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Assessment of Customer Satisfaction with Postal Services – a Statistical Approach

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Abstract: *In this paper the objective is to seek and measure the level of customer satisfaction and services rendered in the postal industry through the chosen methodology. The question of assessment of customer satisfaction with postal services is treated using discriminant analysis as a statistical approach. It has been proven that by applying discriminant analysis it is possible to separate users and not users, as well as to determine which parameters are crucial for discrimination groups. The paper proves that is possible to separate, using Fisher's linear discriminant analysis, respondents who are classified as loyal users and respondents who are classified as occasional users, as well as respondents who are classified as potential users and respondents who belong to the group of those who never use postal services. Also, it has been proven that is possible, using predictive Fisher's linear discriminant analysis, to classify new respondents into one of the mentioned groups.*

Keywords: Postal services; Management; Customers; Satisfaction; Discriminant analysis

JEL Classification: C44, L87, R49

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Introduction

Services have become an integral part of human existence and they are one of the important components of living standards. The service is produced and provided to meet the needs of non-producers. The provision of the service cannot usually be separated in space or time, services are usually consumed at the time and place where they are produced which results from their intangibility. When providing services, live work is needed above all, and the results of this work are consumed in the provision.

The growth of services over the past decade has been remarkable. Services are increasingly attracting attention of many authors. Nowadays in a competitive service environment people who have the role of marketer in businesses are seeking customer satisfaction to create and improve relationships between businesses and new or existing customers (Webster and Sundaram, 2009). Customers are seen as the basis of a company's profitability (Pishgar et al., 2013). Service quality has become a key marketing tool for achieving competitive differentiation and fostering customer satisfaction and loyalty.

Kotler and Keller (2016), as well as numerous marketing experts, state that successful, modern companies in the era of globalization and consumerism should build their strategies based on marketing and business orientation. That is, in such a way that a quality offer implies matching the company's offer and capabilities with the user's requirements, and not the other way around. They suggest ways that marketers can implement to help their companies increase of business volumes and revenues and state that in the age of consumerism, it is necessary to conduct your marketing activities proactively. This type of marketing requires constant examination and analysis of the market to identify new customer needs and satisfy those needs.

There are several theoretical approaches to measuring customer satisfaction, including, for example, the differential model of customer satisfaction, the model of possible reactions, the Kano model, model GAP 5, and others. New and new recommendations and procedures are constantly being created around the world and go into absolute detail on the issue of achieving customer satisfaction. A small number of scholarly researches to date have been carried out to classify quality elements and complete features of services and their associations with customer satisfaction (Zeithaml et. Al., 2002; Yang and Fang 2004). One of the more generally used tools for measuring customer satisfaction is SERVQUAL extended by Parasuraman et al. (1988). Researchers have concentrated more on the close relationship between service quality and customer satisfaction (Bitner et al., 1990; Parasuraman et al., 1985; Parasuraman et al., 1988).

Quality is a concept that probably has the most different definitions that can be accepted as correct. The meaning and scope of this term have changed and expanded over the years. Stuart (1969) says that there is no single definition of quality, i.e. that

quality represents the feeling that something is better than something else. It changes during human life and depends on many aspects of human nature. Crosby (1989) defines it as compliance with requirements. Feigenbaum (1999) says that he represents the desire of customers. Juran (1979) says that quality is suitability for purpose and use. According to the ISO standard, quality is defined as the sum of characteristics of an entity that makes it possible to satisfy stated or unspecified needs. Regardless of the adopted definition, it can be concluded that the quality of a product or service represents a set of characteristics aimed at satisfying the expectations, needs, and demands of clients.

The perception of services is strongly influenced by their quality. What is the quality of service? The most popular characteristics generally indicate that it can be defined as a set of service features that meet customer needs (Urban, 2013). Concerning the characteristics of services (diversity, immateriality, service enterprise-customer interaction), the needs and expectations of customers are key aspects of service quality (Bielawa, 2011). Given the information provided, improving the quality of services that will allow meeting the changing needs of customers is a prerequisite and basis for enabling service enterprises to operate in a competitive market (Dziadkowiec, 2007).

The literature distinguishes several different classifications of service quality criteria. Kowalik (2020) states that worth mentioning is the classification of the SERVQUAL (research instrument for measuring service quality) which groups quality factors into five sets: features of tangibles, reliability, assurance, responsiveness, and empathy. Also states that many modern classifications derive from the definition of Gronroos (1988), according to which the quality of services can have a technical dimension (tech-quality) - which concerns the effect of the service process, and functional (touch-quality) - concerning the course of the service provision process.

Similarly, in this paper, through conducted survey the respondents evaluated their satisfaction with postal services. The evaluation of the service was performed through different types of attributes, and the research included users as well as not users. The main hypothesis of this paper is determining the presence of significant differences in the respondents' answers and is it possible to make a separation, using Fisher's linear discriminant analysis, between respondents who are users of postal services and those who are not, as well as to determine which parameters (variables) are crucial for discrimination and customer satisfaction. The respondents were individuals from the territory of the Republic of Serbia, with a sample of 800 respondents. The contribution of the research presented in this paper is the combination of respondents' responses and discriminant analysis, to obtain a group of users of postal services and a group that does not use postal services. Through discriminant analysis, it would be possible to more precisely distinguish the service attributes that create the greatest separation between groups and to clearly classification of users into groups. This leads to the number of users and those who are not, with the cor-

responding subgroups. In the Republic of Serbia every two years the answers of the respondents could be used for analysis by regulatory authority and for analysis by discriminant analysis. The result would be monitoring changes in user satisfaction from two independent sources and monitoring changes in the number of users by defined groups. This information is important to the postal operator to undertake marketing and business ventures for better positioning in the market and gaining more users. Discriminant analysis served as a tool that a proactive marketer can use to examine and analyze the postal services market, from the customer's point of view. In this research, application of discriminant analysis separated loyal (permanent) users, occasional users, respondents who used postal services but did not do so in the last year (potential users), and respondents who do not use postal services (i.e. did not use them in the last year). After discriminating respondents into the groups, how potential users would be allocated was shown.

