CUSTOMER ROLES IN THE LAST-MILE: IMPROVING DELIVERY PERFORMANCE

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ABSTRACT

Customer involvement is regarded as the new way to increase last-mile efficiency. Improved delivery designs call for customer involvement although it is not clear how customers can be involved and what the consequences are for organizations and customers involved in the last-mile. While literature describes several roles for customers in service delivery, these roles have not been considered in the last-mile context, and their implications for performance and control over the last-mile are unknown. In this thesis, important customer roles are identified while both the organizational and customer perspectives for the effects of involvement in these roles are examined. By performing interviews with a broad range of experts on the last-mile, it is shown that customer involvement is possible in a multitude of roles and that these roles can lead to increased performance and control. By involving customers, the last-mile can become more customer-centered while customer satisfaction, efficiency, and control over the process can be increased concurrently.

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1. INTRODUCTION

1.1. Introduction

A major factor contributing to the success of e-commerce is the speed at which customers receive their orders (Turban, King, Lee, Liang & Turban, 2015), as it directly influences customer satisfaction (Senapati, Mishra, Routra, & Biswas, 2012). Ultra-fast delivery, or delivery within 24 hours, presents significant challenges for retailers seeking to provide this service (Tompkins, Singer & Kennedy, 2014). The need for same-day deliveries lowers the delivery volumes and leads to low efficiency for e-retailers and their partners, making it the single most expensive element in the entire supply chain (Gevaers, Vanelslander, & Van de Voorde, 2011; Zijm & Klumpp, 2016). Furthermore, high volumes of shipments take place in densely populated areas which lead to congestion on roads (Ploos Van Amstel, 2014) and high air and noise pollution (Quak, Balm, & Posthumus, 2014). In cities, up to 55% of vehicle emissions are caused by the distribution of goods (Faccio & Gamberi, 2015). This shows that currently, same-day deliveries in the last-mile are not economically nor environmentally sustainable.

New solutions for the last-mile have been developed in order to increase efficiency for ultra-fast deliveries. Literature has focused on vehicle routings (Cleophas & Ehmke, 2014), delivery designs like reception boxes (Punakivi, Yrjölä, & Holmström, 2001), pick-up-points and locker-banks (Allen, Thorne, & Browne, 2007), and has recently focused on innovative solutions within the domain of city logistics (Ploos Van Amstel, 2014) and crowdsourced transport (Paloheimo, Lettenmeier, & Waris, 2014; Chen, Pan, Wang, & Zhong, 2016). Some of these solutions focus on customer involvement to increase efficiency and customer convenience (Paloheimo et al., 2014; Iwan, Kijewska, & Lemke, 2016).

Customer involvement is a fundamental element of recent business models (Kortmann & Piller, 2016) and could lead to competitive advantage (Prahalad & Ramaswamy, 2000). Customers co-produce the service through their vital inputs, which offers service providers the ability to tailor the service to the needs of the customer in such a way that a favorable perception of service performance is promoted (Cheung & To, 2011). The benefits of customer

participation in the service process include cost reductions, efficiency in the process and psychological benefits (Rodie & Kleine, 2000 IN Cheung & To, 2011). Moreover, customers can participate in co-production to maximize efficiency in a self-service setting while their input may also affect overall satisfaction (Jacob & Rettinger, 2011). This implies that customer involvement can improve both the efficiency and perceived satisfaction of the last-mile process. However, it is unclear in which roles customers can be involved in order to improve these processes. While research has been performed on customer roles in service supply chains in general (e.g. Sampson & Spring, 2012), no research has linked customer roles to last-mile delivery.

While customer involvement can improve the last-mile process, it may have some drawbacks. Increased customer involvement may affect the level of perceived control over the process as the power of the customer increases (Collier & Sherrell, 2010). This may lead to a decrease of perceived control of the e-retailer and third party logistics providers (3PL's) involved in the process. Moreover, it is not clear how customer's satisfaction is influenced by customer involvement. The goal of this research is to investigate the roles in which customers could be involved in the last-mile process. Additionally, this research seeks to find the influence of customer involvement in these roles on the level of perceived control by the involved parties, as well as last-mile performance when offering ultra-fast product deliveries to customers. This research will then attempt to answer the following research questions:

1. *What kind of roles can customers take on in the last-mile process?*

2. *How can these customer roles influence last-mile performance?*

3. *How can customer involvement in these roles influence provider's perceived control over the last-mile process?*

To answer these questions, expert interviews will be conducted. These interviews will take place at a broad range of both experts and parties involved in the last-mile in order to gather a

comprehensive view of this problem. Qualitative and explorative research is performed in order to take both the context and content of the last-mile problem into account.

This research adds to current literature by determining the roles in which customers can contribute to last-mile delivery. First, it will attempt to confirm and extend the roles currently described in literature. Second, it will consider the implications of each role for last-mile performance and control over the last-mile. By investigating not only the effects of customer roles on efficiency but also their effects on customer satisfaction, it will offer an analysis of both customer and organizational performance.

In addition to this theoretical contribution, this research will cover practical insights as well. Many companies are still struggling with the efficiency of the last-mile process. Efficiency is a vital performance measure, yet customer satisfaction is becoming equally important in the e-commerce sector. By establishing the roles in which customers can add value to the last-mile, managers can increase last-mile efficiency while enhancing customer satisfaction. Moreover, this study provides insights as to how customers in these roles should be managed in order to benefit from the increased performance, which is critical in this cooperation.

This thesis will continue as follows: first, a theoretical background of the problem will be reviewed. Then, the methodology of the research will be discussed. Next, the results will be presented. Finally, in the discussion and conclusion, four propositions will be stated, theoretical and practical implications will be presented after which concluding remarks will be provided.

2. THEORETICAL FRAMEWORK

In this section, a review of the current state of literature will be provided. To put in a perspective of what has been done to improve last-mile delivery by involving customers, a short overview of delivery modes will be provided after explaining the problems that are present in the last-mile. Following this, it will focus on the performance measures efficiency and satisfaction. Then, customer involvement and its implications will be discussed.

2.1. Last-mile delivery

The very last step in the e-retail delivery process is the process of delivering the ordered product to the consumer. This step is generally called the last-mile and is defined as the final leg in a business-to-consumer (B2C) delivery service whereby the consignment is delivered to the recipient, either at the recipient's home or at a collection point (Gevaers et al., 2011; de Souza, Goh, Lau, Ng, & Tan, 2014). Last-mile deliveries in B2C e-commerce may be made to customer's home, place of employment, reception boxes, pick-up-points (PUP's) or lockers. These modes will be discussed below. B2C deliveries mainly consist of small parcels (Allen et al., 2007) and are typically low volume and very fragmented, while customers are expecting fast delivery (Allen et al., 2007; Iwan et al., 2016). Therefore, the delivery of the final product to the customer's door is logistically challenging, inefficient and thus very expensive (Boyer, Prud'homme, & Chung, 2009).

Research by the European Union suggests that the promised speed of deliveries is a vital aspect of the decision to buy at an e-retailer (Okholm, Thelle, Möller, Basalisco, & Rølmer, 2013), and that logistics performance measures like speed and reliability are strong determinants of customer loyalty (Okholm et al., 2013; Ramanathan, 2010). This results in e-retailers promising and offering high delivery speeds, i.e. within 12 hours after ordering, which often implies same-day deliveries. The increased speed means that the volume of packages per truckload is reduced, which leads to empty trucks and decreased efficiency (Faccio & Gamberi, 2015), resulting in amplification of the last-mile problems. By offering the service of same-day deliveries, e-retailers have thus made the last-mile even less efficient.

Last-mile deliveries to customers are often performed by small trucks to individual addresses. These deliveries need to be attended by the customer. According to Song, Cherrett, McLeod & Guan (2009), more than 25% of first-time delivery attempts fail, for example when a customer is not at home. This is a major source of inefficiency which prompts research in developing delivery modes that involve customers to increase efficiency by eliminating the need for attendance of customers or increasing coordination with customers. These modes are shown in *table 2-1*.

