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The Value Proposition of innovative Last-Mile delivery services from the perspective of local retailers

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Abstract: The last-mile (LM) delivery is probably one of the most expensive and complex among global Supply Chain processes, and it suffers from problems such as road traffic congestion. On the other hand, urban goods delivery systems can be held accountable for the same negative externalities they suffer. The complexity of last-mile delivery systems arises from the heterogeneity of stakeholders and their objectives. In this context, local retailers might be called upon to adopt innovative last-mile delivery services offered by Logistics Service Providers (LSPs). The attractiveness of selected LM initiatives to local retailers has been explored by a stream of literature that focuses on the utility provided to the retailer by a sub-set of initiatives s, based on the retailers' preferred requirements. With this paper, we aim to build on this stream of literature by analyzing the perception of local retailers regarding the value proposition of a wider set of LM delivery innovations, including the ones that do not comprise retailers among their paying customers. To this end, a survey is submitted to retailers of different sizes and type located in the limited traffic zone (LTZ) of Turin (Italy). Through the survey, we aim to assess the relative importance of nine service requirements retrieved from literature, and cluster them into factors, i.e. value propositions, by means of a confirmatory factor analysis. Results show that retailers are able to accept higher costs for the delivery for deliveries that are more reliable and for the reduction of stock. Retailers also appear to correlate punctuality and flexibility of the LM delivery service, because flexible and on time deliveries allow for better inventory management, higher control and in turn improved customer service level by the retailer. The convenience of the delivery service is seen as correlated with its sustainability, because logistics activities can be carried out with small and low impact vehicles that allowing easier deliveries into the city center. The highlighted factors serve as a basis for the value propositions to be taken into account by practitioners in the design of LM innovations.

Keywords: Last-mile delivery; Value Proposition; Retailers; Survey; Factor Analysis.

1. INTRODUCTION

The whole set of activities performed for delivering goods in urban areas, namely the last-mile delivery, is probably one of the most expensive and complex within global Supply Chain processes. Road traffic congestion in urban areas is perceived as one of the most important factors that negatively affect the costs of urban goods delivery systems (Sankaran, Gore and Coldwell, 2005), which can add up to 40% of supply chain costs (Roumboutsos, Kapros and Vanelslander, 2014). On the other hand, urban goods delivery systems can be held accountable for the very traffic congestion they suffer, in addition to the contribution they bring to other negative externalities such as pollution, noises and traffic accidents (Bohne and Ruesch, 2013).

The complexity of last-mile delivery systems arises from the multitude and heterogeneity of stakeholders and their business links. In this context, information related to the different preferences and perceptions of each stakeholder become crucial especially considering that their interests are often divergent and conflicting (Harrington *et al.*, 2016). Within the urban logistics ecosystem, Logistics Service Providers (LSPs) usually offer their services to the shippers, which stand outside of the urban boundaries, rather than to local retailers, who instead operate inside our cities and need the LSPs to deliver their goods in a timely fashion and in good condition.

Hence, the requirements of local retailers bring pressure to the LSPs operations and thus the negative externalities they generate. Last mile criticalities are further worsened by other requirements of local retailers, namely the need for a wider range of goods, a noticeable reduction in life cycle of products and a limited capacity in warehouse sales floor (McKinnon et al., 2010). In this context, local retailers might be called upon to adopt innovative last-mile delivery services offered by LSPs, by assessing their value proposition, as in the case of Urban Distribution Centers offering value-added services such as extra storage space (Paddeu, Fancello and Fadda, 2017). Hence, the success of LM initiatives targeting the requirements of LSPs and shippers could be significantly enhanced by taking into account the requirements of retailers as well.

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The attractiveness of selected LM initiatives to local retailers is explored by a stream of literature that focuses on the requirements of the service and the utility provided to the retailers (dell'Olio *et al.*, 2016). Such methods are useful to assess the sensitivity of retailers when confronted with CL public policies such as off-hour deliveries (OHD) and Urban Consolidation Centers (UCC). As a result, from quantifying the attractiveness of different policy alternatives for the retailers, scholars can estimate the related potential demand (Marcucci and Danielis, 2008). Johansson and Björklund (2017) assess the challenges related to urban retailers through a set of structured interviews, with a particular attention to the UCC. Through the proposed study, we aim to build on this stream of literature by analyzing the perception of local retailers about the value proposition of the most common LM innovations, including the ones that do not comprise retailers among their paying customers. Furthermore, we aim to assess the relative importance of nine service requirements retrieved from literature, and cluster them into factors, or value proposition, by means of a confirmatory factor analysis. To this end, a survey is submitted to retailers of different sizes and type located in the limited traffic zone (LTZ) of Turin (Italy).

