IMPACT OF E-COMMERCE LOGISTICS ON NEIGHBOURHOODS AND COMMUNITIES IN PEEL REGION, ONTARIO[1]

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Introduction

The past decade has witnessed a remarkable growth in logistics industry and e-commerce seems to be the key enabler in this growth. The growing online market offers companies with newer markets and more opportunities. In fact, logistics companies these days strive for a market environment with minimum inventory, higher investments in warehouses and improved delivery process. Owing to the growth of e-commerce market worldwide, its adoption and usage in Canada has also been influenced significantly in the past few years. According to Statistics Canada, Canadian companies have sold more than $136 billion worldwide in goods and services online in 2013 (CIRA, 2016). This rising demand of e-commerce deliveries has put pressure on the road networks and communities. Canadian companies are reconfiguring their supply chains in order to meet the increase in demand for short and frequent deliveries to households and businesses, whilelocal governments are struggling to understand the impact of e-commerce deliveries on their infrastructures and communities.

Realizing the significance of final delivery, stakeholders have made innovative changes in parcel delivery and city logistics landscape in order to improve the effectiveness of the final delivery process. Such innovations include automated parcel stations (APSs), which are smart lockers that provide the security of parcels, and collection and delivery points (CDPs), which are stores that are used for package pick-up and drop-off services. As the e-retailing industry is growing very fast, APSs and CPDs are expanding rapidly worldwide. However, city planners do not yet understand the impact of these innovative delivery methods on communities. They are interested in devising land use policy and regulations to achieve a balance between the conflicting needs of businesses (to increase deliveries) and residents (desire to have alternative delivery methods)while minimizing traffic volumes and their related negative environmental and safety impacts in their communities.

In this regard, Peel Region, formed by the cities of Brampton, Mississauga and Caledon, and known as the significant freight hub for Canada, has developed a Goods Movement Strategic Plan, that would not only support the goods movement industry, but also, maintain liveable and sustainable communities. Goods movement has contributed $49 billions of GDP, accounts for 43% of jobs and contributed 48% of industrial and commercial tax income in the Region (Peel Region, 2017). This plan involves all stakeholders from residents, government policy makers, university researchers and companies from different industries, and seeks to understand the impact of e-commerce on urban, suburban and rural areas within the region in order to support an efficient and effective freight land use.

This research paper focuses on delivery infrastructure capabilities and their impact on communities in the Peel Region. Theobjective is to assess the impact of e-commerce logistics on urban, suburban and rural communities within the region, as the demand for home deliveries keeps rising. In particular, the paperconsiders the following key questions: how the two delivery services, APSs and CDPs, enhance residents' satisfaction in terms of ease of delivery and product return?;what is the impact of these deliveries on traffic flow and land-use planning?;and what are the potential local economic, environmental, and social impacts of increase e-commerce deliveries?

Relevant works

In literature, researchers have focused on the deployment of various alternative options to home

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delivery. For instance, Morganti et al. (2014) compared home delivery with pick-up points in stores and automated lockers networks in France and Germany, and analyzed key drivers of these two delivery options in termsof customer preferences and strategies of e-commerce firms. Another study on deployment of collection and-delivery points by Weltevreden (2008) utilized data from an online consumer survey and major CDP companies in Netherlands. Recently, Xiao et al. (2017) conducted an empirical studyto examine the impact of final delivery solutions on online shopping usage behaviour. For this purpose, theyfocused on residents living in different neighborhoods and studied their attitude towards automated parcelstations, collection and delivery points, and the direct-to-home delivery stations of parcel express firms.

In 2018, Amirjamshidi et al. published a report on e-commerce by discussing existing surveys and highlighting the need of data based research on last mile. With regard to the existing surveys, they reported the National Household Travel Survey (NHTS) in the US and the Transportation Tomorrow Survey (TTS) in Canada as potential surveys that could be modified to better understand the impact of online shopping. Both surveys were originally designedtounderstandgeneral trip patterns (commuter trips) and were not focused on understanding the shopping behaviour of people. More specifically given that online shopping does not result in a shopping trip for the shopper, it will not be captured by such surveys unless specific questions are added to the survey. The 2017, NTHS included two general questions related to estimating the number on online orders from a household. However, the 2016 TTS still does not include any questions on online shopping. Both of the surveys, given that they are national and already well known, can be revised to help understand the online shopping behaviour of households. Further, Amirjamshidi et al. (2018) identified the major data related gaps on last mile specifically, those related to the adverse impacts of the delivery (congestion, emissions, delay, cost, return rates, etc.). They pointed out that customer and carrier surveys, and field observations are the main source of information for the last mile and supplementary information could be gathered through existing data such as parking violation records or parking payments.

