ISMC 2019
15th International Strategic Management Conference

LOGISTICS, SATISFACTION AND LOYALTY IN E-COMMERCE VALUE NETWORK: DISCRIMINANT APPROACH

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Abstract

Beneficiaries of e-commerce growth are both companies and customers. E-commerce creates new opportunities for development for already existing entities and gives prospects for rapid growth to emerging ones. Customers can simply and quickly find products, compare them and choose the best one. Thanks to e-commerce, an additional value is created for the customers which is associated with a lower price of the product, convenience in the form of twenty-four hour access to e-shops, various methods of deliveries and possibility of product return. Logistics, then, plays a very important role in e-commerce. The logistics value is created not only by the online sellers but also by many other entities, such manufacturers, distributors, marketplaces, and logistics and couriers companies. They can be grouped into the following stakeholders: e-tailers, suppliers, complementors, as well as the final customers. All together are a part of the e-commerce value network. The aim of these studies is to determine the relationship between perceived logistics value, customer satisfaction and loyalty in e-commerce. For the needs of this paper, we scrutinized a random sample of 800 individuals representing retailers, customers, suppliers and complementors of e-commerce in Poland. To test this relationship, a discriminant analysis was performed to establish whether differences in perceptions exist between the e-commerce stakeholder groups.

1. Introduction

Thanks to the Internet, trade has become as easy and convenient as never before. Its beneficiaries are both companies and customers. Almost each firm has the potential to become a successful trader (WTO, 2016). E-commerce creates new opportunities for development for already existing entities and gives prospects for rapid growth to emerging ones. It is possible thanks to low entry barriers that encourage more and more companies to sell their products on the Internet. They can offer a wider range of products without having to physically present them. Companies are able to save on both fixed and variable costs, such as rent, labour and other overheads associated with physical presence in shopping centers and bricks-and-mortar stores. In turn, customers can simply and quickly find products and compare them. Moreover, they may buy new products, which they did not previously use due to their unavailability in terms of location in distant places (e.g. goods from abroad), lack of time or a different lifestyle. Moreover, online shopping allows customers to save money.

Today, one of the most important contemporary challenges facing e-commerce seems to be logistics and meeting the high expectations of e-commerce customers, ensuring their satisfaction and, consequently, loyalty to the place of purchase. The unique role of logistics in e-commerce (Bask, Lipponen, & Tinnilä, 2012; Masmoudi, Benaissa, & Chabchoub, 2014; Ramanathan, George, & Ramanathan, 2014; Yu, Wang, Zhong, & Huang, 2017) and in the creation of value for the customer was indicated by many authors (Willersdorf, 1990; Francis, Fisher, Thomas, & Rowlands, 2014). One of the most frequently indicated imperatives of the need for changes in the e-commerce industry is technology. However, the dynamics of changes in the e-commerce industry is related not only to technological innovations (Bakker, Zheng, Knight, & Harland, 2008), but also to changes in customer behavior and their expectations, as well as the need to adapt other stakeholders of value in e-commerce. The issue of e-customers' expectations and preferences has been the subject of research for many years (Bhattacherjee, 2001), as well as the problem of logistics challenges in e-commerce, consisting in ensuring an adequate level of services. Finding an optimal balance between pricing, customer expectations and logistics service levels has been an increasing challenge. This aspect points to the need for continuous monitoring of customer preferences and provision of appropriate and profitable (in a cost-effective manner) logistics value. The problem of the actual proper understanding of the final e-commerce customers' expectations by the remaining participants co-creating the logistics value in the network seems to be weakly recognized. The confrontation of e-commerce customers' preferences and the knowledge of co-creators of values on this subject may be an extremely important decision-making premise in the area of shaping an appropriate level of logistics in e-commerce. The ultimate goal of the created logistics value corresponding to the customers' preferences is satisfaction and, in accordance with the relationship marketing approach, the loyalty of final customers. This aspect, i.e. achieved satisfaction and loyalty of final customers, can be understood differently by individual participants in the value network. Satisfaction and loyalty have been the subject of research for some time. However, it is rare to confront customer satisfaction and loyalty with knowledge on this topic from other participants in the value network. Conclusions from such research can significantly affect the undertaking of actions eliminating any gaps in the customer satisfaction and loyalty.

