

EVALUATING THE IMPACT OF E-COMMERCE FREIGHT MOVEMENTS IN SOUTH AFRICAN CITIES

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ABSTRACT

E-commerce is rapidly increasing in supply chains with online shopping leading the way, increasing the number of freight movements. The impact of e-commerce on South African cities' freight movements are not well known and needs to be researched. It is necessary to consider how e-commerce impacted other countries and how they embraced the resulting change and growth in traffic volumes, in order to understand how South African supply chains can take advantage of opportunities arising from the growth in e-commerce in the country. To this end, this paper conducts a systematic literature review, which focuses on determining how other countries' urban areas were affected by increased e-commerce freight movements and how they managed it. The research is then considered on how it can be applied to urban South African supply chains. A conceptual solution for the way forward is also provided in order to provide guidance for better planning to accommodate future e-commerce growth.

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1 INTRODUCTION

The internet is changing the world, altering the ways in which people do business and function on a day to day basis (Rayport et al [1]). The internet has made it possible for a person to sit at home or work and order goods which get delivered straight to their door. Lately, the option of picking up the ordered goods from allocated collections points have also become a popular alternative. For all this to function efficiently, courier and delivery companies and the logistics behind them has to be planned extremely well (Nemat Error! Reference source not found.).

A term which has evolved alongside the internet is electronic commerce, or e-commerce. Wigand [3] refers to e-commerce as a marketplace where supply and demand come together for the exchange of goods and services. Wigand [3] states that e-commerce “includes any form of economic activity conducted via electronic connections”, between different parties such as individuals and businesses. The evolvement of the internet and e-commerce have forced companies to change and adapt their business plans in order to grow with online shopping. Taniguchi Error! Reference source not found. note that e-commerce offers businesses new ways of selling goods and services to customers without having a physical location. Online stores are always open, they provide customers with a more personalised experience and they are cheaper to operate than the usual brick and mortar businesses (Goga et al [5]).

Various types of e-commerce models exist which can be differentiated by looking at the interaction between the parties involved. Nemat Error! Reference source not found. defines four types as follows:

- Business-To-Business (B2B): the business taking place between organisations in a supply chain, for example between manufacturers, wholesaler and retailer.
- Business-To-Consumer (B2C): the exchange of goods or services from businesses to consumers, for example, an individual buying a chair from a business.
- Consumer-To-Consumer (C2C): involves exchanges between consumers with help from third-party applications, such as *Bid or Buy* online auctioning.
- Lastly Consumer-To-Business (C2B): a commerce model where individual consumers sell products and services to businesses.

The two most popular interactions are B2B and B2C (Leinbach [6]) where trading between consumers and businesses are known to require physical methods of transport in order to assist with completing the transactions. For example, businesses have to transport goods between warehouses and retail stores and between stores and consumers. In most cases delivery trucks or third-party logistics companies and couriers are used for the last-mile delivery. The last-mile delivery movement is very important in the e-commerce environment because it is the part of the process which directly reflects on the company, and businesses want to make it as efficient as possible for themselves and their customers.

E-commerce statistics published by Jimenez et al [7] showed that online shopping revenues are increasing every year. By 2020 online retail in the United States (USA) is expected to be more than four billion US dollars, as shown in Figure 1.

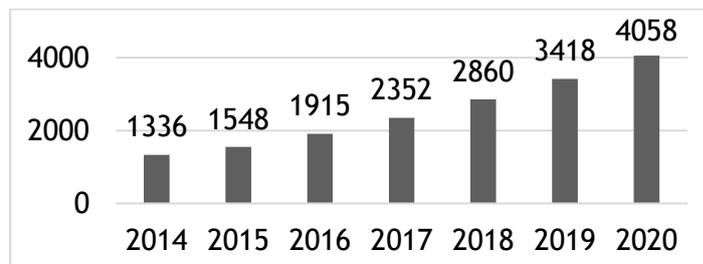


Figure 1: Projected E-commerce sales in U.S. billions (Jimenez et al Error! Reference source not found.)

In the UK, online shopping accounted for 14% of retail sales in 2016 and is expected to increase to 20% by 2021 (Allen et al [8]). The Netherlands expected a growth of 38% in traffic volumes of freight transport between 2000 and 2005. In 2014 the impact of e-commerce in the Netherlands was expected to grow even more, as it was anticipated that a third of retail stores will be closed down by 2020 because of online stores competition (Visser et al [9]). Sheffield [10] mentioned that e-commerce sales for the USA is projected to be 780 billion dollars by 2020, a 304 billion dollar increase from 2014. The expected growth will result in increased congestion in urban areas and will also cause more environmental issues (Taniguchi [4]).

