WHITE-LABEL PICKUP STATIONS: A CONJOINT ANALYSIS

Reinhold Schodl
University of Applied Sciences BFI Vienna, Austria, E-mail: reinhold.schodl@fh-vie.ac.at

Sandra Eitler
University of Applied Sciences BFI Vienna, Austria

Bernhard Ennser
University of Applied Sciences BFI Vienna, Austria

Johannes Braith
Storebox Holding GmbH, Austria

Georg Hauger
Vienna University of Technology, Austria

Matthias Steinbauer
Variocube GmbH, Austria

Matthias Prandtstetter
AIT Austrian Institute of Technology, Austria

ABSTRACT

This paper deals with the customer-centric implementation of white-label pickup stations in the challenging field of parcel logistics. A white-label pickup station is a point for parcel deliveries that is not limited to one parcel delivery company, but open to other ones as well. The concept offers consumers a convenient way for receiving parcels around the clock, and logistics companies the opportunity for improving operational performance. Moreover, a network of white-label pickup stations can help to reduce traffic. Consequently, white-label pickup stations can ease the environmental impact of last mile delivery. The research takes place in the context of the project alBOX, which aims to develop sustainable business models for white-label pickup stations. This requires a thorough understanding of potential customers. In order to investigate customer preferences, a conjoint analysis is carried out. This allows to understand how people value alternative service configurations of white-label pickup stations.

Keywords: white-label deliveries, parcel lockers, last mile delivery, conjoint analysis, green logistics.

1. INTRODUCTION

The booming e-commerce opens new possibilities for consumers and businesses. However, increasing numbers of parcel deliveries put pressure on cities, as deliveries add to a city's traffic volume. Innovative logistics solutions can help to reduce congestions and emissions, while offering customer-centric services. Such a potentially sustainable solution is a network of white-label pickup stations. If a parcel delivery company operates pick-up stations, it usually does

not permit competing parcel companies to use them. In contrast, a white-label pickup station is not limited to a specific parcel delivery company, but open to other ones as well.

A pick-up station is an infrastructure that acts as a delivery point for parcel deliveries. It can be an automated parcel locker that supports unattended delivery and pick-up of parcels around the clock. The functionality results from a combination of soft- and hardware. A courier opens a locker by selecting a recipient from an electronic interface attached to the parcel locker. After the delivery is put into the locker, an electronic notification together with a code is sent automatically to the recipient. The recipient uses the electronic interface to enter the code, which opens the right locker, and allows to collect the delivery. Automated parcel lockers are an efficient solution for last mile delivery and offer consumers a convenient way to receive their parcels (Iwan et al. 2016). Automation saves labor costs and relatively compact dimensions reduce the required space and associated costs. High accessibility in terms of time and location promote customer convenience. An automated parcel locker can be either used as primary point of delivery or, in case a delivery to a customer's address is unsuccessful, as secondary delivery point. In the first case unsuccessful delivery attempts can be avoided, which saves time, money, and reduces traffic. Due to these and other advantages, automated parcel lockers are already in use by many parcel delivery companies and seem to be a major direction for last mile delivery in cities and a good opportunity to reduce negative environmental impacts of last-mile delivery (Iwan et al. 2016).

Generally, collaborative strategies for goods delivery can be applied to reduce transport cost, congestion and pollution (Montoya-Torres et al. 2016, Ko et al. 2018, Yao et al. 2019). Sharing of resources is a way of collaboration in last mile delivery. Urban consolidation centers are a typical example of this (Marcucci and Danielis 2008). A white-label pickup station follows the idea of sharing logistics resources to improve performance and decrease environmental impact. The particularity of a white-label pickup station lies in its openness to all (or at least a group of) parcel delivery companies as delivery point. A white-label pickup station may be operated by a logistics company, any other company or the public sector. Independent of its operator, it potentially offers various benefits.

