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THE ECONOMICS OF DRONE LOGISTICS AND FREIGHT DELIVERY CASE STUDY:IMPLEMENTATION OF A DRONE DELIVERY SYSTEM IN CONSTANȚA

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Abstract: The rapid expansion of e-commerce has increased demand for efficient, reliable and sustainable last-mile delivery. This paper evaluates the economic and operational feasibility of an illustrative drone delivery system for Constanța, Romania, using Cargus as a hypothetical implementation context rather than describing an existing company project. The study applies a scenario-based cost comparison between conventional couriers and autonomous air deliveries. Its assumptions include a total investment of EUR 20 million, a drone acquisition allocation of EUR 9.6 million, a unit acquisition price of EUR 20,100, ten operating hours per day and a twenty-minute average delivery cycle. Under these assumptions, 477 drones could theoretically complete 14,310 delivery cycles per day before accounting for charging, weather, airspace restrictions, payload limits and demand. At assumed costs of EUR 5–10 for conventional delivery and EUR 1–2 for drone delivery, the illustrative gross daily cost difference ranges from EUR 42,930 to EUR 128,790 when comparing the respective cost extremes. These figures do not constitute verified savings or a financial forecast because operating availability, staffing, depreciation, energy and regulatory compliance costs require further validation. The analysis identifies potential benefits in time-sensitive distribution while highlighting airspace safety, infrastructure, reliability and investment risks. It concludes that a phased pilot and a detailed regulatory and financial assessment are prerequisites to any commercial deployment.

Key words: autonomous delivery; cost analysis; drone logistics; last-mile delivery; urban transport.

1. INTRODUCTION

The paper entitled "The Economics of Drone Logistics and Freight Delivery" analyses the economic, operational, and technological impact of using drones in logistics and freight transportation, in a context where e-commerce and the demand for fast deliveries continue to grow rapidly [1]. The development of autonomous technologies and artificial intelligence has led to the emergence of new transportation models, and drones represent one of the most innovative solutions for optimizing urban logistics processes [2-4].

In recent years, international courier and transportation companies have started investing in autonomous delivery systems in order to reduce operational costs, decrease delivery times, and improve the efficiency of services provided to customers. Compared to traditional distribution methods, drone delivery offers significant advantages such as avoiding urban traffic congestion, reducing fuel consumption, automating operations, and enabling rapid delivery of urgent or lightweight products [5-7].

This paper aims to highlight both the economic advantages of drone-based logistics and the challenges associated with implementing this technology. The study analyses the possibility of implementing an autonomous delivery system in Constanța within Cargus by evaluating the required investments, operational capacity, and economic profitability of the project [7-8].

The paper compares the costs of traditional courier systems with autonomous drone deliveries while also examining the impact on logistics infrastructure, consumers, and the future development of intelligent transportation systems. In addition, aspects related to scalability, maintenance, reliability, and the adaptability of drone systems during high-demand periods such as Black Friday and public holidays are presented.

Through this analysis, the study aims to demonstrate that drone-based logistics can represent a viable and sustainable solution for the future of urban deliveries, with the potential to significantly transform the transportation and courier industry [1-.

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2. CONTEXT AND OBJECTIVES OF THE CASE STUDY

In order to evaluate the practical applicability of drone logistics, this case study analyses the implementation of an urban drone delivery system at the company Cargus in the city of Constanța, Romania.

Constanța represents a suitable environment for such an implementation due to: its medium urban density; existing logistics infrastructure; increasing demand for e-commerce deliveries; relatively manageable geographic area.

The main objectives of this case study are: to determine the operational capacity of a drone delivery system; to evaluate its economic efficiency; to compare it with traditional delivery methods; to assess its feasibility in the Romanian context.

3. INVESTMENT PARAMETERS AND INVESTMENT STRUCTURE

The implementation of the system requires an initial investment, structured as follows:

- Total budget: €20,000,000
- Drone budget: €12,000,000
- Cost per drone DJI FlyCart : €20,100
- Allocation for infrastructure and operational costs (20%): €2,400,000

(20% x 12,000,000 = 2,400,000 €)

- Remaining budget for drone acquisition:

€9,600,000 =12,000,000-2,400,000.

Number of drones:

$$9{,}600{,}000 \div 20{,}100 \approx 477 \text{ drones;}$$

20,100 x 477 = 9,587,700 €

Thus, the system includes approximately 477 operational drones.

- *Urban infrastructure and logistics* –€ 5,000,000: urban hubs; take off/landing platforms; hangars, charging stations; security, cameras, operational spaces.

- *Software and staff training* – €2,000,000: fleet management platform; AI, route optimization; real-time monitoring.

- *Licenses and insurance* – €1,000,000

Types of licenses: Urban UAV operation license; Communications license; AI and fleet management software license.

Types of insurance: Third-party liability; Drone and equipment insurance; Transported goods insurance.

- *Organizational Structure*.

Total: 42 employees

- 10 drone maintenance technicians
- 15 control and surveillance operators
- 10 logistics and coordination staff
- 7 IT, software, and AI specialists

4. OPERATIONAL CAPACITY

Each drone operates under the following conditions: operational time of 10 hours/day and average delivery cycle of 20 minutes.

Deliveries per drone:

$$(60/20) \times 10 = 30 \text{ deliveries/day.} \quad (1)$$

Total system capacity:

$$477 \times 30 = 14{,}310 \text{ deliveries/day.} \quad (2)$$

This represents a significant delivery capacity for an urban environment.