Morganti et al [11] wrote in 2014 that the expected e-commerce growth until 2017 was 12% per year. In European countries, about 83% of citizens already had internet access in 2014, and 60% were shopping online. Thus, these countries have already been adapting with the times a lot sooner than South Africa, and have made changes to their e-commerce freight transport a few years ago.

According to Budree [12], South African e-commerce is still in its development stage with limited availability of statistical information. The growth of e-commerce in South Africa has been delayed as a result of expensive and substandard internet services and unreliable and costly delivery services (Goga et al [5]). However, recently a trend of significant increases in e-commerce and online shopping customers has been observed, as data prices are lowered and more delivery options are becoming available. Figure 2 illustrates the current and expected e-commerce growth in South Africa. At present, it can be seen that almost 40% of the population is online shoppers (eShopWorld [13]).

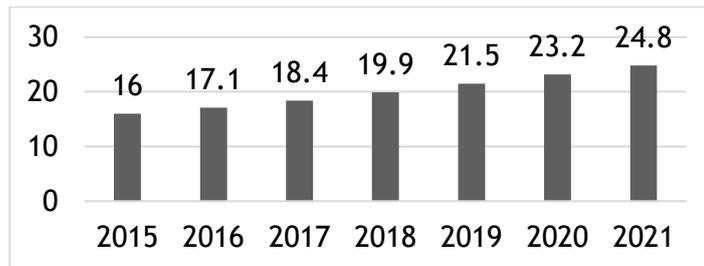


Figure 2: Expected number (in millions) of Online shoppers in South Africa from 2015 - 2021 (eShopWorld [13])

World Wide Worx [14] wrote in the 2018 e-commerce report that the total revenue for South African e-commerce sales added up to R14 billion, making up for about 1.4% of the total retail sales. It is expected that South Africa will reach the 2% mark by 2022. Even though this is a very small portion of the total sales, the increase looks very promising.

Retail e-commerce sales forecast are illustrated in Figure 3. It shows India growing at a rate of 17,8% for the projected period in terms of the B2C e-commerce, with South Africa at 9,9%, above global average (Clement [15]). This shows that e-commerce in South Africa is definitely busy developing and that attention needs to be paid in order to ensure deliveries and freight movements are functioning efficiently.

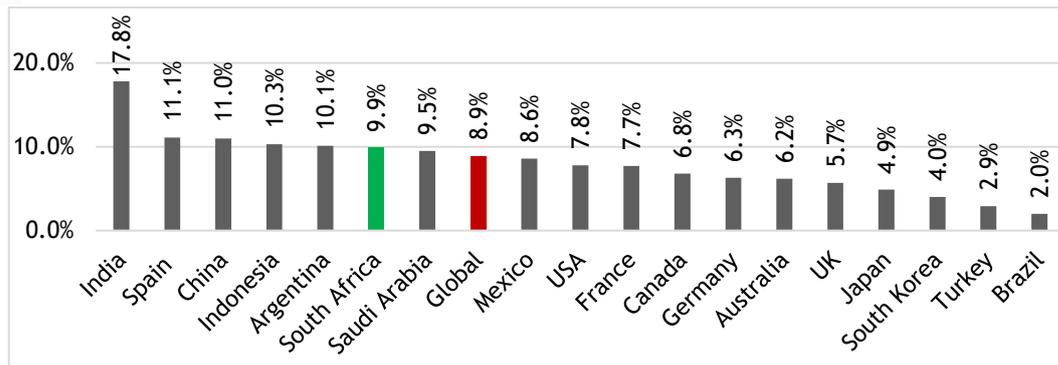


Figure 3: Retail e-commerce sales CAGR forecast in selected countries from 2019 to 2023 (Clement [15])

2 PROBLEM STATEMENT

The expectation and reality is that online shopping will increase, resulting in more freight transport and delivery vehicles in urban areas (Visser et al [9], Goga et al [5]). An increase in online shopping emphasises the need for committed delivery services. Morganti et al [11] also emphasize that delivery plays an important part in improving the e-commerce market, making it a two-way street. Efficient delivery will encourage more people to use online shopping, but promoting e-commerce also requires efficient delivery services and freight movements.

Very little attention has been paid to freight movement in comparison with normal urban transport (passenger transport), especially by city planners and policy makers (Wolmar [16]). In Europe, freight movement has been seen as a problem for some time and little has been done by the government to assist the problem.