(1) Transports and environment: Consider networks of pickup stations, where each network is assigned to one parcel delivery company. In the case of an unsuccessful delivery attempt the courier has to transport the parcel to a pick-up station belonging to the own company and the recipient has to travel to the same station to pick-up the parcel. Assume that all stations are transformed to white-label pickup stations. In this alternative situation the choice of stations for the deposit of a particular parcel increases. This maximizes the options to optimize the location for depositing a parcel with the aim of minimizing travel distances for the courier and the recipient. Shorter transports do not just save time and money, but can reduce traffic and emissions. In the case of a recipient receiving deliveries from different parcel delivery companies at the same time, white-label pickup stations can further reduce the required transports due to bundling effects.

(2) Operational performance: Economies of scale may be achieved by merging several networks of pick-up stations into one white-label network. A lager network may reduce costs for installation, operation and maintenance. Moreover, extending the network can create positive pooling effects. This potentially allows to increase service levels at a given level of capacities or to decrease capacities while maintaining a given service level.

(3) Customer experience: Picking-up all deliveries at one familiar place with well-known procedures can create trust and convenience. Thus, white-label pickup stations can improve the customer experience.

(4) The infrastructure of a pickup station is not necessarily limited to deliveries from parcel delivery companies but allows additional services. The station can be used for direct

deliveries by local shops and producers. Also private individuals can use the box for exchanging goods between them. Such additional services can further contribute to the attractiveness of the concept und help to make it a solid business.

This research takes place within the project alBOX, which develops sustainable business models for white-label pickup stations under consideration of the specific requirements of different user groups. This work focuses on potential customers' preferences in order to design attractive services, thus aiming to answer the following question: What are customer requirements on white-label pickup stations? The paper is structured as follows: In section 2 a conjoint analysis addresses the research question. In section 3 results of the analysis are presented, including a comparison of different user segments, while section 4 presents the conclusion.

2. METHOD

In order to investigate customer requirements on white-label pickup stations a conjoint analysis is carried out, which is an established survey-based statistical technique in market research. Contrary to simple surveys, this method mimics the decision process made by customers in reality, and, in particular, considers tradeoffs consumers have to make (Orme 2005). Conjoint analysis has been applied to some problems in logistics. For instance, Nguyen et al. (2019) determine consumer preferences for delivery options related to online purchases.

Conjoint analysis assumes that products or services are composed of various attributes and levels. An attribute is a characteristic of a product or service and can take on various levels. An attribute's level has a utility, which reflects how valuable it is for a consumer and contributes to the overall utility of a product or service. In a conjoint experiment products or services are composed by varying attribute levels and presented to respondents. Based on the expressed preferences a statistical analysis estimates the utility score for each attribute's level. Subsequently, the relative importance of each attribute can be calculated.

In this study respondents rate a service with seven attributes, each having two levels. Attributes and their levels have been identified based on expert opinion of a team consisting of senior managers of companies offering related products and services and senior researchers in logistics. In doing so, three dimensions are assumed to be of particular importance to consumers when they make their decision, i.e., scope of the offered service, accessibility of the service in terms of location and time, and price of the service.

(1) Scope: The delivery of goods by parcel delivery companies forms the core service and, therefore, the presence does not have to be described by an attribute. However, two attributes are introduced to describe if an additional service is offered or not. First, the direct deposit of goods into the automated parcel locker by a company other than a parcel delivery company can be offered as additional service. This opens local businesses (e.g., dry cleaner) and producers (e.g., agricultural direct marketers) a new distribution channel that complements stationary trade and ecommerce. Consequently, white-label pick-up stations can help them to access existing and new customers. Second, the deposit of goods by private individuals can be offered as an additional service. Thus, white-label pick-up stations can play a role in the sharing economy.

(2) Accessibility: It can be hypothesized that accessibility constitutes a critical success factor of white-label pick-up stations. Therefore the personal time required to reach the station is added to the set of attributes with the two levels 7 minutes and 15 minutes. If good parking possibilities are available and whether the automated parcel locker is installed inside a building or outdoors are two additional attributes. Moreover, the opening times with two levels, i.e., always open and open at typical opening hours of Austrian grocery stores are considered.

