Chances and Challenges of Drones in Logistics Applications

Bachelorarbeit

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vorgelegt von

Name: Flohr Vorname: Moritz

[redacted] [redacted] [redacted] [redacted]

Prüfer: Prof. Dr. M. H. Breitner

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1. Thematic introduction

1.1 Relevance of the theme

The world is constantly changing. Many different megatrends influence our views and behavior. Global trends, such as climate change, require a rethinking of global energy production and consumption. At the same time, the growing globalization and the emergence of new economic centers result in continually changing commodity flows. Moreover, social trends such as urbanization and demographic change also lead to a new consumption and mobility behavior.

Driven by a growing e-commerce sector and the rising supply of goods on the market, parcel shipping has increased by more than 70% since 2000 (Bundesverbandes Paket und Expresslogistik e. V. (BIEK), 2016). While more and more receivers live in densely populated cities and are not always available, the demand for fast, uncomplicated and reliable delivery is expanding. Furthermore, delivery specifications, driving prohibitions and new environmental requirements lead to new challenges in logistics.

On the other hand, there have been tremendous advances in automation within the last few years. Driven by an ever smaller and more economical production of electronic components and ongoing technological development, autonomous vehicles and aircrafts are becoming more and more interesting for commercial use. The growing popularity also includes drones, which are aroused by a by the latest technological advancements and decreasing costs in the logistics sector.

1.2 Derivation of the question & research design

The present work attempts to clarify the properties of drones in logistics applications in order to find a way to overcome the described multifaceted challenges. To this end, the individual critical environmental factors of the commercial use of drones are investigated using the PESTEL methodology. The chances and risks are elaborated within the individual divisions, in order to provide a statement on possible areas of application in logistics. Finally, it is to be clarified to what extent drones can be integrated into logistics supply chains.

With the help of the PESTEL methodology the analysis is divided into the following areas: politics, economic, social-cultural, technology, environment and law. While the political section deals with current views and objectives of the policy against drones in logistics, the legal area deals with current laws and framework conditions for the use of the regarded technology. Within the economic sphere, the focus is on the examination of economic viability, the social-cultural environmental analysis deals with the acceptance of the commercial use of the drones in the population. Furthermore, the current technological state of the art is considered in a separate section. Finally, the interaction of drones with their surroundings is investigated in the environmental field. Within all areas, the SWOT methodology is used to derive challenges and risks from the individual strengths and weaknesses.

The research is based on expert interviews of various interest groups and preliminary results of successful test projects by logistics service providers. The experts are of different backgrounds such as members of teams of existing logistical drone projects as well as from the area of the city and the legislator.

2. Theoretical Framework

2.1 Megatrends

In times of constant global challenges, a variety of different trends affect the world community. Among the most important of these trends are shifting centers of economic activity**,** urbanization, consumerism, changing demographics and climate change. These trends influence the logistics sector in particular. The most significant trends influencing logistics applications are presented below.

Climate change: Of all global trends, climate change certainly has the greatest impact on the logistics sector. Throughout the course of human development, increased consumption of fossil fuels has resulted not only from industrialization, but also from intensive land use and radical deforestation. Since the pre-industrial era (1750), greenhouse gas concentrations have steadily increased in the atmosphere. Carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) number among to the most widespread long-lived greenhouse gasses (LLGHGs) responsible for climate change. The concentration of these LLGHGs increased significantly between 1750 and 2015 (World Meteorological Organization, 2016).

surveys addressing acceptance and feasibility of drone-delivery are based only on ideas and estimates. Thus, the hitherto positive attitude towards drones could change rapidly once people actually perceive drones in their direct environment.

In addition, a common literature search was not possible due to missing primary literature. Consequently, the results of the scientific work are based on expert interviews conducted in advance. At the same time, the interviews were difficult to obtain and the interview partner were not always able to provide the exact information requested. A detailed analysis of the interviews was dispensed in view of the small scale of the work. Within a more comprehensive work one could consider performing a qualitative content analysis according to (Mayring, 2010). The analysis includes filtering out content-related passages, paraphrasing and summarizing them and finally classifying the collected information into categories. With the help of these categories, a quantification of the output can be achieved.

Finally, it can be said, that all areas have only been roughly torn, and that there are other questions regarding economic efficiency, which could be solved in other research projects. Furthermore, first commercial deployments are expected for the future, which will provide new results and new opportunities for research and thus may open up new insights.

5. Conclusion and Outlook

Drones in logistics applications clearly provide the most possibilities in niche markets such as the medical field. In this application area, costs play a subordinate role and temporal factors are the most prioritized. Considering that, the drones' features can be of high benefit. Medical specimens or organs must arrive quickly and without detours. At the same time, it is not a mass market, which can therefore be efficiently replaced by drones. Since this task is otherwise done by an underutilized transporter with unused capacities, drones also save emissions. Moreover, examples from past projects show that political support is available in this area of application, which makes it easier to obtain legal exemptions.

In addition, another recommended field of application is the supply of remote areas. These include both remote mountain regions and islands, as well as rural regions where merely insufficient transport infrastructure is available. On the one hand these regions can be supplied with urgent goods, such as medicine, food or spare parts, in case of an emergency. On the other hand, the drone supported logistic applications provide the possibility to avoid expensive infrastructure investments. These construction measures are often economically

inefficient, since they serve only a small amount of people and present a great challenge in construction. In this field of application, drones provide relief and fit the expectations of the population excellently.

Furthermore, drones are able to reduce costs in the logistic chain by supporting the delivery process. This includes the support of everyday standard delivery, as well as by supplying of vessels during their journey. As part of the parcel delivery drones, which starting from the transporter, could supply remote receiver while the delivery vehicle continues to distribute packets. A partial integration of drones into the delivery benefits from its advantages without overloading the technology. Acceptance in politics and the population is also higher if the new technology is first given partial participation and responsibility.

In general, using drones on their own is not efficient within the standard parcel business segment, as the established concepts, such as delivery vans in combination with spread distribution centers, are economically more attractive. However, with their speed and flexibility, drones offer the opportunity to expand the SDD market by providing new, faster delivery options. Within the segment, there is only a small group of buyers, which is, however, willing to pay a lot of money to quickly receive important documents or goods. Especially the B2B segment is addressed here as a customer group.

Altogether, it can be said that drones in logistics applications wherever their positive characteristics, such as speed, flexibility and independence can be used optimally. At the same time, costs must not be the decisive factor for decision-making, and the limited loading capacity as well as the acceptance in the population must be taken into account. The key stakeholders of integrating drones in logistic applications in the future will be mainly regulators, manufactures and the research and development segment. In the future, new laws will create the framework in which logistic service providers can move in the future. With regard to further developments, the transport of the Last Mile will be further automated and drones will play an important role as part of this network. If an estimation should be given of the necessary time period, one assumes that drones can be economically integrated into logistics networks over a period of 5 years. In order to perform this integration, the statutory requirements need to be adjusted in a favorable way and the networking of logistics needs to increase . Finally, the technology of the drones has to evolve in order to ensure future safety in complex and difficult to capture situations.