



HAL
open science

Towards sustainable logistics: study of alternative delivery facets

Christian Otter, Christian Watzl, Daniel Schwarz, Pamela Priess

► **To cite this version:**

Christian Otter, Christian Watzl, Daniel Schwarz, Pamela Priess. Towards sustainable logistics: study of alternative delivery facets. *Entrepreneurship and Sustainability Issues*, 2017, 4 (4), pp.460 - 476. 10.9770/jesi.2017.4.4(5) . hal-01861042

HAL Id: hal-01861042

<https://hal.science/hal-01861042>

Submitted on 27 Aug 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Publisher

TOWARDS SUSTAINABLE LOGISTICS: STUDY OF ALTERNATIVE DELIVERY FACETS

Christian Otter¹, Christian Watzl², Daniel Schwarz³, Pamela Priess⁴

^{1,2,3} Pan-European University, Faculty of Economics and Business, Tematínska 10, 851 05, Bratislava; Slovakia

E-mails: ¹christian.otter@lestin.at; ²chriwa@yahoo.com; ³SchwarzDaniel@gmx.at; ⁴office@priessreal.at

Received 13 December 2016; accepted 17 March 2017

Abstract. The Courier, Express and Parcel services (CEP) sector is a constant growing one. The changes concerning e-commerce have impact in the industry which is looking for solution. This research, based on a web survey with 1019 computer assisted web interviews, presents e-commerce customer expectations in alternative delivery time frames and considers the impacts in the last mile of attended home delivery, reception boxes and collection-and-delivery points. The analysed alternative delivery time frames are Express delivery within 3 hours, evening delivery, Saturday delivery, Sunday delivery and customer selected time frame. Within these the focus is on e-commerce purchase habits, frequency of purchase, products, time of purchase, interest in alternative delivery time frames, usage or preferences and finally the willingness to pay for an alternative delivery. The results show a tendency of more than two thirds towards consumer selected delivery time frame, Saturday delivery and evening delivery, which is accompanied by easy accessible Reception Boxes (RBs). The research study also performs regression analysis and finds a significant impact of Alternative Delivery Time Frame (ADTF), and Delivery Methods (DM) on customer's willingness to pay.

Keywords: sustainable logistics, parcel delivery customer expectations; e-commerce, last mile problem, courier express parcel services, delivery time windows

Reference to this paper should be made as follows: Otter, C.; Watzl, C.; Schwarz, D.; Priess, P. 2017. Towards sustainable logistics: study of alternative delivery facets, *Entrepreneurship and Sustainability Issues* 4(4): 460-476. [http://doi.org/10.9770/jesi.2017.4.4\(5\)](http://doi.org/10.9770/jesi.2017.4.4(5))

JEL Classifications: M11, M16, M31

1. Introduction

Well organized logistics is important constituent of sustainable entrepreneurship and overall sustainable development (e.g. Samašonok et al., 2016; Beifert, 2015, 2016; Urbonas, Alonderis 2016; Vaško, Abrahám, 2015). As music, software and information are the only things that can be sent digitally, the online purchase of physical products in a virtual online shop is just midway of e-commerce – with physical delivery seeming to be still a weak-point with complex challenges (Heiserich & Helbig & Ullman, 2011). And the last mile is one of the key factors for e-commerce-failures (Xu & Ferrand & Roberts, 2008). Regarding this, the aim of this article is to get a detailed analysis of the e-commerce-costumer needs in alternative parcel delivery time frames, focusing primarily on delivery time – considering and combining the effects of the last mile problems and barriers in the Courier, Express and Parcel services (CEP) sector and the results of the web-survey.

To achieve this goal, 1019 computer-assisted-web-interviews were analysed. The analysed alternative delivery time frames, a part of the regular daytime delivery from 8 o'clock in the morning to 6 o'clock in the afternoon and night time delivery in general, are evening delivery, Saturday delivery, Sunday delivery, delivery within 3 hours and delivery within a selectable time frame. The fields analysed within the alternative delivery time frames are e-commerce-purchase habits, like purchase frequency or products, interest and willingness to pay for an alternative delivery time frame. To be able to repeat sustainable advantage in the market, companies operating the last mile need to have strategies (Boyer & Frohlich & Hult, 2004) and alternatives. This paper focuses on these alternative time frames.

2. Literature review

Under a historical point of view the CEP growth started in the 60s (Fenkart, 2000) and courier-companies, like FedEx, TNT or UPS came to Europe in the 70s (Olfert, 2014) having already started with a 24-hour service (Dreier, 2000), which is to be considered almost a norm service (Gilbert, 1989), even though not guaranteed (Müller, 2002). The parcels are collected on day one until the evening, sorted and transported during night-time and delivered on day two (Fortmann & Kallweit, 2007). Due to the internationalisation of added value systems in industry and commerce (Baum & Fransoo & Göpfert, 2004) and the growth in e-commerce business-to-consumer, which rises the cost of the last mile, the CEP-market is expanding (Schneider & Siebel, 2002) and within the last years a constant growing one (Fenkart, 2000; Wang & Zhan & Ruan & Zhang, 2014).

Especially small items transportation within the regular online markets, which minimize stress-factors and save time during purchase for the customer (Lammers, 2012), and consumer-to-consumer-markets (Potzmann, 2006) are the main drivers.

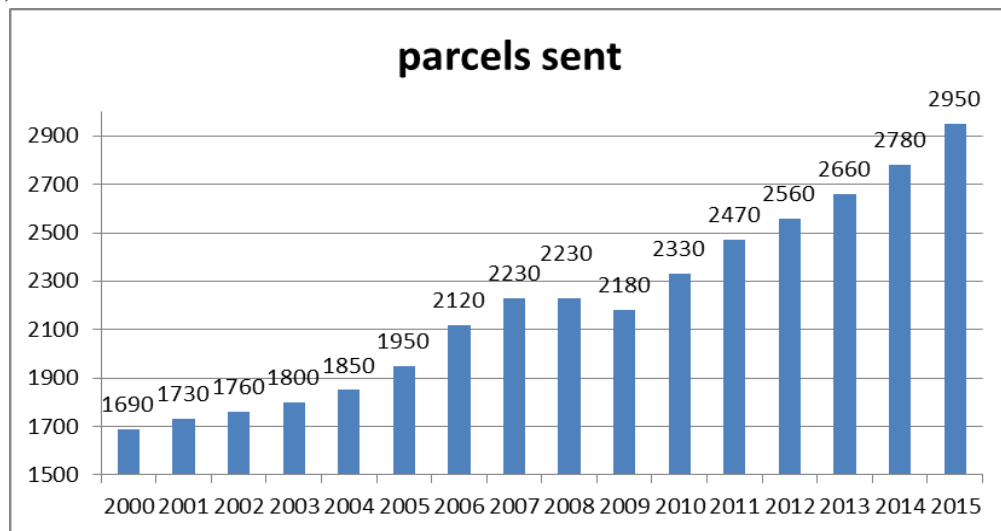


Fig.1. German CEP market in the years 2000 to 2015 in million parcels sent (Bundesverband Paket & Express Logistik, 2016)

In Germany, the volume of delivered goods increased from the year 2000 to 2015 about 74% and from 2014 to 2015 the volume increased by 5,9% (Figure 1) (Bundesverband Paket & Express Logistik, 2016). Similar results are seen in the figures on the Austrian CEP-Market, with an increase of the volume of the parcel business, for example the Austrian Post AG, from 59 million parcels in 2009 to 80 million parcels in 2015, which is to be

ascribed to the increase of e-commerce (Österreichische Post AG, 2016), that provokes consumers to have their purchase delivered at home rather than pick goods up in stationary retail shops (Klaus, 2002).