Theoretical framework and research objectives

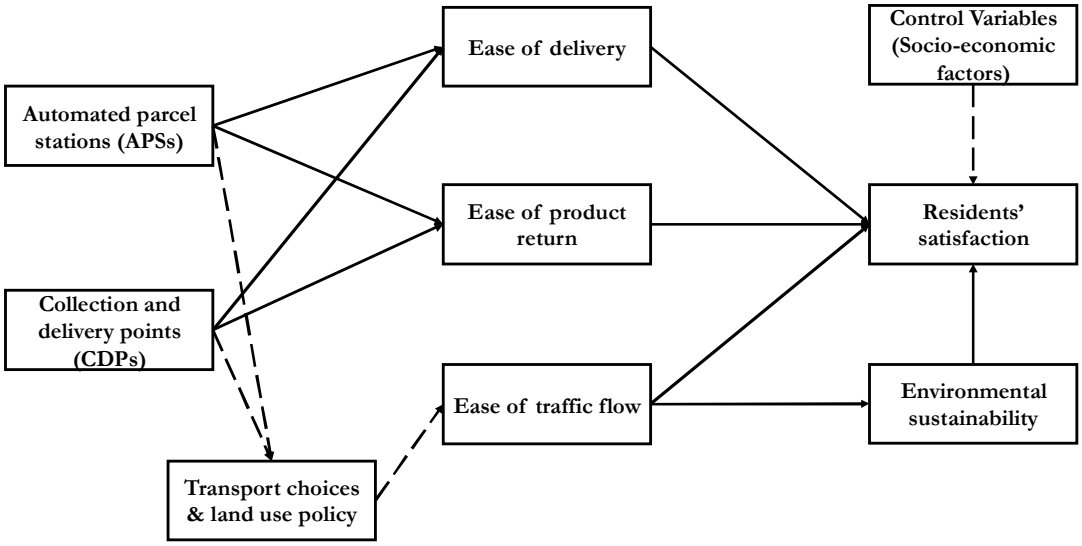
The boom in e-commerce in recent years has accelerated the demand for convenient places to pick-up and drop-off packages. This has challenged the last mile delivery process to the extent that companies are now setting up efficient distribution systems in order to meet the expectations of the residents. In literature, scholars have discussed various flexible delivery services; APSs and CDPs, so that the residents living in the cities and towns will be able to enjoy their benefits (Song et al., 2009, Cao et al., 2018). These delivery services provide improved direct-to-door delivery solutions in terms of number of delivery stations within specified catchment area. In their work on e-commerce logistics, Hsu (2008) mentioned that accurate delivery of goods to the resident's door and easy return of goods are the two major factors that influences the satisfaction of residents who are purchasing online. In 2018, Gordon Reed, director, industrial engineering, UPS Canada, stated that "Ease of use and free returns are the driving factors why consumers are increasingly making the shift to ship returns more often versus taking them back to the store".

As such,the primary objective for this paper is to establish the relationship between the innovative delivery services; APSs and CDPs, and residents' satisfaction through ease of delivery and ease of product return, and also to compare these relationships within the Peel Region (see Figure 1).

Further, as traffic congestion has increased due to online retailing, companies are looking for developing some innovative technologies to deal with this problem. These innovative technologies can be an alternative fuel vehicle, autonomous or self-driving vehicles and electric bicycles. In this paper, we are arguing that company collaboration on consignment consolidation is one of the important techniques to minimize traffic flow. Based on this technique, two different companies might be consolidated at a convenient location for final delivery to the residents. Companies like UPS and DHL are performing these operations and subsequently reducing the city traffic (Cullinane, 2009). In addition, urban cities should

encourage use of self-driving vehicles and electric bicycles for delivering goods. By doing this, cities willreduce greenhouse gas emission and congestion on streets that helps residents and goods move faster through the cities. These technologies can also be helpful for town areas (Caledon), where residents like to purchase online but do not like to face traffic congestion and pollution. Additionally, alternative fuel vehicles (AFVs) are also becoming a critical part of the transportation system. These vehicles use rechargeable batteries, natural gas, hydrogen, or other non-petroleum-based fuels and automatically reduce the greenhouse gas emissions (Greene and Plotkin, 2011). *Based on these arguments, we put forward our second objective, that is, to establish the relationship between the innovative delivery services; APSs and CDPs, and the ease of traffic flow under the mediation effect of transport choices. Third, we also aim to understand how traffic control will help the cities in maintaining their environmental sustainability, thus leading to residents' satisfaction. We intend to examine and compare all these relationships among the Peel Region.*

