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The Status of Cargo Companies in E-Commerce Logistics and Innovative Solution Proposals to Improve Their Competitiveness[1]

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ABSTRACT

Purpose: This study aims to make innovative suggestions in line with the principles of urban logistics that will increase customer satisfaction and competitive power of cargo companies.

Methodology: Turkish parcel distribution industry was was discussed and the innovative solutions brought to the sector by the technological developments and how they can affect the business processes are examined with the literature review method.

Findings and Practical Implications: In order to achieve success in e-commerce, logistics processes must be customized to meet customer needs. With the growth of e-commerce, the cargo sector continues to grow. The success of cargo companies depends on timely delivery which directly affects customer satisfaction. Therefore, it is very important to improve the performance and efficiency of delivery operations. On the other hand, parcel deliveries, one of the main components of e-commerce growth, are becoming increasingly difficult as urban logistics problems increase. At the time of delivery, the absence of customers at home increases the return processes and costs, and negatively affects customer satisfaction.

Originality: This paper is aimed to provide theoretical and practical suggestions for parcel delivery companies to improve their competitiveness in e-commerce logistics.

Keywords: Distribution Models, E-Commerce, Parcel Delivery Sector, Urban Logistics

Jel Code: L81, L87, O18, O31

E-Ticaret Lojistiğinde Kargo Şirketlerinin Konumu ve Rekabet Güçlerini Geliştirecek Yenilikçi Çözüm Önerileri

ÖZET

Amaç: Bu çalışmada, müşteri memnuniyetini ve kargo firmalarının rekabet güçlerini arttıracak, kentsel lojistik ilkeleri ile uyumlu çeşitli inovatif önerilerde bulunulmuştur.

Yöntem: Kargo sektörünün Türkiye'deki durumu ele alınmış, teknolojik gelişmelerin sektöre getirdiği yenilikçi çözümler ve iş süreçlerini nasıl etkileyebileceği literatür taraması yöntemiyle incelenmiştir.

Bulgular, Sonuç ve Öneriler: E-ticarette başarı için internetten ürün satışı yeterli değildir, lojistik süreçlerin de müşteri ihtiyaçlarını karşılayacak şekilde bireyselleştirilmesi gerekmektedir. E-ticaretin büyümesi ile kargo sektörü de büyümesini sürdürmektedir. Kargo şirketlerinin başarısı, doğrudan müşteri memnuniyetine etki eden zamanında teslimata bağlıdır. Bu nedenle, teslimat işlemlerinin performansının ve verimliliğinin arttırılması çok önemlidir. Diğer taraftan, e-ticaret büyümesinin ana bileşenlerinden biri olan kargo teslimatları, kentsel lojistik sorunlarının artmasıyla gittikçe zorlaşmaktadır. Teslimat sırasında, müşterilerin evde bulunmaması iade süreçlerini ve maliyetleri arttırırken, müşteri memnuniyetini de negatif etkilemektedir.

Özgün Değer: Kargo dağıtım firmalarına e-ticaret lojistiğinde rekabet güçlerini arttıracak teorik ve pratik öneriler sunulmasını amaçlayan bir çalışmadır.

Anahtar Kelimeler: Dağıtım Modelleri, E-Ticaret, Kargo Sektörü, Kentsel Lojistik

Jel Sınıflandırması: L81, L87, O18, O31

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1. Introduction

Today, 53% of the global population is connected to the internet, and 92.6% of them use mobile devices to connect to internet (The Nielsen Company, 2018: 2). Internet accessibility, mobile technology and digital innovations change consumers' lifestyles and habits. When companies realized that their presence on internet and social media has an impact on store sales growth, the origin of e-commerce retail was shaped. For producers and retailers, success and sustainable growth will be of strategic advantage in developed and emerging markets and across multiple channels, contact points and experiences acquired through the purchase journey.

In 2017, global online sales was 10.2% of total retail sales with a value of US$2.3 trillion and is expected to reach 17.5% by 2021 (The Nielsen Company, 2018: 3). Despite the fact that world's largest e-commerce company Amazon is going to be 25 in 2019 and in spite of significant improvements such as addressable, personalized advertising, mobile payment and drone delivery, e-commerce is still in its initial stage. As a result of the technological innovations, the growth in e-commerce is expected to outperform the traditional forms of trade in the following years. This means more deliveries and more transport vehicles in residential areas. Increased transport vehicles in urban areas causes traffic congestion and environmental pollution (Visser et al., 2014: 20).

For clean transport in cities, walking and cycling solutions should be used. Urban transport accounts for a quarter of the CO2 emissions. The solution is suitable fuel and electrical vehicle systems. Smaller and lighter vehicles should be supported. Delivery to the final destination with long-haul transportation should be organized efficiently. The most efficient routes should be determined to limit individual deliveries. The use of Intelligent Transport Systems and real-time traffic management would reduce delivery times and traffic jams. With the use of electricity and hybrid technologies, emissions and noise can be reduced (Tanyaş et al., 2014: 60).