(3) Price: As in most consumer decisions, it can be assumed price plays a central role. So the price a consumer has to pay per received delivery is included as attribute. Based on expert opinion, the levels are set to 0.45 EUR and 0.90 EUR.

Respondents score profiles according to their preference on a 5-point Likert Scale, ranging from "very low attractiveness" to "very high attractiveness". Each profile represents an alternative service design, i.e., a specific combination of levels for each of the seven attributes. In order to reduce the number of profiles that have to be evaluated, a fractional factorial design is applied. The statistical package IBM SPSS Statistics (version 24) is utilized to generate an orthogonal design with 12 profiles, including four holdout cases for validation.

An online survey has been carried out among consumers in Austria between April and June 2019. The idea of white-label pickup stations was explained and it was asked to rate the defined profiles in the context of white-label pickup stations. Invitations to participate in the survey were sent by partners of the research project alBOX to their business partners, employees, and students. In total 112 fully completed questionnaires can be used for analysis. The sample consists of 57% men and 76% of the respondents live in a city with more than 10,000 citizens. Respondents typically receive on average 3.54 parcels per month (minimum 0, maximum 14, standard deviation 2.76). The particular characteristic of the sample should be taken into consideration when interpreting results.

The data has been analyzed with the "Conjoint" procedure of the statistical package IBM SPSS Statistics (version 24). The software performs an ordinary least squares regression. Ratings of eight out of the twelve profiles are used to build the preference model. For validation the correlation between the observed and the estimated preferences is calculated. Pearson's r and Kendall's tau statistics are computed to evaluate the goodness-of-fit. The value of Pearson's r is 1.000 and of Kendall's tau is 1.000. The correlation between the observed and the estimated preferences is also calculated for the four hold cases, which are not used to estimate preferences. Kendall's tau for the holdout cases is 0.667. Thus, results can be considered valid.

3. RESULTS

In this section results of the conjoint analysis are presented. Table 1 shows the estimated utility score for each attribute's level as interval data. The total utility corresponds to the sum of the level-dependent utility values of all attributes plus a constant with the value 4.122. Table 1 also indicates each attribute's relative importance. The relative importance of an attribute is determined by relating the range of the attribute's level-dependent utility values to the sum of all attributes' ranges. The calculation is done per response and an average value is built.

Table 1. Utility and importance for overall sample

Attributes	Levels	Utility	Importance
Deposit of goods by local businesses	Yes	0.152	10.31 %
	No	-0.152	
Deposit of goods by private individuals	Yes	0.244	14.40 %
	No	-0.244	
Personal time required to reach box	7 minutes	-0.354	13.59 %
	15 minutes	-0.760	
Good parking options	Yes	0.277	15.22 %
	No	-0.277	
Installation site of box	Indoors	0.240	10.37 %
	Outdoors	-0.240	
Opening times	Always open	0.416	20.79 %
	Mon-Fri 07-19, Sat 07-18	-0.416	
Price per received delivery	0.45 EUR	-0.562	15.32 %
	0.90 EUR	-1.125	

For most attributes, the preferred level can be predicted by common sense. For instance, longer opening times should be more valuable than shorter ones. Results confirm the expected preferences. Only for the installation site of the box no preferred level derives from logic. A parcel locker inside a building might be safer and offer better weather protection, while an installation outdoors could allow faster and more convenient accessibility. According to the survey, consumers favor automated parcel lockers inside a building.

The relative importance of the attributes are of particular interest for service design. Opening times is the most important attribute. It can be noted that price is important, but opening times is even more important. The deposit of goods by local businesses and the installation site of box play less important roles for consumers. Interestingly, the possibility of deposits by private individuals is considered more important than the possibility of deposits by businesses.

In the following, the view is on segments of the overall sample. Table 2 presents the utility scores for the segment of respondents living in a city with more than 10000 citizens (“urban”) and a segment of the remaining respondents (“rural”). The constant for calculating the total utility is 4.137 for “urban” and 4.076 for “rural”. The level of validity is comparable to that of the overall sample.