The rest of the paper is structured as follows. First, an overview of current literature focused on the most important requirements of retailers and on the value propositions offered by LM initiatives is proposed. Then the methodology is described, and the results of the analysis are shown. Finally, implications and conclusions are addressed.

2. LITERATURE REVIEW

2.1 Last-mile delivery services and the requirements of local retailers

From a logistics point of view, retailers are looking for a reliable, consistent and smooth delivery process to fulfil their orders at the time agreed with the LSP and the supplier of the goods (Macharis, Milan and Verlinde, 2012). In addition, retailers benefit from a flexible and quick delivery service, able to respond to more on-demand, dynamic restocking requests (Muñuzuri *et al.*, 2016). Moreover, the delivery of goods should not hinder the retailer's daily operations. In particular, the operations of loading, unloading and controlling inbound goods should take little time and personnel so to devote these resources to the actual selling of the goods (Alho and de Abreu e Silva, 2015). Therefore, retailers usually establish strict delivery time windows for receiving the goods (Den Boer et al., 2017). Balancing the amount of goods displayed on the shelf (i.e. display stock) and the backroom inventories (i.e. logistics stock) is a key capability of retailers, especially because retail shelf space has been referred to as "the most expensive real estate of the world" (Kaikati and Kaikati, 2006). Whereas an empty shelf (i.e. no display stock) may result in lost sales (Gruen and Corsten, 2007), too much backroom storage can lead to increased costs and greater operational complexity (DeHoratius and Raman, 2008). Hence, retailers seek to reduce their inventory carrying costs and the related operational complexity by decreasing the overall stock or its unit cost. Local retailers are usually not aware that they are partially responsible for the level of pollution generated by last-mile deliveries (Van Rooijen and Quak, 2010). However, there are increasing concerns raised within the industry, as retailers, especially fashion chains, are becoming more committed to include sustainability in their supply chain processes (Blissick *et al.*, 2017).Finally, retailers' key capability is to create the right assortment mix of goods in order to attract customers and increase revenues. Hence, by adding extra services retailers could increase the inflow of potential customers. Such is the case of the collection-and-delivery points delivery solutions offered by express couriers (Morganti, Dablanc and Fortin, 2014).As shown by the example of the collection-and-delivery points, last-mile delivery innovation can provide benefits to the local retailers. Therefore, to strengthen the theoretical background of this work and support the development of the survey, the next sub-paragraph explores several last-mile delivery innovations from the perspective of the value propositions they might offer to local retailers.

2.2 Last-Mile delivery Value Proposition

UCCs are one of the most studied last-mile delivery innovations (Browne, Allen and Leonardi, 2011). UCCs are warehouses where goods are being delivered by different suppliers or LSPs and are later handled and transshipped onto freight vehicles for the last leg of journey inside the city Centre. The objective is to manage the last-mile centrally so to consolidate the deliveries using a smaller number of vehicles and thus reducing the total amount of vehicle trips in urban areas. Usually UCCs target local retailers by offering benefits in terms of fewer deliveries per day, a more pleasant business environment and also by offering buffer storage to decrease inventory costs (Van Rooijen and Quak, 2010).

To lessen the negative impacts of last-mile deliveries, goods can be delivered to smaller warehouses, called terminal satellites or micro-consolidation centers, located inside the city centers. Mobile depots are also used in order to reduce the necessity for real estate space and move the inventory closer to the final customers (Arvidsson and Pazirandeh, 2017). From such satellite terminals, goods can be transshipped to even lighter and environmentally friendly vehicles for the final leg of the delivery. This "two-tier system" coupled with zero-emission vehicles has proved to be impactful in reducing total distance travelled and CO2 emissions (Schliwa et al., 2015), hence aiming to deliver a value proposition centered on sustainability. Through collection-and-delivery points express couriers can consolidate more deliveries into one single point of delivery, asking the final recipients of the parcel to do the final pick up themselves (Weltevreden, 2008). Pickup points are physical stores which benefit from increasing the number of potential customers but also from adding extra revenues, as they receive a reimbursement fee by express couriers (Zenezini *et al.*, 2018). Automated parcel lockers station are instead composed by modules resembling a locker where the parcel is retained until the final recipient picks it up by typing the order ID or her name (Iwan, Kijewska and Lemke, 2016). Automated parcel lockers are mostly used for B2C deliveries, and retailers are still dubious about their value, given the fact

that they would need to devote time and personnel for the pickup activities (Carlin *et al.*, 2018). However, such solution might provide buffer storage for small volume items, as in the case of UCCs.