The increasing mobility of people represents another constraint to successful delivering. E-commerce brings changes to consumer behavior and parcel delivery requirements in regard to reliability, speed, mobility and proximity. E-shoppers want delivery as easy and fast as ordering (Visser and Lanzendorf, 2004: 202) and, as multichannel retailing develops, as convenient and flexible. The increas-

ing mobility of people makes delivery difficult (Ducret, 2014: 20). Although free delivery remains the primary purchase driver across all generations and markets, financial incentives like rewards and discounts and consumer reviews rank as the second and third-most prominent drivers in the last stage of the purchase journey (GlobalWebIndex, 2018: 3).

E-commerce continues to grow in Turkey parallel to its global growth. Between the years 2013-2016 the average volume of retail e-commerce grew by 34% in Turkey and online's share in total retail sales was 3.5% in 2016. Compared to the world average of 8.5%, Turkey still has a long way to go (Kantarcı et al., 2017: 4-5). While 69% of Internet users in 34 European countries use online shopping in 2018, this rate has remained at 35% in Turkey (Eurostat, 2018: 2). Although online shopping trend is expected to continue, order fulfillment along supply chains is still one of the major bottlenecks that effects e-commerce (Wang et al., 2014:1).

The most important value proposition of e-commerce for Turkish consumers is price advantage whereas it is convenience in developed e-commerce markets. Only one out of three customers who use the Internet in Turkey shop online. One out of four customers who shop online state that they have had problems in the post-purchase, fulfillment and return processes (Kantarcı et al., 2017: 6).

For the development of the e-commerce sector, the development of Internet, logistics and payment systems infrastructures is very important. In the transition to e-commerce, it is essential for traditional retailers to understand and implement the necessary supply chain competencies required for processes such as planning demand, inventory, procurement, distribution, and product tracking. While important trends such as free delivery, same-day delivery, and synchronized tracking of the shipment should be followed, it is also necessary to deliver the customers' products completely and without damage (Kantarcı et al., 2017: 68). Order delivery times in e-commerce are measured by hours instead of days. Customers want to decide on the delivery time and delivery cost of their orders as well as tracking their orders in real time and redirecting them to a different address if necessary. However, 23.2% of the individuals who participated in the TÜİK (Turkish Statistical Institute) survey and placed an order over the Internet in the 12-month period until March 2015 stated that they had problems. 47% complained about late delivery and 45.4% complained about wrong or dam-

aged product delivery (TÜİK, 2015). Therefore cargo companies should improve their processes. In order to differentiate from price competition and to make a difference, cargo companies should develop solutions for e-commerce sector with automation solutions, capacity increase and innovation (Taşıma Dünyası Gazetesi, 2017).

In the second part of the study, the parcel delivery sector in Turkey is discussed and in the third part, the literature review is summarized. Part 4 summarizes the future delivery models, and the fifth part various innovative suggestions have been made for short, medium and long term which will increase customer satisfaction and competitive power of cargo companies and which are compatible with the principles of urban logistics.

2. Parcel Delivery Sector

The journey of the parcel starts with pickup operations. After the pickup operations, the volume, weight and content of the parcels are controlled. After barcoding, parcels are loaded to the branch vehicles and sent to the hubs. In the origin hubs, parcels are sorted and loaded on long-haul vehicles. In the destination hubs, parcels are sorted according to their destinations and loaded on the branch vehicles. According to the customer preferences parcels are either delivered at the branches or at the customer addresses. Return processes are carried out for the parcels that cannot be delivered or by customer request.

Figure 1. Framework of parcel delivery processes (Gevaers et al., 2009)

As shown in Figure 1 (Gevaers in Van Duin et al., 2016: 15), when a consumer is not at home, the courier returns to the branch and the next day or a at a chosen customer delivery time the courier will deliver again. This is repeated four

times at maximum and then the goods are returned to the shipper or the consumer can pick up their goods at a nearby collection point. This 'rework' results in additional parcel handlings and costs (Van Duin et al., 2016: 15).

Parcel delivery companies can follow different methods when forming their operational structures (Dikmen, 2010). In the Transfer Centers, sorting operation can be done manually using hand-held terminals or by using automatic sorting machines. In the technological transfer centers equipped with automatic sorting systems, the cargo operations are made automatically and the cargoes are more likely to be delivered quickly, in the required time, without error and damage. An alternative to the Branch-Transfer Center-Branch distribution method is the Hub-and-Spoke model. The Hub-and-Spoke model distributes directly to customers from the Transfer Centers without any branches.

The parcel delivery sector has undergone significant changes over the last decade with the pressure of e-commerce and the development of innovative green technologies. B2B, which provided constant stable income and higher margins for the cargo sector (Accenture, 2015: 8) is not expected to grow significantly in the future. On the contrary, B2C online retail sales have shown a steady increase in recent years and have increased by 17% from 2007 to 2012 (ATKearney, 2013: 3). However, B2C deliveries have higher costs and lower incomes and reduce the profitability of the cargo sector (Zenezini et al., 2018: 595).

Parcel delivery companies in Turkey, with their branches all over the country serve companies and individual customers. They operate to provide the closest and most affordable transport services in the shortest time. Inadequate infrastructure, price policies, rail network which cannot be used in cargo transportation, companies which operate without authority and the address structure in Turkey which causes troubles in finding addresses and lack of qualified personnel are among the reasons that hinder the development of cargo transportation in Turkey (Akbulut, 2016: 1-2). Table-1 shows the SWOT analysis of Turkish parcel delivery sector.