The CEP-market divides into courier services, which are delivering fast small documents or good up to 2 kilograms (Köberlein, 1997; Gilbert, 1989), express-service, without weight limit and door-to-door-service (Ihde & Bloech, 1997) and the parcel service, with parcels up to 31,5 kg (Hornbacher & Horvath & Munstermann, 1997; Mencler, 2006) - highly systemized and mass-oriented (Vahrenkamp, 2000). Especially integrators, like UPS or DHL, try to provide services in all three parts (Mencler, 2006; Gogic, 2005; Aberle, 1991) and the logistic structural offer of a transportation service provider from picking up to deliver within an international frame (Gleißner, 2008).

The creation of competitive advantage within the CEP-market is reached through the differentiation of the service (Gebhard & Jäger & Schlichting, 1997), which leads to a customer-needs-evaluation within the growing market of e-commerce-based parcel delivery, considering the accompanying last mile problems and barriers. Basic hypothesis is that e-commerce-customers are interested in times of delivery, apart from regular business-hours-delivery, i.e. evening-delivery, Saturday, Sunday, customer-specified-time or delivery within 3 hours – followed by the hypothesis that customers are willing to pay for it. Within this research influencing elements like time of online purchase, purchased product, frequency of purchase, living area and building were evaluated, especially to be able to connect to the delivery process and the last mile barriers.

The delivery process is roughly separated in sender → sending hauler → freight carrier (airline) → receiving hauler → recipient (Hornbacher et al., 1990). The receiving hauler, if integrated, is a part of the same company as the sending-hauler and freight carrier with the same quality standards (Vahrenkamp, 2003) and is responsible for the last mile (Bachmeier, 1999), which is to understand as the delivery to the recipient after the last hub (Meffert, 1997).

The last mile is, with 30% of the cost (Wang et al., 2014), a costly part of the delivery (Brown & Guiffrida, 2014), especially considering the delivery to customers (Kummerer & Grün & Jammerneegg, 2013), because there is a higher possibility, that they are not present during daytime (Mencler, 2006; Fernie & Sparks & McKinnon, 2010; Maurer, 2013). These cases are likely to rise, as e-commerce rises (McKinnon & Tallam, 2003). Nevertheless, an intense customer orientation in logistic processes is constructive, concerning an increase in customer loyalty (Zadek, 1999), and that customers tend to avoid online-shops, if they are dissatisfied with the delivery (Richter, 2015; Lee & Wang, 2001). On a meta-level, there are three ways of delivery in the e-logistics: The attended home delivery (AHD), the reception boxes (RBs) and the collection-and-delivery points (CDPs) (Wang et al., 2014).

CDPs are primarily shops or chain-stores, with storage areas and staff, where customers have to go to (Weltevreden, 2008), to pick up their parcel. On one side, if it is not open 24-7, it comes with the disadvantage of opening-times and on the other side with the necessity and at least imputed costs of employees. There are central located automated CDPs to pick up parcels (Fernie et al., 2010), with the need of technical functionality (i.e. lock, power) and high investment costs (Bensinger, 2012) and long amortization (Punakivi & Tanskannen, 2002). There are four different possibilities of a RBs. Directly at the customer's door (or close to it) can be a permanently installed box or a lock into system for delivered boxes (Punakivi, 2003), or the similar system within a multi-party house, with shared permanently installed boxes (Wang et al., 2014) or lock into systems. The AHD requires the customer to be present and personally receive the parcel (Punakivi, 2003), especially if a signature is needed (Macharis & Melo, 2011). If the customer is not present, this leads to rising costs (Richter, 2015; Heiserich et al., 2011). If the customer is present, there are still higher costs- in comparison with RBs or CDPs, due to stop-costs, i.e. checking and signing the parcel. Concerning the cost-sensitivity of the last mile, distributors are looking for ways to reduce costs (Felisberto & Finger & Friedli & Krähenbrühl & Trinker, 2006). Pick-up points (CDPs) or

safe-deposit-box-systems (RBs) are possible solutions (Schneider et al. 2002; Mencler, 2006) to minimize costs up to 60% (Punakivi & Yrjölä & Holström, 2001). Regularly CDPs are the most cost efficient, then RBs and followed in the end by AHD – although considering small amount of orders, the investment costs of CDPs or RBs can even turn it to the opposite (Wang et al., 2014).

Cost influencing elements, besides the already mentioned ones, are practical ones within the last mile. Driven kilometers per parcel are different in rural than in urban areas, due to population density (Macharis et al., 2011), traffic flow affects the possible delivery speed and parking possibilities are different (Morris, 2009). Even on the last meters there are different building entry barriers in family homes and multi-party houses, with digital or mechanical locking systems (Biehling, 2005). During the last year the locking systems in multi-party houses have changed through technical possibilities. The number of digital locking systems is rising, although they are by far not as widespread as conventional mechanical key systems (Ohland, 2015). The card based digital systems uses standardized and individually programmable passive transponder technologies (e.g. RFID), that enables different card holder groups, like firefighters, trash collectors, newspaper deliverer or CEP services, to enter the building within certain time frames (Begeh, 2016).

3. Methodology

The survey started with preliminary research, development of the questionnaire (Callegaro & Manfreda & Vehovar, 2015) and a pre-test of the questionnaire with minor changes. The used methodology was a web survey. The paper analyses empirical data of a sample of 1019 computer-assisted web interviews with semi-standardized questionnaire. The sample was taken in Austria in November 2016 being active for two weeks. 19 contacted interviewees were screen outs, because they had not purchased any goods online so far, which makes 98,14% of internet users, and these being 85% of Austrians between the age of 16-74 years (KMU, 2016), potential online-customers. The target group were online oriented adults who had already experience with online purchase, which makes the significant disadvantage of web surveys – that non-internet-users are inaccessible – insignificant (Häder, 2015). The participants attended the survey anonymously and were asked to leave socio-demographic information. A 4-point Likert-type scale was used to measure interest in the different services, for time measurement there were specific time frames to choose of, i.e. for the purchase frequency there was weekly, monthly, quarter, annual, for the will to pay a slide control (€ 0 to € 20) was used for a placement on the continuum. The statistical fluctuation range is within +/- 3,2%. Contacts were taken randomly, but with a focus on rural and urban equilibrium, considering the differences in CEP-distribution in these areas. Data analysis was performed by SPSS 20.0. The research method is based on the studies of Maurer (2013), who analysed the last mile problem in online ordered food delivery to customers with 543 interviews (Maurer, 2013), and Richter (2015), who analysed the same day delivery in e-commerce with 243 interviews (Richter, 2015).