TABLE 2-1:

Last-mile modes that involve customers

Mode	Details:	Performance	Customer	Literature
Traditional delivery*	Delivery via small trucks, electric vehicles or bikes	Inefficient because of high first-drop failures, convenient for customer	Customer can supply delivery address and time	(Allen et al., 2007)
Lockers*	Delivery to shared lockers	More efficient but less convenient	Customers pick up their shipment	(Allen et al., 2007) (Iwan et al., 2016)
Pick-up-point (PUP)*	Delivery to pick-up location	More efficient but less convenient	Customers pick up their shipment	(Allen et al., 2007) (Song et al., 2009) (Weltevreden, 2008)
Crowdsourced delivery*	Customers pick-up and deliver the shipment	Can be efficient, can be convenient	Customers deliver shipment	(Paloheimo et al., 2014) (Chen et al., 2016)

**pictures of these modes can be found in appendix A*

PUP's and Lockers require customers to pick up their shipment themselves (Allen et al., 2007; Iwan et al., 2016). Literature shows that by involving customers this way, efficiency can be increased (Iwan et al., 2016; Song, Guan, Cherrett, & Li, 2013). These modes do require more effort by customers, which could reduce customer's convenience (Allen et al., 2007). A radically different approach to the last-mile problems are crowdsourced deliveries which could offer a reduction of resource use by involving customers (Paloheimo et al., 2014). The crowd would be any volunteer(s) who is (are) capable of carrying out the task, no matter professional or not, preselected or not (Chen et al., 2016). Paloheimo et al. (2014) show that in a trial in Finland, where deliveries of library books were performed by crowdsourcing, a carbon footprint reduction up to 60% could be realized. This indicates that crowdsourcing can improve efficiency by involving customers in the last-mile.

2.2. Last-mile performance

To research the influence of customer involvement on the performance of the last-mile, performance measurements need to be defined. For this research, last-mile efficiency and customer satisfaction are proposed.

Efficiency

When delivery speed increases, delivery volumes get smaller and efficiency of the last-mile decreases (Zijm & Klumpp, 2016). Improving efficiency has been the focus of much of the academic work on the last-mile (e.g. Boyer et al., 2009; Iwan et al., 2016), which is important since an e-business that can deliver the goods and services at a reasonable cost will have an advantage (Lee & Whang, 2001). Moreover, problems associated with the last-mile like high supply chain costs (Gevaers et al., 2011), pollution and city congestion can be reduced by improving efficiency (Allen et al., 2007).

This research focuses on the problem of the high degree of failed deliveries, discussed by Gevaers, Van de Voorde, & Vanelslander (2009). More specifically, it targets the delivery efficiency of the first-drop, which is the first time a shipment is offered to the final customer. The definition of efficiency for this thesis can then be adapted from Van Duin, de Goffau, Wiegmans, Tavasszy, & Saes (2016) by adding the notion 'the first time':

$$Efficiency = \frac{(the\ amount\ of\ parcels\ successfully\ distributed\ the\ first\ time)}{(the\ amount\ of\ parcels\ distributed\ the\ first\ time)}$$

Improved efficiency will then lead to lower costs (Vanelslander, Deketele, & Van Hove, 2013) and will decrease the environmental impact of the last-mile (de Souza et al., 2014; Ploos Van Amstel, 2014). McKinnon & Tallam (2003) noted that 3PL's achieve high first-time delivery rates when parcels are left at alternative locations, like neighbors, PUP's or lockers. These modes allow for a high efficiency without influencing the service level to customers (Punakivi et al., 2001). Van Duin et al. (2016) describe specific timeslots, dynamic changes in the route and a change in behavior as other measures to increase efficiency for the last-mile.

Customer satisfaction

Customer satisfaction is important for any e-retailer as it has a potent effect on repeat sales, customer loyalty and e-commerce performance (Anderson & Srinivasan, 2003; Oliver, 2010). Delivery is often the only real contact of the customer with the e-retailer and has shown to be a very important factor in customer satisfaction (Vanelslander et al., 2013). Involvement of customers provides customers with a feeling of accomplishment that enhances satisfaction (Meuter et al., 2000), which is why satisfaction is established as the customer-centered performance variable of this research. This research proposes three elements of customer satisfaction: delivery *convenience*, *speed* of delivery and delivery *reliability*.

Collier & Sherrell (2010; p. 492) define customer convenience in a self-service setting as "the ability to reduce the physical and sometimes cognitive effort to initiate a transaction independent of employee involvement". For the last-mile, this implies that reduced physical and cognitive effort required by customers will make the process more convenient. It has been found that customer convenience directly and positively affects customers satisfaction with a service experience (Collier & Sherrell, 2010; Zhang & Prybutok, 2005). Last-mile modes like PUP's and lockers require more involvement and physical effort of customers than the traditional modes since customers need to travel to the physical location. This increased effort could reduce the level of perceived convenience and satisfaction (Collier & Sherrell, 2010).

However, involved customers perceive more control over the last-mile which could increase satisfaction (Collier & Sherrell, 2010).

Customers increasingly demand faster deliveries and more delivery schedule reliability (Hülsmann & Windt, 2007). Customers of e-retailers are demanding same-day deliveries hence shorter delivery times must be provided in order to receive greater customer satisfaction (Senapati et al., 2012). Delivery *speed* can be defined as "the time between order taking and customer delivery" (Morash, Droge, & Vickery, 1996). Literature shows that for some customer groups, satisfaction can be increased by offering faster deliveries but other groups do not value *speed* of deliveries as much (Brusch & Stüber, 2013).

Delivery *reliability* is defined as "the ability to exactly meet quoted or anticipated delivery dates and quantities" (Morash, Droge, & Vickery, 1996; p. 3). *Reliability* is also considered as an important factor for customer satisfaction as late arrivals of orders are a significant cause of customer dissatisfaction (Ramanathan, 2010). Wang & Xiao (2015) note that delivery *reliability* is important for customer satisfaction and determines the quality of the delivery.

2.3. Customer involvement

Customers are crucial in the creation of value for themselves and for others, which has led them to become an integral part of the supply chain (Maull, Geraldi, & Johnston, 2012). Customer involvement in service delivery is often referred to as customer co-creation in literature (Heidenreich, Wittkowski, Handrich, & Falk, 2015). Co-creation of services requires customers to invest effort or share information in return for tailored services (Heidenreich et al., 2015), which can increase efficiency for the provider and increase the speed of the service (Meuter et al., 2000). This means that customer involvement through co-created services can yield benefits for both the provider and the customer which can unlock new sources of competitive advantage and provide customers with offerings tailored to their needs (Heidenreich et al., 2015).

Sampson & Froehle (2006) stated in their work on the Unified Services Theory that services cannot be performed until the appropriate customer input is received. As such, the service of package delivery can only be performed by the involvement of a customer in the

form of inputs to the process. For example, to receive a delivery, at least an address needs to be provided. Additionally, by involving customers, service processes can become more efficient while delivering better quality, as they are customized to the customers' specific need (Chan, Yim, & Lam, 2010). This is particularly important for the need for fast deliveries since more collaboration with customers can lead to shorter service times (Holl, Pardo, & Rama, 2010).

Sampson & Spring (2012) have shown that customer involvement can take different forms and have developed a model of the resulting customer roles. Customers can provide specific inputs which leads to eight roles that manifest itself in a service supply chains (Sampson & Spring, 2012). These roles are shown in *table 2-2*.

TABLE 2-2:

Customer service roles. Adapted from Sampson & Spring (2012).

Customer role	**Tasks**
1. Supplier	Deliver inputs, by offering minds, bodies or information
2. Labor	Co-produce a service
3. Design Engineer	Influence design of a service
4. Production manager	Altering service delivery
5. Product	Be the product, like in healthcare or education
6. Quality Assurance	Offer feedback about service quality
7. Inventory	Waiting for themselves, their belongings or information processing
8. Competitor	Perform themselves what the service does

Sampson & Spring (2012) state that it is possible to combine these customer roles or to shift between them, but note that more involvement in one role could also lead to a decrease in another, which could have efficiency and quality implications. It is possible that a customer first provides information as input for a service, will then perform physical labor in a later stage as

they gather more knowledge about how to perform the service and will design the process themselves if they become even more knowledgeable about the process (Sampson & Spring, 2012).

Involvement in the last-mile

When looking at the last-mile modes that currently exist, some of these customer roles are visible. For every mode, the customer must input information to start the delivery process. Moreover, a customer needs to perform physical labor when using PUP's or lockers as they need to pick up the package themselves. In all the modes, customers can offer feedback about the service. These elements can be seen in *table 2-3* and will be discussed below.

TABLE 2-3:

Customer roles in the last-mile.

Customer role	**Tasks**	**Last-mile mode**
Customer as ***Supplier of information*** in the last-mile	Providing information: - Delivery timeframe - Delivery mode - Delivery location	Traditional delivery Lockers Pick-up-point Crowdsourced delivery
Customers as ***Labor*** resource in the last-mile	Performing parts of the last-mile: - Locker-bank - Pick-up-point - Crowdsourcing Attending a delivery: - Neighbor	Lockers Pick-up-point Crowdsourced delivery
Customers adding to ***Quality Assurance*** in the last-mile	Quality control: - Attending a delivery - Checking state of package Providing specifications Assuring service quality	Traditional delivery Lockers Pick-up-point Crowdsourced delivery

The first role that has been recognized in literature is the *customer as supplier of information*. Van Duin et al. (2016) states that customer can input a preferred delivery time, next to their address in order to improve first-time deliveries by eliminating non-attendance of the customer. This tailors the delivery to the customer's wishes, which increases satisfaction (Chan et al., 2010).