Table 1. Turkish parcel delivery sector SWOT analysis (Akbulut, 2016: 98)

Strengths	Weaknesses
▪ Cargo volume ▪ Technological developments ▪ Cargo companies that are organized nationwide ▪ Road Transport Law and Regulations ▪ A large and modern vehicle fleet ▪ The liberalization of the postal sector ▪ The growth of e-commerce	▪ Lack of qualified inspections ▪ Lack of trained and qualified personnel ▪ Lack of technological infrastructure (insufficient physical infrastructure) ▪ Lack of data in the transport sector ▪ Lack of working procedures and principles for the cargo sector
Opportunities	**Threats**
▪ Geographical location of Turkey ▪ Introduction of foreign origin firms to the sector ▪ Dynamic structure & development of the sector ▪ Increased outsourcing in transportation	▪ Regional risks (border with the Middle East) ▪ Firms operating without authorization ▪ Expansion of the use of air cargo

Parcel delivery problems are the most important problems related to the operation in the cargo sector in Turkey. According to the Road Transport Regulations, cargo companies are obliged to deliver the cargo to the buyer. When the recipient cannot be found at the address, the customers require the parcel to be delivered to the address for the second time. Parcels that cannot be delivered are returned to the branches and if they are not received within the defined periods, parcels are returned to the shipper. There are some practices for the possible solution of this problem. For example, in Germany there are approximately 3700 Packstations (DHL, 2019) where customers can get their packages 24/7. FedEx also has self-service drop boxes in 35,000 different locations in the US such as office buildings, shopping centers and airports (FedEx, 2019).

3. Literature Review

When literature review is carried out with the keywords "parcel delivery sector" and "optimization", mainly studies on "Time-Dependent Vehicle Routing Problem" (TDVRP) and "The Vehicle Routing Problem With Simultaneous Pick-Up And Delivery" (VRPSPD) related to route optimization are found. Route optimization is the process of determining the most cost-effective route taking into account various factors such as the number of stops to visit, the location and

the order in which they should be visited. TDVRP is the problem that the speed of the transportation vehicles and the transportation times change according to the road and the time of the transport during the day. VRPSPD is the problem where distribution and collection of parcels is carried out with the same vehicles at the same period of time. Table 2 shows some examples. In these studies, mainly heuristic optimization method is used.

Table 2. Some studies on parcel delivery sector and optimization

Study	Title	Method
Badeau et al. (1997)	A Parallel Tabu Search Heuristic For The Vehicle Routing Problem With Time Windows	Parallel Tabu Search Heuristic Algorithm
Wasner and Zapfel (2004)	An Integrated Multi-Depot Hub-Location Vehicle Routing Model For Network Planning Of Parcel Service	Vehicle Routing Model
Bianchessi and Righini (2007)	Heuristic Algorithms For The Vehicle Routing Problem With Simultaneous Pick-Up And Delivery	Heuristic Algorithms
Bianchessi and Righini (2007)	A Particle Swarm Optimization For The Vehicle Routing Problem With Simultaneous Pickup And Delivery	PSO (Particle Swarm Optimization)
Balseiro et al. (2011)	An Ant Colony Algorithm Hybridized With Insertion Heuristics For The Time Dependent Vehicle Routing Problem With Time Windows	Ant Colony Algorithm Heuristic Optimization
Johar et al. (2015)	Solving the Time Dependent Vehicle Routing Problem by Metaheuristic Algorithms	Variable Neighborhood Search, TA Algorithm

Last mile delivery is defined as the last leg in a supply chain. The significance of solving Vehicle Routing Problem (VRP) is increasingly apparent not only to the organizations involved, but also poses significant national and international implications due to the escalation of traffic congestion and air pollution experienced by many urban cities globally. This is mainly due to cost escalation with soaring fuel prices, inflation and downward cost pressures from customers. Therefore, it is not surprising that there is a growing demand for planning systems capable of producing sustainable, economic and efficient delivery routes. However, being

one of the most important practical problems of operation research, VRP is considered as one of the most difficult problems due to its complex combinatorial nature (de Souza et al., 2014: 426-427).

In the current situation in the parcel sector, especially in Turkey, the distribution model in Figure 2 (Ben-Ayed, 2013: 213) is applied. Parcels are sent from the customer's address to the departure branch, forwarded to the Departure Transfer Center, from the Departure Transfer Center they are forwarded to the Arrival Transfer Center and then to the Arrival Branch, and at last delivered to the customer by the courier vans. This creates time loss, inefficiency, traffic and vehicle density. By applying the Hub & Spoke Distribution Model shown in Figure 3 (Ben-Ayed, 2013: 214), it is possible to increase the delivery speed by skipping loading and unloading at the branches as well as reducing logistics costs by reducing the number of branches. It is possible to develop algorithms that can cluster the areas where e-commerce submissions are intensive and that can indicate at what capacity, how many vehicles, how many employees and which route planning should be used.