The purpose of this article is to explore the differences between members of the e-commerce value network in the perception of customer preferences towards logistics value as well satisfaction and loyalty of customers. The research used a discriminatory analysis allowing identification of the assessed elements (i.e. logistics value, satisfaction and loyalty) as the most diversifying stakeholders in terms of their role in the value network.

2. Literature Review and Theoretical Framework

2.1. Logistics as a value

A value is a core concept of marketing and strategic management. It is worth to remember that its theoretical roots lie in economics. Worth and price were explained by representatives of the classic school of economics, such as A. Smith and D. Ricardo, who formulated the methodical approach to value. They incorporated customer utility into the value definition and the value creation parameters, such as capital inputs, technologies, labour costs, esteem value and relative shortages. In general meaning, a "value can be defined as an evaluation of the utility of a product understood as a relationship between what has been received and what has been given – value represents a compromise between what can be obtained and what should be given" (Kawa & Światowiec-Szczepańska, 2019). Moreover, value in management is referred to the customer and it is named a value for the customer (Kotler, 1994).

One of the key factors of value in e-commerce is logistics. It is to provide the right product, at the expected time, cost, in the right quantity, condition, location, and to the right customer. Thanks to its processes and tools, the promise of fulfilling the order can be realized. Logistics is undoubtedly an important area of activity for e-commerce companies – apart from supporting the processes of managing the flow of goods, it fulfills the function of integrating and interconnecting the separate business entities. Logistics spans the boundaries between goods suppliers, service providers, and customers (Stank, Goldsby, Vickery, & Savitskie, 2003). Researchers understand value for customer in terms of logistics in quite a similar way. Very often, logistics value refers to the reduction of lead time and business costs, and improvement of flexibility, responsiveness and reliability of shipping services (Lee & Song, 2010). The level of service performance should be based on an accurate assessment of what the customer truly values. Understanding the consumer perception of service quality is a critical issue that will provide valuable information for sellers to understand and retain their existing consumer base. Customers' perceptions are formed on the basis of their experience of the services received from an organization. It is believed that customers' perception and expectations are strongly related concepts as to how customers recognize service quality. The unstable e-market conditions may justify the necessity to analyze customer preferences and evaluate future behavior (Christopher, 2000; Bakker, Zheng, Knight, & Harland, 2008).

2.2. Network value in e-commerce

The issue of the value network has been the subject of research for many years. Broadly speaking, value network is a set of cooperating entities in order to produce specific items, sell them and consequently create a specific benefit (Lusch, Vargo, & Tanniru 2010). Value network entities include not only enterprises (online sellers, and their suppliers), but also customers which are be almost any individual or business person. The sellers are mostly online retailers (e-tailers) which have Internet shops

or sell products or services on marketplaces, auction platforms , etc. The term "supplier" is broadly understood here and includes both providers of products (goods and services) sold through the electronic channel and other entities offering complementary services, e.g. financial and logistics services, IT solutions, price comparison services. The latter are named as complementors (Kawa & Światowiec-Szczepańska, 2019). Today, the biggest challenge is a creation of value network in which apart from the particular interests of individual network participants, the customer's preferences and expectations are taken into account, as well as his or her willingness to incur costs in return for the benefits obtained (Kawa & Światowiec-Szczepańska 2018).

2.3. Satisfaction and loyalty

According to Olivier (1999), satisfaction is treated as a response to the customer's fulfillment which is not simply about the extent of being pleased, but it is a process, as well (Nisar & Prabhakar, 2017). Kotler (1994) claims that satisfaction is the degree to which the experience of the product meets the customer's expectations.

Next, loyalty can be defined as the customer's eagerness to buy the product of a specific brand or to use a service once again. It obviously translates into repeatability of purchases, regardless of the marketing efforts to promote rival brands (Olivier, 1999). In such a case, the customer will still want to buy a given product or services even if those offered by other providers appear more competitive. The customer's trust in that company is, then, determined by loyalty and is mainly noticeable as the customer's emotional attachment to a given entity and willingness to maintain this special type of ties.

Both of these constructs, i.e. satisfaction and loyalty are frequently and deeply discussed in the literature on various industries. The dynamic growth of e-commerce has caused researchers to o study satisfaction and loyalty in the Internet, in particular the mutual impact of both of them. In fact, most studies show that satisfaction has a positive effect on loyalty (Cyr, 2008) or repurchase intention (Kwon & Lennon 2008). Furthermore,, researchers have observed a positive relation between satisfaction and customer spending when higher satisfaction leads to more spending in e-commerce (Nisar & Prabhakar, 2017).