The paper is presented in seven sections. In the first section, the basic principles of the paper were presented. The second section of the paper presents the nature and characteristics of postal services as subject of conducted research. The third section provides the basic characteristics of discriminant analysis and a literature review of the application of discriminant analysis in traffic and transport. The fourth section of the paper contains the results of a survey that included 800 respondents. As part of the third section, the quality attributes evaluated by the respondents are shown. These attributes were selected based on the systematization of literature by experts in this field, the field of postal traffic. This way of selecting attributes ensures the validity of the questionnaire. The reliability of the research is ensured by Cronbach's coefficient α. In the fifth section, the problem is formulated and presented in several stages. Models based on discriminant analysis were developed to solve the mentioned problem, the discrimination of respondents into groups was carried out and the procedure of allocation of new respondents was presented. In the sixth section, the research discussion is presented, with a special reference to the previously developed alternative approach to the discrimination of respondents. In the seventh section general conclusions are formulated.

The Key Parameters of Quality of Postal Services

The quality of postal services is an issue worthy of interest. The postal service market has been dynamically changing. National trends coincide with the trends of global postal markets. In recent years, the number of traditional letters has been regularly decreasing with the simultaneous increase in the number of parcels and the increase in the popularity of courier parcels (Kowalik, 2019). Also, high requirements in terms of flexibility and adaptability to user requirements increase the cost of postal infrastructure. Postal traffic is a business area in which a complete ''door-to-door''

and ''just-in-time'' service is provided, which is a rather demanding and expensive process. It is necessary to adjust the business strategy of postal operators in a way to maximize the efficiency and productivity of work in the current conditions. Also, the offer should be marketed in a way that recognizes and meets the needs of the environment in which the operator operates.

The most important requirement of postal customers for the services provided is their quality. Quality is an important aspect that has come to the attention of postal service providers a long time ago. The quality of postal services serves as a basic tool for the postal company to maintain and increase competitiveness in the market (Rostasova et al. 2020). Quality is expressed as the conformity of correctly defined requirements that satisfy customer needs. The definition of the quality of postal services emphasizes the goal of quality of service, in which the needs and expectations of customers are met through a price that represents the value of the service. As with other service providers, the reasons for interest in quality issues of the postal items are defined according to several aspects.

Generally, postal services are related to the delivery of parcels, letters, and documents. Also, the postal transportation process consists following activities: collection, input sorting, transportation, output sorting, and distribution (Noordin et al., 2012) and they should be rated as high quality or not high quality.

The requirements of postal service users are constantly increasing, and if a postal operator wants to expand its services and survive, it must constantly monitor the demands of the users following their needs. To that end, it is necessary to conduct continuous research and implement the obtained information into business decisions (Pavlović et al., 2021).

The demands of users today are very high. They know exactly what they want and how much they are willing to spend on it. If the operator provides them with a service that will satisfy their needs, quality service has been achieved. From the aspect of postal services quality can be defined as the ability to recognize the demands and needs of users and to perform services within the legal framework. Postal operators are obliged to transfer and deliver the postal items in the condition in which it was collected, and to perform postal services under the conditions, in the manner, and within the deadlines.

Quality control of postal services is one of the crucial elements in the postal market. It can be done internally using company resources for that purpose and externally if it is a service that has a monopoly status on the market, and it is of state interest. To achieve this undertaking, it is necessary to determine adequate factors which contribute to the overall quality of service for users (considered from the user's point of view), as well as the performance of the network, i.e. its ability to ensure the realization of the service on the predetermined way. From the user's point of view, the quality of postal services is defined by more parameters such as speed of transport, the convenience of providing the service, supplementary service capabilities, perfor-

mance capabilities (service availability, service preservation), etc. In the paper Lai et al. (2022) the authors investigates the antecedents of customer satisfaction with parcel locker services in last-mile logistics based on the service quality (SERVQUAL) model and logistics service quality (LSQ) model.

There are some examples of quality attributes of postal services based on the level of achieved quality is determined (Table 1).

Table 1: Quality attributes of postal services

Paper	**Quality attributes of postal services**
Kowalik (2020)	Price (price is an important quality feature of both products and services); Service delivery time; Scope of service digitization: traditional postal services, hybrid, completely digital; Multichannel; Ease of use; The location/availability of posting/pickup points; Additional services (parcel machines, home posting, applications, and many more); Contact with the postal operator; Postal operator's image; Experience with operator
Post of Serbia (2021)	The availability of the postal service; Speed and reliability of items transport; Items security; The effectiveness of resolving complaints; User satisfaction with information; Level of standardization and typification; Organizational climate and job satisfaction
Heco (2015)	Security - risk reduction, physical and financial security, guarantee; Reliability in the provision of services - fulfillment of promises, consistency in the provision of services; Affordability of prices to users of postal services; Professionalism and responsibility - willingness and availability of employees to provide a certain service; Competence - knowledge and skills, the expertise of staff who communicate with service users; Accessibility - service availability (suitable working hours, location, waiting time for service); Friendliness - kindness, respect, understanding, and cordiality; Communication with users - understandably informing users and respecting opinions; Credibility - respect; Professionalism, reputation, and trust enjoyed by the company.
Sengazani Murugesan et al. (2020)	Diversity and range of service; Intensity and depth of service; Digital and physical security; Service availability; Convenient operating time; Effectiveness of employee skill; Prompt service to customers; Employees' proper behavior; Consistently pleasing and courteous; Simplified delivery process; Structured delivery process;