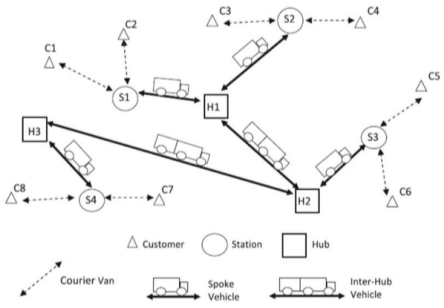


Figure 2. Current parcel distribution network

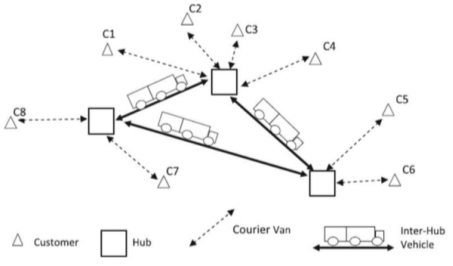


Figure 3. Hub-and-Spoke distribution model

When literature review is carried out with the keywords "parcel delivery sector" and "distribution models", mainly studies related to the "Hub-and-Spoke" distribution model are found. In these studies, as shown in Table 3, different methods such as MILP (Mixed integer Linear Programming), Genetic Algorithm, Branch-and-Bound are used as well as heuristic optimization method.

Table 3. Some studies on parcel delivery sector and distribution models

Study	Title	Method
Zapfel and Wasner (2002)	Planning And Optimization Of Hub-And-Spoke Transportation Networks Of Cooperative Third-Party Logistics Providers	Network Optimization Heuristic Optimization
Correia et al. (2011)	Hub And Spoke Network Design With Single-Assignment, Capacity Decisions And Balancing Requirements	MILP, BCSAHLP (Single-Allocation Hub Location Problem With Capacity Choices And Balancing Requirements)
Alumur et al. (2012)	Hierarchical Multimodal Hub Location Problem with Time-Definite Deliveries	MILP
Ben-Ayed (2013)	Parcel Distribution Network Design Problem	PDNDP, Mixed Integer Program
Saraiva de Camargo et al. (2013)	A New Formulation And An Exact Approach For The Many-To-Many Hub Location-Routing Problem	Benders Decomposition Method
Lee and Moon (2014)	A Hybrid Hub-And-Spoke Postal Logistics Network With Realistic Restrictions: A Case Study Of Korea Post	ILP MILP
Rieck et al. (2014)	Many-to-Many Location-Routing with Inter-Hub Transport and Multi-Commodity Pickup-and-Delivery	MILP Genetic Algorithm
An et al. (2015)	The Reliable Hub-And-Spoke Design Problem: Models And Algorithms	Lagrangian Relaxation Branch-and-Bound

One of the distribution models in the cargo sector is cargo bikes. Last Mile Leeds, founded at the end of 2012, was inspired by the use of cargo bikes instead of inefficient and expensive existing transportation modes to make delivery to the address more sustainable. The vast majority of Last Mile Leeds' work is last-mile deliveries for global courier DHL, performed on cargo bikes. Due to the city centre location of Last Mile Leeds' premises, the maximum delivery distance is approximately a mile and a half which enables them to offer DHL a very competitive price. Because of this economic advantage, DHL have replaced one of the two vans they operate in Leeds with Last Mile Leeds' services (Schliwa et al., 2015: 55). In Figure 4 (Schliwa et al., 2015: 53), 2-wheel cargo bikes used by DHL and the 3-wheel tricycle used by Outspoken Delivery are shown.

Figure 4. Examples of 2-wheel cargo bikes & a 3-wheel tricycle

Urban Logistics is the optimization of logistics and transport activities carried out by different companies in the urban areas, considering the traffic conditions and environmental impacts as well as the energy consumption and social market economy (Tanyaş et al., 2014:37).

The requirements of public authorities regarding delivery and sustainability in the city are the final driving force behind the creation of the urban parcel delivery sector. The constant urbanization of the population and globalization of the economy have led to a huge concentration of parcel deliveries in cities. This has made urban freight an essential activity for the city to grow and be livable. However, urban goods distribution is also considered by public authorities and citizens to be responsible for congestion, environmental pollution and global warming (NCFRP, 2013).

When literature review is carried out in terms of the interaction between the urban logistics and the parcel delivery sector, as shown in Table 4, the studies are mostly limited to Europe, focusing on the market potential or specific case studies of the city or companies.

The major trends today in Europe are to forbid or limit access to the city center for goods distribution vehicles most of the time through environmental or quality-of-life motivations, like implementing time windows, pedestrian zones, one-way streets and congestion charges, which complicate parcel distribution to consumers and threaten delivery productivity (Ducret, 2014: 21). In prior years cargo companies could provide specialized delivery services depending on the recipient, e.g. express and guaranteed delivery for businesses as opposed to ordinary and slow delivery for the individual consumer (Savy & Burnham, 2013). Nowadays, consumers are as demanding as companies, regarding speed and reliability. Following the examples of e-Bay, Amazon and Google in the United States, in 2012 the USPS started providing same-day delivery in San Francisco for online purchases at selected online retailers. Parcel providers in Europe have done the same, i.e. DPD in Germany provides delivery within 90 minutes or a specific time window in 15 German cities, as does Royal Mail in the UK (Ducret, 2014: 20).

Urban distribution consists of vehicles leaving the transfer center and going to the branches, and vehicles from branches to customers. The innovative logistics model offers a concept that takes advantage of two types of vehicles: larger vehicles which are loaded at the transfer centers with several load units or containers that can carry generic parcels and smaller delivery vans which are light vehicles and to which load units can be transferred. These interoperable vehicles and containers form an improved logistics chain, reducing the number of vehicles entering the city, kilometers driven and CO_2 emissions (Dell'Amico and Hadjidimitriou, 2012: 1505).

