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Drone technology and performance of retail logistics

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Abstract: The purpose of this research study was to explore drone technology and performance of retail logistics by offering academic and practical benefits, explaining the preceding, and recommending a research plan based on a conceptual framework for drone technology and performance of retail logistics. A literature review has been created to assist today's retail logistics managers and researchers in scrutinizing what has been previously researched and what needs to be explored. From the standpoint of retail logistics, the study adds to our knowledge of drone technology as it relates to the performance of retail logistics and the constraints of future research. This study utilized a systematic literature review to design a suggested conceptual framework for a research agenda on drone technology and performance of retail logistics. The research paper provides insights into deficiencies in the drone technology, along with performance of retail logistics literature. The research paper explicitly recommends exploring the drone technology as it relates to expected and actual performance of retail logistics. This article contributes to the literature in a number of ways. To begin with, it provides the first comprehensive succinct synopsis of the essential concepts in the drone technology and retail logistics. Second, the impact of retail logistics in the growth of the economy. Third, the application of drone technology in retail logistics. Fourth, unnoticed challenges in retail logistics are then exposed as ideas for potential research. Finally, the technique utilized to conduct the systematic literature review can be used as a model for prospective researchers when conducting similar research. Contemporary research is aimed at providing a research group that address the needs of adopting the current technology on the performance of retail logistics. For performance of retail logistics, the article presents a suggested conceptual framework for drone technology and performance of retail logistics.

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1. Introduction

Logistics is the process that integrates the movement of goods, services, information and capital, right from the sourcing of raw material, to the consumer (Springinklee & Wallenburg, 2012). According to the Council of Logistics Management, "logistics is the process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services, and related information from point of origin to point of consumption for the purpose of conforming to customer requirements." Efficient retail logistics has gained increased focus as one of the critical success factors in gaining of competitive advantage (ROK, 2018c). After retailers like Amazon released ground-breaking disclosures concerning their plans to utilize drone technology for the last retail delivery services, there's been a growing need to understand how retail logistics networks should adapt and change as technology advances. Unmanned Aerial Vehicle which is referred to as drone is an aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expandable or recoverable, and can carry a lethal or nonlethal payload (Mandžuka *et al.,* 2016). Unmanned Aerial Vehicles (UAVs) have received attention in the last decade because of their low cost, small size, and programmable features (Mandžuka *et al.,* 2016).

According to Milovanović *et al.* (2017), globalization has led to increased complexity on logistics due to increased competition because of reduced barriers. On the other hand, customers have become more aware and demanding about prices, and quality (Milovanović *et al.,* 2017). Currently, the majority of retail drones are augmentation robots which are managed by their controllers via mobile devices. Although drones are beginning to be utilized within warehouses for managing inventory, several enterprises are exploring how well this invention may be capable of improving various logistics operations. Drone delivery is one of the most promising applications to deliver packages efficiently (Kim, 2017). According to Chitta & Jain (2017), Amazon is the largest online retailer with revenue of 88.9B in 2014. It has been the most public and advanced in experimenting with drones for package delivery. Amazon launched Prime Air - a delivery system designed to get packages to customers in 30 minutes or less using unmanned aerial vehicles this has really enhanced retail logistics (Macaulay *et al.,* 2015).

According to (Tiwari & Dixit, 2015) UAVs has different types of application in developing countries as in agriculture, critical assistance during disaster management and relief operation, monitoring large rugged areas, tracking down criminals, disaster areas and observing forest fire. Unmanned Aerial Vehicles (UAVs) are currently used in the cargo delivery system, where the delivery of emergency medical supplies is essential, especially in rural areas (Eichleay *et al.,* 2019)

In Kenya, Company such as Orbital Geospatial services obtains mapping land information using drone technology; this involves the use of GPS-enabled drones to conduct aerial surveys. Drones are able to capture high-resolution images, which are then used by land planners to not only identify, but also digitize the record of boundaries of any land (Pablo & Petzold, 2016). Drones' advantages over the traditional methods of mapping are increased speed, increased reliability, and fewer costs than with sending surveyors out to physically map (Pablo & Petzold, 2016). Changes in the current turbulent business environment have made it increasingly important to reduce cost and provide better customer service as key strategies to win in the long term. The advancements in technology have led to more opportunities and have paved way to new product, process and business model innovations (Palomero & Chalmeta, 2014).