Second, by involving customers as labor by using PUP's or lockers as unattended delivery modes, first-time failures can be mitigated which increases efficiency for the 3PL's that otherwise would need to visit the individual homes (Punakivi & Saranen, 2001; Weltevreden & Rotem-Mindali, 2009). These modes, however, require customers to perform the last part of the last-mile themselves, in order to receive their delivery (Allen et al., 2007). The customers then co-create the delivery, as the service cannot be created without their participation (Bitner, Faranda, Hubbert, & Zeithaml, 1997). This does however require significant effort of the customer, which could lead to less convenience and satisfaction, as discussed before. Crowdsourcing logistics lets customers participate in not just the last-mile process of their own deliveries but also deliver orders for other customers. In crowdsourcing, logistics are outsourced to a crowd, and transportation pooling is applied as a solution for unsustainable transport and resource use (Saxton, Oh, & Kishore, 2013). This means 3PL's do not have to perform the very expensive 'last-mile' themselves, because they outsource the most expensive part.

Third, customers can help to assure the quality of the last-mile. In traditional attended delivery to the customers' doorstep, customers attend the delivery of the package and can, therefore, perform a rudimentary check and confirm product quality. Moreover, customers provide the specifications of service quality and are often involved in assuring service quality of both the process and outcome (Sampson & Spring, 2012). This means that customers can both set the standards for delivery quality and inspect the quality of the delivery.

It is likely that customers can perform more customer roles in the last-mile, and it will be interesting to consider the existence of roles that are not mentioned by Sampson & Spring (2012) or find other intepretations of these roles in the last-mile. This will be the goal of this study. Moreover, the roles that have been found may have other implications for efficiency and

satisfaction, which will also be researched. Customer involvement may have implications for the level of perceived control over the last-mile, which will be discussed in the next section.

2.4. Providers view on perceived control

Involving customers in the last-mile may have implications for the level of perceived control that providers like e-retailers and 3PL retain over the last-mile process. By co-creating a service with customers, companies essentially outsource parts of the last-mile to customers. When customers perform physical labor, for instance, 3PL's outsource their delivery to customers. Fitzsimmons, Fitzsimmons, & Bordoloi (2014; p. 262) explain that outsourcing can reduce costs while it could also lead to a loss of control over quality and higher coordination costs. These coordination costs result from managing and governing the entity that performs the task.

There is, however, another element of control which is established in literature. Rönnberg Sjödin, Parida, & Wincent (2014) state that the provider-customer relationships in co-creation are neglected in literature and establish a basic understanding of how organizations can cope with these relationships. Customer involvement could transform the nature of the interaction between the buyer and seller from a transaction-based to a relationship-based collaboration, which could lead to unclear expectations, opportunistic behavior, conflicts and failures of the service (Rönnberg Sjödin et al., 2014). They find that co-creation with customers requires the management of role ambiguity and note that the required governance mechanisms like contracts could lead to high coordination costs.

Crowdsourcing, for instance, requires mechanisms in order to enable bidding on tasks, perform quality control and establish compensation for participants (Saxton et al., 2013), as the quality and efficiency can be different per supplier. These mechanisms are types control that promote self-regulation and the interpretation of the organization and its objectives (Costa, Duarte, & Palermo, 2014). Röndell, Sörhammar, & Gidhagen (2015) add the concept of co-governance to explain the approach in which companies neither have full control over the process, nor completely abdicate responsibility. They state that giving customers access to and influence on the process does imply ceding control to some extent. This could lead to negative outcomes, where the offering and its brand may take a direction that was not planned by the firm (Jaakkola & Alexander, 2014).

It is important to look at the impact of various roles and responsibilities when implementing governance structures and contracts between customers and providers, as role ambiguity between customers and providers is the main source of decreased performance of the service (Rönnberg Sjödin et al., 2014). This indicates that while governance mechanisms are important in co-creation, it should be very clear which roles both the provider and the customer adopt to profit from customer involvement.

This theoretical framework suggests the following. First, customer involvement and co-creation is well established in literature but require additional research in the last-mile context. Second, seven customer roles for co-creation have been established by Sampson & Spring (2012) but validation is required to determine to what extent these roles are applicable to the last-mile context. Third, other customer roles might be present, which should be researched. Fourth, customer involvement has shown to influence efficiency and satisfaction in the last-mile, but the influence of individual roles is not well known and should be further developed. Fifth, customer involvement has shown to have implications for perceived control by providers which warrants research into the influence of individual roles on this level of perceived control. This results in the following questions:

1. *What kind of roles can customers take on in the last-mile process?*

2. *How can these customer roles influence last-mile performance?*

3. *How can customer involvement in these roles influence provider's perceived control over the last-mile process?*

3. METHODOLOGY

To answer the established research questions an exploratory study was performed. Multiple methods were used to collect data. The main method were interviews to gather rich descriptions of the research issue that was investigated while leaving the interpretation of results to the investigators (DiCicco-Bloom & Crabtree, 2006). The rich data resulting from this research method is valuable for the explorative nature of this research. As multiple parties are involved in the last-mile process, e.g. customer, 3PL and e-retailer, interviewees were chosen to represent most of these parties. Individual in-depth interviews made it possible to discover shared understandings. This was important for the research at hand, as not all factors had been thoroughly covered by literature.

3.1. Data collection

The data collection compromised interviews and document analysis. A broad range of companies involved in the last-mile delivery process and experts were interviewed. Logistic service providers and large e-fulfillment parties that are positioned between customers and e-retailers were included for their knowledge of the logistics market. Unfortunately, e-retailers did not want to participate in any research about the last-mile, as this is a competitive advantage for them and this information is therefore classified. Further, consultants who have close ties with e-retailers and know what is happening in this business were interviewed as experts. To look at the implications of the last-mile on customers and cities, experts on city logistics and logistics in municipalities were also interviewed as experts. Finally, to get insights into customer involvement and last-mile performance, a company representative of a firm that innovates last-mile delivery was interviewed. An overview of the data collection can be seen in *table 3-4* on the next page.

TABLE 3-4:

Overview of Data Collection

	Code	Category	Business	Time/Pages
Round 1 Interviews	E1	Expert	Expert Logistics / Advisory	75 minutes
	E2	Expert	Municipality / City Logistics	55 minutes
	E3	Expert	Expert E-mobility / City Logistics	35 minutes
	E4	Expert	Expert City Logistics	55 minutes
	P1	Involved party	Last-mile Innovation	60 minutes
	P2	Involved party	e-Fulfillment	40 minutes
	P3	Involved party	e-Fulfillment	55 minutes
Document Analysis	D1	Expert	HvA report City Logistics	16 pages
	D2	Involved party	DHL Logistics Trend Radar	55 pages
	D3	Expert	McKinsey – The Future of Last Mile	32 pages
	D4	Expert	Stanford Business – Technological Disruption and Innovation in Last-Mile Delivery	26 pages
Round 2 Interviews	P4	Involved party	Logistics Service Provider	75 minutes
	P5	Involved party	Logistics Service Provider	40 minutes
	E5	Expert	Expert Logistics / Advisory	65 minutes

This research used an iterative approach in which some questions were altered before the second round of interviews based on the results from the first round (DiCicco-Bloom & Crabtree, 2006). In the first interviews, interviewees provided documents with insights which were not known when developing the theoretical framework and the interview questions. These documents were added to the document analysis and were used to develop more specific interview questions for the second round. These documents are listed in *table 3-4*. In this second round, interviews with an expert on logistics and e-retailers and two 3PL's took place.

An interview guide was developed in order to strengthen the reliability of the research and increase the quality of research (Castillo-Montoya, 2016) and to guarantee reliability of the research (Yin, 2009), see appendix A. A total of 10 interviews were performed, which took between 45 and 90 minutes each and took place between November 2016 and January 2017. The interviews took place in person or by Skype or phone. Most interviews were recorded, after permission was granted. Recording of one phone interview was not possible. The interviews were semi-structured and left enough room for additional questions about phenomena of interest or other points that emerged during the interview, in order to develop insights into both the context and the content of the problem (Edwards & Holland, 2013). These semi-structured interviews allow for more space for interviewees to answer on their own terms compared to structured interviews but still provide structure for comparison across interviewees (Edwards & Holland, 2013).

By recording and transcribing the interviews, as well as asking for verification when points were unclear, reliability was further improved (Yin, 2009). Every face-to-face interview was supplemented by a hand-out about customer roles and a hand-out about the relations between the variables of the research to improve the findings. Both hand-outs are found in *Appendix B*.