Therefore, this paper concerns itself with studying the impact e-commerce growth had on freight movements in urban cities around the world and how they managed it. The research can then be applied to analyse e-commerce freight movements in South Africa and how it can be effectively applied to the supply chain. A Systematic Literature Review (SLR) methodology is used in order to evaluate this issue.

3 AIM AND RESEARCH OBJECTIVE

This paper concerns itself with identifying the potential impact of e-commerce on freight movements in cities, understanding how other countries embraced e-commerce growth, and exploring possible approaches for South African business to plan for future e-commerce growth whilst reducing the negative impacts of increased freight traffic in urban areas

The research objectives for this paper are:

1. To consider alternative methods to traditional home delivery urban cities across the world used to improve freight movements as a result of the e-commerce growth.
2. To research alternative methods in which e-commerce freight movements can be compared and evaluated.
3. To assess the applicability of the research in South African context.

4 RESEARCH METHOD

The purpose of this paper is to evaluate the techniques used in urban cities across the world in order to address the constant growth of e-commerce and its impact on freight movement. From this a better idea can be formed regarding the way South African cities can approach an increase in freight movement as a result of e-commerce growth. The method applied was based on the eight-step procedure for conducting a Systematic Literature Review (SLR) by Okoli & Shambram [17]. Each step of the procedure is explained in detail in the following sections.

4.1 Purpose

The paper concerns itself with doing an in-depth research regarding the impact e-commerce growth has on freight movements in urban cities across the world. The research also considers delivery alternatives and looks at ways in which South African supply chains can adapt in order to reduce the negative impact on urban freight movements.

4.2 Protocol

Once the purpose of the paper was established a research plan and protocol was developed. It consists of four steps:

1. Google Scholar and the University Library were used to find appropriate articles, journals or papers, by using specific keywords and terminology.
2. A screening process with inclusion and exclusion criteria was set up in order to refine the search process. Section 4.4 discusses the criteria used.
3. A paper was “quality checked” by reading its abstract and conclusion and considering whether it will assist in answering one or several of the research objectives.
4. Once several references were found, the sources were reworked and merged into relevant sections.

4.3 Search

The following keywords were used to search for articles and research papers on Google Scholar, they include: “E-commerce growth South Africa”, “E-commerce freight movements South Africa”, “E-commerce growth”, “E-commerce freight movements”, “E-commerce urban impact”, “E-commerce statistics”. More articles were found when looking at similar topics on some databases and forward snowballing (articles that have since cited that article (Okoli & Shambram [17])) was also applied. In some cases, websites were used to gather information for the SLR, but these are not included in the screening, extraction, quality or synthesis steps. A sum total of 50 articles and books were found.

4.4 Practical Screen

In order to sift through the research more easily only English papers were considered and articles written from 2010 to 2019 were evaluated first. Older articles were also used if their applicability to the topic is not outdated.

4.5 Quality Appraisal

The quality of the articles was based on the following quality assessment questions:

- Does the abstract and conclusion show the reader that it can be relevant to the current study?
- Does the tools and techniques used in the article lend itself to being applicable in South Africa?

4.6 Extraction

Figure 4 shows the number of articles per year considered for the study, taking the practical screen into consideration. From the 50 sources, only 24 articles and books were chosen. Figure 5 shows the chosen articles per year published. As seen, more recent work was used. The older articles are highly cited works in most cases.

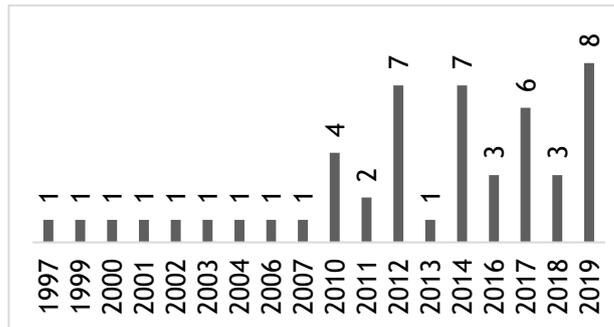


Figure 4: Number of articles per year considered for the SLR

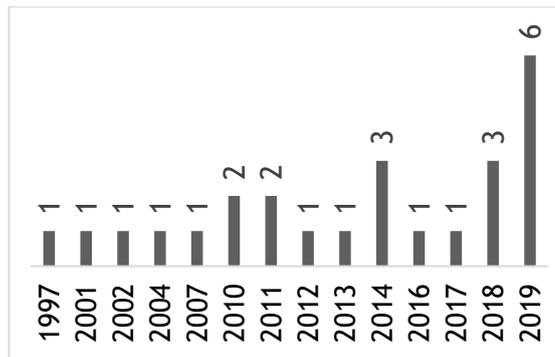


Figure 5: Number of articles per year actually used in SLR

4.7 Synthesis

Figure 6 shows the number of citations per study used in the SLR. Six of the articles or books had an unknown amount of citations and was not included in the graph.