Table 4. Use of cargo cycles for sustainable urban logistics (Schliwa et al., 2015: 51)

Research Subject	Study	Content	Scope	Key Findings
Small electric vehicles (SEV)	Melo et al. (2014)	Quantitative analysis	Portugal	SEVs are a viable solution to satisfy public and private stakeholders
Electric Cargo Bikes (E-CB)	Gruber et al. (2013), Gruber et al. (2014)	Technical Potential, User Requirements	Berlin, Germany	19-48% of the mileage of courier logistics by combustion engine vehicles can be substituted by E-CBs
Bikes for Urban Freight	Riehle (2012), Lenz and Riehle (2013)	Exploratory Study	Europe	High potential for the food and courier, express & parcel market. Obstacle: perception of cargo cycles as a suitable mode of transport and their acceptance with customers
Bicycle Messengers Bike Couriers	Maes and Vanelslander (2012)	Exploratory Study	Belgium, Netherlands	Specific market for bike couriers exists. Obstacles: "chicken–egg-problem", doubts about professionalization and linkages with logistical network
Role of urban consolidation centres in use with electric vehicles & electric cargo cycles	Browne et al. (2011)	In depth case study of Gnewt Cargo, London	London, UK	Total distance travelled and the CO_2 emissions per parcel delivered fell by 14-55%, trial successful from company's perspective in transport, environmental and financial terms
"Ich Ersetze Ein Auto" "I substitute a car"	Institute of Transport Research at DLR (2014)	National Climate Initiative project funded by the German Federal Ministry	Germany (8 cities)	E-CB is more accepted by bike messengers than car users; transition towards use of electric cargo bikes for the "last mile" of urban deliveries is not complete
"Cyclelogistics"	FGM, AMOR, Outspoken, ECF, CTC (2014)	EU project co-funded by Intelligent Energy Europe Programme	Europe	In average 51% of all motorised trips in European cities that involve transport of goods could be shifted to bikes or cargo bikes
"Pro E-bike"	Energy Institute Hrvoje Pozar (2016)	EU project co-funded by Intelligent Energy Europe	30 pilot companies in 8 European pilot cities	Programme, promoting "E - bikes", for delivery of goods pilot companies and passenger transport
"Cyclelogistics Ahead"	Cycle logistics Federation (2017)	EU project co-funded by Intelligent Energy Europe Programme	Europe	The main aim is to reduce energy consumption and emissions from freight transport in urban areas by triggering near zero emission logistics applications across Europe

Another source of unnecessary driven kilometers is unsuccessful deliveries when the receiver is not at home. The Modular BentoBox system introduces the concept of removable modules that is trolleys with various size drawers. These trolleys and drawers are filled in with parcels at the transfer centers. The carrier transports the trolleys to the city and inserts them into BentoBox. As soon as the customer is notified, the parcel is ready to collect. To access the parcel, the customer enters the special code on a user interface. The modular system can also be provided with a weighting and payment system and used also for shipping parcels (Dell'Amico and Hadjidimitriou, 2012: 1505). The comparison of the standard distribution model with the distribution using modular BentoBox showed a reduction of delivery time and unsuccessful deliveries, thus improving pollution and traffic congestion (Dell'Amico and Hadjidimitriou, 2012: 1513).

Although home delivery is appreciated by consumers, consumers mention issues like not on-time, not at home, not delivered, delivery charge too high, delivery time too long, and forced to stay at home. Carriers mention additional costs for repeated delivery and non-deliverables. Most home delivery services only inform the customer on what day the goods are to be delivered and use a time frame of 9.00 am until 19.00 pm. With new information and communication technologies it is easier to give more accurate information on the time of delivery but the carriers hardly implement such new technology. An alternative for home delivery is the use of pickup points (Visser et al., 2014: 18-19). Parcel delivery and pickup points can be located in markets and stores. Unmanned, locked cabinets - parcel lockers can also be used. Parcel lockers are an unattended delivery machines, located at chosen, mostly attended places It is a system of reception boxes, which enable to receive and send parcels 24 hours a day, 7 days a week (Iwan et al., 2016: 644).

Quak et al. (2012) and Dell'Amico and Hadjidimitriou (2012) suggest that parcel lockers represent an innovative solution for urban logistics by offering an alternative solution to the last-mile-delivery problem. French and German parcel delivery operators developed pick-up points in stores and automated lockers networks as an alternative to home delivery (Morganti et al., 2014: 178).

Parcel lockers can be located in residential areas, shopping malls, public transport stations, within stores and business centers, as well as in public areas where many clients can access them through short-distance trips. Parcel lockers

as a delivery option contribute to raising both consumer satisfaction and last-mile delivery optimization. Those benefits are related to higher flexibility regarding time windows and convenient sites available to end consumers. Additionally, there can be a reduced number of missed deliveries and travelled kilometers by delivery services providers. Besides that, other advantages are: customers can collect their products at these points when they cannot be delivered at home, high customer satisfaction, performing 100% of the deliveries generating a reduction in travelled kilometers by delivery vehicles.