Crowd logistics is an alternative to traditional deliveries, whereby excess capacity of private vehicles is used as parcels and passengers are co-transported along a trip that was originally intended for another purpose (Cohen and Munoz, 2016). Local retailers can benefit from crowd logistics since they can receive quick, same-day deliveries at lower costs (Schreieck *et al.*, 2016). Moreover, under certain circumstances crowd logistics could reduce the environmental impact of last-mile deliveries, for instance by achieving a critical mass of users (Buldeo Rai, Verlinde and Macharis, 2018). Other crowd logistics services also offer additional storage solutions using space from the crowd (Carbone, Rouquet and Roussat, 2017). Crowd Logistics could also reduce the problems generated by the first-attempt-failure of delivery by leveraging on friends and acquaintances (e.g. co-workers or neighbors) who may have overlapping schedules with the consignee (Devari, Nikolaev and He, 2017).

Finally, several off-hour delivery initiatives have been experimented to reduce the level of congestion by moving deliveries to off-peak hours. This solution could increase the efficiency and reliability of the delivery operations, due to lower and less uncertain journey times (Holguín-Veras *et al.*, 2014). Moreover, the additional labor costs from working overtime might be offset by the more efficient delivery inbound process.

3. METHODOLOGY

The research has been conducted through the following steps. First, a structured questionnaire has been administrated to eighty-one retailers operating in the LTZ of Torino. Survey find large application in logistics and supply chain research (Jeble *et al.*, 2018; Queiroz and Telles, 2018). The proposed questionnaire has been administrated to guide the respondents in order to reduce the risk of misunderstanding. The questionnaire has been developed during 2 sessions of brainstorming wherein the previously identified requirements have been assessed. After that, the questionnaire has been tested with 10 retailers and based on their concerns some parts related to the description of the requirements have been clarified and better explained. A total number of 500 retailers has been contacted and 81 out of the total has accepted to take part to the study with a response rate equal to 16.2%. This value can be considered acceptable for carrying out further analysis on the answers since it is close to those experienced in previous studies (Tokman *et al.*, 2012; Arditi, Mangano and De Marco, 2015). Aiming at obtaining more insights, the respondents have been selected with different sizes and they account for different type of goods sold. The first part is related to the evaluation of nine potential retailers' requirements. The requirements are namely: cost, reliability and safety, punctuality, flexibility, stock reduction, convenience, sustainability, and extra revenues. Each requirement is assessed through a 1 to 5 Likert Scale. In the second part questions related to the respondent's profile are administrated (warehouse floor area, usable store area, number of employees, type of goods sold). The gathered data are then analyzed via statistical analysis. In particular, a correlation analysis has been carried out. A factor analysis has been also performed on the identified requirements in order to obtain their classification.

As previously mentioned, 81 retailers have been involved in the research. They operate in different sectors, and have been grouped in 5 different categories, according to the classification proposed by Alho and de Abreu e Silva (2015) namely:

- Apparel (37);
- Pharmacy (10);
- Culture and spare time (10);
- Others (24).

In terms of employees working in the stores, there are typically three to four employees per retailer. However, a significant minority (20%) of retailers occupy only one person (i.e. the shop owner). By analyzing the usable floor area of the store, its average value is equal to 130 square meters, and it ranges from 12 to 1500 square meters. Finally, the area of the warehouse shows an average value equal to 60 square meters. In some cases, this value is equal to zero, in the sense that there is no space associated with the storage of goods in the store.

4. FINDINGS

First, a correlation analysis among the identified requirements has been carried out. The level of dependence between two different requirements is expressed by the Spearman coefficient. Its reliability coefficient is associated with the p-value, ranging from 0 to 1 and it is the probability of rejecting the null hypothesis given below:

H0: there is no significant relationship between the requirements under analysis.

H1: there is significant relationship between the requirements under analysis.

The critical value is equal to 0.05. Lower values indicate that the null hypothesis has to be rejected, and in turn that the two variable are significantly related. Greater value than 0.05 indicate that the null hypothesis can be accepted and consequently there is not enough evidence to prove significant relationship (Bhattacharya and Habtzghi, 2002).