The structure of the sample included 74% employees and 26% unemployed participants and 51,3% male and 48,7 % female. 18% were single households, 38% couples, 26% families, 19% others. 42% live in one-family homes and 58% in multi-party houses - 57,4% in rural areas and 42,6 % in urban areas. The age distribution is evenly distributed as follows: < 29 years 21,7%, < 39 years 22,3%, < 49 years 22,8%, <59 years 20,7% and > 60 years 12,5%. The income distribution turned out to be < € 1.000 5,7%, € 1.000 - € 2.000 24,8%, < € 2.000 - € 3.000 26,5% > € 3.000 39,3% and not specified 3,7%.

The questionnaire consisted of 46 questions, focussing on the topics - apart from sociodemographic questions: purchase frequency, purchased products, physical distance to next stationary purchase possibility, time of online purchase, time frames of delivery and interest in it, ways of delivery, willingness of additional payment.

4. Goals

Going back to the basics, logistics has to make sure, that the right product in the exact amount is delivered in the right condition, to the correct place at the exact expected time – with minimal costs (Pfohl, 1996). Considering customer’s needs, the questions are: Which alternative delivery time frame is the customer interested in, focussing on the different delivery areas and buildings? Is the customer willing to pay for alternative delivery time frames? Which effects are to expect for delivery companies in the CEP sector?

5. Research results

Within the presentation of the survey results within this article, the primary focus is on e-commerce purchase habits - like frequency, products or time of purchase - and alternative delivery time frames – like interest, usage or preferences – and finally the willingness to pay for an alternative delivery time frame.

5.1. E-Commerce Purchase Habits

83,4 % of the Austrian population has already purchased at least once a product in an online shop. Already 63,0% shop online weekly or at least once a month - another 30,6% once every 3 month (Figure 2). The purchase in rural areas is significant lower than in urban areas, which increases the problem of delivery density on the country side.

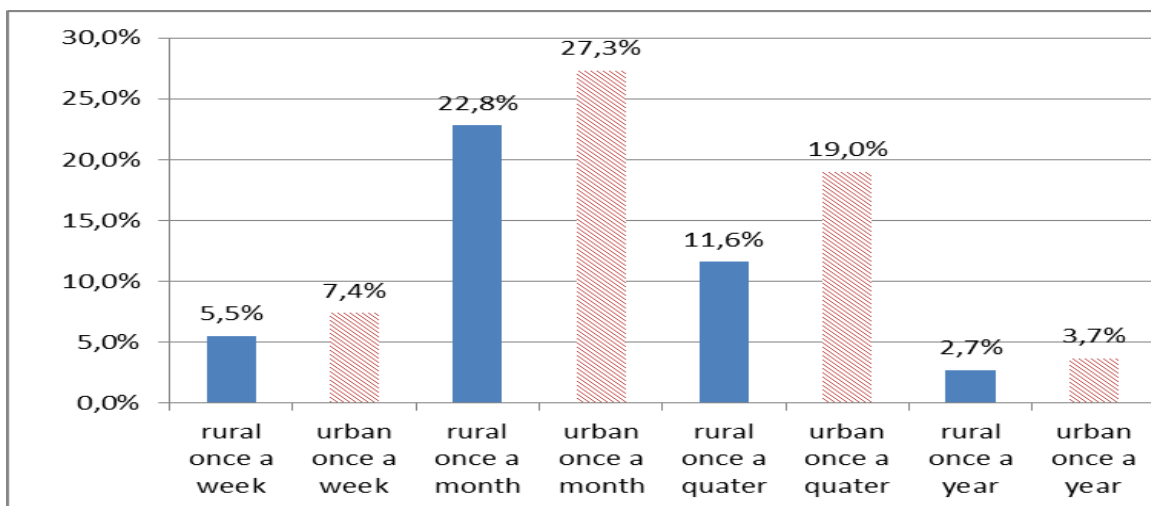


Fig. 2. Purchase frequency in rural / urban areas in percent (n=1000) of consumers

In the statistic scales the leading online most purchased product groups are books, music, videos, games, sports goods, clothes with over 50% (up to around 80%) - the end of the scale usually are food products (Eurostat, 2016; Richter, 2015; Edwards & McKinnon & Cullinane, 2009). Similar is the outcome of this study, with books, music, videos and games being purchased by 89,4% and the different food clusters between 13,9% (dairy products) and 17,0% (grain-products). Combining purchase frequency and purchased products shows that the top groups leading the purchased products are purchased monthly (15,8%-20,9%) in the quarter (34,5% -39,7%) and annually (29,5% - 30,8%) in a high frequency but weekly in a low frequency (1,1% to 3,2%). On the other hand, food products are with up to 8,6% (grain-products) weekly purchase on the top (Figure 3) of the scale, making it a niche delivery segment with high frequency.

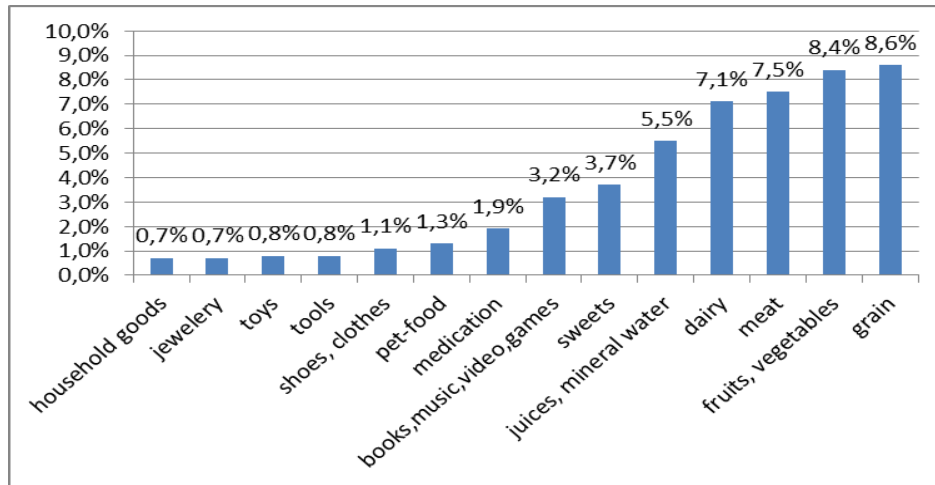


Fig. 3. Weekly online purchased products in % of consumers (n=1000)

For evaluating alternative delivery time frames, the time of the actual online shopping process is of interest, especially considering same day delivery (SDD) or express delivery (ED) within 3 hours. Figure 4 shows that the next day delivery leads the consumer expectations with 55,8% of the consumers. For SDD 27,7% would shop in the forenoon 20,2% in the afternoon. 37,0% would shop two days and the rest 3 days or more before delivery.