Table 2. Utility for urban and rural segment

Attributes	Levels	Utility urban	Utility rural
Deposit of goods by local businesses	Yes	0.162	0.120
	No	-0.162	-0.120
Deposit of goods by private individuals	Yes	0.245	0.241
	No	-0.245	-0.241
Personal time required to reach box	7 minutes	-0.370	-0.308
	15 minutes	-0.793	-0.660
Good parking options	Yes	0.255	0.343
	No	-0.255	-0.343
Installation site of box	Indoors	0.230	0.280
	Outdoors	-0.230	-0.280

Attributes	Levels	Utility urban	Utility rural
Opening times	Always open	0.468	0.259
	Mon-Fri 07-19, Sat 07-18	-0.468	-0.259
Price per received delivery	0.45 EUR	-0.590	-0.481
	0.90 EUR	-1.179	-0.963

Figure 1 illustrates the relative importance for the "urban" and "rural" segment. It becomes obvious, that good parking possibilities are more important to rural residents, which could be due to a higher share in car users. Contrary, long opening times are more important to persons living in urban areas. An explanation may be found by examining differences in occupational structures.

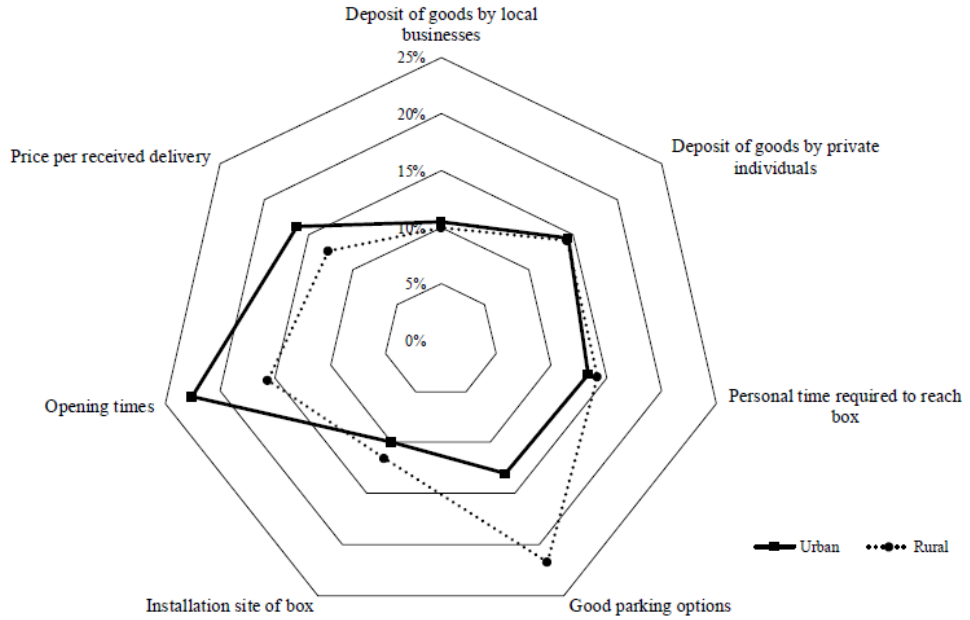

Figure 1. Importance for urban and rural segment

Table 3 gives utility scores for the segment "infrequent", consisting of respondents receiving less than four parcels per month. Four parcels per month is the rounded average value of all respondents. Table 3 also shows results for the segment "frequent" which contains the remaining respondents. The constant for calculating the total utility is 4.146 for "infrequent" and 4.088 for "frequent" and the level of validity is again comparable to that of the overall sample.