According to ROK (2018c), the retail logistics sector in Kenya is confronted with a number of significant problems in an urban setting. Local carriers usually use old vehicles that emit large amounts of pollutants in order to reduce the increasing costs. For instance, in Kenya the trucks that serve as the medium of retail logistics companies cause 76% of vehicle congestion and nearly 27% of particle emissions (KNHDR, 2013). This affects retail logistics companies not to operate efficiently leading to a higher than optimal vehicle-kilometers due to ineffective logistics planning. Along with the dynamic character of science, technology is constantly changing and improving. Adoption of drone in retail logistics has faced a number of limitations; urban delivery, limited capabilities of operating, weather

conditions, insurance cost and high cost of acquisition of government license and maintenance (Patella *et. al,* 2021). The challenge therefore, for many retail logistics firms is the adoption of the right technology capable of playing complementary roles in fostering success and safeguarding consumer welfare.

2. Literature review

Several studies have taken an international perspective to the study of drone technology. For instance, the study by DHL (2014) involved respondents from the Nokia's headquarters in Espoo in Finland, while the ones conducted by Smith et al. (2016) and Lachow (2017), have provided empirical insights. Motlagh *et al.* (2016), investigated the effects of drone technology on performance of logistics firms in Kenya by conducting a survey on 10 logistics firms in Nairobi. Their findings showed the importance of drone technology adoption on competitive advantage of logistics firms in Nairobi. In addition, several studies have investigated on adoption of drone technology in logistics specific geographical areas.

Akshay *et al.* (2018), examined the drone technology in production, supply chain and logistics. The study provided systematic insight on how drone technology is used in production, supply chain and logistics; thereafter the study recommended that drone delivery offer tremendous benefits in the form of cheaper and faster shipping. According to Bamburry (2015), unmanned drones have been described as on the verge of blowing a big hole in the logistics. The main reason that retailers are using drone technology is to solve the last mile issue within the retail logistics (Kunze, 2016). Drones solve this issue by eliminating the need for delivery vehicles, as drones can fly straight to and from someone's doorstep using an electric motor (McKinnon, 2016). Furthermore, drones can add value in the form of quick, reliable, same day delivery, which in today's fast pace environment is very important (McKinnon, 2017).

Weise (2015), investigated the potential application of drones in security and search-and-rescue missions. Drone manufacturer DJI is pairing with FLIR, the company named for its thermal imaging technology used in systems of "forward looking infrared radar," to produce drones that can be used in search-and-rescue, firefighting, security, and surveillance. Weise (2015), adds that the current application of thermal imaging by police is on helicopters when searching for suspects at night. Hayat *et al.* (2016), posit that drone technology has many advantages such as reduced time, increased safety, and higher quality of images thus enhancing the performance of retail logistics.

According to Ro *et al.* (2007), a promising application of drones is to enhance the systems of traffic monitoring which serves as an important component in the Intelligent Transportation System (ITS). Kanistras (2015), states that in rural areas, the sparse traffic monitoring systems are used only for observing simple traffic counts at specific locations. Comprehensive traffic operations are obviously not recorded in rural areas. Ro *et al.* (2007), poised that the reason behind this limited use of the traffic monitoring system in rural areas is cost effectiveness. Hayat *et al.* (2016), highlighted that UAVs provide a cost-effective mode that meets rural traffic surveillance system needs short landing, and special recovery system that prevent communication failures with redundant communication systems.