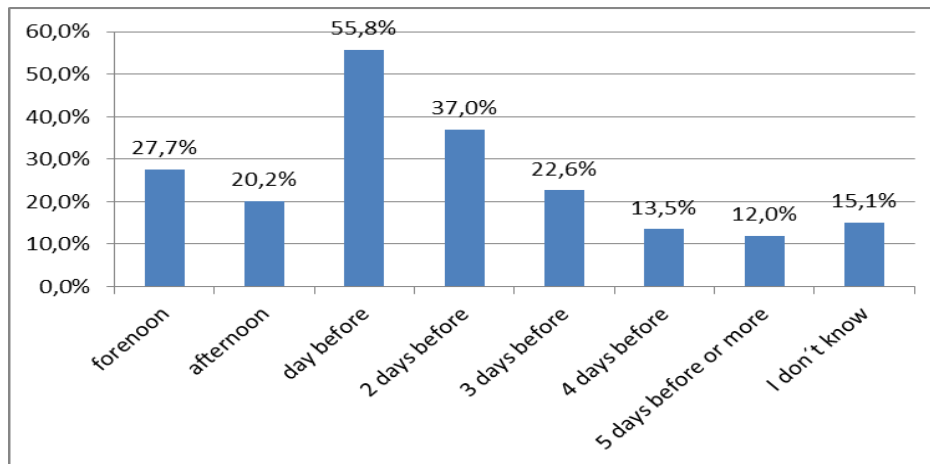


Fig. 4. Time of actual online shopping, if delivered when wanted in % of consumers (n=853, multiple selections possible)

5.2. Alternative Delivery Time Frames

Basically, delivery process can take place 24 hours a day, not everywhere and not always with the possibility of personal handover. The regular daytime parcel delivery time is between 8 – 18 o'clock, UPS for example until 17 o'clock (United Parcel Service, 2017). The time before the daytime delivery, from 9 o'clock in the evening until the morning, can be described as night time delivery, where e.g. newspapers are delivered. The downside of night time delivery is that personal handover, with exception of a concierge service, is not common within the B2C distribution; nevertheless, a distribution in RBs or CDPs can be a possibility. The analysed alternative delivery time frames for AHD, a part of daytime delivery and night time delivery, are evening delivery, delivery within 3 hours, delivery within a selectable time frame, Saturday delivery and Sunday delivery. As Figure 5 shows Sunday

delivery has the least of interested or very interested consumers with only 31,4%. The most interest with 76,1% is in the personal selected time frame, followed by Saturday delivery (72,9%) and evening delivery with 68,8%. Furthermore, these three time frames have the highest results within purchase frequencies as well, which makes them the favourite alternative delivery time frames of the consumer perspective within the evaluated ones.

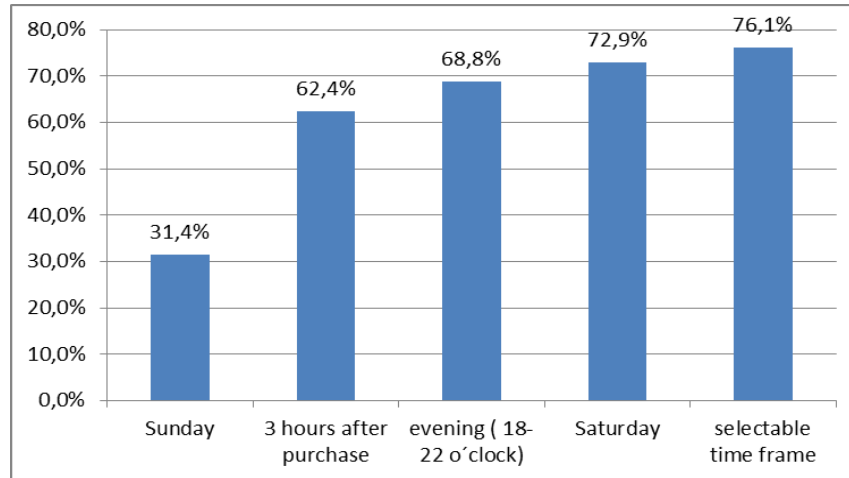


Fig. 5. Interested and very interested consumers in alternative time frames in % of consumers (n=1000)

Combining alternative time frames and purchasable products leads to a similar result seen in other researches based on regular daytime delivery, with books, music etc. with the highest results (Einwiller, 2013) and food with the least percentage (Ahrhold, 2009; Eurostat, 2016; Richter, 2015), in this research an average of 22,8%. Exceptions are Sunday delivery, where the delivery of food products, e.g. grain products with 40,8% of consumers (top figure is books, music etc. with 48,8%) would use the service, and delivery within 3 hours, where food products 35,2% would use the delivery (top figure is books, music etc. with 45,5%). To be able to perform an alternative delivery time frame, it is necessary to know, how the order behaviour is, especially the point of time the order is done (multiple selections possible for the following answers). With the ED purchase within 3 hours, as an SDD service, two thirds are interested in, 20% would order until 8 o'clock in the morning, 47% between 8 and 12 'clock and 30% in the afternoon, which makes the main delivery time frame between noon and early afternoon. On Sunday one third are interested, 37,3% would like to order until 12 o'clock and 23,3% still in the afternoon. Basically, it can be said, that order times for alternative time frame delivery is less before noon then in the afternoon and that almost two thirds would order one day in advance and approximately 30% two days before. Surprisingly 88,5% (evening delivery) up to 93,0% (delivery within a selectable time frame) want to receive their ordered product personally, which implies the necessity of AHD for consumer satisfaction, and only in average 28,4% would want their products in RBs and in average 11,4% in CDPs.

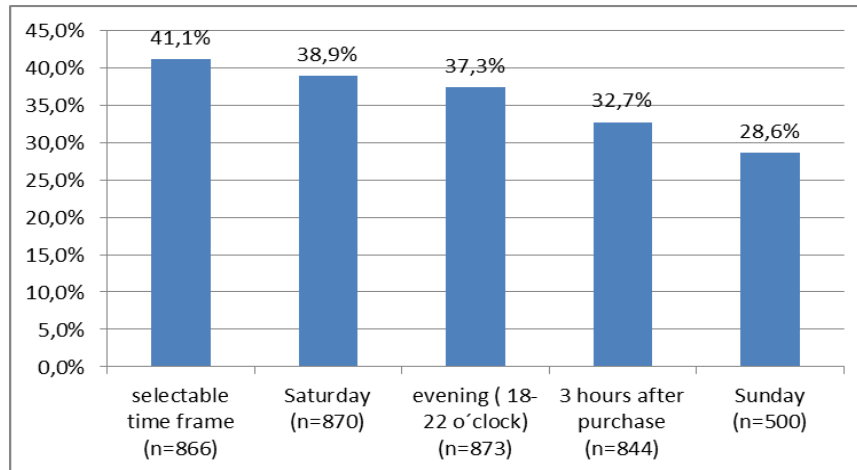


Fig.6. Purchase frequency (Σ of weekly and monthly) in % of potential alternative time frame delivery users

In purchase frequency (Figure 6: Σ of weekly and monthly estimated usage) the top three are selectable time frame delivery (41,1%), Saturday delivery (38,9%) and evening delivery (37,3%). If the two parameters, purchase frequency (weekly & monthly) and interest in service, are considered, Sunday delivery is the one with only 12,2% of potential customers.

5.3. Willingness to Pay

In the times of Amazon prime, when Amazon prime member pay a yearly fee and enjoy free shipping besides other benefits (Welch, 2015; Krämer & Kalka, 2017) and approximately 60% of online retailers cite “free shipping with conditions” (Yang & Essegai & Bell, 2005), it seems questionable if costumers are still willing to pay for extra service. To answer this question for each alternative time frame delivery the interviewees where asked, if they are willing to pay and how much they are willing to pay. One third of the consumers are not willing to pay, with the exception of Sunday delivery (50,2%; n=450) and ED (46,3%; n=805). On average the consumers would be willing to pay € 4,88 for the services. At a closer look between 82,5% (evening delivery; n=263) and 91,4% (ED; n= 373) would pay € 3,- or more for the delivery.