The process of value co-creation for customers entails the formation of shared goals and values, which should coincide with customer preferences and be responsive to their perceptions. Thus, a successful value network should be seen by all the members' aligned perception of it. The key determinants of a well-functioning value network are proper understanding of customers' preferences and a consistent assessment of their satisfaction and loyalty. The idea of the value network in e-commerce as a scope of our research is presented in Figure 01.
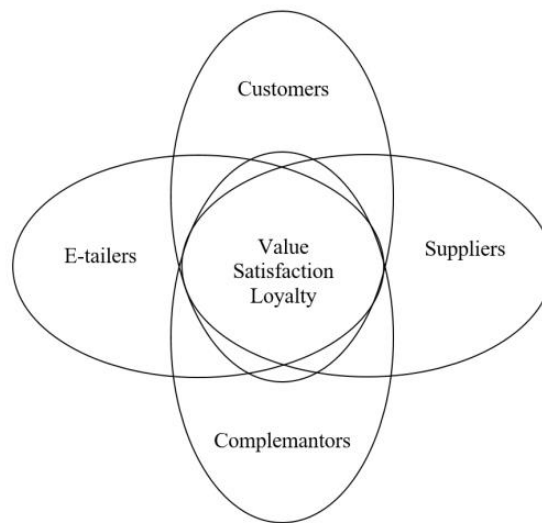
Figure 01. E-commerce value network – the scope of research

3. Research Method

3.1. Data collection and sample

The assumption behind the research was that the respondent (representing retailers, customers suppliers, complementors and) was to look at the value from the viewpoint of the final customer, no matter what their role in e-commerce was. This attitude was adopted because the value network is built around its customers. The customer is the core of the e-commerce system and it is the customer who finally assesses the value (Kawa & Światowiec-Szczepańska, 2018). Computer-assisted telephone interview was chosen as the technique of information collection in the research, preceded by focus group interviews. The qualitative methods were used for an initial analysis of the issue of value creation, in order to provide information necessary for the right organization of the research by the quantitative method, including, first and foremost, the development of a measuring instrument.The study was conducted from November 2017 to May 2018 by an external agency. A total of 800 correctly filled questionnaires was obtained (200 records in each group – retailers, customers, , suppliers, and complementors) (Kawa & Światowiec-Szczepańska, 2019).

3.2. Measurements

On the basis of the theoretical considerations, 7 corresponding measures were distinguished in the study; namely, Packaging, Delivery monitoring, Time and flexibility of delivery, Convenience of return, Convenient place of delivery (all referring to the logistic value) as well as Satisfaction and Loyalty. Because relationship related variables were latent, a multi-item scale approach was adopted in this research in order to increase item reliability. All items for measuring the variables of interest found in the literature were applied. A five-point Likert-type scale was used by the respondents to indicate the extent to which they agreed with a given statement. For each of the constructs the scale was as follows: 1 = strongly disagree to 5 = strongly agree. The results were then verified in terms of quality with the use of validity and reliability measures (Cronbach's alpha coefficients of all constructs were higher than 0.76).

3.3. Multiple discriminant analysis

Given our interest in exploring the dimensions of logistics value contributing to differences in perception between value network participants as well as those in perceived satisfaction and loyalty, we deemed discriminant analysis an appropriate analytical approach. Multiple Discriminant Analysis is a multivariate technique using several variables simultaneously to classify an observation into one of several a priori groups, in this case: four groups of e-commerce value network participants. This is done by the statistical decision rule of maximizing the between-group variance relative to the within-group variance, and is expressed as the ratio of the between-group to the within-group variance. Discriminant analysis is preferred because it has an advantage over the t-test in that it compares two groups in terms of group centroids, thereby taking into account the interactions between the individual variables. Discriminant analysis is useful when the researcher is interested either in understanding group differences or in classifying objects into groups. The technique is most appropriate in situations with a single categorial dependent variable and several metrically scaled independent variables. Given the purpose of the research, we considered discriminant analysis as a type of profile analysis, which provides an objective assessment of the differences between groups on a set of independent variables (in this situation discriminant analysis is similar to multivariate analysis of variance; about differences see: Hair, Black, Babin, & Anderson, 2010, p. 446). The discriminant model is developed by applying a simultaneous procedure in SPSS to the 800 respondents included in the sample. The independent variables are the five logistics value scales with high inter-item reliability (Packaging, Delivery monitoring, Time and flexibility of delivery, Convenience of return, Convenient place of delivery), as well as Loyalty and Satisfaction. The dependent variable is the type of role in the e-commerce chain supply (e-tailer, supply, complementor, customer). All calculations and the analysis in this study were done with IBM SPSS Statistics version 25.