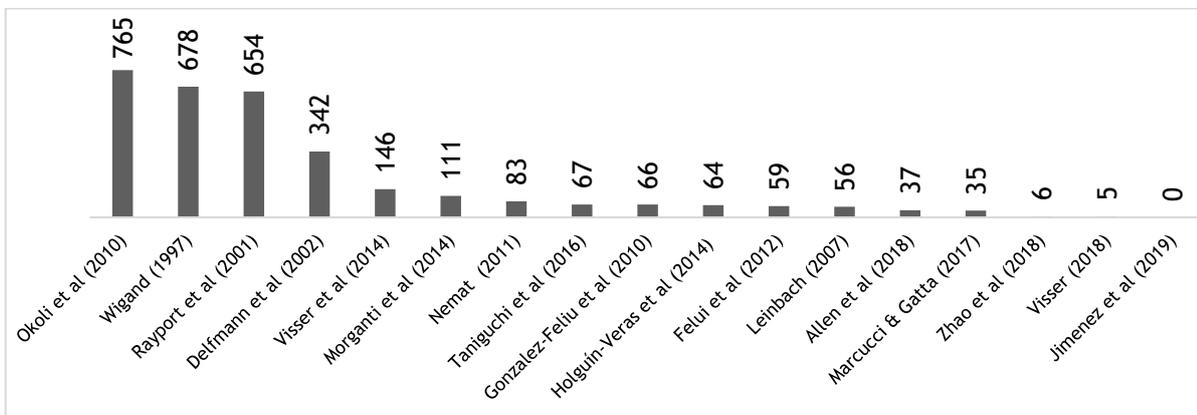


Figure 6: Number of citations per study used

4.8 Key Findings

The key findings are broken down according to the research objectives and are discussed in the next section.

5 LITERATURE REVIEW

Across the world e-commerce growth has been experienced. Some countries embraced the growth and accepted the change, where others are struggling to keep up with the changes e-commerce development require. Online shopping and e-commerce have played a big part in the development of the retail sector (Goga et al [5]) as well as transportation logistics. The reason for this is because goods ordered online results in increased freight movements due to

multiple deliveries to different locations. E-commerce requires businesses to provide customers with fast and prompt deliveries, to ensure customer satisfaction and regular customers (Taniguchi **Error! Reference source not found.**). The role of e-commerce drastically changed the way in which a normal supply chains operate (Delfmann et al [18]), resulting in more complex delivery patterns. Therefore, the deliveries have to be planned and more importantly, executed effectively.

In order to evaluate the impact of e-commerce and research its international influence, a systematic literature review was conducted. The following sections addresses each of the research objectives with the hope of finding ways in which South Africa can embrace and accept the change e-commerce is bringing to urban cities across the country.

5.1 Home delivery alternatives in global urban cities

Home delivery is the traditional type of delivery where Light Good Vehicles (LGV) are used to deliver goods. It is seen as a more problematic, but preferred, type of delivery method even though it is costlier and requires more scheduling (Morganti et al [11]). Visser et al [9] mentions that outsourcing deliveries to a third-party logistics company is one way in which businesses have tried to consolidate freight movement in order to aim at reducing the number of LGV in urban areas, but this just shifts the routing problems to someone other than the business.

The last-mile shipments (the last leg of the delivery process), are the most problematic part of e-commerce freight movement. The last-mile is also the biggest cause of rescheduling for home deliveries when customers aren't home when the delivery has to be made. *Pickup points* and *Click and Collect* are alternative options consumers can choose when making purchases online (Morganti et al [11], Visser et al [9]) and these are some of the options urban cities across the world have implemented in an attempt to solve e-commerce freight movement problems.

Apart from the United Kingdom (UK), Germany and France are leading the European e-commerce industry and in 2012 these three countries were responsible for 71% of electronic commerce in Europe and in 2014 it was recorded that 45% of Europe's consumers made use of online shopping (Morganti et al [11]). Between 2010 and 2011, Germany and France's e-commerce turnover increased by 17% and 22% respectively. The increase in online shopping increased the demand for dedicated delivery services significantly compared to when only normal parcel deliveries were needed.