5.4. Relationship between Alternate Delivery Time Frames (ADTFs), Delivery Methods (Last Mile), and Customers’ Willingness to Pay

The section examines relationships between different constructs related to E-customer expectations in alternative delivery time frames. It includes interest of the customers in various alternative delivery times, preference towards the three delivery methods (AHD, RB, and CDPs), and customers’ willingness to pay. The variables, measured via multiple items in the questionnaire, are computed using factor analysis.

Table1. Relationships between Interest in ADTFs and Willingness to pay (Source: Author’s own estimation)

Relationships	Chi Sq.	Sig.	Cramer's V	Strength
Interest in ED * Willing to Pay for ED	37.892	Yes	0.213	Moderate
Interest in BD * Willing to Pay for BD	70.163	Yes	0.295	Moderately Strong
Interest in SatD * Willing to Pay for SatD	26.394	Yes	0.177	Weak
Interest in SunD * Willing to Pay for SunD	12.604	Yes	0.167	Weak
Interest in DPD * Willing to Pay for DPD	38.113	Yes	0.211	Moderate

The Table 1 computes relationships between Interest in ADTFs (Evening delivery, block delivery, delivery on Saturdays, delivery on Sunday, and delivery within desired period) and customer’s willingness to pay for the respective ADTFs using Chi square statistic. According to the result, the association between each of the given set of variables is statistically significant at 0.05 level. In other words, interest in ADTFs and willingness to pay are not independent. However, the relationships with respect to delivery on Saturday and delivery on Sunday are weak.

Table.2. Correlation between ADTFs and Delivery Methods (Last Mile)

Correlations			
		Alternate Delivery Time Frame	Delivery Methods
Alternate Delivery Time Frame	Pearson Correlation	1	.234**
	Sig. (2-tailed)		.000
	N	1000	1000
Delivery Methods	Pearson Correlation	.234**	1
	Sig. (2-tailed)	.000	
	N	1000	1000

** . Correlation is significant at the 0.01 level (2-tailed).

The association between ADTFs and delivery methods is statistically significant at 0.01 level (Table 2). The Pearson correlation coefficient is equal 0.234 (weak correlation). It suggests that increasing interest of the customers in various alternative delivery times is associated with high preference of the customers towards the three delivery methods.

Table.3. Regression Analysis

Coefficients^a				
Model		B	t	Sig.
1	(Constant)	.997	14.125	.000
	Alternate Delivery Time Frame (ADTF)	.116	6.560	.000
	Delivery Methods (DM)	.130	6.098	.000
a. Dependent Variable: Willingness to Pay				
Sig. Value				0.000
F Statistic				49.63
R Square				0.093
Adjusted R Square				0.092

The study proposes a regression model in the context of E-customer expectations in alternative delivery time frames (Table 3). The model examines the impact of ADTFs and preference towards delivery methods on willingness to pay of the customer. The results show a statistical significant impact of the regression model on

customers' willingness to pay at 0.01 level. The R-square value is equal to 0.093; it means that 9.3% of the variance in the dependent variable is explained by the two predictors. Both predictors (independent variables) are individually significant (at 0.01 level) with positive beta values. It suggests that with an increase in customer's interest in ADTFs and preference towards the three delivery methods, customer's willingness to pay increases.

On the basis of the above analysis, the regression model of the study is:

$$WTP = 0.997 + 0.116 (ADTF) + 0.130 (DM)$$

Where WTP, ADTF, and DM represent willingness to pay, alternative delivery time frame, and delivery methods respectively.

6. Discussion

The discussion focusses on the different alternative time frames, last mile problems and barriers as well as financial factors, that applies to the consumer requested kind of delivery. Not considered are national employment laws or environmental topics, e.g. CO2 emissions.

In urban multi-party houses 74,2 % (fig. 7) are interested in evening delivery and over 32,5 % are willing to pay that makes 24,1% of total potential customers (family homes a maximum between of 15,3% urban and 18,4% rural) who are willing to pay for the service with 37,3% using the service at least monthly, particular consumers until the age of 39 years. The upside of evening delivery is that it starts with the end of rush hour at 6 o'clock (Zhang & Batterman & Dion, 2011) with less risk of traffic disadvantage and time controlled locking systems being closed. The possibility of encountering the consumer rises as well after working hours. A higher rate of encounter minimizes costs, as well as faster average speed due to less traffic. As the consumers are not used to evening delivery and could be offended by an interruption in their private sphere, in the questionnaire it was asked until when an evening delivery could be possible. 91% accept a delivery until 20 o'clock, 61% until 21 o'clock and 31% until 22 o'clock in the evening, which leaves a two to three-hour time frame for delivery.

38,9% would use Saturday delivery at least once a month (notably almost half of families would use it once a month) with up to 74,5% (Figure 7) consumer interest within urban multi-party houses and 31,1% of these are willing to pay for it (similar results in the rural areas). 61% of the potential customers would want the delivery until 12 o'clock, with young customers until 29 years being more flexible and accepting delivery in the afternoon. The risk of traffic or parking disadvantage is less than Monday to Friday, which has a direct impact on speed and costs. On the other hand, the possibility of locked doors is rising on weekends. With the same last mile problems and barriers, the least of interest is in Sunday delivery - from 23,6% in family homes to 39,0% in urban multi-party houses - but the highest results in willing to pay - up to 56,2 % in rural areas. Furthermore, the product interest tends more to food products, e.g. grain products (40,8%), with a tendency towards consumers of higher age. Like on Saturday is with 57% preferred until noon. This makes Sundays an economical niche for food products.



Fig.7. Consumer interest, willingness to pay (of interested consumers) and willing to pay of total e-customers in % related to urban / rural alternative time frame delivery

Express delivery within 3 hours is of interest for more than 60% of e-customers. Out of these are 46,3% willing to pay for it, but only one third would use it once a month or more often. High costs in transportation come with this service (Geimer & Becker, 2001) and it needs for the availability of the products additional advanced warehousing solutions. Decentralized storage facilities, which enable a short delivery time, raise costs additionally. Parking, traffic and locked door risks depend on the purchase and delivery time. The risk of consumer absence is lower than on the regular daytime delivery without delivery awareness.

The delivery within a selectable time frame is of high interest, especially for urban multi-party house e-customers with 80,4% and still over 72,6% in rural areas, with a low willingness to pay for the service (23,4% to 38,5% - fig.7). Customer selectable narrow time windows are more costly, up to 45% for a 3 hours delivery window (Boyer & Prud'homme & Chung, 2009), due to minimized routing efficiency (Agatz & Campbell & Fleischmann & Savelsbergh, 2011). The last mile risks still depend on the customer selected time frame, with the advantage for the online shop of being able to set an earliest delivery time after the purchase and the length of the time frame. This reduces the problem of decentralized storage facilities, raises the plannability of delivery tours and the probability of the presence of the customer for an AHD. The recent tests of DHL (DHL, 2017) in Germany with selectable time frames and UPS having a patent on “parcel or service delivery with partially scheduled time windows” (Young, 2007) shows that service will go this direction.