Table 1. Results of the Correlation Analysis

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)
1) No damage	1											
2) Cost	-0.0481 0.6695	1										
3) Reliability and safety	-0.0644 0.5679	**0.272** **0.014**	1									
4) Punctuality	0.0596 0.5971	0.0329 0.7706	-0.0189 0.8671	1								
5) Flexibility	-0.0387 0.7317	0.0348 0.74	0.0378 0.7378	**0.3545** **0.0012**	1							
6) Stock Reduction	-0.0805 0.475	**0.2278** **0.0408**	0.0853 0.449	-0.0653 0.5627	-0.0172 0.8786	1						
7) Convenience	-0.0556 0.6218	0.2358 0.034	0.155 0.1669	158 0.8883	0.0547 0.6275	0.0317 0.7787	1					
8) Sustainability	0.0896 0.4262	0.0438 0.6979	-0.0138 0.9024	0.037 0.7428	0.0078 0.9448	0.1531 0.1725	**0.2664** **0.0162**	1				
9) Extra revenues	-0.1527 0.1735	0.0469 0.6777	0.1596 0.1546	-0.1761 0.1158	-0.0237 0.8338	0.1421 0.2058	0.1319 0.2404	**0.2851** **0.0099**	1			
10) Number of employees	-0.1325 0.2382	-0.2117 0.0578	-0.022 0.8453	0.0309 0.7843	0.1976 0.077	0.0293 0.7948	0.1438 0.2004	0.0805 0.4751	0.0817 0.4685	1		
11) Store area	-0.0803 0.476	-0.1797 0.1084	**-0.2195** **0.049**	-0.0416 0.7126	-0.1365 0.2243	-0.0162 0.8859	0.0087 0.9387	0.1104 0.3267	0.0299 0.7911	**0.4995** **0**	1	
12) Warehouse area	-0.0733 0.5156	-0.0057 0.9594	**-0.2699** **0.0148**	0.039 0.7298	-0.1522 0.175	0.0546 0.6281	0.0608 0.5895	-0.0588 0.6019	0.1284 0.2534	**0.3379** **0.002**	**0.4536** **0**	1

The results are shown in Table 1. In each cell, the upper value is related to the Spearman Coefficient that explains the level of strength of the relationship. The lower one is the P-value showing the level of significance (and consequently of reliability) of the relationship. This correlation has been selected since data are not normally distributed. It allows to quantify how much two columns of data monotonic depend on each other(Zhang et al., 2016) The results show that there is a significant relationship between reliability and safety and the cost. This result shows that retailers are able to accept higher costs for the delivery for having deliveries that are more reliable. The cost is also related to the reduction of the stock. This is due to the fact that higher costs are often associated with the exploitation of external warehouses allowing to have lower warehouse space in the store. The positive relationship between punctuality and flexibility points out that typically if a retailer asks for flexible shipments, he expects to obtain a consequent on time delivery. Sustainability appears to be correlated with convenience and extra revenues. In particular, sustainable logistics activities are carried out with small and low impact vehicles that are more suitable to be used in the city center allowing easier deliveries. As well as, sustainability is considered a lever to get more revenues especially for retailers more aware about the environmental issues. By taking into account the variables associated with the respondents, a negative relationship comes up between reliability and safety, and warehouse and store area. This means that the higher usable floor areas, the lower the importance associated with the reliability of the delivery. This result can be explained by the fact that greater space can accommodate more stock and thus wrong deliveries do not have heavy impacts on the available assortment. Store and warehouse areas are also significantly related to the number of employees. This shows that typically in big stores work a greater number of people. Finally, store and warehouse areas appear to be correlated. As a matter of fact, usually bigger stores require bigger warehouses.

A factor analysis is then conducted among the requirements in order to obtain primary requirements. As a matter of fact, this method is broadly used to obtain a classification of the data, in the sense that correlated measured variables are expected to reflect the presence of a smaller number of hidden underlying factor (Jafari, de Juan and Tauler, 2018). Two prior tests on the data have been carried out in order to validate the goodness of the sample. In particular, the Kaiser-Meyer-Olkin test shows a value equal to 0.542. The typical threshold for considering the available data as suitable for the purpose of the study is 0.5 (Kaiser, 1974). After that the Bartlett test the null hypothesis on the homoscedasticity (namely the same variance of the variable) (Dziuban and Shirkey, 1974). Given a p-value equal to 0.009, the null hypothesis is rejected and it is possible to conduct a reliable analysis.