A study was done by Morganti et al [11] about the changes European countries have made regarding the growing e-commerce sector. Pickup Points (PP) and unmanned pickup points or retrieval lockers, reffered to as Automated Parcel Stations (APS), have been opened all over Europe. Between Demark, Finland, Norway and Sweden about 5 000 alternative distribution point were in operation in 2014. However, the leaders in this area are Germany at about 36 000 and France at around 18 000 PP sites. According to Morganti et al [11], 90% of the German population is within 10 minutes of a PP or every 600m, in rural areas this will be about 3km. In France, PPs have become the preferred delivery option as they are similarly located across urban and rural areas. In summary, Morganti et al [11] feels that consolidating deliveries in the form of PPs and APS helps delivery companies to simplify routing problems, decrease undelivered home delivery parcels and lower operating costs. Simpler routing also assists with the complex delivery routes, resulting in a positive impact on urban city traffic congestion as routes are automatically less complex and can be better planned.

Allen et al [8] did a case study in London, to assess the impact of e-commerce on freight movement and city logistics, and explains that e-commerce growth has increased the number of LGV on the road by 70% from 1995 to 2015. The reason for the increase is not fully known but one of the reasons mentioned is the growth in online shopping and consequently, the last-mile delivery. Packages cannot be delivered by the normal post-box option anymore as they cannot fit through the letterbox, thus courier vehicles are needed. Customers required to sign

for packages is another reason why face-to-face delivery has become important, making collection points a viable option.

A few problems which have been picked up by the growth in e-commerce packages are discussed by Allen et al [8], most of which also affect the profitability of the businesses:

- Free delivery encourages customers to shop more frequently, increasing the number of packages that must be distributed, resulting in more complex delivery schedules.
- In some cases, customers can choose specific delivery time slots which places pressure on delivery companies, since late deliveries result in unsatisfied customers.
- Deliveries done during peak traffic periods place pressure on accurate delivery schedules, as these things cannot always be planned ahead.
- Product returns adds to complex routing problems and in most cases the customer does not know when they can expect the package to be picked up.
- Undelivered items are the biggest problem that businesses faced as a result of home delivery. Since alternative delivery options were made available, this problem has minimised.

Last-mile deliveries were researched in the case study by using tracking devices in vehicles to obtain more information regarding their delivery efficiency (Allen et al [8]). The city of London has been promoting walking, cycling and using the bus system, and implemented dedicated cycling and bus lanes for this reason. This resulted in less kerbside parking for courier and delivery vehicles and thus, from the data gathered it was seen that the drivers ended up having to walk 60% of their trip times in order to deliver goods. A large amount of parking fines was also obtained as a result thereof. Allen et al [8] gave a list of alternatives to home delivery (discussed below) in order to reduce the LGV traffic as well as its environmental and social impact. The alternatives provided are less costly, reduces the number of returned packages, allows larger parcel delivery, reduces the number of failed home deliveries and it hopes to reduce the number of LGV on the road.

- Click and Collect (C&C), a service provided by retailers such as *Walmart* in the USA, where customers order goods online and come to the store to pick it up (Visser et al [9]). The customers are mostly ensured of product availability and more options to choose from, for example when buying clothing or shoes, sizes are available on a bigger scale. Although C&C saves the customer time, it still requires them to drive to the store for collection. The retailers see this as an opportunity to get customers into the store to buy even more products (Allen et al [8]).
- Collection points or PP are locations where parcels are delivered by logistics companies and customers collect it at their own time. The costs for these types of deliveries are much lower than home deliveries (Visser et al [9]) and the problem of undelivered goods is eliminated (Morganti et al [11]). APS delivery is also very effective as customers place their order online and select a locker location of choice as delivery option. The only disadvantage of an APS is the fact that the purchase has to be small enough to fit in a locker, so customers can't, for example, purchase anything larger than a medium sized coffee machine. Using PP simplifies the routes delivery vehicles have to follow when transporting goods to consumers. It saves time and decreases the number of LGV on the road. They can also be provided as an alternative when home delivery options fail on first try. PP are used by *Royal Mail* and *Parcelly* in the UK. *Parcelly* even allows customers to order from various stores and collect it in the same place (Parcelly [19]). Verlinde et al [20] did a case study in Belgium and concluded that APS are only viable when the consumer does not use a car when picking up the package, except if the APS is located on a route the customer is already travelling by.
- Try-and-buy outlets, let customers order products online and then collect them in stores, where they can try on the items and immediately return them if necessary. *Zoot*, a Czech online retailer, follows this concept (Allen et al [8]).