The AHD is not possible between 22 o'clock in the evening and 6 o'clock in the morning - the night time delivery. Nevertheless, it can be the most cost efficient way of delivery, considering the fact that traffic is less of a problem. To be able to use this time frame, the delivery has to be in RBs or CDPs that are accessible and the customer does not have to be present to sign an acceptance. The accessibility of CDPs that are part of the delivery company or contract partners can be achieved easier than the accessibility RBs on private property. RBs on private property need permission, space and a box with an easy operable locking system and furthermore the general door locking system of the building has to let the carrier pass during night time. The base of this delivery choice has to be a data base that collects constantly all this information of the building for the last mile delivery. RBs, besides decreasing costs up to 60%, there is one further strategical point of few: If the RB on private property is only usable by the delivery company that mounted the RBs, it is building up a market entry barrier (Trinker & Holznagel & Jaag & Dietl & Haller, 2012), like letterboxes in the USA, that only can be used by one

deliverer, USPS (Kruse & Liebe, 2005; Dieke & Jung & Zauner, 2010). This market barrier will pull the consumer towards the delivery company for the convenience of having the purchased goods delivered to a save and close delivery point. Still there is limited investment in RBs by delivery companies (Fernie & Leigh, 2014). The results of the survey show that an average 28,4% would accept a delivery in an RB by the first delivery and only 11,4% to the CDPs, which are useful for returning the online purchased products (Weltevreden, 2008).

7. Conclusions

From a consumer point of view, e-commerce and distribution of physical products start with an actual online purchase within a web shop. There are the possibilities for a consumer to make choices concerning the delivery, if the necessary delivery information data are available. Choices such as which delivery company should deliver, the time frame of delivery, preferred delivery (AHD, RB, CDP) should be available for an optimum of consumer satisfaction with immediate presentation of prices. As 90% of consumers prefer AHD, personal handover to the consumer within a personal selected time frame, which 76,1% are interest in, is most likely to be selected. If the consumer is not present within the selected time frame, although he had been noticed shortly before the arrival of the deliverer, the delivery should go to the nearest RB, preferably in the building or walking distance, which as well the consumer chose during the purchase process (as alternative deposit if not present). The last choice should be a CDP, the consumer has to go or drive to. As evening delivery and Saturday delivery are of interest for two thirds of the consumers, it should be a selectable alternative. ED can be an option for specific products, with low purchase frequency, but 46,3 % willing to pay for the service. Sunday delivery can be seen as a niche product for weekly food consumers, with 50,2% are willing to pay for the service.

Considering the delivery companies side delivery within a consumer selected time frame can be a distinguishing feature or selling proposition, if the choice is available in the online shop. It can have positive effects on the first-time delivery rate to the customer, as the probability of the customer being presence increases. The option of a selected time frame will have effects on the route planning and will lead to more kilometers within the last mile (Macharis et al., 2011), which has effects on the costs. An efficient route planning software and not to narrow time frames can antagonize this effect. As tracking systems are already advanced, an automatically generated notice on a phone (e.g. SMS, APP) should notify the customer before the AHD. The selectable time frames do not necessarily have to be a part of the regular daytime delivery, but it can be a possibility of service differentiation if evening delivery and Saturday delivery is provided. If the consumer can choose a second alternative deposit possibility, if not present, it is most likely to choose the service provider that has the nearest facility, which will be the one with an RB within the property. If RBs are available, they even can be a market barrier. CDPs should be provided for pick up products, that have to have an acceptance signed and for a possibility to send back goods.

The results from statistical analysis suggests the significance of ADTFs and DMs (AHD, RB, CDP) in driving customer's purchase intention. As delivery companies start to develop and test consumer selected time frames for delivery, it will be an asset that comes as soon as technology makes it possible. The density of RBs will rise, especially provided by national market leaders who have enough financial resources to mount RBs and defend their market. As drones or robots, which are tested already in Hamburg (Hermes, 2016), RBs can be a solution for delivery and return. The combination of alternative selected time frame delivery and second deposit possibility, the RBs, will reduce second deliveries and costs as well as increase consumer satisfaction.

References

- Aberle, G. (1991). Trends bei Logistikanbietern im Verkehrsbereich [Trends of logistics business within the traffic sector]. *Logistiktrends*, 91, 137-147.
- Agatz, N., Campbell, A., Fleischmann, M., & Savelsbergh, M. (2011). Time slot management in attended home delivery. *Transportation Science*, 45(3), 435-449.
- Ahrholdt D. (2010). *Erfolgsfaktoren einer E-Commerce-Website: Empirische Identifikation vertrauensfördernder Signale im Internet-Einzelhandel* [success factors of an e-commerce webpage: empirical identification of confidence stimulating signals in internet retail]. Gabler.
- Bachmeier, S. (1999). Integrators. Die schnellen Dienste des Weltverkehrs [The fast service in worlds traffic]. *Nürnberger Wirtschafts- und Sozialgeographische Arbeiten*.
- Baum, H., Fransoo, J. C., & Göpfert, I. (2004). Die sich verändernde Welt des Gütertransports-Herausforderungen für die Verkehrspolitik/The changing world of goods transport-challenges for the traffic policy . *Zeitschrift für Verkehrswissenschaft*, 75(1). 50-64.
- BEGEH Schließsysteme GmbH. (2016). *BEGEH CARD. Prospekt 2016*, 3.1-8.
- Beifert, A. (2015). Business development models for regional airports – case studies from the Baltic Sea region, *Journal of Security and Sustainability Issues* 5(2): 199-212. [http://dx.doi.org/10.9770/jssi.2015.5.2\(6\)](http://dx.doi.org/10.9770/jssi.2015.5.2(6))
- Beifert, A. (2016). Regional airports' potential as a driving force for economic and entrepreneurship development – case study from Baltic Sea region, *Entrepreneurship and Sustainability Issues* 3(3): 228-243. [http://dx.doi.org/10.9770/jesi.2016.3.3\(2\)](http://dx.doi.org/10.9770/jesi.2016.3.3(2))
- Bensinger G. Amazon's newest secret weapon: Delivery Lockers. In *Wall Street Journal* (last modified 7. Aug. 2012; cited 14.Dez. 2016). https://www.wsj.com/article_email/SB10000872396390443545504577567763829784538-1MyQjAxMTAyMDAwNzAwODc3Wj.html?mod=wsj_valetleft_email
- Biehlig, C. (2005). *Haustechnik für Verwalter, Vermieter und Makler* [Building equipment for administrative authorities, renter and real estate agents].Haufe-Lexware.
- Boyer, K. K., Frohlich, M. T., & Hult, G. T. M. (2004). *Extending the supply chain: How cutting-edge companies bridge the critical last mile into customers' homes*. AMACOM Div American Mgmt Assn.
- Boyer, K. K., Prud'homme, A. M., & Chung, W. (2009). The last mile challenge: evaluating the effects of customer density and delivery window patterns. *Journal of Business Logistics*, 30(1), 185-201.
- Brown, J. R., & Guiffrida, A. L. (2014). Carbon emissions comparison of last mile delivery versus customer pickup. *International Journal of Logistics Research and Applications*, 17(6), 503-521.
- Bundesverband Paket & Express Logistik – BIEK (2016). KEP-Studie 2016 – Analyse des Marktes in Deutschland [CEP- Study 2016 – Analysis of the German Market]. Berlin. 11. [cited 2016 January 16]. http://www.biek.de/tl_files/biek/downloads/papiere/BIEK_KEP-Studie_2016.pdf
- Callegaro, M., Manfreda, K. L., & Vehovar, V. (2015). *Web survey methodology*. Sage.