3.2. Data analysis:

All data from documents and interviews were coded. The software ATLAS.ti was used throughout the coding process. Based on a list of 30 deductive codes, all material was coded. In some cases, an inductive code was added. This led to a total of 52 first order codes. Multiple codes were added to a quotation if applicable, which led to some quotations having more than five codes added to it. These combinations of codes could imply a link between concepts and were also a basis for building connections between concepts. After coding, the 52 descriptive codes were reduced to 41 second order codes when merging codes that seemed duplicates. From these second order codes, five interpretive themes were derived: involvement, control, last-mile, method or performance. By assigning these themes, explanation building made it possible to discover relationships between the themes (Yin, 2009). Besides this, connections between codes were first traced by using co-occurrence analysis in ATLAS.ti, as well as by building networks of common neighbors, and followed up by content-analysis. *Table 3-5* shows the second order codes and third order themes.

TABLE 3-5:

Overview of codes

Third order code (themes)	Second order code (descriptive code)
Control	Company
	Customer
	Gain
	Loss
Involvement	Customer
	Customer_Role_Information
	Customer_Role_Labor
	Customer_Role_Quality
	Customer_Role_Other
	Involved parties
Last-mile	Barriers
	Challenges

Third order code (themes)	Second order code (descriptive code)
Control	Company
	Customer
	Gain
	Loss
Involvement	Customer
	Customer_Role_Information
	Customer_Role_Labor
	Customer_Role_Quality
	Customer_Role_Other
	Involved parties
	Complexities
	Cooperation
	Customer_Centered
	Customer_Demands
	Incentives
	Intelligence
	Technology
	Research
	Tailored
	Trends
Method	Batching
	Crowdsourcing
	Lockers
	Pick-up-point
	Other
	Multiple_Options
Performance	Convenience
	Costs
	Efficiency

Third order code (themes)	Second order code (descriptive code)
Control	Company
	Customer
	Gain
	Loss
Involvement	Customer
	Customer_Role_Information
	Customer_Role_Labor
	Customer_Role_Quality
	Customer_Role_Other
	Involved parties
	Informed
	Reliability
	Satisfaction
	Visibility
	Security
	Social
	Service
	Sustainability
	Speed
	Transparency

By cross-checking the third order codes and their relevant second order codes against other concepts, patterns were discovered and explanations developed. In order to increase external validity, it was chosen to perform this research by interviews across the field. This increases the generalizability of the study's findings (Yin, 2009). While it still might be hard to generalize the findings of this research, it is important to note that qualitative data in this research is used to describe relevant constructs and their context of the last-mile problem and customer involvement in an explorative fashion; generalizing causalities is therefore not the objective of this study.

4. FINDINGS

4.1. Last-mile performance

Efficiency

The efficiency of last-mile deliveries is still a major issue, most experts confirmed. A big 3PL stated that *"last-mile deliveries are the most expensive part for us"* (P5), explaining that the last-mile is much costlier than transporting to hubs. Logistics are still primarily being judged on *"costs, supply chain costs and efficiencies"* (E5), which makes improvements to efficiency even more important.

Customer involvement is recognized by all experts as a way to organize the last-mile more efficient. It can make customer's demands more clear which can lead to a more tailored and efficient delivery process. The efficiency implications for each role and for control will be discussed in *section 4.2* and *4.3*.

Satisfaction

Most experts agreed that customer satisfaction is of great importance, and that therefore the last-mile should be more focused on customer satisfaction (P1). It was said that customer involvement and satisfaction are inseparable, as one expert noted that *"as you increase the level of involvement, the level of satisfaction will grow"* (P5) and that satisfaction results from involvement in the process (E1). One expert explains that this results not only from the fact that customers want to be in control, they also want to be taken seriously (P5). Interestingly, 3PL P5 noted that when customers enjoy high satisfaction of the delivery mode, it also leads to more loyalty to the delivery mode. This could make customer satisfaction important for the efficiency of the last-mile, as adoption of new methods is enhanced by satisfaction. The implications of customer roles on satisfaction are discussed in the next section and shown in *table 4-9*.

4.2. Customer roles

In order to answer the first research question, the findings about customer roles will be provided first. Then, the implications for last-mile performance will be discussed per role, and

are visible in table *4-7* and table *4-8*. In describing these roles, an important distinction had to be made between actual customers of e-retailers, the customers who order and receive their shipment, and individuals that take over a role, either from a company or an actual customer. We call this second group "customer agents". '*Customers'* refer to a group that buy articles and receive them; they are connected to a specific order (order-specific), whereas the '*customer agents*' are order independent. This may be illustrated with the example in *box 4-1*.

BOX 4-1

Customer & Customer Agent - Distinction

In the theoretical framework, crowdsourced delivery was discussed. This entailed deliveries that were performed by someone in 'a crowd'. In this case, a *customer agent* will perform the delivery for the '*actual customer'* of the order. This distinction can be made when an '*actual customer'* is supplying information to an e-retailer as well. An '*actual customer'* can supply information about its specific availability: e.g. "I am home between 18:00 and 22:00". A group of *'customer agents'*, might also supply information to e-retailers, which is aggregated. This could be address data like the average delivery time per house in a neighborhood. The difference is the same, in the first case the information is specific to an order, in the second case it is aggregated. In the following part, the distinction between customers and customer agents will be made continuously.

Table 4-6 shows the customer and customer agent roles that were found to be present in last-mile deliveries. Roles that were also detected in the theoretical framework are emphasized in bold.

TABLE 4-6:

Customer Roles in the Last-Mile

Role	Customer	Customer Agent
Information Supplier	**- Information about availability (time/day)** - Information about neighbors **- Information about point of delivery** - Customer contact information	- Make general delivery preferences available via platform - Providing data for Address intelligence and Big Data

Role	Customer	Customer Agent
Labor	**- Picking-up package at locker/pick-up-point** - Click-and-collect	- Functioning as a pick-up-point - Receiving as a neighbor - Crowdsourced logistics
Design Engineer	- Portal of choices between 3PL at web shop	
Production Manager	- Choice of delivery date/time - Choice of delivery mode - Choice of point of delivery	
Quality Assurance	- Being available for delivery **- Offering correct delivery information** **- Feedback on delivery (rating, pictures)**	- Feedback on delivery modes
Inventory	- Waiting for delivery on time-slot - Waiting for delivery after receiving text-message	
Competitor	- Picking-up package	- Crowdsourced logistics - Peer-to-peer sharing networks - Acting as a pick-up-point

Information supplier

Supplying information was often the first customer role which interviewees found to be relevant in the last-mile delivery. Customers can supply information by providing availability information such as when they are at home: what time and what day. They also can provide real-time information of their location to which 3PL's can adjust their delivery. One expert noted that: *"The more information you have about your customer, the better you can tailor the delivery"* (E4). Customers can also provide information about their preferences. For instance, they can note if packages should be delivered to their neighbors or not and they can provide

contact information which 3PL's can use. One 3PL noted that *"many customers do not leave their phone number or e-mail address at websites, which they should do as this might be used to make an appointment"* (P4).

It was found that next to specific customer information, many experts see possibilities for using more aggregated customer agent data in order to improve delivery and tailor the last-mile to the needs of customers: *"when you know your customers at address-level, with big data, you are smart as you can predict your network better, which improves your delivery"* (E4). Another expert noted that *"it is important to map which flows of deliveries happen at which location, as it is hard to optimize efficiency at places where not much is ordered"* (E3). This was confirmed by E4 as "*it is possible that 20% of your customers is responsible for 80% of your inefficiencies*, [...] *and as tailored deliveries are more expensive than normal deliveries, it makes sense to only [tailor deliveries] where it is needed*". Being better informed about customers in a specific area makes it possible to tailor that specific area to the customer's need and design the last-mile process more efficiently.

Experts also note that specific customer information offers possibilities for dynamic pricing in shipment costs. One expert noted that "*you can monitor a customer's sensibility to price over a period of time. When it seems that a particular customer does not respond negatively to price increases, you can increase the margin for shipping. It is even possible to direct orders, by changes in shipping costs, to a time-slot which is most convenient for you to dispatch the shipment"* (E1). Other experts note the possibility for a shipment-platform which resembles Ideal. Ideal is used in the Netherlands for payments at web-shops, and is a platform to which most banks are connected. Such a platform can also be developed for choices between 3PL's, time-frames, addresses and preferences regarding neighbors. Customer agents can save these delivery preferences in this platform, which is shown at check-out at an e-retailer, just like Ideal. The customer can then confirm the use of this platform after payment. With this information, the involved parties like 3PL's or customer agents can, with the consent of the customer, use the delivery preferences of the customer regarding time, neighbors and locations to improve their last-mile process.