Paper	Quality attributes of postal services
Sengazani Murugesan et al. (2020)	Fool-proof procedure; Adequate facilities provision; Adequate personnel provision; Comfortable HVAC provision; Equipment/physical layout; Housekeeping; The appearance of visual sign boards; Neat and professional appearance; Equal treatment; Service transcendence; Availability of service in all places; Sense of public responsibility;
Zhang (2019)	Service convenience; Service responsiveness; Service care; Service tangibility; Service economy;
Kowalik (2019)	The attractiveness of the institution; The modernity of equipment; Staff's appearance; Availability of materials; Punctuality of service delivery; Faultlessness of service delivery; Staff's help in problem-solving; Compliance with the offer; Staff's competence; Staff's politeness; Staff's trust inspiration; Ensuring security; The efficiency of service delivery; Transmission of all the information; Immediate response to requests; Individualized treatment; Willingness to help; Paying attention to customers; Customers need understanding
Rostasova et al. (2020)	Adequacy of postal fees; Opening hours during the afternoon; Opening hours during weekends; Waiting time at the compartment; Availability of post offices and mailboxes; Post office interior; Parking spots nearby; Willingness and helpfulness of employees; Identification of employees by logo; Informativeness of providing services; Security of shipment delivery; Handling of complaints and grievances; Electronic services offer

The evaluation of customer satisfaction of postal service providers consists of the application of various methods of measuring quality. Customers expect the postal provider willing to help them and to provide prompt service. Thus, postal providers are expected to be very responsive toward their customers and to be prompt in addressing their requests, queries, and complaints (Roopchund and Boojhawon, 2014). In the paper Khairunnisa et al. (2018) customer satisfaction and loyalty on customer delivered value of postal and shipping service were analyzed through causal research by Structural Equation Modeling. Each method of measuring the quality of services has its specific features, which evaluate the specific features of the provided postal service. These aspects concern: time availability, availability of contact and access points, security during the relocation process, staff expertise, affordability of postal services, waiting time at post offices, handling of complaints, and information on postal services (Diabelkova, 2013). The objective of this paper is to seek and measure the level of customer satisfaction and services rendered in the postal sector in the Republic of Serbia through the chosen methodology that the researchers consider to be effective and suitable for its application. The chosen methodology is discriminant analysis. Research has been carried out on customer satisfaction with postal services in Serbia up to now. Only a few researchers, in not very recent literature, have paid attention to the service quality of postal services in Serbia. Past studies from Serbia relate the quality of postal services, as perceived by customers, with their satisfaction with specific features of these services (Pavlović et al., 2021; Šarac et al., 2017; Lečić-Cvetković et al. (2012), Stojanović-Višić et al. (2012); Marković et al. (2011); Ratković and Pavlović (2017)). According to the author's knowledge, by analyzing the Clarivate Analytics Web of Science database, there is no evidence in the literature about the application of discriminant analysis in the process of assessing customer satisfaction with postal services.

Research on the quality of postal services in Serbia is conducted every two years by the Regulatory Authority for Electronic Communications and Postal Services. Through that survey some aspects of the universal postal service provided by the public postal operator were analyzed. The area of express services provided by other operators was also considered. A special group of questions relates to complaints regarding universal and express/courier services, as well as the impact and consequences of COVID-19 on individuals in terms of the use of postal services, e-commerce, and complaints to the regulatory authority.

Discriminant Analysis

Discriminant analysis is an important statistical instrument whose application is wide and consistent. The theoretical definition of discriminant analysis dates back to the thirties of the 20th century. It was mentioned for the first time in the paper of the Indian scientist Mahalanobis (1936) and the British scientist Fisher (1936).

The discriminant analysis deals with the problem of separating groups and allocating observations into previously defined groups. The application enables the identification of the variable that most contributed to the separation of the groups, as well as the prediction of the probability that the object will belong to one of the groups, based on the value of a set of independent variables. It is an adequate technique in cases where the dependent variable (is categorical (nominal, descriptive), and the independent variables, , , etc., are numerical. In most cases, the dependent variable consists of two groups or categories (in this paper, the group of users and the group of not users). In a rarer number of cases, it consists of several groups (in this paper, loyal users, occasional users, potential users, and respondents who never use postal services and their attraction requires radical changes and large costs). Discriminant analysis is the classification of individuals into groups according to certain criteria.

The most common case of application of this analysis involves the selection of several variables (usually two), which contribute in the best way to the separation between predefined groups. After that, Fisher's linear discrimination function is formed, the discrimination score is determined for each respondent, and the means of the discrimination scores for each group. Then the mean of the class means, i.e. pooled mean that contributes the most to the separation is determined. Based on the discrimination score and the pooled mean (cutting score) the respondents are discriminated into pre-defined groups (Lovrić et al., 2009). In the end, the results are presented graphically, on a two-dimensional graphic for the case with a smaller number of respondents or on a one-dimensional graphic for the case of a large number of respondents for better visibility of the results.

The application of discriminant analysis can have a dual purpose, so a distinction can be made between descriptive (canonical) discriminant analysis and predictive (linear) discriminant analysis. Descriptive (canonical) discriminant analysis is used to determine whether there is a difference between two or more groups concerning a set of quantitative characteristics. Therefore, in descriptive analysis, a mathematical function is defined, which, under the conditions of certain assumptions and limitations, makes the greatest possible difference between two or more populations or groups (Tenjović, 2021). This analysis is very similar to the multivariate analysis of variances (MANOVA), but in addition to answering the question of whether there are differences between groups and how big they are, it provides answers to some other questions that will be presented in the further part of the paper. Predictive or linear discrimination analysis serves to classify individuals into one of two or more well-defined groups, using mathematical rules. Classification discriminant analysis procedures minimize classification errors and they are based on maximum posterior probabilities (Tenjović, 2021). In this paper, Fisher Linear Discriminant Analysis (also called Linear Discriminant Analysis) was used for the case of two or more groups.