5. OPERATIONAL MODEL OF DRONE DELIVERY

The drone delivery process is fully automated and consists of:

- Order placement via digital platform
- Automatic drone allocation
- Route optimization using AI
- Package loading at logistics hub
- Autonomous delivery
- Digital confirmation of delivery

This system minimizes human intervention and increases operational efficiency.

6. ANALYSIS OF TRADITIONAL DELIVERY SYSTEMS

Traditional courier services rely on: vehicle fleets; human couriers; road infrastructure.

Estimated operational parameters:

- -Deliveries per courier: 80–120 parcels/day,
- -Working time: 8–10 hours/day.

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Identified issues: traffic congestion; delivery delays; failed deliveries (10–15%); high operational costs.

7. COST ANALYSIS: TRADITIONAL VS. DRONE DELIVERY

- Traditional delivery: Cost per delivery- €5–10
- For 14,310 deliveries: €71,550 – €143,100 per day
- Drone delivery: Cost per delivery: €1–2
- For the same volume: €14,310 – €28,620 per day .

COST SAVINGS

- Daily savings: between €57,000 and €114,000
- Annual savings: between €20 million and €40 million .

This demonstrates a significant economic advantage of drone-based logistics.

REVENUE MODEL

A premium fast-delivery service is introduced.

- Additional fee: €1.5 per delivery
- Daily revenue: $14{,}310 \times 1.5 = 21{,}465€$
- Annual revenue: approximately €7.7 million

INVESTMENT PAYBACK PERIOD

- Total investment (extended system): €20,000,000
- Payback period: $20{,}000{,}000 \div 7{,}700{,}000 \approx$ 2.6 years

This indicates a fast return on investment.

8. SEASONAL DEMAND AND PEAK PERIOD ANALYSIS

During peak periods such as: holidays (Christmas, Easter); Black Friday. The volume of deliveries increases by 50% to 200%.

Challenges for traditional systems: overloaded couriers; delayed deliveries; parcels redirected to warehouses; customers forced to pick up packages themselves [8-10].

Advantages of drones in peak periods: scalable operations (multiple drones simultaneously); faster processing of urgent deliveries; reduced pressure on traditional logistics systems.

COMMONLY DELIVERED PRODUCTS

Drone delivery is suitable for lightweight and urgent goods such as: pharmaceuticals (medications); food products; small electronics; baby care products; urgent documents.

BENEFICIARY CATEGORIES

Drone delivery is particularly beneficial for:

1. Parents with young children: need for urgent supplies, limited mobility;

2. Elderly people: reduced mobility, frequent need for medication;

3. People with disabilities: difficulty accessing physical stores;

4. Urban professionals: limited time availability, preference for fast delivery.

FEASIBILITY IN ROMANIA

Currently, drone delivery is not widely implemented in Romania; regulations are still evolving.

There are opportunities, such as: first-mover advantage; technological innovation; improved logistics efficiency.

Drone systems offer: high reliability through automation; reduced mechanical failure risk; predictive maintenance capabilities.

Compared to traditional systems: lower maintenance costs; fewer operational disruptions.

Our analysis demonstrates that: drone delivery is significantly more cost-efficient; delivery times are considerably reduced; operational scalability is improved; investment recovery is rapid.

9. CONCLUSIONS

In conclusion, the paper highlights that the use of drones in logistics and freight transportation represents a modern and efficient direction for the development of urban delivery services. The analysis demonstrates that implementing an autonomous drone delivery system in Constanța within Cargus can generate significant economic and operational advantages compared to traditional distribution methods.

From an economic perspective, the analysed investment proves to be profitable, with an estimated payback period that is relatively short compared to the financial benefits and annual operational savings generated. In addition, the implementation of this system can contribute to the modernization of urban logistics infrastructure and increase the competitiveness of courier companies in the fast-delivery market.

However, the development of drone-based logistics depends on the evolution of the legislative framework, air safety regulations, and the adaptation of urban infrastructure to new autonomous technologies. Although this technology is still at an early stage in

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Romania, the study demonstrates a strong potential for the future implementation of drone delivery systems.

Therefore, drones can represent a sustainable and innovative solution for the future of urban transportation, contributing to the optimization of logistics chains and transforming the way commercial deliveries are carried out in urban environments.

10. REFERENCES

[1] Bowersox, D. J., Closs, D. J., & Cooper, M. B. (2019). *Supply Chain Logistics Management*. McGraw-Hill Education.

[2] Chopra, S., & Meindl, P. (2022). *Supply Chain Management: Strategy, Planning, and Operation*. Pearson Education.

[3] Rushton, A., Croucher, P., & Baker, P. (2021). *The Handbook of Logistics and Distribution Management*. Kogan Page.

[4] Christopher, M. (2016). *Logistics & Supply Chain Management*. Pearson Education.

[5] Otto, A., & Agatz, N. (2018). "*Last-mile delivery challenges and solutions in urban logistics*." International Journal of Logistics Management, Vol. 29, No. 4.

6] Amazon Prime Air (2023). *Drone Delivery Systems Overview*. Amazon Corporate Publications.

[7] DHL Trend Research (2020). *Drones in Logistics: A Strategic Guideline*. DHL Customer Solutions & Innovation.

[8] https://www.zenatech.com/drone-delivery-shipping-industry/

[9] colet.ro/ro/viitorul-este-aici-dronele-care-livreaza-colete-in-romania/

[10] https://onedrone.com/industries/transport-logistic/

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