4. Findings

Table 01 shows the correlations between the independent variables. The largest correlation rates ($r > 0.5$) were demonstrated by the following pairs: convenient place of delivery and packaging as well as loyalty and satisfaction.

Table 01. Correlation matrix

	Variables	1	2	3	4	5	6
1.	Packaging	-					
2.	Delivery monitoring	0.236					
3.	Time and flexibility of delivery	0.356	0.464				
4.	Convenience of return	0.476	0.408	0.449			
5.	Convenient place of delivery	0.505	0.303	0.478	0.378		
6.	Satisfaction	0.183	0.172	0.231	0.233	0.155	
7.	Loyalty	0.285	0.084	0.174	0.224	0.159	0.522

The typical measures of significance for the differences across groups is Wilks' lambda and *F* test. Table 02 provides the group means and the test of equality for each independent variable. Despite the relatively high value of the Wilks' lambda measures (the smaller the Wilks' lambda, the more important

the independent variable to the discriminant function), all the variables display significant differences between the group means.

Table 02. Group Descriptive Statistics and Test of Equality

Independent Variables	Dependent Variable Group Means				Test of Equality of Group Meansa		
	Custome rs	E-tailers	Supplie rs	Comple-mentors	Wilks' Lambda	F value	P
X2 Packaging	3.451	3.406	3.759	3.416	0.959	11.243	<0.001
X3 Delivery monitoring	4.170	3.939	4.037	3.879	0.971	7.835	<0.001
X4 Time and flexibility of delivery	3.633	3.780	3.951	3.614	0.952	13.517	<0.001
X5 Convenience of return	3.813	3.707	3.918	3.396	0.933	18.914	<0.001
X6 Convenient place of delivery	3.367	3.497	3.897	3.257	0.921	22.741	<0.001
X7 Satisfaction	4.061	3.420	4.003	4.119	0.829	54.895	<0.001
X8 Loyalty	3.177	2.963	3.885	3.862	0.818	58.840	<0.001

ª Wilks' lambda and univariate F ratio with 3 and 796 degrees of freedom.

Because the grouping variable divides the participants of the value network into four groups, the discriminant analysis distinguishes between three discriminatory functions. This means that the location of each respondent is determined on the basis of three discriminatory results. Table 03 presents the eigenvalue and canonical correlation, which determine how much in percentage terms the Discriminant Function explains the discrimination between the groups. The larger the eigenvalue, the better the discriminating power of the function. We can achieve this by increasing the canonical correlation to its squared value. Thus, r^2 for function $1 = (0.477)^2 = 0.227$, for function $2 = (0.424)^2 = 0.179$ and for function $3 = (0.278)^2 = 0.077$, respectively. This means that function 1 and function 2 explained 22.75%, 17.98%, respectively, and function 3 only 7.73% of the discrimination between the groups. The Wilk's Lambda value and the Chi-Square value are also assessed to determine discriminating power. Wilk's Lambda is used to measure the differences between groups and the homogeneity within groups. A low Wilk's Lambda and a large Chi-Square with a significant p-value will indicate good discriminating power of the discriminant function. Table 03 shows that all the discriminant functions are statistically significant.

Table 03. Eigenvalues, Canonical Correlation and Wilks' Lambda Test

Eigenvalues				
Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	0.294	49.2	49.2	0.477
2	0.220	36.8	86	0.424
3	0.084	14	100	0.278
Wilks' Lambda				
Test of Function(s)	Wilks' Lambda	Chi-square	df	p
1 through 3	0.584	426.172	21	p < 0.001
2 through 3	0.757	221.4	12	p < 0.001
3	0.923	63.742	5	p < 0.001

The relative contribution of a variable to each discriminant function is represented by discriminant loadings (i.e. correlations of each variable within each discriminant function). Variables with high valued loadings (more than 0.40) play a significant role in the Discriminant Analysis. Additionally, when more than one discriminant function is derived, the measure useful in describing the contributions of variables across all significant functions is Potency Index. It indicates the discriminating power of each variable. Table 04 provides the discriminant loadings and calculations of the Potency Index for the variables in our research.