- DHL Paket GmbH. (2017). *Lieferung zur Wunschzeit* [delivery on requested time]. (cited 2017 Feb. 20) <https://www.dhl.de/de/geschaeftskunden/paket/ab-200-pakete/zeitfenster/wunschzeit.html>
- Dieke A-K, Junk P & Zauner M. (2010). Netzzugang und Zustellwettbewerb im Briefmarkt [network access and deliverycompetition in the letter market]. *Wissenschaftliches Institut für Infrastruktur und Kommunikationsdienste*, Diskussionsbeitrag Nr. 336.
- Dreier, M. (2000). *Die Distributionsnetzwerke der Kurier-, Expreß- und Paketdienstleister (KEP) und deren Positionierung in der Logistikbranche* (Master Thesis) [Distribution networks of CEP and the positioning in the logistics industry]. Wirtschaftsuniversität Wien.
- Edwards, J., McKinnon, A., & Cullinane, S. L. (2009). Carbon auditing the ‘last mile’: modelling the environmental impacts of conventional and online non-food shopping. *Green Logistics Report*, Heriot-Watt University.
- Einwiller, S. (2013). *Vertrauen durch Reputation im elektronischen Handel* [Trust through reputation in electronic retail]. Springer-Verlag.
- Eurostat.(2016). *Online purchases, EU28, 2016 (% of individuals who bought or ordered goods or services over the internet for private use in the previous 12 months)* . (cited 2017 Feb 17). [http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Online_purchases,_EU28,_2016_\(%25_of_individuals_who_bought_or_ordered_goods_or_services_over_the_internet_for_private_use_in_the_previous_12_months\).png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Online_purchases,_EU28,_2016_(%25_of_individuals_who_bought_or_ordered_goods_or_services_over_the_internet_for_private_use_in_the_previous_12_months).png)
- Felisberto, C., Finger, M., Friedli, B., Krähenbühl, D., & Trinkner, U. (2006). Pricing the last mile in the postal sector. In *Progress toward liberalization of the postal and delivery sector* (pp. 249-264). Springer US.
- Fenkart, A. (2000). *Die Anforderungen an Kurier-, Express- und Paketdienstleister (KEP):Eine Untersuchung über Bedürfnisse und Zufriedenheit der KEP-nutzenden Wirtschaft in Österreich* (Master Thesis) [Requirements to CEP: A Research of requirements and satisfaction of CEP using business in Austria]. Wirtschaftsuniversität Wien.
- Fernie, J., & Sparks, L. (2014). *Logistics and retail management: emerging issues and new challenges in the retail supply chain*. Kogan Page Publishers.
- Fernie, J., Sparks, L., & McKinnon, A. C. (2010). Retail logistics in the UK: past, present and future. *International Journal of Retail & Distribution Management*, 38(11/12), 894-914.
- Fortmann, K. M., & Kallweit, A. (2007). *Logistik* [Logistics]. W. Kohlhammer Verlag.
- Gebhard, T., Jäger, F. & Schlichting, T. (1997). Dienstleistungsmarketing im Aufbruch – Das Umdenken in der KEP-Branche am Beispiel von United Parcel Service [Service marketing in upraise – rethinking within the CEP-industry using the example of UPS]. *Internationales Verkehrswesen*, 49(5). 231-237.
- Geimer, H., & Becker, T. (2001). Supply Chain-Strategien [supply chain strategies]. In *Supply Chain Management* (pp. 19-37). Vieweg+Teubner Verlag.
- Gilbert, C. (1989). Demnächst in Stunden messen [Measuring in hours]. *Logistik Heute*, 11.8.
- Gleißner, H., & Femerling, J. C. (2008). Grundlagen der Logistik [Fundamentals of logistics]. *Logistik: Grundlagen—Übungen—Fallbeispiele*, 3-20.
- Gogic, D. (2005). *Internet Services bei österreichischen KEP-Diensten: Fallstudie Cargo Partner AG* (Master Thesis)[Internet Services in Austrian CEP-Services: Case study Cargo Partner AG]. Wirtschaftsuniversität Wien.
- Häder, M. (2015). Forschungs-und Untersuchungsplanung [Research and study planning]. In *Empirische Sozialforschung* (pp. 69-137). Springer Fachmedien Wiesbaden.
- Heiserich, O. E., Helbig, K., & Ullmann, W. (2011). *Logistik. Eine praxisorientierte Einführung* [Logistics. A practice oriented introduction]. 4., vollständig überarbeitete und erweiterte Auflage. Gabler.

- Hermes Europe GmbH. (2016) *Im Test: Starship-Zustellroboter in Hamburg* [Testing: Starship-delivery robots in Hamburg]. (cited 2017 Feb. 25) <https://newsroom.hermesworld.com/starship/>
- Hornbacher, M., Horvath, E. & Munstermann, H. (1990). Integrator—eine Herausforderung für den Transportsektor [Integrator – a challenge for transportation sector]. *Internationales Verkehrswesen*, 42(4), 206-216.
- Ihde, G. B., & Bloech, J. (1997). *Vahlens großes Logistiklexikon* [Vahlens Logisticslexicon]. Vahlen.
- Klaus, P. (2002). Die europaischen Paket-und Kurierdienstmaerkte. Trends und Entwicklungen. *Internationales Verkehrswesen*, 54(1/2), 44-45.
- KMU Forschung Austria – Austrian Institute of SME Research. (2016). Internet Einzelhandel 2014 [internet retail]. *KMU Forschung Austria – Austrian Institute of SME Research*.
- Köberlein, C. (1997). *Verkehrlexikon* [Trafficlexicon]. Oldenbourg.
- Krämer, A., & Kalka, R. (2017). How Digital Disruption Changes Pricing Strategies and Price Models. In *Phantom Ex Machina* (pp. 87-103). Springer International Publishing.
- Kruse, J, Liebe A. (2005). *Netzzugang und Wettbewerb bei Briefdiensten* [Network access and competition in letter services] . HWWA Institute of International Economics Report, 257.
- Kummer, S., Grün, O., & Jammerneegg, W. (2009). *Grundzüge der Beschaffung, Produktion und Logistik* (Vol. 1) [Basics in supplying, production and logistics]. Pearson Deutschland GmbH.
- Lammers, L-M. (2012). Efficient Consumer Response: Strategische Bedeutung und organisatorische Implikation absatzorientierter ECR-Kooperationen [Strategic relevance and organizational implications of market oriented ECR-cooperations]. in Ringsletter, M-J. *Schriften zur Unternehmensentwicklung*. Springer.
- Lee, H. L., & Whang, S. (2001). Winning the last mile of e-commerce. *MIT Sloan Management Review*, 42(4), 54-62.
- Macharis, C., & Melo, S. (Eds.). (2011). *City distribution and urban freight transport: multiple perspectives*. Edward Elgar Publishing.
- Maurer, K.(2013). *Möglichkeiten, Einflüsse und zukünftige Potenziale bei der Zustellung von online bestellten Lebensmitteln zum Letztverbraucher* (Master Thesis) [Possibilities, Effects and future potentials in delivery of online purchased food to consumers]. FHWien
- McKinnon, A. C., & Tallam, D. (2003). Unattended delivery to the home: an assessment of the security implications. *International Journal of Retail & Distribution Management*, 31(1), 30-41.
- Meffert, H. & Bruhn M. (1997). *Dienstleistungsmarketing* [Servicemarketing]. Wiesbaden.
- Mencler, M. (2006). *Entwicklung von Speditionen und KEP-Dienstleistern in Österreich* (Master Thesis) [Development of freight forwarding businesses and CEP-Service provider in Austria]. Wirtschaftsuniversität Wien.
- Morris, A. (2009). The Last Mile: Developing Efficient Freight Operations for Manhattan’s Buildings. *Stephen L. Newman Real Estate Institute, Baruch College, New York*.
- Müller, B. (2002). So entwickelt sich der KEP-Markt [Development of CEP-market]. *Internationales Verkehrswesen*, 7+8, 38-40.
- Ohland, G. (2015). *Keine Angst vorm smarten Heim: Das Ende der Geschichten vom Bier bestellenden Kühlschrank und dem Hacker, der die Haustür öffnet* [No fear of smart homes] . BoD
- Olfert, K. (2014). *Kompodium der praktischen Betriebswirtschaft*. In Ehrmann H. *Logistik*. NWB.
- Österreichische Post AG. (2016). *Geschäftsbericht 2015 / Magazin* [Annual Report of Austrian Post AG 2015]. *Vienna*. 13-77.