The Bentobox was one of the solutions tested in Berlin-Germany and Turin-Italy. The results indicated financial advantages for the logistics operator when automatic delivery stations are located next to the customers. DHL implemented the system called Packstation in Germany, with a network of 2650 locations, including a test for fresh-food deliveries in refrigerated lockers (Oliveira et al., 2017: 35). Postal and logistics operators have implemented parcel lockers in France and many other European countries (Morganti et al., 2014:182), as well as in Colombia, Australia, Russia, Saudi Arabia, Finland, Estonia, Ukraine, Slovakia, Lithuania, and the Czech Republic, as reported by Folkert and Eichhorn (2007) and Iwan (2016). In the last mile distribution phase, JingDong – China's second biggest e-commerce company- provides parcel lockers where customer can pick up their orders and customers can also choose to pick up their orders in nearby convenience stores which are called self- pickup points. There are 4142 self-pickup points all over the country (Yu et al., 2016: 181-182)

Carotenuto et al. (2018: 194) compared home delivery and delivery to parcel lockers in Italy, when parcel lockers were used, total distance travelled fell by more than 24%; similarly, total travelled time decreased by more than 50% and CO_2 emissions decreased by more than 21%.

Approximately 95% of customers using parcel lockers are satisfied with their choices (Lemke et al., 2016: 276). Global parcel lockers market is expected to reach US $ 1.06 billion by 2025 (GVR, 2017). The use of consolidated deliveries to automated parcel lockers benefits both transport operators and users (Muerza et al., 2018: 348). Transport operators are benefited by increasing the number of successful first-time deliveries, optimizing delivery rounds, and lowering operational costs (Morganti et al., 2014: 188).

Implementation and efficient utilization of parcel lockers is also important

and requires the support of local residents, delivery companies and the owners of places where parcel lockers are located. Also, local authorities must be involved in the stage of implementation with regard to the permission and the selection of sites. However, the most important condition of efficiency of parcel lockers is the willingness of e-commerce companies to deliver goods to the location, which does not match the address of the purchaser and, on the other hand, the willingness of customers to receive their goods from parcel lockers. Additionally, local authorities should share or rent public space for the installation of parcel lockers and provide planning and building permission for pack station installations (Iwan et al., 2016: 649). Table 5 shows SWOT analysis of parcel lockers.

Table 5. SWOT analysis of parcel lockers (Torrentelle et al., 2012: 127)

Strengths	**Weaknesses**
▪ Customers have the possibility to access to their packages 7 days per week and 24 hours per day ▪ Customers are informed via SMS or e-mail ▪ Reduction of freight transport trip km in comparison with attended delivery, reduction of emissions, noise and energy consumption ▪ Low delivery costs	▪ Parcel lockers are a private action, and the public authorities do not have information about the impacts ▪ The final leg of the journey have to be made by the customers
Opportunities	**Threats**
▪ Efficiency gains for logistic providers ▪ Transferable to other cites	▪ E-commerce is expected to grow further in the future, and this can cause a higher freight mileage due to high number of parcel lockers

In e-commerce logistics, different retailers use different cargo companies, resulting in low utilization of trucks, excessive truck movements, higher system-wide costs and negative environmental impacts. Consolidation Centers can be established to consolidate delivery of different retailers' shipments. Thus, vehicle utilization increases, vehicle traffic decreases, CO_2 emissions are reduced and overall service level increases (de Souza et al., 2014: 428).

An increasing number of studies investigate the efficiency of delivery systems that deploy drones. However, a limited number of these studies focus on

the coordinated delivery of a truck and a drone. The drones are thought to complete the delivery vehicles due to their low cost, ability to access difficult areas and without being exposed to traffic. Es Yurek and Ozmutlu (2018: 250) used a mixed integer linear programming model to minimize the delivery completion time with a vehicle carrying a drone on its roof.

Wang et al. (2016:279) proposed a crowd- tasking model formulated as a min-cost flow problem in order to construct a network that optimizes the routes. Crowd workers may take public transports or drive a car. Akeb et al. (2018: 225) investigates how to use the power of crowd logistics, focusing on parcel delivery by a network of neighbors in the case of home delivery failure. Using the platform, the transporter delivers the parcel to the nearest neighbor to guarantee the final delivery.

Amazon proposed the On My Way service that consists to enlist people to pick up and drop off packages for customers for a sum of money in 2015 (Fortune, 2015). These people may be Amazon customers that pick up their own parcel and then grab other parcels to others at their convenience.

Another example is from DHL, by launching its MyWays service, with a mobile app that allows individuals to share their geographical location and accept selected deliveries (Carbone et al., 2015:7). Devari et al. (2017: 117) has analyzed the use of friendship/acquaintance networks in receiving e-commerce orders from retail stores. The survey with 104 participants showed that 72% of the respondents would agree to deliver packages to their friends or close friends. For co-workers or neighbors, this rate is 17.33% and 14.21% on average. In addition, more than 60% of the participants stated that they can make a delivery to their friends for free and 80% can spend an extra 15 minutes in providing this assistance.

Reverse logistics is also important in the e-commerce sector. For example, the largest e-commerce company Alibaba Group announced that $9.3 billion worth 278 million e-commerce orders were given in 24 hours (Alibaba Group, 2015). However, the percentage of returned goods was in average 25%, even 40% for some products like apparel (Pan et al., 2015: 1984). Pan et al. (2015: 1984) proposed the use of taxi cars instead of cargo vehicles in e-commerce return logistics.