- Last-collaboration, refers to the collaboration of courier and logistics companies to work together to simplify the last-mile delivery. *Gnewt Cargo* is a logistics company in the UK who receives goods and packages via Heavy-Goods-Vehicles and then redistributes them on to LGV for a more efficient delivery service (Allen et al [8]).
- Logistic hotels are concepts where multiple partners use centrally located warehouses from where more environmentally friendly vehicles go to deliver the goods. Paris, France, is currently implementing two such logistic hotels: *Beaugrenelle*, a converted parking lot and *Chapelle International*, which has rail road connections (Allen et al [8]).
- Shared drop zones, which are areas on the side of the road reserved for delivery and collection. From there trolleys, bikes, carts or smaller electric LGV are used to do the last-mile delivery. These designated areas are very popular and useful in Paris.
- Delivery and servicing plans (DSP) are plans where customers are encouraged to rather choose one delivery per week than several small deliveries spread over the week. A pilot project carried out in 2009 in central London by *Transport for London* showed a 20% reduction in delivery trips (Allen et al [8]).
- Crowdshipping involves getting people (like taxis) who are already travelling to a certain point, to transport packages and drop it off at the required location. This type of freight movement is similar to *Uber Eats* or *Uber Freight*. *Uber Freight* is currently only available in the USA, and allows individuals to transport goods across states. Ballare & Lin [21] conducted a study on the possibility of combining micro hubs with crowdshipping. This concept involves crowdshipping packages to collection points like APS. The results proved to be very efficient and resulted in less freight movements.

Table 1 provides a brief summary of home delivery alternatives for e-commerce freight movement in term of their advantages and disadvantages.

Table 1: Summary of techniques as alternatives to home delivery

Technique	Advantage	Disadvantage
Click & Collect	No delivery vehicles have to be scheduled, eliminates undelivered orders.	Customer still has to drive to the store to collect.
Pickup Points	Saves the delivery vehicle from making various trips and eliminates undelivered orders.	Customer still has to drive to chosen PP to collect.
Automated Parcel Stations	Saves the delivery vehicle from making various trips and eliminates undelivered orders.	Customer still has to drive to chosen APS to collect and package has to be small enough to fit in “locker”.
Personal workplace deliveries	Eliminates undelivered orders.	Delivery vehicle still has to make various trips to different businesses.
Try-and-buy outlets	Eliminates the possibility of returning products.	Customer still has to drive to the store to collect.
Last-collaboration	Saves multiple courier companies/businesses from travelling to similar locations.	Integration of delivery information could be difficult if not managed properly.

Technique	Advantage	Disadvantage
Logistics hotels	Saves multiple courier companies/businesses from travelling to similar locations.	Some business or courier company has to carry initial cost of building “warehouse”.
Shared drop zones	Saves the delivery vehicle time by not doing last-mile delivery.	The delivery vehicles are still on the road, driving to shared drop zone locations.
Delivery and servicing plans	Could decrease number of LVG on the road making small deliveries.	Customers have to plan ahead and place their orders in advance.
Crowdshipping	Saves multiple vehicles from driving to similar locations.	Serious organisation needed to ensure the packages reach the specified destinations and could be unsafe.

Daytime home delivery is a popular type of e-commerce freight movement. With the various alternative day time deliveries options discussed above, it is necessary to consider whether there is not an extremely different method which can be considered, such as after hour or off-hour deliveries.

5.1.1 Off-hour-delivery (OHD)

In order to assist with congestion and as an economic and environmental solution, the City of New York started an off-hour-delivery (OHD) program. The OHD program started in 2002 and showed that after hour deliveries could switch more than 20% of congestion time in the city to after-hours and also have major benefits on the amount of pollution. Lower delivery cost was also mentioned as a huge benefit. Holguín-Veras et al [22] provide an in-depth study into the implementation and valuable lessons taken from the OHD implementation. An important aspect which is pointed out is the importance of running multiple pilot tests.

Similarly, Marcucci & Gatta [23] studied the possibility of OHD in Rome, Italy in order to improve urban freight transport. 200 Retailers, located in the city centre, were involved. Overall 60% of them were willing to adopt OHD after the trial run was conducted. Compared to the OHD program in New York, the Rome OHD research was not implemented, only investigated. However, positive feedback was received from businesses in the city and other studies also show that it will benefit the urban area and improve freight movement and delivery.

OHD as well as normal day time home delivery alternatives are all possible solutions for efficient freight movement around urban areas. Their applicability in South African still has to be considered and evaluated. Another alternative is to consider moving freight by another method of transport, underground or off-road.