According to Joshi (2017), private companies and governmental organizations have started using drone technology for their operational needs. Among key players in the drone market are Amazon, Google, and Facebook. There are many different applications for drones such as parcel delivery, rescue operations, construction monitoring, military operations, inspection of facilities, and agriculture monitoring and (Tiwari & Dixit, 2015). Drone technology replaced expensive helicopters, experience has shown that drones are incredibly advantageous in hard-to-reach places or places where a human cannot carry out tasks effectively and timely (Colomina, 2014). Expansion of retail logistics has led to many companies and researchers interested in using several drones at the same time (Hayat *et al.*, 2016). The term "drone swarm" usually refers to a group of UAVs that are flying at the same time and communicating with each other with only limited control by a human (Lachow, 2017). Intel proved that swarm of hundreds of drones is possible to enhance the performance of retail logistics (Hayat *et al.*, 2016).

Unmanned Aerial Vehicles (UAVs) are gaining in popularity and are projected to be utilized in a variety of sectors. They can perform a variety of jobs ranging from pizza delivery to people transportation through flying taxi (Motlagh *et al.,* 2016). The term 'Unmanned Aerial Vehicle' means an aircraft without a human pilot on board. It is controlled remotely from an operator on the ground. UAV

is a part of the unmanned aircraft system (Rosnell & Honkavaara, 2012). Unmanned Aircraft System (UAS) is a system that consists of unmanned aircraft vehicle, the control station and other elements necessary to enable flight (Rana *et al.,* 2016). Drone delivery is expected to be significantly cheaper than existing delivery methods, thanks to rapidly maturing technology (Desjardins, 2018) besides innovative ideas such as aerial (floating) warehouses (Thomas, 2017). Essentially, a cheaper and more efficient DDS can profitably exploit clients' acuity to timely delivery, leading to an increase in both the optimal delivery speed and the optimal number of delivery centers (Perera *et al.,* 2020). In other words, delivery networks will become more dispersed or decentralized.

Whereas one might anticipate faster connectivity to consumers to drive a retailer's delivery service network toward centralized control, the value to the retailer from a surge in demand is caused further by decentralization. According to Joglekar, Davies and Anderson (2016), this effect as well prompts us to prospective unforeseen effects of drone technology adoption in retail logistics in the context that unrestrained decentralization can quickly lead to the risk of "overcrowding in the skies" and the logistical difficulties that are encompassed in last-mile delivery (Captain, 2018). Consequently, the optimal number of distribution centers significantly reduces as the speed limit tightens for the speed constrained variant of the retailer's conundrum, where the maximum speed of drones is bounded from the above (Perera *et. al.,* 2020). Whenever the majority of distribution centers must be kept constant; due to the physical congestion in the retailer's market (Chen, Hu & Solak, 2021); consumers show that if the fastest available time to market exceeds a threshold, it is optimal for the retailer to deliver at the threshold level in order to throttle unprofitable demand; that is, the retailer prefers to offer a delivery guarantee that is inferior to the highest potential (Perera *et. al.,* 2020). It thus happens since, once you pass the minimum requirement, the time to market and the number of distribution centers become complimentary; in other words, better delivery rates profit greatly the retailer only if they are supported by an increasing number of distribution centers (Persson, 2021). The literature review shows that there is little research done on drone technology and performance of retail logistics. Much research that has been done majorly focused on the adoption of drone technology on the logistics in general. This paper intends to explore more on the drone technology and performance of retail logistics.

3. Research methodology

A systematic literature review should clearly state the process in order to ensure replicability and transparency (Denyer & Tranfield, 2009). The process should include planning and formulating the problem, searching the literature, data gathering and quality evaluation (Thomé *et al.,* 2016). The research question and the scope of the review should be well established ex ante (Thomé *et al.,* 2016) and the criteria for inclusion and exclusion of papers need to be clear (Shea *et al.,* 2007). The systematic literature review identifies contributions that reconcile drone technology and performance of retail logistics provide a state-of-the-art panorama of the research; identify research gaps; and propose a future research agenda. All related articles are included in the evaluation. A systematic literature review should have broad enough keywords to ensure relevant contributions are not excluded (Thomé *et al.,* 2016). Additionally, the review should follow a clearly defined protocol or plan where the criteria is clearly stated before the review is conducted; it is a comprehensive, transparent search conducted over multiple databases and grey literature that can be replicated and reproduced by other researchers (Thomé *et al.,* 2016). It involves planning a well thought out search strategy, which has a specific focus or answers a defined question (Levy & Ellis, 2006).