Table 04. Potency Indices for Three Group Discriminant Analysis

Independent variables	Discriminant Loading			Potency Value			Potency Index
	1	2	3	1	2	3	
X_8 Loyalty	0,734*	0,513	0,247	0,265	0,097	0,009	0,370
X_7 Satisfaction	0,774*	-0,229	0,474	0,295	0,019	0,032	0,345
X_6 Convenient place of delivery	-0,107	0,410	0,736*	0,006	0,062	0,076	0,144
X_5 Convenience of return	-0,211	0,024	0,833*	0,022	0,000	0,097	0,120
X_4 Time and flexibility of delivery	-0,124	0,364	0,454*	0,008	0,049	0,029	0,085
X_2 Packaging	0,070	0,253	0,567*	0,002	0,024	0,045	0,071
X_3 Delivery monitoring	-0,036	-0,220	0,470*	0,001	0,018	0,031	0,049

* Largest absolute correlation between each variable and any discriminant function

Comparing the variables on their potency index reveals that the independent variable Loyalty shows the greatest discrimination between the four types of role in e-commerce value network. It is followed in impact by Satisfaction. Within the logistic value, the variables with the highest discriminative power are Convenient place of delivery and Convenience of return. Much smaller differences in individual groups are displayed by Time and flexibility of delivery, Packaging and Delivery monitoring.

The final step of assessing the overall model fit is to determine the predictive accuracy level of the discriminant functions. The determination is accomplished by examining the classification matrices and the percentage correctly classified (i.e. hit ratio) in each sample. Table 05 shows that three discriminant functions in combination achieve 51.8 % of the classification accuracy. The hit ratio must be compared with the chance classification. In our research, the sample sizes of the 4 groups are equal (N=200; k=4), thus the chance probability is 25 percent. The classification accuracy should be at least one-fourth greater than that achieved by chance (Hair, Black, Babin, & Anderson, 2010, p. 367). In our case, the threshold value for the classification accuracy is 31.25 percent (25% × 1.25), much below the hit ratio (51.8%).

Table 05. Classification Results

	Role type in e-commerce value network	Predicted Group Membership				Total
		Customers	E-tailers	Suppliers	Comple-mentors	
Count	Customers	75	41	41	43	200
	E-tailers	31	123	24	22	200
	Suppliers	21	40	98	41	200
	Complementors	27	29	26	118	200
%	Customers	37,5	20,5	20,5	21,5	100
	E-tailers	15,5	61,5	12	11	100
	Suppliers	10,5	20	49	20,5	100
	Complementors	13,5	14,5	13	59	100

The visualization of the four-group model: customers, e-tailers, suppliers and complementors is shown in Figure 02. The most important element is the position of the group centroids relative to the coordinates representing the first and second functions. The observations concerning the corresponding groups concentrate around the most typical points for a given group. The graph indicates a significant range of the area common to all groups. Nevertheless, there are significant differences between the group centroids and the distribution of the observations behind them. According to the classification results (Table 05), the most homogeneous group is e-tailers, while the least homogenous one embraces clients.
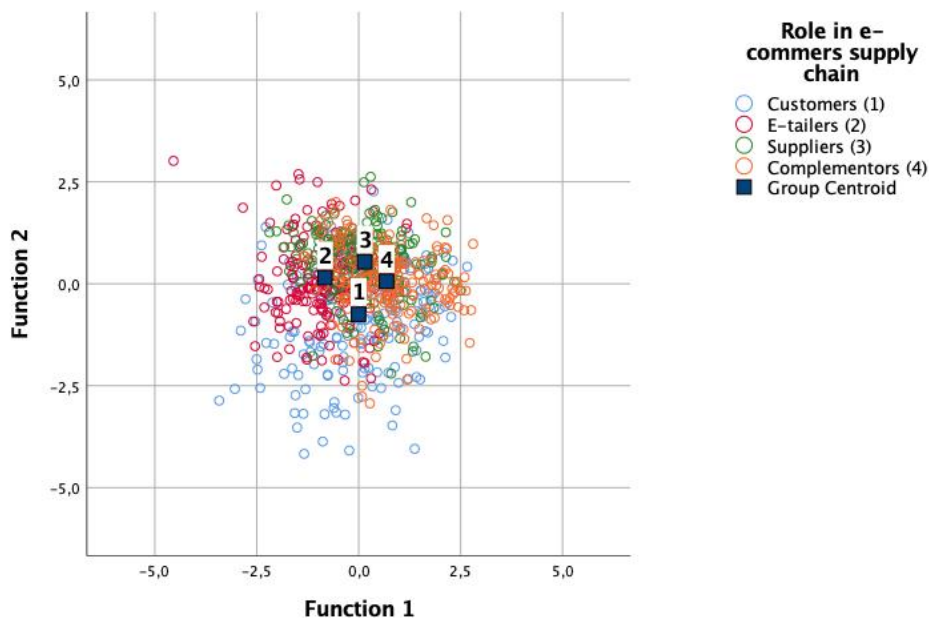