There are many diverse areas in which discriminant analysis was applied, and some of the papers related to the application of discriminant analysis in traffic and

transport are mentioned below. Aksoy et al. (2003) conducted a study aimed at determining whether there is a significant difference between passengers using domestic and international airline companies at Alanya Airport. Lee et al. (2005) analyze the demand for Thai railways using discriminant analysis. Saffan and Rizki (2018) use discriminant analysis to find out why railway passengers use OJEK for the realization of the first and last mile of travel. Li et al. (2020) analyzed the attitude of rail service users toward rail traffic safety. The goal of the paper by Kuljanin et al. (2015) was to determine the characteristics and behavior of passengers of traditional and low-cost airlines on competitive lines, i.e. lines on which both types of carriers provide their services.

In marketing, this analysis is used to determine factors that distinguish types of customers based on data collected in surveys. Its application is generally carried out through several sequential phases that include: formulation of the problem, identification of key attributes (variables), collection of responses from respondents, problem solving, and interpretation of results (Huberty, 1994).

Discriminant analysis is described in more detail in the papers by Johnson and Wichern (2007), Manly and Navarro Alberto (2016), Timm (2002), and Walde (2014). When the observed area is slightly narrowed, i.e. when only the postal sector is observed, there is no paper on this topic. Therefore, the further part of the paper and the application of discriminant analysis can serve as a pioneer in research of this kind.

Determining the Key Parameters and Survey Research

Information on the satisfaction of users of postal services was collected through a survey. Respondents rated the various attributes. The questions in the survey were of a closed type, and the answers are rated numerically on a Likert (Likert, 1932) scale, where the lowest number represents the worst rating for the observed attribute. This scale is used to quantify the qualitative characteristics of services and compare them. For this paper, this scale has been modified so that the answers overlap as little as possible, so instead of the usual 5 divisions, it now includes 10.

The survey also contained questions that requested the following information from users: gender, age, business status, education, and region. For this reason, the survey had a longitudinal design (that is, the survey was conducted at different geographical areas and during a certain period) and was conducted through different survey channels (besides tête-à-tête the survey was also conducted in electronic form by filling out questionnaires). The research aimed to determine how respondents perceive the quality of postal services (group of users) and what expectations (or opinions) they have (group of not users), to conclude which attributes are key when choosing the type of service and how the postal operator could direct its resources and marketing activities to retain existing and attract new users.

The research was conducted in the period from September 2022 until October 2022 throughout the Republic of Serbia. 800 respondents participated in the research.

Reliability and Validity of the Questionnaire

Bolarinwa (2015) defines reliability as the degree of repetition of data obtained by a measuring instrument, while he defines validity as the degree to which a measuring instrument measures what it is intended to measure. Emphasizes the difficulty in quantifying abstract and intangible concepts (such as postal services, as opposed to a product). To observe and measure such concepts, it is necessary to choose an adequate ''measuring instrument''. Accordingly, the most common problem when formulating such questionnaires is determining a reliable and valid measuring instrument.

Reliability is a necessary condition for validity, but it is not sufficient. A questionnaire can be reliable without being valid and vice versa. In any case, the more reliable the questionnaire, the higher the chances that it is valid. The validity of the questionnaire can be ensured in two ways, theoretically and empirically. For this paper, the first method was used, the sublimation of papers compiled by experts in the field of research (so-called face validity), as well as using a Likert scale that contains questions in the form of statements and is easy to interpret.

Cronbach's Coefficient A (Reliability of the Questionnaire)

Cronbach's alpha or coefficient α, developed by (Cronbach, 1951), measures reliability or internal consistency. Cronbach's tests are used to determine whether surveys with multiple-question Likert scales are reliable.

This coefficient α is calculated by the following formula:

$$\alpha = \frac{N * \bar{c}}{\bar{v} + (N-1) * \bar{c}}$$

where:
N is the number of questions,
$\bar{c}$ is average covariance among groups (questions),
$\bar{v}$ is average variance within the group.

Cronbach's coefficient α gives the lower limit of the reliability of the questionnaire. Also, its potentially low value may suggest that the questionnaire has a small number of questions (evaluation criteria). In the case of large values of this coefficient, there is a possibility of a high correlation between the questions, that is, it suggests that some questions may be redundant. The following Table 2 shows the values of this coefficient and how they can be interpreted.

Table 2: Values of Cronbach's coefficient α

Cronbach's α	Rating
$\alpha \geq 0,9$	Perfect
$0,9 > \alpha \geq 0,8$	Good
$0,8 > \alpha \geq 0,7$	Acceptable
$0,7 > \alpha \geq 0,6$	Questionable
$0,6 > \alpha \geq 0,5$	Bad
$0,5 > \alpha$	Unacceptable

The Application of Discriminant Analysis

Based on the received answers, a discriminant analysis was carried out for discrimination of users (separation between groups) and classification (or allocation) of potential users.

First, it is necessary to check the validity and reliability of the questionnaire because if one of these two conditions is not met, the results and conclusions obtained from the analysis could be rejected a priori.

Validity is provided theoretically, through sublimation of the attributes that experts in the field of postal traffic cite as key in assessing quality. By systematizing the mentioned attributes in Table 1, the key criteria were selected:

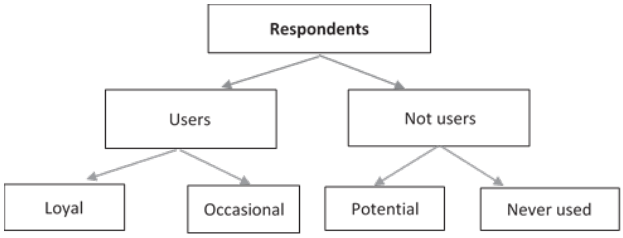
- The effective procedure of collection and delivery
- Security of transport
- Number of counters
- An acceptable price
- Speed of service provision
- Attitude towards users
- The possibility of items tracking (Track&Trace)
- Waiting time for service
- Availability and accessibility.

The reliability of the questionnaire is ensured by the method of checking the internal consistency by calculating the Cronbach coefficient α, as described in subsection *Cronbach's Coefficient α (Reliability of the Questionnaire)*. The calculated value is 0.75 and according to Table 1 this result as acceptable. After ensuring the reliability and validity of the questionnaire, the formulation of the problem is approached.