According to Denyer and Tranfield (2009), as a tool of academic and scientific study, thorough literature reviews play an important role in the collection and dissemination of knowledge within the management field. The current literature comprehensive review technique entails a complete use of research methodology (Thomé *et al.,* 2016). The importance of literature reviews in assessing, distributing, and mapping a study area's intellectual domain cannot be overstated. (Denyer & Tranfield, 2009). In each point of the study evolution, such an evidence-based approach to analysis follows a logical and transparent scheme that strives to utilize reliability while keeping a high degree of transparency and scientific bias (Shea *et al.,* 2007). Qualitative content analysis is one of the several qualitative methods currently available for analyzing data and interpreting its meaning (Schreier, 2012). As a research method, it represents a systematic and objective means of describing and quantifying phenomena (Schreier, 2012).

A prerequisite for successful content analysis is that data can be reduced to concepts that describe the research phenomenon by creating categories, concepts, a model, conceptual system, or conceptual map (Elo & Kyngäs, 2008). According to De Miguel Molina *et al.* (2018), several scholars have recommended using qualitative content analysis as an effective instrument for thorough, systematic and replicable study of drone technology literature. Qualitative content analysis can be used in either an inductive or a deductive way. Both inductive and deductive content analysis processes involve three main phases: preparation, organization, and reporting of results (Schreier, 2012). The study used the three-step framework to content analysis in reviewing the literature scientifically.

4. Findings

4.1. Drone technology

Drone technology represents arguably the most encouraging technological innovation towards performance of retail logistics. Drones are getting popular in every sector. Firstly, Domino's Pizza started to use drones to deliver pizzas to its customers. Thereafter, Amazon embraced the use of drones to deliver a speed service to customers. After noticing the success of utilizing drones, German cargo company-DHL, as well initiated using drones in order to deliver heavier products and in long distance. According to the report of DHL called 'Unmanned Aerial Vehicles in Logistics' in 2014, seven different areas for best practices have identified as energy/infrastructure, agriculture and forestry, construction sector, environmental protection, emergency response and police, film and photography development. When using drone delivery technology, retailers may face a number of practical constraints. Whilst still perfect delivery-time personalization is (possibly) preferred solution, managing and communicating such a delivery strategy to consumers is plainly and practically impossible. Furthermore, by using a limited number of delivery zones, retailers can recover a significant portion of the profit under perfect delivery-time customization options.

Retailers might well be limited to a fixed number of delivery centers in physically congested markets such as metropolises. At such a degree of physical congestion mostly in retailer's market increases, so does the effectiveness of delivery-time personalization. In these kinds of marketplaces, retailers might very well find it advantageous to provide delivery assurances that are less than the best available, and hence pinging some growing market. Drones used for retail deliveries will significantly improve the customer experience and enable retailers to reach customers in remote areas. Nevertheless, due to regulatory constraints as well as the logistical technical challenge of coordinating paths for flights, managing airspaces over populous areas, but also managing multiple payloads, retail is indeed a longer-term experience for drones.