Most experts explained that information could make the last-mile method more efficient as customers can supply providers with information to act on. This can be the delivery

information of the customer themselves, but also aggregated data on cities or neighborhoods, on customer agent level. For densely populated areas, for instance, it could be more economical and efficient to create a PUP. By using customer information and data on address level, you can deliver as efficient as possible, as providers know which mode performs the best. The last-mile, then, becomes tailored to the specific customer or neighborhood. It was noted that *"having clear data on the time spent per address could make your deliveries much more efficient"* (E4). This expert raised the point that, as tailored deliveries are more expensive than regular deliveries, this aggregated "address intelligence" could be used to establish which deliveries need to be tailored, as *"20% of the customers might be responsible for 80% of the inefficiencies" (*E4).

Address intelligence and big data might thus be invaluable for deciding which delivery option(s) to offer to which specific customer or neighborhood. This is confirmed by another expert, who added that *"deliveries are like menu's in a restaurant, the better you know which option is best for your customer, the better you can control your volumes and your efficiency"* (E1). Data from the DHL Logistics Trend Radar supports this view, as *"logistics is being transformed through the power of data-driven insights. Unprecedented amounts of data can now be captured from various sources along the supply chain. Capitalizing on the value of big data offers massive potential to optimize capacity utilization"* (D2 p.17). This shows that information supplied by customers is a very important method of improving last-mile efficiency.

As noted before, data can be used to steer demand into convenient time-slots by dynamically adjusting shipping costs. The importance of this is explained by another expert: "*as you keep the volumes of orders at the same level, you could create a cadence in your logistics, which improves efficiency"* (E4). Leveling demands by using customer information, peaks can be diminished and the logistics process can be more in control, therefore making a big impact on efficiency.

While it was shown that customer information could increase efficiency, it also could have positive implications for customer satisfaction. D2 (p.36) states that by tailoring the service levels by using customer data, the customer experience could be improved.

Every single expert mentioned the reliability of deliveries as the most important factor in deliveries for customers. This also entails the reliability of the time-frame that is provided (E3). Expert P4 noted that Just-In-Time is more important than speed of delivery. This establishes the importance of customer involvement even further, as just-in-time also considers when the customer prefers their delivery. The unreliability of deliveries is also quoted as a major driver of dissatisfaction at customers by E4. The information customers provide in this role seems to influence customer satisfaction through tailoring the delivery to their needs and by increasing reliability. However, expert E1 notes that the sharing of information as a customer or customer agent may lead to privacy concerns, which may lead to reduced satisfaction. This was confirmed by D2 (p.19), which states that data security and privacy can be issues when working with customer data while D4 (p.4) notes that "customers have an increasingly complex set of expectations regarding security.

Labor

The customer role 'labor' was detected in most interviews, as customers could perform physical tasks in order to receive their delivery. A pick-up-point (PUP) is the most obvious example but one expert also noted the click-and-collect business model that a lot of click-and-mortar e-retailers use. In this model, the customer can order online and pick up the order at a physical store.

When the scope is broadened to involve the concept of customer agents, more possibilities were detected. Customer agents can perform as a PUP themselves, which is also what happens when they receive packages for their neighbors. Some experts came up with interesting possibilities for this form of customer involvement. Multiple examples were given of a PUP that also functioned as a social gathering, *"in which customers could pick up their package at a place in their neighborhood while grabbing a cup of coffee"* (E2). Another interviewee confirmed this and added that *"a* pick-up-point *could also be used to add value to the neighborhood [...] and offer possibilities for the purchase of small items [...] or add value for customers in other ways"* (E3). These PUP's were even used by the couriers of big 3PL's, without cooperation between the 3PL and the PUP; these are informal emergent structures. The couriers, however, did participate in the system and were even added to 'Whatsapp' instant-messaging groups with the neighbors to know where the packages need to be delivered.

Another possibility is for customer agents to join a peer-to-peer network of logistics and to be an *"on-demand last-mile delivery concept"* (D2, p.16). This trend report notes that *"Crowd-based parcel delivery services use dynamic and flexible networks comprising everyday residents of a city to enable 24/7 courier services to all parts of the city and allow rapid delivery of goods. Local residents can transport packages or pick up groceries along their daily routes and deliver these items to the requestor in their neighborhood, for a small fee"* (D2, p.28). The findings of this level of involvement will be discussed more in the section 'competitor', as this involvement directly competes with 3PL's.

By using PUP's, efficiency can be improved, as one expert noted that *"efficiency is mostly about the volume of deliveries"* (E3), which is one of the important benefits of using PUP's. A large 3PL confirmed this by stating that *"a service-point can increase the volume and eliminate stops which makes it more efficient"* (P4). The other 3PL added to this: *"in a theoretical world you would put a package-locker at every corner in order to let customer's pick-up their packages"* (P5). This would have disadvantages such as large investments, but this example shows that labor by customers could significantly increase efficiency according to experts.

A convenient PUP seems to be able to improve customer satisfaction, as they *"serve to increase the convenience of the customer"* (P4). However, another interviewee noted that *"people like to be in control, that's why they want to receive a package in person […], which makes picking it up yourself at a personal locker more personal [than a neighbor or post office*]" (P1). This indicates that people like personal deliveries the most, which is confirmed by most experts. While PUP's seem to be convenient and therefore add to the satisfaction of some customers, most do prefer traditional delivery.

Design engineer

Customers can also be involved in the design of a service, however, possibilities seem limited. One expert noted the possibility of a "portal of logistics suppliers" in which the customer can pick their preferred 3PL (E5). This way, customers can influence the design of the last-mile delivery. Moreover, the DHL Trend Radar (D2, p.11) notes that *"a customer-centric view to open innovation is pivotal as feedback from customers can help incorporate feedback and understanding challenges"*. They state that they (DHL) have platforms that focus on driving

discussions with customers on trends and challenges, which might also be a form of customer involvement in the process design.

One expert (P3) noted that the ability for customers to choose the 3PL might complicate the logistics section before the last-mile, as fulfillment parties need to sort the packages per 3PL. This could lead to more inefficiency in the process before the last-mile. More influence on efficiency and satisfaction has not been found.

Production Manager

Most interviewees considered this role to be the most important for last-mile delivery. In this role, customers can *"change the delivery address or method during the delivery process"* (E3). An expert stated: *"When I know that my delivery, planned for tomorrow, will not be possible [...] I want to change the delivery online beforehand, so by doing that I can change the process"* (E1). E-fulfillment party P2 notes that *"when an order comes in from a web shop, changes are still possible like adding gift wrapping, changing the address and even canceling."* However, 3PL P5 states that *"when a package is registered and has arrived, the choice for delivery has been made. All we can do then is to inform [the customer]"* while explaining that *"in a web shop many options for delivery can be chosen by customers but when a package enters the system, all it can do is move forward and no changes are possible anymore"*.

Most 3PL's, however, do offer the possibility to change delivery information after the first delivery attempt. They would let customers make more changes during the delivery process, if that would be possible. 3PL P4 offers the possibility to change details of the delivery with an app when the package is registered for shipment to accommodate changes before delivery. However, as most national orders are processed at night, shipment is often faster than a customer can respond. For most shipments, interviewees stated that it is important that the web shop offers possibilities for choices in delivery: *"for us [as 3PL] it is a cooperation with the web shop because the web shop has to offer these options [...] where the customer can choose which delivery they want [...] for the first delivery attempt. If we cannot deliver the first time we can leave a note and leave the package at a neighbor, which is good for our hit-rate as the package is then near the customer"* (P5). Another expert notes that *"being able to choose [as a*

customer] is most important, as it cannot be mandatory to perform labor [as a customer], but it is up to the customer to take a role in the improvement of their deliveries.

Most experts recognize the customer role of production manager as being crucial for an increase of efficiency. One expert noted that "a customer can help you make [the process] more efficient for yourself" (E4), for instance by *"letting customers choose between time-frames that are most efficient for you ["* (E4). This way, the customer also feels in control over the delivery process. This is important as a 3PL notes that *"the more control the customer has over the process, the higher the chance that delivery will succeed the first time and the fewer packages need to be reoffered to the customer"* (P4). Additionally, he adds: *"the customer is going to determine when to deliver the package and this will make the process much more efficient as we are not confronted with customers that are not at home to receive their package"* (P4). The other 3PL confirms this by stating that *"we can be most efficient when we hand over a part of our control over the process [to the customer], as we cannot deliver packages when people are not home"* (P5).

Offering customers more choices in the process can be possible through modern technology. The document analysis provided examples of dynamic routings, routings in which customers could change their preferences while the package is in transit, making the delivery process much more efficient (D4, p.8). These findings show that more involvement and control by letting the customers tailor their deliveries could lead to a more efficient process. The problem at involving customers in these choices are often the web-shops, as "*only 10% of web-shops offer time-slots for delivery"* (E4).