The problem is presented in several stages (Figure 1). The first represents the classification of respondents into a group of users and respondents who do not use postal services (group of not users). To solve this model, Fisher's linear discriminant analysis was used to separate the respondents into those two groups. Respondents who stated that they used postal services at least once in the last few months were classified as postal service users. All remaining respondents were classified into the second group.

The second stage includes the classification of respondents into 4 groups. That is, the category of users is divided into the subcategory of loyal users (the frequency of using postal services is at least once a week) and the subcategory of occasional users. The group of respondents who do not use postal services is further divided into the subcategories of respondents who used postal services at least once in the last year (potential users) and the group of respondents who have not used them in the last year (or never).

Figure 1: Research approach



With the model defined in this way, for the case with four groups, the results indicate that the success rate in three of the four groups is higher compared to the case when the classification was done randomly. Also, the overall success rate of correct discrimination is higher than the random classification rate in the case where the a priori classification probabilities are equal (0.25 for the case with four groups), but such results are characterized as unsatisfactory according to Kovačić (1994), i.e. they provide only slight improvements. For this reason, that model calculation is not presented in this paper.

After discriminating the respondents into groups, how potential users would be allocated is presented.

Each of the mentioned stages also contains several steps, as part of which the following is calculated:

- Which variable (attribute) has the greatest importance when allocating respondents to one of the groups;
- Percentage of error when allocating respondents into groups;
- Degree of the significance of each of the discrimination functions;
- To which of the above groups do the new 100 respondents belong?

Solving the Problem Using Discriminant Analysis for the Case with Two Groups

Due to the robustness of the data containing the responses of all respondents, the average scores for each attribute will be presented here. The analysis was conducted using the discriminant procedure in Statistical Package for the Social Sciences (SPSS).

It can be seen from the respondents' answers that the ''waiting time for service'' is the worst-rated attribute among users of postal services (Table 3). Among respondents who are not users of postal services, the worst rated attribute is ''attitude towards users''. ''Availability and accessibility'' and ''acceptable price'' are the best-evaluated attribute (criteria) by both groups of respondents.

As discriminating criteria (attributes which create the biggest separation) in this case figure the ''speed of service provision'' and ''attitude towards users''.

Table 3: Mean values of the attributes by groups (case with two groups: users and not users)

Group	The effective procedure of collection and delivery	Security of transport	Number of counters	An acceptable price	Speed of service provision	Attitude towards users	The possibility of items tracking (Track& Trace)	Waiting time for service	Availability and accessibility
Users	5.84	5.94	6.90	7.88	6.72	6.26	7.38	5.62	8.16
Not users	5.22	5.26	5.84	7.2	5.04	4.40	6.34	4.94	7.84
Difference	0.62	0.68	1.06	0.68	**1.68**	**1.86**	1.04	0.68	0.32

After the attributes that have the greatest importance in the discrimination of respondents into groups have been determined, the next step is to calculate the sample indicators. The most important indicators will be presented here.

The mean values from the group samples are:

$$\overline{X}_1 = \begin{bmatrix} 6.72 \\ 6.26 \end{bmatrix};$$

$$\overline{X}_2 = \begin{bmatrix} 5.04 \\ 4.40 \end{bmatrix};$$

Sample covariance matrices by groups:

$$S_1 = \begin{bmatrix} 4.33 & 1.21 \\ 1.21 & 4.18 \end{bmatrix};$$

$$S_2 = \begin{bmatrix} 6.30 & 1.76 \\ 1.76 & 3.81 \end{bmatrix};$$

General covariance matrix:

$$\bar{S} = \begin{bmatrix} 5.42 & 50.97 \\ 50.97 & 4.08 \end{bmatrix}$$

Fisher's linear discriminant function is as follows:

$y=0.34x_1 + 0.29x_2;$

Means of discrimination scores by groups are:

$\bar{y}_1 = 0.41;$
$\bar{y}_2 = 0.30;$

The mean of the class means (pooled mean) is:

$\mu_y = 0.35;$

After the mentioned procedure, the discrimination of users according to groups is carried out (Table 4). All attributes of the services figure in the calculation, and in this part of the analysis, only the attributes that create the greatest separation are shown. As discriminating criteria (attributes which create the biggest separation) in this case figure the ''speed of service provision'' and ''attitude towards users''. If the discrimination score is higher than the pooled mean, then observation takes ''good'', otherwise ''bad''. Due to the robustness of the data, all data and results cannot be presented in the paper.

Table 4: Mean values of the attributes by groups (the part of results)

Group	Speed of service provision	Attitude towards users	Pooled mean	Classification	Group	Speed of service provision	Attitude towards users	Pooled mean	Classification
Users	6	8	0.35	good	Not users	6	4	0.35	good
	9	10		good		3	3		good
	10	4		good		7	10		bad
	7	8		good		7	3		good
	6	3		bad		10	7		bad
	4	3		bad		7	8		bad
	4	5		bad		6	3		good
	7	7		good		4	6		good
	5	7		good		3	1		good
	7	6		good		7	2		good
	8	10		good		4	2		good
	8	6		good		6	6		bad
	2	4		bad		4	4		good
	9	6		good		7	2		good
	4	6		bad		5	6		good
	8	2		bad		6	7		bad
	10	10		good		4	5		good
	9	7		good		7	3		good
	5	6		bad		5	6		good
	7	9		good		4	5		good
	3	5		bad		2	3		good
	10	8		good		6	4		good

Group	Speed of service provision	Attitude towards users	Pooled mean	Classification	Group	Speed of service provision	Attitude towards users	Pooled mean	Classification
Users	8	9	0.35	good	Not users	8	4	0.35	bad
	8	5		good		6	4		good
	8	7		good		4	6		good
	9	5		good		7	2		good
	6	7		good		6	5		good
	7	6		good		6	4		good
	8	8		good		5	2		good
	7	7		good		5	5		good
	9	9		good		4	4		good
	1	5		bad		5	6		good
	9	8		good		8	3		bad
	7	10		good		7	3		good
	8	5		good		6	8		bad
	7	5		good		5	6		good
	5	2		bad		6	5		good
	6	4		bad		2	6		good
	9	5		good		5	3		good
	3	7		bad		4	3		good
	8	6		good		1	3		good
	6	6		good		3	4		good
	6	5		bad		2	4		good
	4	8		good		4	4		good
	6	7		good		1	2		good
	6	8		good		5	4		good
	7	6		good		5	7		bad
	8	6		good		2	5		good
	6	5		good		5	5		good
	6	2		bad		5	3		good
	...	...		...		...	...		...