McKinnon (2016), established that the main advantages of using drone technology is to liberate humans in retail logistics from stress and dangers from vehicle driving especially on the last mile delivery context. According to Khofiyah *et al.* (2020a), drone technology enhances effective competitive advantage of retail firms due to efficient product delivery in the global market. Moreover, drone technology would lead to higher product delivery at lower prices and a leap in accessibility (Meyer, 2017). Goldstein Research, (2017) established that Industry reports predict drone technology in retail warehouse compound annual growth rate varies from 7.6% through 2024 up to 11.5% through 2021 and 11.6% through 2023 (Dasyam, 2017). Drone technology in retail warehouse has gone from novelty to mainstream for larger companies seeking competitive advantage in an era of labor shortages and highly demanding customers (Futch, 2017). The last mile delivery has become a key process for retailers, and in order to get competitive advantage, the drone technology emerges as one possible solution for the cost reduction on last mile delivery (Chen, Hu & Solak, 2021)

4.2. Retail logistics

Retailers across the globe are working hard to find ways to improve last-mile deliveries. Delivery drones are ostensibly the most incentivizing technological advancement in this direction. Drone technology is being construed as truly disruptive, with the potential to provide retailers with previously unheard-of delivery-time assurances and near-perfect versatility through the use of designated autonomous drones for specific orders. Throughout physically overcrowded marketplaces in which

retailers might well be compelled to work only with just few distribution centers, it may also be preferable to stifle some prospective demand by offering delivery assurances which are subordinate to the best option available. If practical constraints force regulatory agencies to inhibit the cruising speed of drone deliveries, the retailer's optimal number of delivery centers decreases as the speed restriction tightens. It is noteworthy that the retail sector is booming continuously due to improved technology as well as due to the rise of economy. Therefore, demand for retail products is high.

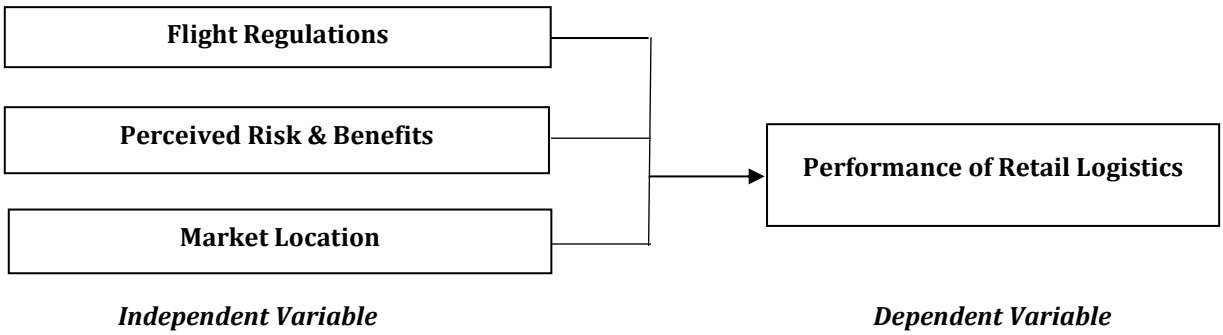
Esper *et al.* (2003), established that last mile delivery can be seen as the connection between the customer order and the physical delivery. Drone technology has become a key factor for the retail logistics viability and a source of competitive advantage (Madlberger, 2004). This is mainly because fast and precise deliveries mean value to the customer (McKinnon, 2016), which is especially important on the least efficient segment of the delivery. Excellence in retail logistics enables the strategic progress of the firms and plays an important role for overall company performance in terms of profitability and growth (Sandberg *et al.,* 2011). Moreover, drone delivery services enable retailers to cost-effectively offer unprecedented delivery speed and adaptable delivery lead times using dedicated aerial vehicles for individual orders (Perera *et. al.,* 2020). However, Kenya has been facing high traffic issues in roads since recent years, which have led to several logistic issues. Therefore, using drones as a logistic medium in retail logistics sector would be a great opportunity to increase the productivity of this sector more.

