing the two critical factors of time and cost.

This improved efficiency in delivery times and the notable reduction in costs affirm the effectiveness of the UAV-based model. Such advancements could revolutionize the delivery sector, particularly in its final stages, by offering a faster, more economical alternative to traditional methods.

Figure 5 visually compares the delivery costs of using drones versus other conventional models, further illustrating the advantages of UAV deployment in delivery services.

Figure. 5: Delivery costs by drone vs other models



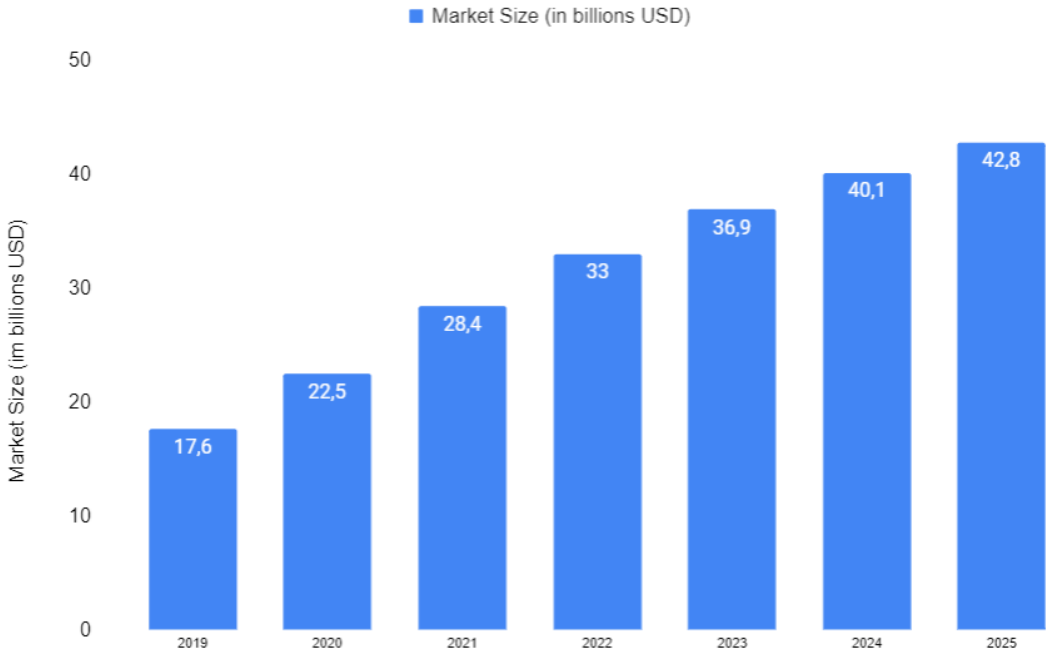
Source: Author's production

The comparative study on delivery methods reveals that using UAVs can offer significant cost advantages, potentially saving up to $12 per delivery compared to other models. In terms of delivery speed, UAVs are comparable to the fastest model currently available, which is motorcycle couriers. However, UAVs present a 25% cost reduction over motorcycle courier services, highlighting their economic efficiency.

These findings were derived from estimates obtained from the websites of the respective delivery services. The calculations were based on deliveries weighing 10kg and covering a distance of 15km.

Figure 6 provides an overview of the drone market's evolution in terms of its financial growth, further illustrating the increasing significance and potential of UAVs in the delivery sector.

Figure. 6: Drone market evolution



Source: Author's production

An entry point and market acceptance for the proposed alternative have been identified, evidenced by the overall growth of the UAV market, which is expected to reach $42.8 billion by 2025. This growth should lead to increased investments and a subsequent reduction in the costs of operating systems and equipment. Additionally, recent market research confirms that the UAV delivery segment is anticipated to grow by 53.8% annually from 2020 to 2030 (Market and Markets, 2020), surpassing the general UAV sector average and potentially reaching $39.0 billion by 2030. The delivery market is expanding in the same direction, affirming initial estimates and showing various segments adopting this technology. The outlook for the delivery market is optimistic. Given the current situation, entering this segment appears favorable and may even mitigate potential regulatory risks.

Through strategic analysis, regulatory challenges, particularly with ANAC, have been identified as the most significant barriers at present. However, these are not deemed substantial risks to the business model. The analysis also clarifies the value that the enterprise can add, including its scalability and ability to pivot to different markets.

This study does not delve deeply into the operationalization of this model. For future developments, it is recommended to identify UAV models already on the market that meet the

project requirements, which will aid in projecting all operating costs, including those for pilots, systems, and periodic maintenance. Another avenue for future development is to weigh the benefits of developing proprietary operating systems against purchasing existing ones. Proprietary models could more precisely meet a specific company's needs but may prove costlier. This consideration is particularly relevant for the proposed trucks/vans and UAVs model.

A theoretical advancement would involve automating the entire delivery chain, incorporating autonomous trucks into the processes. Subsequent analysis could explore optimal ways to initiate this model in a specific region, focusing on the most favorable entry points and in-demand products.

Other business models, such as using fixed bases instead of a hybrid model, could also be considered. In Brazil, large retailers already employ a model where individuals distribute products from their homes or small storage units. Integrating UAVs into such a system could optimize logistics in microeconomic regions, presenting a theoretically viable yet practically appealing option.

Lastly, it would be beneficial to explore other segments and applications for UAVs, given their emerging trend across various domains with potential for cost reduction and operational optimization.

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