Classification of Respondents into the Group of Users or into the Group of Respondents Who Do Not Use Postal Services

To determine the classification success rate, a confusion matrix is defined that shows the number of correctly and incorrectly classified observations by a group. In this case, a confusion matrix is formed for the case with two groups (Table 5). The elements on the main diagonal represent the number of observations that were correctly allocated, while the off-diagonal elements represent the number of observations that were incorrectly allocated. In the literature, this term is also known as the hit ratio. The hit ratio gives the correctly classified observations divided by the number of observations.

Table 5: Confusion matrix

		True class membership	
		Users	Not users
Predicted class membership	Users	250	100
	Not users	150	300
Sample size		400	400

Assessing group membership prediction accuracy – hit ratio (HR):

$$HR = \frac{150+100}{400+400} = 0.31;$$

That is, the overall allocation success rate is:

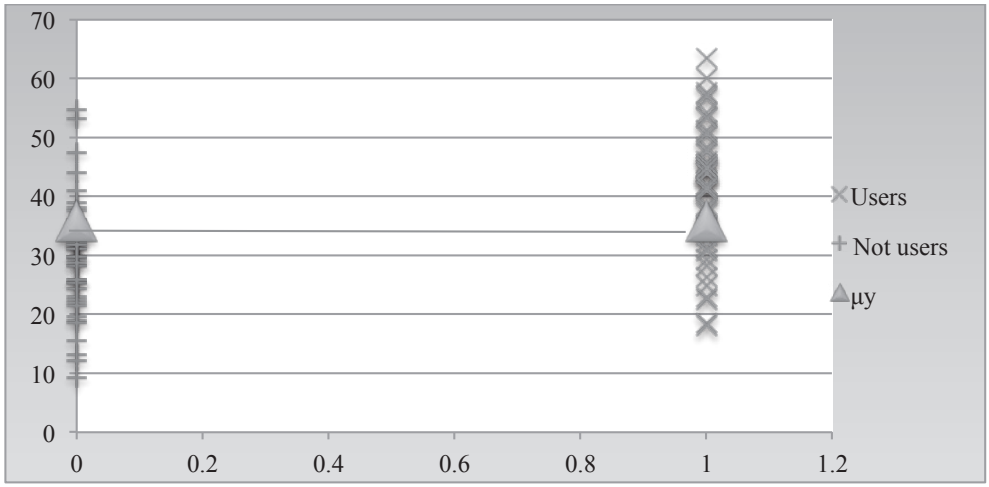
$$OASR = 1 - HR = 1 - 0.31 = 0.69.$$

As in the discrimination of respondents in two groups with equal observations, the observations can be randomly allocated to one of the groups with equal probability, this means that in the case of classification, randomly, the error rate would be 50%.

As the error rate of 69% (overall allocation success rate) was obtained using Fisher's classification procedure, it can be concluded that the used observations classification procedure is a good tool for their reliable allocation by groups. That is, according to the answers received in the survey, it is possible to make a clear distinction between respondents who declared themselves as users of postal services and those who were not.

The following graph shows the allocation between these two groups (Figure 2). To make it easier to see the allocated respondents, their discrimination scores are shown on a one-dimensional graphic. Users are represented in blue, respondents who are not users are in red, while the green triangle represents the mean of the class means, i.e. pooled mean μ_y. Well-allocated respondents in the group of users are all those whose discrimination score is above the pooled mean, while in the group of not users, the case is reversed (i.e., all those whose discrimination score is below the pooled mean are well-allocated).

Figure 2: Allocation of respondents in the case with two groups



An Alternative Approach to Group Separation

In an alternative group separation procedure, instead of separation being done all at once, it will be done iteratively. The procedure is carried out analogously to the procedure in the presented case for two groups. After the respondents have been classified into the initial two groups, the variable that makes the biggest difference between the subgroups in each of the groups is determined.

In this stage, the respondents were classified into 4 groups. The previously exposed category of users was additionally divided according to the frequency of using the postal services into occasional and loyal users. The category of respondents who are not users is also divided into a subgroup that has used the postal services at least once in the last year and a subgroup that has not.

Solving the Problem Using Discriminant Analysis with an Alternative Approach

As a discriminating criterion (attributes) for the group of users' figure ''security of transport'' and the ''waiting time for service'', i.e. these two factors make the biggest difference in the formation of subgroups of loyal and occasional users (Table 6).

Table 6: Mean values of the attributes by groups (users: loyal and occasional)

Group	The effective procedure of collection and delivery	Security of transport	Number of counters	An acceptable price	Speed of service provision	Attitude towards users	The possibility of items tracking (Track& Trace)	Waiting time for service	Availability and accessibility
Occasional	5.86	5.51	6.70	7.92	6.89	6.43	7.62	4.97	7.95
Loyal	5.77	7.15	7.46	7.77	6.23	5.77	6.69	7.46	8.77
Difference	-0.10	**1.64**	0.76	-0.15	-0.66	-0.66	-0.93	**2.49**	0.82

The discriminating factors for the group of respondents who are not users and which make the biggest differences between the subgroups the respondents who used postal services at least once in the last year and those who have not (or have never used postal services) are an ''effective procedure of collection and delivery'' and the ''number of counters'' (Table 7).