4. Findings: Delivery Models and Suggestions

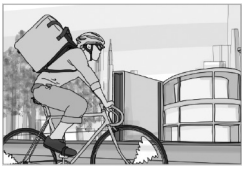
The last mile in a B2C environment is currently regarded as one of the more expensive, least efficient and most polluting sections of the entire logistics chain (Gevaers et al., 2014: 398). High competition, a consumer-driven economy, failed delivery issues, reverse logistics and environmental measures taken by policymakers are factors that increase the costs of delivering online orders (Cardenas et al., 2017: 123) Due to the complexities involved in e-commerce deliveries, the availability, quality and affordability of delivery solutions are defined as one of the objectives of promoting e-commerce growth (European Commission, 2013: 12).

Last-mile delivery has become a critical source for market differentiation, motivating retailers to invest in a myriad of consumer delivery innovations, such as buy-online-pickup-in-store, autonomous delivery solutions, lockers, and free delivery upon minimum purchase levels (Frederick et al., 2018: 308). New delivery models are designed for the parcel delivery industry in order to meet the changing customer demands with the developing technology, e-commerce and urban logistics. Table 6 shows today's and future delivery models.

Table 6. Today's and future delivery models (Joerss et al., 2016: 20-21)

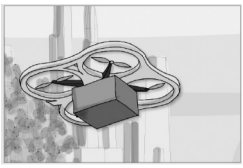
Today's Model
A dedicated delivery person employed by the parcel delivery service provider picks up the parcels at a consolidation point, e.g., delivery base, and delivers them directly to the recipients. Large vans are typically used as delivery vehicles. (Joerss et al., 2016: 20).

Bike Couriers
Couriers employed by the parcel service provider deliver a small number of parcels by bike. Today, this is often seen in point-to- point delivery, especially for B2B documents and prepared food. (Joerss et al., 2016: 21).



Droids
Small autonomous vehicles, only slightly larger than a regular parcel, deliver parcels to the doorstep. These vehicles are relatively slow at 5 to 10 km/h and use the sidewalk rather than the street to reach their destination. Such droids also need to be supervised, but due to their size and low speed, developers currently believe that a single supervisor could manage 50 to 100 of them (Joerss et al., 2016: 21).

Drones
Drones can allow logistics companies to provide faster, cheaper (about 25%), and lower emission (about 90%) deliveries through avoidance of road traffic in last-mile delivery. Drone deliveries are cheaper because of battery power and near-autonomous operation. A group of drones would be required to be overseen by just a single drone minder. Amazon is now working on a drone prototype, which it says can carry payloads of up to 2.3kg at up to 80kmph (Weinelt, 2016: 17).



Crowdsourcing
Any member who has signed up as a driver to the crowdsourcing network can choose to complete a specific delivery order. The advantage of this model is its flexibility in supply, especially in covering peaks and troughs, the multi- purpose use of certain assets such as cars, as well as the low investment requirements for parcel companies. Furthermore, some companies hope to create synergies beyond regular parcel delivery, e.g., with taxi services. Uber has established an UberCARGO van service in Hong Kong , and UberRUSH is offering express services by targeting online retailers. Dolly, another start-up headquartered in the US, has a similar approach and helps people to get things transported within their city by connecting them with registered drivers (Tipping and Kauschke, 2016: 9).

Semiautonomous Ground Vehicles

A delivery person is still required, but could theoretically use the driving time more efficiently to take care of sorting or smaller administrative tasks, e.g., scanning or announcing arrival while the vehicle does the driving. These advantages need to compensate for higher investment costs, as autonomous ground vehicles are likely to be more expensive than regular cars or vans, at least initially. However, the delivery person will likely not be allowed to move freely while the vehicle drives, limiting the tasks that can be performed in transit (Joerss et al., 2016: 21). Mercedes-Benz is already pioneering autonomous trucks (Weinelt, 2016: 9).

Autonomous Ground Vehicles (AGVs) With Lockers

AGVs deliver parcels without any human intervention. Customers are notified of the exact arrival time. Upon arrival at their door, customers are asked to pick up the parcel from the specified locker mounted on the van or truck – picture a mobile parcel locker. It is assumed that a central supervisor could manage roughly 8-10 AGVs (Joerss et al., 2016: 20).

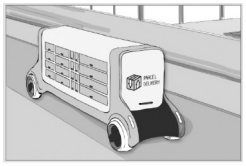


Figure 5 provides a general estimate for when and where delivery technologies may gain adoption (Lee et al., 2016: 20).