4.3. Suggested research agenda

The market for unmanned aerial vehicles has been growing year after year, as seen by market growth. The Kenyan retail sector is one of the fastest expanding sub-sector, currently accounting for 7.3% contribution to the Gross Domestic Product (GDP) according to Republic of Kenya (ROK, 2018). Therefore, the effectiveness and productivity of this sector is highly important to the country. Drone technology is mostly utilized in Kenya for surveying, but it may also be used for parcel delivery, agricultural, disaster management and relief operations, monitoring large rugged areas, and forest fire observation. As a result, the Kenyan government should take the appropriate steps, such as giving incentives, particularly to the MSMEs retail sector, to stimulate the use of drone technology. Meanwhile, major retail logistics companies may use drone technology to improve the efficiency and profitability of their operations. Retail companies will find more innovative ways to use drone technology to deliver products and services and, consequently, customer experiences as the technology evolves. Even as drone delivery technology is still in its formative development, it will become more common for delivery in the years ahead. The prevailing COVID-19 global epidemic has pushed retail firms to acclimate to customers' evolving requirements more rapidly, highlighting the value of remote and contactless deliveries. It nonetheless creates a huge incentive for retailers to utilize drone technology. Unmanned aerial vehicles are now being used as well as trialed in several cities worldwide, indicating that drone technology might very well interrupt and revolutionize of the last logistics deliveries and distribution networks.

Researchers should examine more studies in this sector when assessing drone technology and retail logistics performance. For instance, how does flight regulations in drone technology influence the performance of retail logistics? How does perceived risk and benefits in drone technology influence the performance of retail logistics? Finally, how does market location influence the performance of retail logistics in regards to drone technology? Below is the suggested cause and effect relationship.

Figure 1: Suggested cause and effect relationship



5. Limitations and conclusion

The existing research has weaknesses. Whilst our constructive application is for a retailer with a vertically integrated logistics network, it doesn't include product specific features, and its exploration and perspectives also are relevant to companies providing last-mile logistics services. One of the goals of the recent study was to have an objectively designed review of drone technology and performance of retail logistics, which could provide a conceptual framework for how to continue studying the performance of retail logistics. This is not to say that traditional or subjective literature reviews are invalid. Traditional literature reviews are usually done to speed up the execution of investigations, rather than because writers afraid of detailed research. However, in order to keep research moving forward, a systematic literature review on drone technology may need to be established in this situation when taking an unbiased approach to a literature review on an existing trend. This might have narrowed the researcher's retail logistics approach, preventing a more thorough researching of other important subjects.

The results from this comprehensive systematic review indicate that the associations between drone technology and performance of retail logistics are inconsistent. We live in a technology-driven world. Due to this reason, using the technology with all benefits is our responsibility as a society. Technology has both advantages and disadvantages. In this research paper, we focused on advantages of using drones-unmanned aerial vehicle on performance of retail logistics. Advances in technology and decreasing costs have led to an increased use of unmanned aerial vehicles by the retail sectors. Presently, the delivery of goods in times of critical need is partial to wheeled motor vehicles and manned aircraft, options that are able to be pricey and slow. Therefore, this research explores the requirement for, and possibility related with the use of drones to deliver products or goods. It can be concluded that the use of UAV, apart from optimization effects, also has an effect on increasing worker safety, increase the quality of work done and reducing errors.

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References

Akshay, P. L., Arman, N. S., & Omkar, S. P. (2018). Drones in Production, Supply Chain and Logistics. *International Research Journal of Engineering and Technology (IRJET), 05*(02), 2179-2182.

Bamburry, D. (2015). Drones: Designed for product delivery. *Design Management Review, 26*(1), 40-48.

Captain, S. (2018). The U.S. is opening prime urban sky to commercial drones. *Fast Company*.

Chen, H., Hu, Z., & Solak, S. (2021). Improved delivery policies for future drone-based delivery systems. *European Journal of Operational Research*, *294*(3), 1181-1201.

Chitta, S., & Jain, R. (2017). *Conference: Technology Convergence, innovation & Decision Sciences*. At: Seoul, South Korea.

Colomina, I., & Molina, P. (2014). Unmanned aerial systems for photogrammetry and remote sensing: A review. *ISPRS Journal of Photogrammetry and Remote Sensing*, *92*, 79-97.

Council of Logistics Management. (2001). *CLM's Definition of Logistics*. Retrieved from https://www.clm1.org. Kithinji impact.