Table 7: Mean values of the attributes by groups (not users: potential and never used)

Group	The effective procedure of collection and delivery	Security of transport	Number of counters	An acceptable price	Speed of service provision	Attitude towards users	The possibility of items tracking (Track& Trace)	Waiting time for service	Availability and accessibility
Potential users	5.76	5.68	6.66	7.47	5.53	4.55	6.11	5.18	8.13
Never used	3.5	3.92	3.25	6.33	3.5	3.92	7.08	4.17	6.92
Difference	**2.26**	1.77	**3.41**	1.14	2.03	0.64	-0.98	1.02	1.21

As already mentioned, the alternative approach of classifying respondents into four groups is carried out analogously to the model from subsection *Solving the Problem Using Discriminant Analysis for the Case with Two Groups*. Therefore, the most important sample indicators for each of the groups will be presented first.

The mean values from the group samples are:

a) User group

$$\overline{X}_1 = \begin{bmatrix} 5.51 \\ 4.97 \end{bmatrix};$$

$$\overline{X}_2 = \begin{bmatrix} 7.15 \\ 7.46 \end{bmatrix};$$

b) Group of respondents who are not users

$$\overline{X}_1 = \begin{bmatrix} 5.76 \\ 6.66 \end{bmatrix};$$
$$\overline{X}_2 = \begin{bmatrix} 3.50 \\ 3.25 \end{bmatrix};$$

Sample covariance matrices by groups:

a) User group

$$S_1 = \begin{bmatrix} 1.09 & -0.01 \\ -0.01 & 1.90 \end{bmatrix};$$
$$S_2 = \begin{bmatrix} 0.68 & -0.04 \\ -0.04 & 0.59 \end{bmatrix};$$

b) Group of respondents who are not users

$$S_1 = \begin{bmatrix} 1.10 & 0.13 \\ 0.13 & 4.35 \end{bmatrix};$$
$$S_2 = \begin{bmatrix} 1.87 & 1.53 \\ 1.53 & 2.82 \end{bmatrix};$$

General covariance matrix:

a) User group

$$\bar{S} = \begin{bmatrix} 1.02 & -0.01 \\ -0.01 & 1.63 \end{bmatrix};$$

b) Group of respondents who are not users

$$\bar{S} = \begin{bmatrix} 1.16 & 0.48 \\ 0.48 & 4.24 \end{bmatrix};$$

Fisher's linear discriminant function is as follows:

a) User group

$$y = -1.63x_1 - 1.55x_2;$$

b) Group of respondents who are not users

$$y = 1.69x_1 + 0.61x_2;$$

Means of discrimination scores by groups are:

a) User group

$$\bar{y}_1 = -16.66;$$
$$\bar{y}_2 = -23.18;$$

b) Group of respondents who are not users

$\bar{y}_1 = 13.86;$
$\bar{y}_2 = 7.92;$

The mean of the class means (pooled mean):

a) User group

$\mu_y = -19.92;$

b) Group of respondents who are not users

$\mu_y = 10.88;$

After the mentioned procedure, the discrimination of users according to groups is carried out. How the discrimination was carried out is shown in the following table (Table 8).

Table 8: Discrimination of respondents into groups - alternative model (the part of results)

Group	Discrimination score	Pooled mean	Classi-fication	Group	Discrimination score	Pooled mean	Classi-fication
	-17.58		good		10.92		good
	-17.50		good		18.45		good
	-23.76		bad		15.67		good
	-14.41		good		15.06		good
	-11.23		good		19.06		good
	-12.86		good		17.84		good
	-17.50		good		15.67		good
	-15.87		good		14.45		good
	-18.88		good		13.84		good
	-10.90		good		10.92		good
Occasional	-25.39	-19.92	bad	**Not users / potential**	8.27	10.88	bad
	-14.32		good		23.06		good
	-17.42		good		19.53		good
	-17.50		good		17.23		good
	-17.33		good		10.92		good
	-4.80		good		16.62		good
	-23.85		bad		10.92		good
	-17.50		good		17.84		good
	-15.87		good		13.97		good
	-18.96		good		14.45		good
	-14.24		good		11.53		good
	-17.42		good		10.92		good

Group	Discrimination score	Pooled mean	Classi-fication	Group	Discrimination score	Pooled mean	Classi-fication
	-19.04		good		16.75		good
	-17.50		good		12.61		good
	-14.32		good		16.75		good
	-14.41		good		5.36		bad
	-15.95		good		14.45		good
	-14.49		good		12.28		good
	-14.41		good		15.67		good
Occasional	-17.50		good	**Not users / potential**	5.36		bad
	-19.13		good		16.14		good
	-15.79		good		11.05		good
	-20.67		bad		13.70		good
	-22.13		bad		8.61		bad
	-11.32		good		12.89		good
	-17.58		good		12.75		good
	...	-19.92	...		11.53	10.88	good
	-22.22		good		...		...
	-22.13		good		6.58		good
	-25.48		good		10.31		good
	-25.31		good		2.92		good
	-23.85		good		5.70		good
	-23.76		good		6.31		good
Loyal	-22.13		good	**Never used**	9.22		good
	-18.96		bad		14.17		bad
	-23.93		good		9.22		good
	-25.39		good		11.05		bad
	-17.50		bad		7.39		good
	-25.31		good		4.61		good
	-25.39		good		7.53		good
	.....		.....		....		....

Classification of Respondents into the Group of Users (Loyal and Occasional) or into the Group of Respondents Who Do Not Use Postal Services (Potential or Never Used)

To determine the success of the classification, the confusion matrix is defined again, in which the number of correctly and incorrectly classified observations by a group is shown (Table 9 and Table 10). The elements on the main diagonal in both matrices represent the number of observations that were correctly allocated. All remaining (off-diagonal) elements represent the number of misallocated respondents.