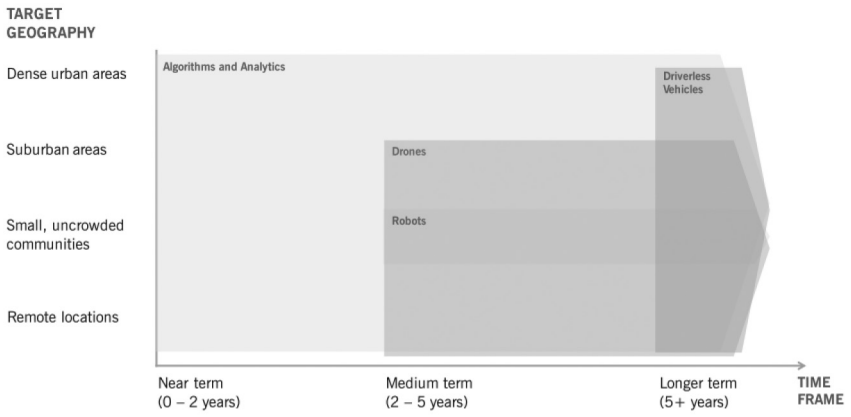


Figure 5. Delivery technologies - main geographies and projected timeline for adoption

By investigating the technological development and with literature review, the following suggestions are made for short, medium and long term which will increase customer satisfaction and competitive power of cargo companies and which are compatible with the principles of urban logistics (İndap, 2018: 36):

Short-term solutions

- Traffic can be relieved by *pedestrian couriers, bicycles and electric bicycles*, and urban livability can be increased by reducing CO_2 emissions. The infrastructure and geography of the city are also very important in order to make cycling and parcel delivery operations economically sustainable. Narrow streets in historic city centers are suitable for use with cargo bikes that facilitate mobility.
- *Evening parcel delivery* service can be extended and the satisfaction of the people who are not at home during the day can be optimized and the traffic intensity during the day hours can be reduced. For the areas where there is an urban and intensive e-commerce shipment, delivery services can be given from the Transfer Centers on Sundays and the parcels of the customers who are not at home during the week can be delivered.
- In the case of e-commerce shipments, using *caged transport model*, shipments can be delivered on-site pre-sorted, and no further sorting is required in the Transfer Centers. Vehicle loading, unloading and delivery speeds can increase. Damages can also be reduced by integrating with barcode or RFID systems and sensor technologies, ensuring the tracking and safety of cages and parcels inside.

Medium term solutions

- *Parcel lockers* can be used without the direct branch contact of the customers and where they can send and receive parcels at any time. Parcel lockers can be located in universities, shopping centers, to reduce costs and to provide easy access to individual customers. For customers who are not at home the first time, a delivery option can be offered from parcel lockers. In addition, the use of common parcel lockers, like common ATMs, can be provided by different parcel delivery companies.

- In *return processes* (reverse logistics), courier platforms or parcel lockers can be used.
- In order to respond the same-day delivery services of e-commerce companies, *Courier platforms* can be created by people who have been well researched and whom provide the conditions. The use of shared courier by different parcel delivery companies reduces the costs, decreases the environmental adverse effects and decreases the delivery speed.

Long-term solutions

- The importance of data analytics in e-commerce logistics has increased with the rapid development of information and communication technologies. The ability to use real-time information for dynamic supply and demand management is critical to the effectiveness of e-commerce logistics. Decision support modules for parcel delivery companies can be created by implementing effective *data mining* techniques into historical data such as past orders and deliveries, taking into account dynamic data such as current customer demands and real-time traffic data (de Souza et al., 2014: 430).
- By *route optimization* for delivery and distribution of couriers and vehicles, costs can be reduced and delivery speed can be increased.
- With the *Hub & Spoke Distribution Model*, the delivery speed can be increased and by reducing the number of branches the logistics costs can be reduced.
- When legal arrangements are made, the logistics costs can be reduced by using *drone, droid and autonomous ground vehicles with lockers*, and urban livability can be increased by reducing traffic and reducing CO2 emissions. In particular, access to hard-to-reach points can be achieved with drones.

5. Conclusion

Parallel to the developments in technology, the expectations of customers in e-commerce sector are increasing. In order to meet the small orders placed on the Internet, high service level and fast and error-free delivery, the parcel delivery

sector should also enable fast and accurate collection and delivery. The parcel delivery sector is a fast growing and highly competitive business area that uses branches and transfer centers as a distribution channel. In recent years, with the increase in e-commerce volume parcel delivery models are developing. The success of parcel delivery companies depends on timely delivery, which directly affects customer satisfaction. For this reason, it is very important to optimize the delivery operations called last-mile.

In this study the status of Turkish parcel delivery industry was discussed and the innovative solutions brought to the sector by the technological developments and how they can affect the business processes are examined with the literature review method. As a result of the literature review, various suggestions have been made for short, medium and long term which can increase delivery rates, decrease logistics costs, reduce risks and environmental impacts, increase mobility, improve traffic and improve urban livability.

The contribution of this article to the literature is that it makes innovative recommendations to Turkish parcel delivery sector like electrical bikes, parcel lockers, caged transport model and Hub-and-Spoke distribution model which are not commonly used in Turkey although they are used in different countries.

The fact that the study was conducted with literature research method is the limitation of the research. In the following studies; bicycles, electric bicycles, parcel lockers and cargo transport cage model, can be tested and compared to the current situation in order to assess the benefits in terms of urban logistics. In addition, methods such as Data Envelopment Analysis can be used to measure branch efficiency and customer satisfaction in parcel delivery operations. The implementation of a direct distribution model from the Transfer Centers can be tested for branches with low efficiency. With the help of the Linear Programming model in distribution channel selection, the areas where to apply Hub-and-Spoke model can be decided in order to minimize the costs.

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