Table 3. Utility for infrequent and frequent segment

Attributes	Levels	Utility infrequent	Utility frequent
Deposit of goods by local businesses	Yes	0.151	0.153
	No	-0.151	-0.153
Deposit of goods by private individuals	Yes	0.258	0.225
	No	-0.258	-0.225

Attributes	Levels	Utility infrequent	Utility frequent
Personal time required to reach box	7 minutes	-0.340	-0.374
	15 minutes	-0.729	-0.802
Good parking options	Yes	0.214	0.364
	No	-0.214	-0.364
Installation site of box	Indoors	0.280	0.019
	Outdoors	-0.280	-0.019
Opening times	Always open	0.409	0.425
	Mon-Fri 07-19, Sat 07-18	-0.409	-0.425
Price per received delivery	0.45 EUR	-0.571	-0.550
	0.90 EUR	-1.143	-1.100

Figure 2 displays the relative importance for the "infrequent" and "frequent" segment. Remarkably, deviations between the two segments are relatively small. Still, there is a noteworthy difference for the attribute "good parking options". For frequent users the parking situation is of higher importance.

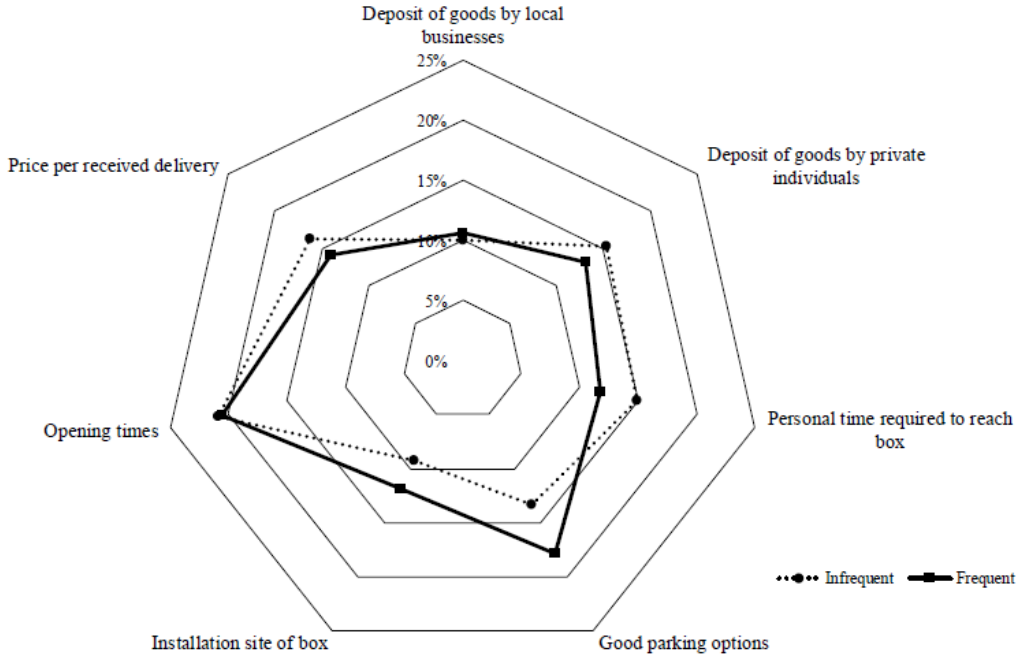

Figure 2. Importance for infrequent and frequent segment

4. CONCLUSION

Consumers and logistics companies can both benefit from white-label pickup stations. Consumers can receive a better customer experience and parcel delivery companies can utilize the concept to improve their operational performance. Furthermore, a network of white-label pickup stations can help to achieve positive environmental effects. Integrating automated parcel lockers into a single open network potentially shortens the distances travelled by couriers and recipients of

deliveries. As a result, emissions caused by transports can be reduced.

This work focuses on potential customer preferences as basis for creating attractive and sustainable services. A conjoint analysis helps to understand which attributes are most important to consumers. Instead of simply asking what they prefer in a service, respondents are asked to make tradeoffs like in real-life decisions. The following general findings of this conjoint analysis should be taken into consideration when designing successful services. Attributes related to the service accessibility, like long opening times or good parking options appear to be notably important to potential users. These attributes may be even more important than the price charged for the service. Furthermore, it is advisable to have a close look at the different requirements of urban and rural residents.

Understanding consumers' preferences is the basis for suitable business models to operate white-label pickup stations. Equally important for their success is acceptance of the concept by all stakeholders, including logistics companies and political decision makers.

5. ACKNOWLEDGEMENTS

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