5.1.2 Underground/off-road freight movement

The negative impact of freight movements on urban areas can be significant, especially from a pollution and congestion point of view. Visser [24] and Zhao et al [25] did separate studies in order to assess the possibility of using the underground metro rails in Europe and Asia for freight movement and deliveries. Zhao et al [25] went a step further and added the use of metro rail hubs or micro hubs, by looking at the effect of transporting goods via metro trails and then delivering the packages to APS collection points close to the railway stations.

5.2 Methods to evaluate alternatives

Gonzalez-Feliu et al [26] modelled the distribution systems of three delivery structure types by creating algorithms that analyse the effects of e-commerce freight movement. The delivery systems included were home delivery, PP and a C&C and the algorithms took into consideration delivery zones, distances and number of deliveries. “Realistic” and “extreme” scenario families were set up in order to model the e-commerce trends more successfully. The three “extreme” scenarios (scenarios which are less likely to occur) were used to determine the limits of each delivery channel. The three scenarios were set up as: 100% of customers make use of 1) Click and Collect; 2) Home delivery; and 3) Pickup Points.

Four more realistic scenarios were modelled as a combination of the three delivery methods, for example 50% of customers make use of traditional shopping and the other 50% make use of C&C (scenario 1) or 50% make use of traditional shopping, 15% of home delivery and 35% of PP (scenario 2). The model showed that the best results were obtained through realistic data with a combination of home delivery and pick-up point collection. This scenario reduced the road occupation in urban areas with about 13%. The results collected by Gonzalez-Feliu et al [26] also show that more PP locations will improve freight movement and reduce traffic in urban areas.

Gatta et al [27] did a similar study in Rome, Italy with agent-based modelling, developing different scenarios with regards to people doing online grocery shopping. The study looked at the last-mile delivery in terms of customers using PP or home-delivery. The model used surveys for data gathering and considered the environmental impact of the different delivery methods. Gatta et al [27] mentioned that it is necessary to find a trade-off between efficient delivery systems and environmental friend and efficient freight movements.

Janjevic et al [28] and Bjerkan et al [29] developed surveys in which they evaluated the different characteristics of e-commerce users in the United States and Norway and their e-shopping behaviour. The conclusion was that customers preferred different last-mile delivery options depending on the product to be delivered (home delivery for heavier items such as furniture or appliances, and pick-up points for smaller items). Taking these two studies into consideration, it can be seen that home delivery cannot be eliminated as a delivery method and it will always need to be considered when planning. Thus, in the cases where home delivery is not needed, an efficient home delivery alternative should be used.

Doing studies that compare different delivery methods is useful when efficient delivery systems have to be developed. Similar studies can be conducted in urban South African cities to evaluate the best delivery system combinations for effective freight movement, in order to minimise traffic and counteract the impact of e-commerce.

6 E-COMMERCE APPROACHES IN SOUTH AFRICA

European countries have already started to grow and adapt as a result of e-commerce much earlier on than South Africa, but this gives the country the opportunity to learn from their successes. Taking into consideration the Literature Review conducted and all the different alternatives which were discussed, their implementation applicability in South African can now be analysed.

From the e-commerce freight movement solutions Allen et al [8] and Morganti et al [11] referred to, the PP and C&C options could potentially be the easiest to implement on a smaller scale, simplifying delivery routes. PP and APS are already being used in some areas in South Africa, but are still relatively new concepts with a lot of room for even further expansion and development. Companies such as *Takealot* and *Superbalist* have started to make use of PP, opening about 25 new locations across South Africa (Bulbulia [30]). Customers can also make use of the PP when returning goods to these companies, solving one of the bigger e-commerce growth problems (Allen et al [8]). Another South African example is *Pargo*, a logistics company which allows businesses, individuals or couriers to send and pick-up parcels at allocated *Pargo*

points located in some retail stores (Goga et al [5]). *Pargo* points are available in some *Clicks* and *Old Khaki* retail stores in the country.

APS, or unattended lockers, are also already used in South Africa. *Makro*, a large retail warehouse and online shopping store, offers customers the option of APS instead of the more expensive home delivery or the store collection option. These designated lockers are usually located at petrol stations and customers receive a locker number and pin once their parcels are delivered at the APS (Goga et al [5]). *DSV*, a transport and logistics company, also use locker APS to distribute parcels. In some areas they share lockers with *Makro* (DSV [31]).

Several other alternative freight movement methods are available, most of which can be used in South Africa. Table 2 provides a brief summary of some of the home delivery alternatives, which were researched and implemented globally, as discussed in the Literature Review and their applicability in South Africa.