Table 2. Results of the Factor Analysis

Factor	Eigenvalue	Variance %	Cumulated Variance
Factor 1	**1.78745**	**22.34%**	**22.34%**
Factor 2	**1.39159**	**17.39%**	**39.74%**
Factor 3	**1.17542**	**14.69%**	**54.43%**
Factor 4	0.98930	12.37%	66.80%
Factor 5	0.85008	10.63%	77.42%
Factor 6	0.65500	8.19%	85.61%
Factor 7	0.62653	7.83%	93.44%
Factor 8	0.52462	6.56%	100%

Table 2 shows the results of the factor analysis. Factors with eigenvalue greater than 1 have been extracted. Thus, 3 factors have been considered and the 54.43% of the variability is explained. No fixed threshold exists, although certain percentages have been suggested in literature. A good model is able to explain a percentage of variance between 50, 60% (Williams, Onsman and Brown, 2010). Thus, the proposed model can be considered as reliable. After that, the loading matrix has been rotated. In fact, in the first matrix the variance related to a variable is homogeneously shared among the factor. Through the rotation, it is possible to assign the variable to the extracted factors, in the sense that it can be possible to understand which factor is able to explain the variability of every variable. Table 3 shows the results of the rotation. Columns report the variables, the value of the loadings of the three main factors previously extracted and the uniqueness. This last factor describes the amount of variance not explained by the factors that is just associated with the requirement. A value of uniqueness equal to zero indicate a factor is perfectly able to explain the variability of a variable.

Table 3. Rotation of the variables

VARIABLES	Factor 1	Factor 2	Factor 3	Uniqueness
Cost	**0,7863**	0,0265	0,1226	0,3659
Reliability and safety	**0,7689**	-0,0275	-0,1753	0,3773
Punctuality	-0,0835	-0,0683	**0,8153**	0,3237
Flexibility	0,0897	0,0411	**0,7558**	0,4191

Stock Reduction	**0,3381**	0,2669	0,0531	0,8116
Convenience	0,3868	**0,4669**	0,1317	0,6151
Sustainability	-0,0670	**0,8478**	0,0609	0,2730
Extra Revenues	0,1059	**0,6704**	-0,2819	0,4598

Based on the values of the loadings the following factors are identified: Economics, Attractiveness and Simplifications and Time Windows Delivery. "Economics" includes the requirements Cost, Reliability and Stock Reduction. In this factor, the variable stock reduction has been included since it is significantly correlated with the other two variables. This factor is mainly associated with the costs required for receiving the goods. Therefore, it can be cited the cost of the order, the lower cost related to a decrease of the levels of stock and the additional cost that has to be borne in the case of wrong delivery. The factor "Attractiveness and simplification" includes Sustainability, Extra Revenues and Convenience. This variable show the highest loadings on the factor 2 and thus they can be grouped together. This factor refers to the extra revenues that can be generated through new sustainable initiative and to the convenience associated in delivering an item. Finally, "Time windows delivery" includes Punctuality and Flexibility. In this case, the highest loadings are related to the third factor. This factor address the need of dealing with time windows in order to obtain higher percentage of on time deliveries and more flexible activities.

5. DISCUSSIONS AND CONCLUSIONS

This paper proposes an investigative analysis on the perception of LM projects by urban retailers. The obtained results show that there are three most important factors associated with successful urban operations. In particular, the Economics factor reflects the attention on cost typical of retailers' business. The Attractiveness and Simplification factor highlight issues related to more and more complex activities that are required to be carried out in order to be competitive. This aspect is also related to Time Window Delivery that is a lever for competitive advantage. As a matter of fact, flexible and on time deliveries allow for better inventory management, higher control and in turn improved customer service level by the retailer. This work addresses some theoretical and practical implications. From a theoretical point of view, this study can be considered as one of the first contributions on the value propositions for LM services for urban retailers. In fact, most of the study have been mostly focused on one single project or retailer's need. On the contrary, this work offers a comprehensive perspective on the requirements of the retailers in relation with the offered service and project. From a practical point of view, the analysis show the main value propositions that should be taken into account by managers and practitioners in the design of LM innovation initiatives. As a matter of fact, a more precise awareness about the most relevant value propositions might support project sponsor in identifying the most promising innovative services in terms of service market fit. Thus, the obtained results could contribute to the development of services more tailored for the retailers' expectations. In order to support the design of more attractive value propositions, future research will be addressed to explore the relation between the identified value propositions and the characteristics of the store namely size, type of goods sold, etc. In addition, future studies will involve a higher number and variety of respondents so to carry out more wide-ranging analysis.

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