Most experts agree that offering choices to customers increases their satisfaction with the process. A big 3PL noted that *"when you offer control to customers over the process [...] it obviously increases the customer satisfaction"* (P5). This was supported by the last-mile innovator which added *"you give them [customers] a role in their own delivery process. We also get feedback about that from customers who note that they appreciate the possibility to choose their own delivery moment a lot"* (P1). While offering choices is very important, some experts note that there are a lot of other variables that cannot be neglected for establishing satisfaction, including price of delivery. For instance, a city logistics expert noted that

"satisfaction is also caused by cost [of delivery], but being able to choose [as a customer] is most important" (E3).

Quality Assurance

Many interviewees indicated that customers can be involved in last-mile processes in a quality role. First, multiple experts note that customers have a role in accepting the package, and their presence at the time of delivery increased delivery quality. One expert (P5) noted that they could even *"place a reception locker at your home"* to increase delivery quality. Second, customers can offer the correct delivery information like address, day and timeframe: *"if customers note that they will be at home on Tuesday evening and they are not, it does not help to have that information"* (P5). Third, customers can rate the quality of delivery: *"customers can be involved in a feedback moment in which you install a control loop [for the process]"* (E5). Customers can also take pictures of the packages (P1) they receive or rate the quality of the delivery (D4, p.9), for instance on the hand-terminal of the courier. This feedback can also be applicable on the 'customer agent level" as customer agents can offer feedback to delivery modes in general, for instance on internet forums.

While quality assurance was found to be an important role in customer involvement, its relation to customer satisfaction is less clear. One interviewee noted that *"satisfied customers are involved in your company, providing feedback"* (P1), and stated that they receive a lot of feedback from their customers on their product by involved customers. A rating system could build trust of customers (D4, p.22) which may increase satisfaction. However, this influence on the satisfaction of the customers has not been proven in this research.

Inventory

When customers are present for delivery, often a timeframe is provided to increase convenience. One expert noted that *"time-slots are in fact a kind of delivery appointment, but these are not binding"* (E5). Customers are staying at home for the delivery, functioning as inventory of the service process. Expert E4 states that *"some online grocers send a text message just before they arrive for delivery, which means that all their customers are ready at the door, which eliminated minutes of delivery time per address"*. By making an appointment with

customers, or by keeping them waiting, customers become inventory of the last-mile process to improve the last-mile. This could increase efficiency by saving time. No influence on satisfaction was noted by experts.

Competitor

As discussed at subsection 'labor', customers have been shown to perform physical delivery instead of 3PL's. This can also lead to a form of competition to 3PL's: *"Uber is an example of competition [for the last-mile]"* (E1). Most experts also noted that this "Uberisation" (P3) is a trend for the near future, while they also note that these crowdsourcing concepts are most relevant for the *'only-mile'* (P4), in which customers or businesses deliver directly to other customers or businesses without the interference of a 3PL. One 3PL noted that it makes more sense to deliver directly from a store in Amsterdam to a customer in Amsterdam, eliminating the need for hubs. In this case, competition by crowdsourced concepts could be more efficient (P4). These peer-to-peer models could therefore be more efficient than the traditional models, but only for short distances and small volumes, according to these experts. A 3PL thus noted that *"mostly couriers will experience competition of customer agents in this way"* (P5). In this view, acting as a PUP might then also be a form of competition to 3PL's, which means that customers and customer agents can be involved as the role of competitor in the last-mile and can increase efficiency especially for short trips.

It has been stated by multiple experts that crowdsourcing and PUP's could lead to security issues, as a stranger will deliver the package (P1) and *"theft and safety concerns can be a challenge when using a crowdsourced workforce"* (D2, p.28). This could have implications for customer satisfaction as well as efficiency in the case of theft, but this has not been noted by experts.

Seven of the eight customer roles defined by Sampson & Spring (2012) have been found to exist in last-mile processes: no expert has come up with explanations of the customer being the product. Moreover, four roles have been found possible for customer agents. It is shown that several roles are closely linked. When customers provide feedback for improvement (*quality assurance*) of the method they are also involved in the design of the process (*design engineer*). Moreover, *labor* and *competitor* are closely linked, as performing physical labor makes the customer a competitor to the 3PL. Lastly, *information* and *production manager* seem closely linked as in the manager role customers make a choice which is also input information for the process. The influence of each role on efficiency and satisfaction are shown in *table 4-7* and *table 4-8*.

TABLE 4-7:

Customer Roles – Influence Efficiency

Role	**Influence on efficiency**
Information	- More information about customer preferences and neighborhoods can increase last-mile control by tailoring delivery. This can increase efficiency by optimizing capacity and investments
Labor	- Customers performing labor could increase efficiency by generating higher volumes and eliminating stops
Design Engineer	- Ability to choose 3PL can decrease efficiency upstream
Production Manager	- Customers choosing method, location and time-frame can increase last-mile control by tailoring delivery. This can increase efficiency by optimizing capacity and routings and lowering failed deliveries
Quality Assurance	- No results
Inventory	- Customers waiting, prepared for delivery could increase efficiency by decreasing delivery time
Competitor	- Customers performing inefficient tasks could increase efficiency

TABLE 4-8:

Customer Roles – Influence Satisfaction

Role	Influence on satisfaction
Information	- Supplying information can increase the service experience and reliability, increasing satisfaction. Privacy concerns can decrease efficiency
Labor	- PUP's can increase satisfaction through more convenience for customers
Design Engineer	- No results
Production Manager	- Offering choices to customers increases satisfaction, as customers like being able to choose
Quality Assurance	- No clear results
Inventory	- No results
Competitor	- No clear results

4.3. Perceived control

While many experts acknowledged the influence of customer involvement on a company's perceived control over the last-mile, it proved hard to link these results to the customer roles. *Table 4-9* shows the roles and their influence on control.

TABLE 4-9:

Customer Roles – Influence Control

Role	Influence on Perceived Control
Information	- Sharing information can increase control by tailoring deliveries to customers' needs
Labor	-

Role	Influence on Perceived Control
Design Engineer	-
Production Manager	- Choices by customers can lead to more control over process
Quality Assurance	-
Inventory	-
Competitor	- Coordinating with more involved parties can decrease control

Not one expert stated that customer involvement would lead to decreased control over the last-mile, while most noted that involving customers would increase control. Multiple experts noted that involving customers could potentially require changes to the process, and would therefore demand significant effort in coordinating this relation. Expert E5 explained that *"this is not the same as loss of control, but might require a different kind of management which is more relation-based"*. This expert also noted that a large e-retailer is split between running an efficient last-mile or offering a high degree of innovation in the last-mile to improve the process for the customer. This innovation would require involvement of customers but this is challenging for the systems, people, organizations and processes that are currently in place (E5). This shows that involvement of customers requires a more relation-based type of management, which is an implication for control of the provider.

Several experts noted that cooperating and coordinating with more delivery parties could decrease control. This could also have implications for using customer agents in the last-mile, as coordination might require effort and lead to less control over the delivery process. This could mean that involvement of customer in the role *labor* leads to more trouble coordinating with this new entity for the provider. This way, customer or customer agent involvement in labor can lead to less control.

It is also revealed by experts that involvement could lead to more control over the processes, because firms know better what their customers demand when they are involved. Customers involved in the roles of *information supplier* and *production manager* can specify their demands and make choices to tailor the delivery, which lets the provider gain control (P1, E1). *"More control over the last-mile through involvement can then lead to more efficiency of the delivery"* (E1). One expert noted the difference between perceived control and actual control with regards to efficiency, stating that *"when you actually control a process it could lead to higher efficiency"* (E5) while stating that perceived control alone is no good for efficiency as *"you perceive the costs as under control but in the meantime, they will rise exponentially"* (E5).

The influence of perceived control on satisfaction has not been discovered in this research. It has, however, been confirmed by the experts that customers would like to be more in control of the process, which could in turn lead to more satisfaction.

5. DISCUSSION AND CONCLUSION

5.1 Discussion

This study finds that seven of the eight customer roles defined by Sampson & Spring (2012) are possible in the last-mile context. No additional roles have been discovered. However, where Sampson & Spring (2012) state that more involvement in one role could lead to less involvement in another, this has not been true for any of the findings of this research. In fact, it has been shown that some roles can overlap as customers participating in *labor* are also *competitors* to providers in the last-mile, customer choices as *production manager* are often *information* as an input for the process and feedback in a *quality* role can let customers *co-design* the process.

While Sampson & Spring (2012) have solely determined roles that could be assumed by customers, this research has noted an additional distinction between customers and customer agents. Customers can provide inputs for their own deliveries, while customer agents can take place in the delivery process of others. This distinction emerged when it was shown that customers could also perform tasks such as receiving packages for their neighbor, involving them in processes other than their own.