Table 2: Solution for effective e-commerce freight movement in South African cities

Initiative (Global studies)	Impact	Applicability in South Africa
Click & Collect (C&C)	Customers place their orders online and but must still to go into the store to collect their orders. Research showed that 20% of these clients buy even more products during collection (Goga et al [5]).	DisChem (Dischem [32]), Makro (Budree [12]) and Cotton On (CottonOn [33]) are some of the store in South Africa that offer this service. C&C is a form of personal shopping, where someone shops on behalf of the customer, but the customers still has to collect their goods in store at their own convenience.
Pickup Points (PP)	Reduces the number of stops delivery vehicles have to make and eliminates undelivered packages. Customers collect the orders from chosen PP at their own convenience.	Already implemented on a small scale by some South African businesses, such as <i>Takealot</i> (Bulbulia [30]), <i>Pargo</i> (Goga et al [5]), and <i>Makro</i> (Budree[12]), and it is in the process of expanding even further.
Automated Parcel Systems (APS)	Same as PP, however, the package has to be able to fit in a specific size locker or storage unit.	Businesses like <i>Makro</i> (Budree[12]) and <i>DSV</i> logistics (DSV [31]) are currently implementing and using the APS delivery systems in order to accommodate more customers.
Try-and-buy outlets	Reduces the possibility of customers returning products but does not eliminate time taken to commute to the store.	Not currently known in South Africa, but could easily be implemented as most stores have an online presence/store.
Crowdshipping	Could reduce the number of vehicles on the road, and use people already going to a specific location to do the delivery.	Crowdshipping could easily be implemented in South Africa, along with <i>Mr Delivery</i> and <i>Uber/Bolt</i> transportation services. The logistics behind it will however need detailed scheduling and serious thought will

Initiative (Global studies)	Impact	Applicability in South Africa
		have to be given to the safety factor thereof.

Other home delivery alternatives which were researched on a global aspect was Off-Hour Delivery (OHD) and Rail Freight Transport. These two options and their possible implementation in urban South African cities is something which has to be researched and evaluated further. The successful implementation of the OHD program will lead to less day time traffic and could even provide quicker package delivery. A study done by Bean [34] on freight movements in the City of Cape Town, showed that after-hour deliveries definitely had financial benefits for freight companies, in comparison to normal day-time deliveries. But further analysis is definitely needed if OHD is to be considered.

The use of the South African Metro Rail as a freight movement alternative is a more questionable solution in comparison with OHD because of security reasons regarding package handling and whether it is realistic to set up APS lockers at Railway stations. Several above ground metro rails are available in most South African provinces, being the only option to consider if a similar application than that of Visser [24] and Zhao et al [25] is to be implemented in South Africa. The *Gautrain* in Gauteng only offers users ten stops, which can only partially assist with the distribution of packages across the province. The idea of using local bus services and apply their stations with APS, as a method for transporting packages is something that can also be considered.

7 CONCLUSION

E-commerce and online shopping are growing fields, showing constant growth world-wide on a yearly basis. E-commerce leads to an increase in freight movements which influence the congestion on the roads. South Africa’s e-commerce industry is still developing and the country has to find ways to embrace the change.

By conducting a systematic literature review, various research objectives were set up and evaluated. Literature provided home-delivery alternatives which can decrease freight movements and simplify the routes of the delivery and courier vehicles, reducing the number of LGV on the road. PPs, APS and crowdshipping are alternatives that can be analysed in more detail in the South African context to achieve an efficient combination of delivery methods for the country. Off-hour-deliveries and underground/off-road freight movements validity can also be researched further when evaluating other freight movement methods for urban areas in South Africa.

Therefore, this paper investigates e-commerce in the South African context and provides alternative methods that businesses in the country can consider to enable more efficient e-commerce freight movements. The successful implementation of alternative delivery solutions could potentially provide urban South African cities with significant improvements in urban freight movements, also positively impacting the environment and improving congestion on roads.

However, since this paper only focuses on researching delivery alternatives used in global cities, more detailed investigations of each of the possible alternatives to home delivery in South Africa is required before selecting the most appropriate alternative for the South African businesses and cities.

Future work will include analysing specific delivery alternatives in more detail in order to establish which one, or combination will provide urban South African cities with the best possible freight movement plan. Collaboration with freight movement companies, in order to

obtain realistic data will assist in investigating different delivery alternatives, in order to establish the best solution and way forward for e-commerce freight movements.

This paper conducted a systematic literature review with focus on the impact increased e-commerce freight movements had on global urban cities and how they embraced the change. The research was then used to discuss the applicability of some of the freight movement alternatives in South Africa and how it can be implemented in the future. However, more research and studies into the valid alternatives are needed in order for informed decisions to be made.

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