Dasyam, N. (2017). *Warehouse Robotics Market*. Allied Market Research report.

de Miguel Molina, M., Santamarina Campos, V., Carabal Montagud, M. Á., & de Miguel Molina, B. (2018). Ethics for civil indoor drones: A qualitative analysis. *International Journal of Micro Air Vehicles*, *10*(4), 340-351.

Denyer, D., & Tranfield, D. (2009). *Producing a systematic review*. The Sage Handbook of Organizational Research Methods. Sage Publications Ltd.

Desjardins, J. (2018). Is the future of ecommerce in drone deliveries. *Visual Capitalist*.

DHL. (2014). *Unmanned Aerial Vehicles in Logistics: A DHL perspective on implications and use cases for the logistics industry*.

Eichleay, M., Evens, E., Stankevitz, K., & Parker, C. (2019). Using the unmanned aerial vehicle delivery decision tool to consider transporting medical supplies via drone. *Global Health: Science and Practice*, *7*(4), 500-506.

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *6*(2), 107-115.

Esper, T. L., Jensen, T. D., Turnipseed, F. L., & Burton, S. (2003). The last mile: an examination of effects of online retail delivery strategies on consumers. *Journal of Business logistics*, *24*(2), 177-203.

Futch, M. (2017). *Rise of the Warehouse Robots*. Material Handling & Logistics.

Goldstein, R. (2017). *Global warehouse robotics market outlook 2024*.

Hayat, S., Yanmaz, E., & Muzaffar, R. (2016). Survey on unmanned aerial vehicle networks for civil applications: A communications viewpoint. *IEEE Communications Surveys & Tutorials*, *18*(4), 2624-2661.

Heutger, M. (2014). Unmanned aerial vehicles in logistics A DHL perspective on implications and use cases for the logistics industry, DHL Customer Solutions.

Joglekar, N. R., Davies, J., & Anderson, E. G. (2016). The role of industry studies and public policies in production and operations management. *Production and Operations Management*, *25*(12), 1977-2001.

Joshi, D. (2017). Drone Technology and Usage: Current Uses and Future Drone Technology. *Business Insider, July*, *13*.

Kanistras, K., Martins, G., Rutherford, M. J., & Valavanis, K. P. (2015). Survey of unmanned aerial vehicles (UAVs) for traffic monitoring. In *Handbook of unmanned aerial vehicles* (pp. 2643-2666). Springer Netherlands.

Khofiyah, N. A., Sutopo, W., & Ardiansyah, R. (2020). Global Business Strategy for Commercializing a Technology of Drone: A Lesson Learned from DJI Drones and Parrot Drones. In *Proceedings of the 5th NA International Conference on Industrial Engineering and Operations Management Detroit* (pp. 10-14).

Kim, M., & Matson, E. (2017). *A Cost-Optimization Model in Multi-agent System Routing for Drone Delivery.* PAAMS.

KNHDR. (2013). *Kenya National Human Development Report* 2013. UNEP.

Kunze, O. (2016). Replicators, ground drones and crowd logistics a vision of urban logistics in the year 2030. *Transportation Research Procedia*, *19*, 286-299.

Lachow, I. (2017). The upside and downside of swarming drones. *Bulletin of the Atomic Scientists*, *73*(2), 96-101.

Levy, Y., & Ellis, T. J. (2006). A systems approach to conduct an effective literature review in support of information systems research. *Informing Science Journal, 9*(5), 558–562.

Macaulay, J., Buckalew, L., & Chung, G. (2015). Internet of things in logistics. *DHL Trend Research, 1*(1), 1–27.

Madlberger, M. (2013). *Electronic Retailing: Marketinginstrumente und Marktforschung im Internet*. Springer-Verlag.

Mckinnon, A. C. (2016). The possible impact of 3D printing and drones on last-mile logistics: An exploratory study. *Built Environment*, *42*(4), 617-629.

Meyer, J., Becker, H., Bösch, P. M., & Axhausen, K. W. (2017). Autonomous vehicles: The next jump in accessibilities*. Research in Transportation Economics*, 62, 80–91.