Figure 02. Observation Values on Canonical Discriminant Functions

The final measure of the classification accuracy is Press's Q. It tests the statistical significance in such a way that the classification accuracy is better than chance.

$$Press's\ Q = \frac{[N - (nK)]^2}{N(K - 1)} = \frac{[800 - (426 \times 4)]^2}{800(4 - 1)} = 340.5$$

The critical value at a significance level of 0.01 is 6.63. Thus, the predictions are significantly better than chance.

5. Discussion and Conclusions

The aim of these studies was to determine the relationship between perceived preferred logistic value, customer satisfaction and loyalty and the role of the stakeholder in e-commerce supply management. To test this relationship, a discriminant analysis was performed to establish whether differences in perceptions exist between e-commerce value network stakeholder groups.

The analysis produced several major findings. First, there are three dimensions of discrimination between stakeholders in e-commerce value network. The first dimension is typified by very high perceptions of customer satisfaction and loyalty. The second dimension is characterized by relatively high loyalty and score of convenient place of delivery along with time and flexibility of delivery. The last

dimension is distinguished by extremely high assessment of convenience of return, convenient place of delivery, along with other dimensions of logistics value (i.e. packaging and delivery monitoring). Profiling the four groups on these dimensions and variables associated with each dimension enables to understand the perceptual differences among them. In terms of logistics value, customers averagely have the highest requirements for delivery monitoring and convenience of return. They show the lowest preferences towards packaging. Interestingly, monitoring of delivery is rated by customers at the highest level compared to the rest of the groups. This may suggest that it is the element of logistics value underestimated by other members of the e-commerce value network.

Customers generally show relatively high satisfaction with their on-line shopping. Only according to the complementors, customer satisfaction is higher. Customers admit relatively moderate loyalty to places of purchase on the Internet. This can be confirmed by the low customer loyalty rate assessed by e-tailers. In turn, suppliers and complementors assess customers' loyalty at a higher and comparable level. E-tailers indicate the highest customer preferences for delivery monitoring along with time and flexibilty of delivery. Still, their monitoring assessment is lower than that made by the customers. In addition, e-tailers assess customers' preferences for returns and packaging at a lower level than customers.

Both in the case of customer satisfaction and loyalty, e-tailers' feelings are the lowest in the entire e-commerce value network. This result may indicate high competitiveness of the marketplace and great difficulties in tying customers to on-line stores. Other value network stakeholders: suppliers and complementors assess customer satisfaction and loyalty at a relatively high level. E-customers' loyalty perceived by them is, however, much higher than the customers themselves indicate. In addition, the suppliers and the complementors underestimate the need for monitoring the delivery; the same is true for the complementors and such aspects of the logistics services as convenience of returns or convenience of the place of delivery.

The research conducted indicates that there is no perfect understanding of clients' preferences towards the level of logistics value, nor customer satisfaction and loyalty in the entire value network of e-commerce. The research allowed to confirm significant differences between particular groups of value network members in the analyzed industry. The statistical analysis carried out confirmed differences in the perception of customer preferences in all variables that create logistics value, but with varying intensity. The greatest determinant of the differences was Convenient place of delivery and Convenience of return. Such elements of logistics value as: Time and flexibility of delivery and Delivery monitoring have much lower discriminating power. The problem of packaging is almost identical to the chain's participants. However, it should be noted that the differences between the groups are not equal.

An equally interesting observation seems to be significant differences in perception - exceeding those related to the logistics services - of customer satisfaction and loyalty. In the case of satisfaction, the greatest distance is observed between the retailers and the complementors. The first group assesses satisfaction lower than the group of clients, while the second group evaluates it significantly higher

Acknowledgements

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