Figure 1 Research model



Based on the aforementioned discussion, we developed the following research model. The constructs used in the model are independent variables (APSs and CDPs), moderator variables (ease of delivery, product return, traffic flow, and environmental sustainability), mediator variable (transport choices), dependent variable (residents' satisfaction), and control variables (socio-economic factors).

Although the database (described in the next section) we aim to utilize is vast, it has not been explored or analysed in this context earlier. Thus, the residents' satisfaction that we anticipate by using and comparing delivery services (APSs and CDPs) is also in its initial stage. Further, this comparison would give insights into the perception of the residents regarding the delivery services, and its impact on environmental sustainability asresidents nowadays are becoming increasingly aware of environmental impact of logistics and transport choices.

Research Methodology

Data will be collected from 1000 residents in Peel Region who do online shopping as they aremore likely to have opinions about last mile facilities such as, flexible delivery services as APSs and CDPs, and product returns and their impact on traffic flow and environmental sustainability in their communities. In addition, in our research we will rely on the Peel's vast proprietary data, which has not been explored or analyzed in this context before. This data includes land-use policy regulations, logistics facilities locations, carriers services and locations, and traffic flow data. The sampling of this study will be limited to individual 18 years or older, residents of Peel, with gender representation and age samples balanced to Statistics Canada population data. The data will be collected via an online survey that has been designed by the research teamand will conducted by Canadian Viewpoint, a Canadian market research company.

For the purpose of this study we divided the questionnaire into five sections. The first section covered the questions related to socio-economic factors (age, income, educational qualification, marital status, Household size, postal code). The second section consisted of questions related to the online shopping behaviour of the residents in terms of product delivery, frequency of order, average spenton online order, product return, traffic flow, and advantages and disadvantages. Third and fourth sections contain questions related to shopping categories (e.g. type of product ordered, size of package) and carrier (type of vehicle, timing of parcel delivery and the manner in which items are delivered). In the last section, questions were designed related to understand the behaviour of residents towards the alternative delivery services; APS and CDPs.

In order to provide a scaled numeric value to each construct, we have used a nominal scale. The multi-item reflective scales (DeVellis, 2003) used to define the constructs were initially developed through a detailed review of the literature, followed by a discussion with 5 experts of the field. Later on, we will perform a pilot study with around 100 respondents randomly selected from the Peel Region to confirm reliability of the measure instrument. If the value of the reliability measure i.e., Cronbach's α is greater than 0.70 then we will conclude that our survey instrument is reliable for further survey.

Response rate plays an integrate role in survey based research,to the extent, that low response rates often lead to the presence of nonresponse bias in the results (Chen and Paulraj, 2004). For this purpose, we will adopta successive wave analysis approach (Armstrong and Overton (1977) and examine the differences in the early and late respondents. If the results show that $p<0.05$, it will reveal that there is no significant difference between the respondents thus, indicating an absence of the nonresponse bias. After this step, we will move ahead with the data analysis where we will use two stage Structural Equation Modelling on IBM SPSS AMOS version 22. In the first stage, we will do Confirmatory Factor Analysis where we will test for validity and reliability. In the second stage, we will do path analysis through which we will test our hypotheses.

Conclusion

In this paper, we aim to analyse residents'perception of e-commerce logistics last mile impact on their communities and infrastructure.We will also use the data to forecast e-commerce adoption, shopping habit shifts, and other key outcomes. Known travel behaviour models and network analytics tools will be used to forecast shopping behaviour along with economic, environmental and social impact models from the literature (Orutzar and Willumsen, 2011). Finally, we will evaluate different land use and infrastructure investment alternatives within the Region, and include details of data, as well as, modelsto support our analysis of the different impacts on the local communities.

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