Most roles have implications for last-mile performance and perceived control by the provider, but not all roles will be discussed as these implications are shown clearly in the results. This research suggests three propositions regarding the role of customers and customer agents and the performance of the last-mile and makes one proposition about control of the customer roles in the last-mile:

> **Proposition 1:** *Customer's and customer agent's involvement through supplying information increases last-mile efficiency, although it can lead to security concerns and decreased satisfaction.*

This research has found that the input of aggregated customer agent data can play an important role in increasing efficiency by tailoring deliveries to the neighborhood. Van Duin et al. (2016) have concentrated their research on improving home delivery efficiency by using

address intelligence. They found that delivery efficiency is greatly dependent on zip-code areas, which requires area-specific solutions to increase the first-time delivery. The results of this research confirm their conclusions, as it was found that many experts see possibilities for using more aggregated customer agent data to improve delivery. This is useful not only for determining which delivery mode is appropriate for a specific location, but also for determining and improving the areas that exhibit the most unfavorable efficiencies while not consuming valuable resources on improving areas that demonstrate high first-time delivery.

Experts did note that customer intelligence could have privacy implications and Kassim & Abdullah (2010) found that security and privacy assurances are positively related to customer satisfaction. This shows that security concerns are important determinants for customer satisfaction, which is important to note when using aggregated data to increase efficiency.

> **Proposition 2:** *Customer agent's involvement in labor can lead to emerging informal structures that can increase both provider efficiency and customer satisfaction.*

It was established that PUP's can be more versatile than was suggested in previous literature. This research indicates that they can also become a social gathering for neighborhoods, offer (voluntary) jobs to people to deliver packages and that PUP's could even be used to add value to the delivery in the form of offering additional services or by selling accessories. Moreover, these PUP's do not have to be initiated or managed providers of the last-mile. Examples have been provided of emerging neighborhood PUP's in which customer agents communicate with the mailman via instant-messaging without other interference of 3PL's. It was shown that even without control by the provider, these PUP's can increase efficiency of the last-mile and enhance customer satisfaction.

> **Proposition 3:** *Customer's choices in the last-mile process increases both customer satisfaction and provider efficiency.*

Although experts agree on the fact that offering choices to customers to tailor their deliveries can increase efficiency, customer involvement has not been self-evident at the involved parties

in the last-mile. Experts note that only 10% of the web-shops offer a time-slot for delivery and most e-retailers charge a fee for a tailored delivery. This seems counterintuitive since tailoring the delivery can enhance the efficiency. The results also show that offering choices to customers increases their satisfaction with the process. This is in line with Collier & Sherrell (2010), who state that letting the customer feel in control is necessary to reap the benefits of customers in a co-production role and could increase adoption of such a service. Since they also note that more perceived control by customers could increase the value of the service experience, this could lead to more satisfaction as well. Keeping this in mind, it may be imperative that in the last-mile, choices are provided to customers.

> **Proposition 4:** *Customer's involvement in the last-mile requires relation-based control instead of transaction-based control in order to benefit from increased performance.*

This research found that while customer involvement does not lead to a loss of control, it does require a more relation-based type of management. This is also found by Rönnberg Sjödin et al. (2014), who stated that involvement of customers could transform the nature of the interaction with customers to a relation-based collaboration when involving these customers. However, their conclusions state that this transformation could lead to ambiguities and even failures of the service, while this was not recognized by the experts in this research. These experts noted that customer involvement needs to be managed in a different way, which will require additional effort but will not lead to decreased control. In fact, these experts noted that after this initial effort, customer involvement will lead to more control over the processes as customers can input choices and information to tailor the delivery to their needs. This could lead to more delivery efficiency and more satisfaction with the service.

It is interesting that it was indicated that involvement of customers could lead to more control over the processes while it was also stated that involving more parties in the last-mile would lead to more complexities, coordination and eventually a process that would be harder to control. While it was also stated that both types of involvement would require a different method of management and that initial coordination may be complex, it is still remarkable that involvement of customers may increase control and involvement of additional parties in the last-mile would decrease control.

5.2 Practical implications

Managers should consider the following aspects when determining the possibilities for customer involvement. It has been shown that customers can be involved in a multitude of ways, most of which could lead to more efficiency and customer satisfaction with the last-mile process. Moreover, it is indicated that while initial coordination might take some effort, customer involvement does not lead to reduced control over the processes. This means that a more customer-centered last-mile process may require additional management to set up, but could potentially lead to savings in costs, a higher efficiency of the process and more customer satisfaction overall.

This research stresses the relevance of using aggregated *information* of customers to tailor processes, as it was found that tailored deliveries may be costlier than regular deliveries and their gains in efficiency are not self-evident for areas where delivery efficiency is high already. This causes the need for address intelligence and data analysis to improve the most relevant areas. Several other roles offer significant potential benefits for the last-mile.

First, participating customers in physical *labor* in the form of PUP's could increase the 'first-drop'. Moreover, these PUP's can offer a social function and possibilities to increase value.

Second, offering choices to customers about the delivery process can make the delivery process more tailored to the customer's wishes. This can lead to high customer satisfaction while this may also increase the efficiency of the process.

Third, it is possible to involve the customer as *inventory* by making an appointment or messaging the customer just before delivery, which could lead to decreases in delivery time.

These options, however, do require a slight word of caution as it is important to note that not every customer would consider being more involved, as some customers will only demand convenience and speed in the delivery process. It should probably not be compulsory for customers to put in additional effort. An optional platform for personal delivery preferences can be a way to overcome this potential hassle.

5.3 Limitations & further research

As could be expected by the explorative nature of this research, some important limitations are present: first, the research explores an e-commerce context while e-retailers were not involved

in the data gathering. Unfortunately, e-retailers did not want to cooperate with the research because of the sensitiveness of their information. This problem was reduced by conducting interviews with experts with extensive knowledge of e-retailers and the e-commerce sector.

Second, the variables that are explored in this research are complicated to quantify, which makes it difficult to examine the influences of these variables on one another. The qualitative nature of this research lacked the possibility to look at the definitive causation between these variables.

Third, the data collection and analysis was performed to be as reliable and objective as possible. However, the results were transcribed, translated and coded by just one researcher. Moreover, the same researcher also reflected on these findings and looked for patterns and conclusions. This means that an observer bias could be possible, even though the reliability measures have been used, as was discussed in the methodology.

Fourth, the research investigated the roles in which customers could be involved in the last-mile, while not involving customers themselves in the data gathering. The purpose of this research was to investigate which roles were possible instead of which roles customers would accept. Additionally, involvement of customers in this research might have led to more results concerning customer satisfaction. For additional research on customer satisfaction and acceptance of roles, it may be paramount to include these customers.

Since this research has been mostly explorative, additional research should take place in order to validate the concepts and relations that were discovered in the last-mile. Furthermore, some results of this research prompt new research directions. A distinction has been made between customers and customer agents in service involvement This has not been researched in the last-mile context before and might be an area of interest for future research.

Additionally, this research attempted to investigate a relation between customer involvement and control. While results show that a positive relation could be present, it is imperative that more in-depth or qualitative research on this topic takes place, since the explorative research of this study is not appropriate for confirming these relations.

Furthermore, future research should also consider how to control and manage these involved customers. This topic may especially be important for PUP's, as the findings of this research show that these PUP's are not always managed by the involved parties and that

customers take control of the last-mile in an emergent fashion. It might be interesting to explore how these PUP's should be controlled.

Experts noted that for improving efficiency, perceived control and control may not be regarded the same, as 'real' control may have influence on efficiency while 'perceived control' does not. This is another element of future interest.

Finally, it is possible that customer involvement in the last-mile could influence the logistics process upstream. For instance, when customers can choose between 3PL's, more sorting needs to take place in the warehouses. Moreover, it was noted that, by involving customers in forecasting and demand smoothening by dynamic pricing, a cadence can be created in logistics. This could mean that last-mile involvement can also increase the efficiency for other parts of the logistics chain, which might be another topic for further research.

5.4 Conclusion

This thesis has investigated the possibilities for customer involvement in the last-mile to improve e-commerce deliveries. The research performed a first step in establishing in which roles customer could be involved in, as this had not been researched in the last-mile delivery context before.

It has been found that customers can be involved in seven different roles. Most of these roles can have an influence on last-mile performance, while it was also shown they can offer opportunities to identify and target particularly inefficient elements of last-mile delivery.

This study took a both an organization-centered and customer-centered view of the last-mile problem and thus also investigated the implications of customer involvement on the satisfaction of the customer. It was indicated that by involving customers, satisfaction can be increased, while customers themselves can also feel more in control over the process. It also considered efficiency of the last-mile process, in which it was found that most customer roles can lead to enhanced efficiency. The involvement of customers has not been proven to cause a negative effect on the level of perceived control by the parties involved by the e-retailers, which opens possibilities for a higher level of customer involvement. However, involvement of customers may require a different kind of control, which is more relation-based.