- Pfohl, H. C. (1996). *Logistiksysteme: Betriebswirtschaftliche Grundlagen* [Logisticssystems: Economics fundamentals]. Springer-Verlag.
- Potzmann, E. (2006). *Produktpolitik in der Stückgutspeditions- und KEP-Branche* (Master Thesis) [Product policy in freight forwarding and CEP industry]. Wirtschaftsuniversität Wien.
- Punakivi, M. (2003). *Comparing alternative home delivery models for e-grocery business* (doctoral thesis). Helsinki University of Technology
- Punakivi, M., & Tanskanen, K. (2002). Increasing the cost efficiency of e-fulfillment using shared reception boxes. *International Journal of Retail & Distribution Management*, 30(10), 498-507.
- Punakivi, M., Yrjölä, H., & Holmström, J. (2001). Solving the last mile issue: reception box or delivery box?. *International Journal of Physical Distribution & Logistics Management*, 31(6), 427-439.
- Richter, P. (2015) *Same Day Delivery für E-Commerce im Großraum Wien* (Master thesis) [Same day delivery for e-commerce in and around Vienna]. Fachhochschule des BFI Wien.
- Samašonok, K.; Išoraitė, M.; Leškienė-Hussey, B. (2016). The internet entrepreneurship: opportunities and problems, *Entrepreneurship and Sustainability Issues* 3(4): 329-349. [http://dx.doi.org/10.9770/jesi.2016.3.4\(3\)](http://dx.doi.org/10.9770/jesi.2016.3.4(3))
- Schneider, C. & Siebel, L. (2002). Wohin fährt der KEP-Zug? [Where to goes the CEP-train?]. *Logistik Heute*, 7+8. 60-61.
- Trinkner, U., Holzngel, B., Jaag, C., Dietl, H., & Haller, A. (2012). Möglichkeiten eines gemeinsam definierten Universaldienst Post und Telekommunikation aus ökonomischer und juristischer Sicht [Possibilities of a collective defined universal service of postal and telecommunications from economical and juridical point of view]. *Study on behalf of Deutscher Bundestag*.
- United Parcel Service of America. (2017). *Ausführlicher Bericht zur Sendungsverfolgung*. [detailed report of shipment tracking]. (cited 2017 Feb. 20) https://www.ups.com/content/at/de/tracking/tracking/detail_help.html
- Urbonas, V.; Alonderis, A. (2016). Precondition of sustainable security: genesis of the Lithuanian aviation institutions, *Journal of Security and Sustainability Issues* 5(4): 501-507. [http://dx.doi.org/10.9770/jssi.2016.5.4\(5\)](http://dx.doi.org/10.9770/jssi.2016.5.4(5))
- Vahrenkamp, R. (2000). *Logistikmanagement. 4., verbesserte Auflage* [Logistics management]. München-Wien.
- Vahrenkamp, R. (2003). Der Gütertransport im internationalen Luftverkehr [Transportation of cargo in international air transport]. *Internationales Verkehrswesen*, 55(3), 71-75.
- Vaško, M.; Abrahám, J. (2015). Issues of secure and sustainable e-tourism: case of the Czech Republic, *Journal of Security and Sustainability Issues* 5(2): 137-148. [http://dx.doi.org/10.9770/jssi.2015.5.2\(1\)](http://dx.doi.org/10.9770/jssi.2015.5.2(1))
- Wang, X., Zhan, L., Ruan, J., & Zhang, J. (2014). How to choose “last mile” delivery modes for E-fulfillment. *Mathematical Problems in Engineering*, 2014. 1-9.
- Welch A. (2015). *A cost-benefit analysis of Amazon Prime Air*. (Honors Thesis). University of Tennessee at Chattanooga
- Weltevreden, J. W. (2008). B2c e-commerce logistics: the rise of collection-and-delivery points in The Netherlands. *International Journal of Retail & Distribution Management*, 36(8), 638-660.
- Xu, M., Ferrand, B., & Roberts, M. (2008). The last mile of e-commerce—unattended delivery from the consumers and eTailers' perspectives. *International Journal of Electronic Marketing and Retailing*, 2(1), 20-38.
- Yang, Y., Essegai, S., & Bell, D. R. (2005). Free shipping and repeat buying on the internet: theory and evidence. *Manuscript, Wharton School, University of Pennsylvania*.
- Young, J. E. (2007). *U.S. Patent No. 7,233,907*. Washington, DC: U.S. Patent and Trademark Office.

Zadek, H. (1999). *Kundenorientierung in logistischen Prozeßketten: Ein Instrumentarium zur Entscheidungsunterstützung und zum Controlling für die strategische Logistiktiefengestaltung in Industrieunternehmen* (doctoral thesis) [customer orientation in logistics process chains]. Technische Universität Berlin.

Zhang, K., Batterman, S., & Dion, F. (2011). Vehicle emissions in congestion: Comparison of work zone, rush hour and free-flow conditions. *Atmospheric Environment*, 45(11), 1929-1939.

Christian OTTER ORCID ID: orcid.org/0000-0001-6422-5506

Christian WATZL ORCID ID: orcid.org/0000-0002-7182-3050

Daniel SCHWARZ ORCID ID: orcid.org/0000-0002-0099-4389

Pamela PRIESS ORCID ID: orcid.org/0000-0001-5623-7283

Register for an ORCID ID:

<https://orcid.org/register>

Copyright © 2017 by author(s) and VsI Entrepreneurship and Sustainability Center

This work is licensed under the Creative Commons Attribution International License (CC BY).

<http://creativecommons.org/licenses/by/4.0/>