Milovanović, G., Milovanović, S., & Radisavljević, G. (2017). Globalization - the key challenge of modern supply chains. *Ekonomika, 63*(1), 31–40.

Motlagh, N. H., Taleb, T., & Arouk, O. (2016). Low-altitude unmanned aerial vehicles-based internet of things services: Comprehensive survey and future perspectives. *IEEE Internet of Things Journal*, *3*(6), 899-922.

Pablo, M. C., & Petzold, O. (2016). *Using drone technology to improve land titling in the Philippines.* Pasig, Philippines: The Asia Foundation.

Palomero, S., & Chalmeta, R. (2014). A guide for supply chain integration in SMEs. *Production Planning & Control*, *25*(5), 372-400.

Patella, S. M., Grazieschi, G., Gatta, V., Marcucci, E., & Carrese, S. (2021). The adoption of green vehicles in last mile logistics: a systematic review. *Sustainability*, *13*(6), 1-29.

Perera, S., Dawande, M., Janakiraman, G., & Mookerjee, V. (2020). Retail deliveries by drones: How will logistics networks change?. *Production and Operations Management*, *29*(9), 2019-2034.

Persson, E. (2021). *A systematic literature review on drones' application in last-mile delivery*. Master thesis. University of Gävle, Faculty of Engineering and Sustainable Development, Department of Industrial Management, Industrial Design and Mechanical Engineering

Rana, K., Praharaj, S., & Nanda, T. (2016). Unmanned aerial vehicles (UAVs): An emerging technology for logistics. *International Journal of Business and Management Invention*, *5*(5), 86-92.

Republic of Kenya. (2018). Third Medium Term Plan 2018-2022. *Transforming Lives: Advancing Social Economic Development Through the 'Big Four"* Government of Kenya.

Ro, K., Oh, J. S., & Dong, L. (2007). Lessons learned: Application of small UAV for urban highway traffic monitoring. *45th AIAA Aerospace Sciences Meeting and Exhibit*, pp. 1-19.

Rosnell, T., & Honkavaara, E. (2012). Point Cloud generation from Aerial Image Data Acquired by Quadrocopter Type Micro Unmanned Aerial Vehicle and Digital Still Camera. *Sensors, 12*(4), 453-480.

Sandberg, E., Kihlén, T., & Abrahamsson, M. (2011). Characteristics of a Logistics-Based Business Model. *Journal of Marketing Channels, 18*(2), 123-145.

Schreier, M. (2012). *Qualitative content analysis in practice*. Thousand Oaks, CA: Sage.

Shea, B. J., Grimshaw, J. M., Wells, G. A., Boers, M., Andersson, N., Hamel, C., & Bouter, L. M. (2007). Development of AMSTAR: A measurement tool to assess the methodological quality of systematic reviews. *BMC Medical Research Methodology, 7*(10), 7–10

Skorput, P., Mandzuka, S., & Vojvodic, H. (2016, September). The use of Unmanned Aerial Vehicles for forest fire monitoring. In *2016 International Symposium ELMAR* (pp. 93-96). IEEE.

Smith, J., Mazur, M., & Wisniewski, A. (2017). *Clarity from above: transport infrastructure*, PricewaterhouseCoopers.

Springinklee, M., & Wallenburg, C. M. (2012). Improving distribution service performance through effective production and logistics integration. *Journal of Business Logistics, 33*(4), 309-323.

Thomas, L. (2017). Wal-Mart has an Idea for a floating warehouse that could make deliveries via drones. *CNBC Retail*.

Thomé, A. M. T., Scavarda, L. F., & Scavarda, A. J. (2016). Conducting systematic literature review in operations management. *Production Planning and Control, 27*(5), 408-420.

Tiwari, A., & Dixit, A. (2015). unmanned aerial vehicle and geospatial technology pushing the limits of development. *American Journal of Engineering Research, 4*(01), 16-21.

Weise, E. (2015, December 11). These drones see in the dark. *USA Today*.

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