This thesis has performed an explorative study into the effects of customer involvement on multiple variables. As limitations in generalizability are unavoidable in this kind of research, further research is necessary to investigate the causation of the relevant variables. Nonetheless, this research has given insight into the broader concept of customer involvement in the last-mile and found how it could be used to improve last-mile delivery, which has been one the most inefficient parts of e-commerce supply chains in the recent past.

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7. APPENDICES

APPENDIX A: LAST-MILE MODES

Traditional delivery

Lockers

Pick-up-point (PUP)

Crowdsourced delivery

APPENDIX B: INTERVIEW GUIDE

Introduction

This interview is part of a master thesis research at the University of Groningen, investigating how customer involvement can influence logistics performance and control at e-retailers. I am going to ask some questions about the business you work in, challenges in logistics, the involvement of customers, experienced control and trends in e-commerce. The reason for this particular interview is your/your business' expertise on ***[…theme…]****. Interviews will be held in different parts of the e-commerce sector over the next month. The results of the interviews will be available around February. If you are interested, I can send you a copy.*

I'm going to note the answers you give. These notes will be handled in such a way that I am the only person seeing them. I will also, with your permission, record the interview with ***[this]*** *phone* ***[ask permission]****. Directly following the interview, I will transcribe the recording and compare it with my notes. Then, I will let you check the results, after which the recording will be erased. During the interview I will hand over a short list of additional questions for you to fill in. The interview will take about an hour. I will explain some key concepts beforehand. Is everything clear?*

Explain key definitions:

- *Ultra-fast delivery = delivery within 24h, also same-day delivery*
- *Last-mile = last part of logistics, handing over to end customer*
- *Perceived control = belief in ability to exert power over process and outcome*
- *Customer involvement = participation of customers in business processes*

[start recording]

Introducing questions

I am going to start with some introducing questions:

1. I had a look at your website and found that you are ….. **Would you like to add something to this? Could you explain what you do?**

2. **What is the most important or interesting aspect of your field of work?**

Last-mile delivery; changing demands?

3. What are the most important challenges you see for delivery in the last-mile?

4. Do you see changing demands of customers regarding delivery speed? Does that make sense?

5. How does your company make sure you are ready to deal with these challenges and demands?

6. What kind of performance measurements are most important for the last-mile? (now, future) (sustainability, efficiency, etc…) (customer, company?)

Last mile delivery: how to meet customer demands?

7. How do you (see companies) account for the convenience of customers in deliveries?

8. (How) can customers change delivery after placing an order? Until which times can a customer change the delivery information? Should that change?

9. How does the speed of deliveries change the last-mile process?

10. What are the advantages and disadvantages of offered last-mile delivery modes?

11. Are there preconditions that are needed for certain delivery modes? (why?)

Customer involvement

12. How are customers currently involved in logistics processes?

13. Do companies consider involving customers more in last-mile processes?

14. How do you see customer involvement in the last-mile?

[hand out appendix 1]

15. What do you see as advantages and disadvantages of involving customers in logistics processes (last-mile)?

16. Are there certain preconditions for involving customers in the last-mile?
    (e.g. technology as enabler, incentives for customers?)

17. Are there certain risks to involving customers in the last-mile?

18. Do you see customer involvement as a threat to existing business processes?

19. How can involving customers influence the efficiency of logistics processes?
    - In what way?

20. How can involving customers influence customer convenience?
    - In what way? (e.g. independence of time windows vs. extra effort)

21. Do you feel that involving customers influences the satisfaction of customers? (e.g. extra effort vs. delivery fitting in own schedule)

22. Do you think the last-mile should be more/less customer-centered? Should customers be able to be more in control?

23. Is it possible to make delivery more personal and to schedule delivery appointments to all customers? Why?

24. Would making an appointment with customers lead to more/less efficiency and satisfaction?

25. Do you feel that involving customers could influence the amount of control over business processes (logistics, last-mile)?

26. Do you feel that involving other parties in the last-mile could influence the amount of control over business processes?

Control

27. What, do you think or feel, is control in business?

28. How do you see control over last-mile delivery?

29. How can the challenges of the last-mile influence the level of control over the processes?

30. Which parties are generally involved in last-mile processes?

31. How can involvement of other parties in the last-mile influence the level of perceived control over the last-mile?

32. How can involving customers influence the level of perceived control?

33. How can the level of control kept by companies influence the efficiency of the last-mile?

34. How can control exercised over the last-mile by companies influence the satisfaction of customers?

[hand out appendix 2]

E-commerce trends

35. What do you think of the level of collaboration between logistics service providers? (Should it increase? Can it be increased?)

36. What do you think of the changing role of customers in e-commerce? (Do you think crowdsourcing startups could be competitors?)

37. Do you think large e-retailers can become competitors in logistics to 3PL's?

38. Do you think last-mile startups can become competitors to 3PL's?

39. Are there delivery modes you see that have high potential for the last-mile? (why?)

40. Do you think it is possible that 3PL's will become more middle-man and less last-mile in the future?

41. How do you think companies will/should adapt to the changes and challenges?

Closing

Do you have any further questions? Any additions?

[Thanking the participant]

[Explain the upcoming process]

After this interview I am going to analyze the answers. The results will be added to the thesis which will be delivered at the end of January. If you would like a copy of the final thesis, please say so.

[Stop recording]

Appendix 1. Customer roles.

Place yourself in the position of a e-retail customer. Could you answer the following questions from the customers' point of view, both now and in the future? (in keywords)

1. (How) can I supply information for last-mile deliveries?

2. (How) can I take on 'labor' in last-mile deliveries?

3. (How) can I influence delivery to be the way that I want?

4. (How) can I make adjustments to elements of the last-mile delivery?

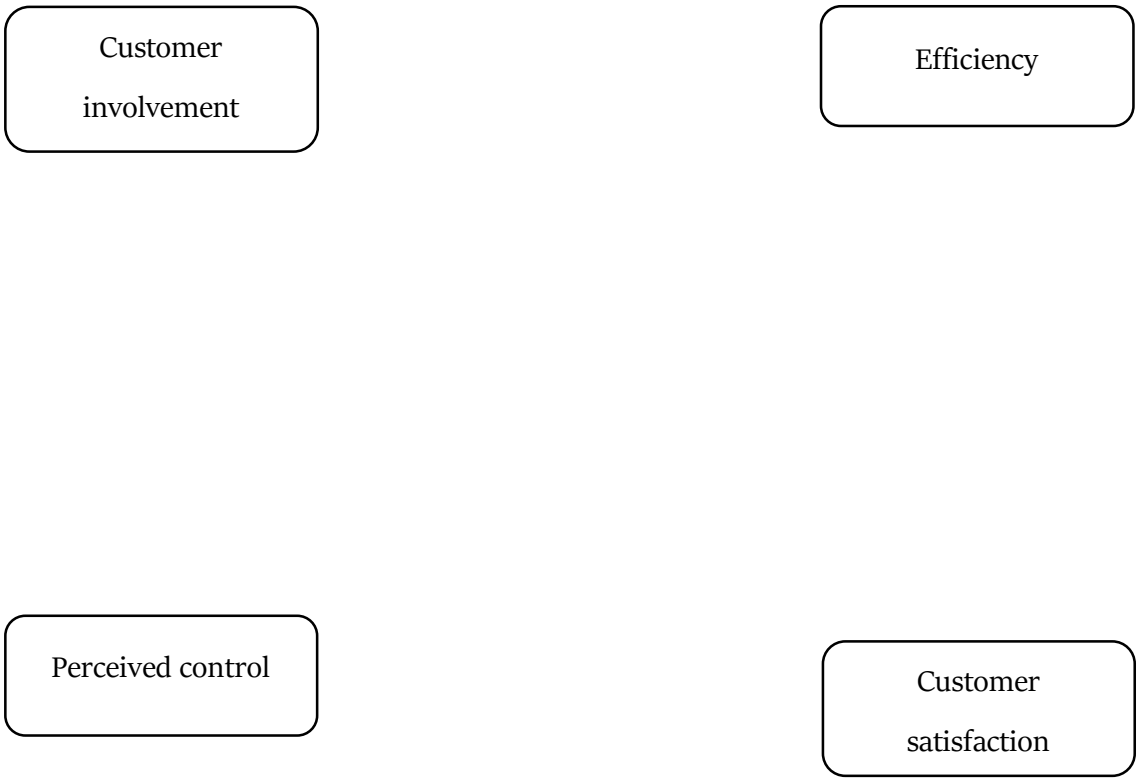
5. (How) can I control the quality of the delivery?

6. (How) can I be a competitor to the current delivery modes?

[Follow up] *What can be (dis)advantages to both parties with every role?*

Appendix 2. Relations

I will draw the 4 variables which are discussed in the research on this paper. Could you draw all possible relations between the variables, and explain to me why these might be relations and which other elements might be important in these relations?



[When answers handed in, ask elaboration]