Table 9: Confusion matrix (users)

		True class membership	
		Loyal	Occasional
Predicted class membership	Loyal	220	20
	Occasional	50	110
Sample size		270	130

Table 10: Confusion matrix (not users)

		True class membership	
		Potential	Never used
Predicted class membership	Potential	240	20
	Never used	40	100
Sample size		280	120

Assessing group membership prediction accuracy – hit ratio (HR):

$$HR = \frac{50+20}{270+130} = 0.18;$$
$$HR = \frac{40+20}{280+120} = 0.15;$$

That is, the overall allocation success rate is:

$$OASR = 1 - HR = 1 - 0.18 = 0.82;$$
$$OASR = 1 - HR = 1 - 0.15 = 0.85;$$

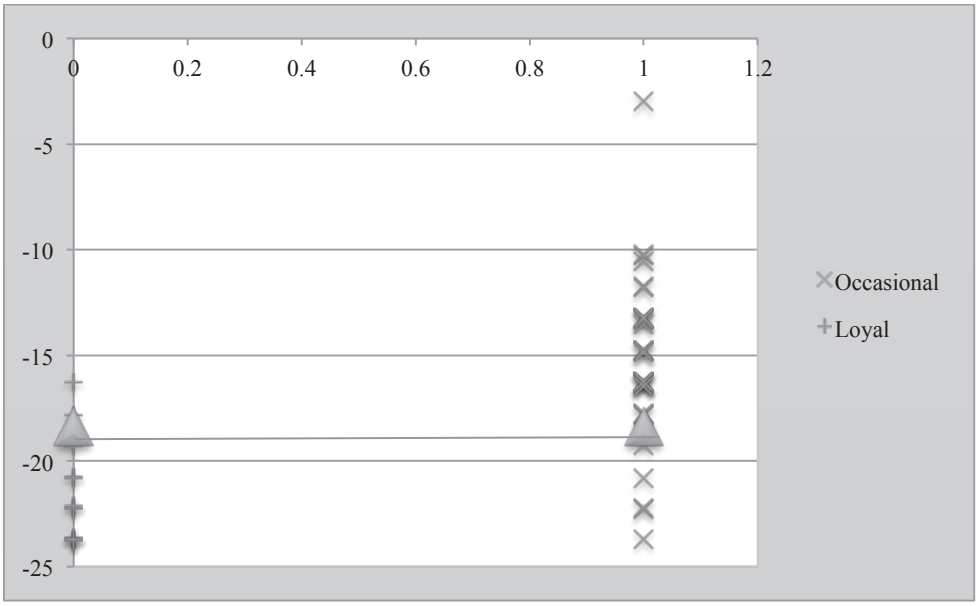
The results of the iterative procedure give very high ratings of allocation success. The success for each of the groups is 0.81 (loyal users), 0.85 (occasional users), 0.86 (potential users), and 0.83 (never used), which can be rated as excellent. When the allocation success rate by groups is multiplied by the overall grade of success of classification into two groups (0.69), the following values for the degree of classification success are obtained:

- Loyal users - 0.56;
- Occasional users - 0.59;
- Potential users - 0.59;
- They did not use (never used) - 0.57.

As in the discrimination of respondents in two groups with equal observations, the observations can be randomly allocated to one of the groups with equal probability, this means that the error rate would be 50% in the random classification. Therefore, it can be concluded that this approach to the classification of observations is a very good tool for the reliable allocation of respondents to one of the groups. That is, with this procedure, it is possible to make a clear distinction between the four mentioned groups.

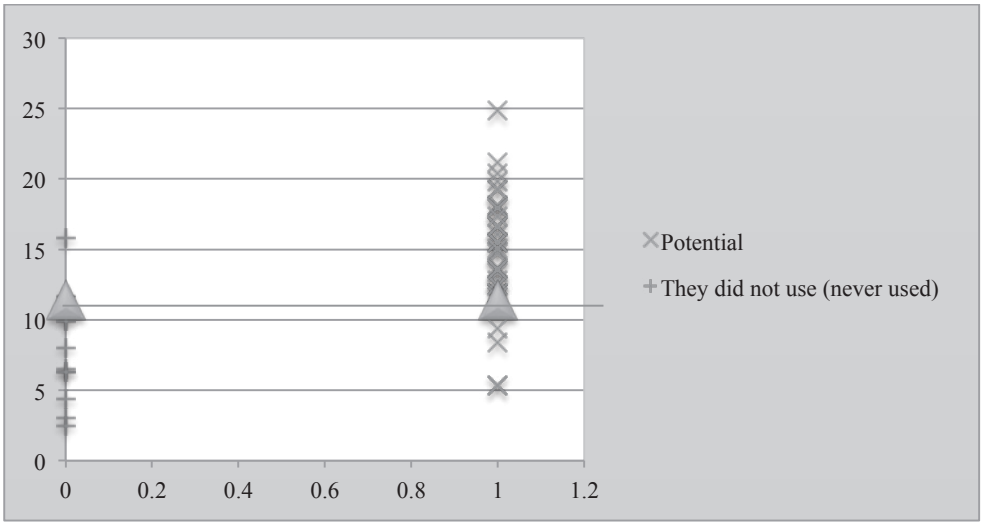
The following graphs show the allocation of respondents in the alternative procedure (Figure 3 and Figure 4). To make it easier to see the allocated respondents, their discrimination scores are shown again on a one-dimensional graphic. Well-allocated respondents on Figure 3 for the loyal group are all those whose discrimination score is lower than the pooled mean (μ_y). Well-allocated respondents for the occasional group are all those whose discrimination score is higher than the pooled mean (μ_y).

Figure 3: Allocation of respondents, alternative approach (users)



The results shown in Figure 4 lead to an identical conclusion, except that now the respondents correctly classified in the group of potential users have a discrimination score above the pooled mean. In the group of respondents who are not users and have not used postal services in the last year correctly classified respondents have a lower value of discrimination score, compared to the pooled mean.

Figure 4: Allocation of respondents, alternative approach (not users)



The Allocation of New Respondents

The allocation of new respondents was carried out through an iterative procedure. Therefore, the procedure for allocating respondents to a group of users or to a group that is not a user of postal services is presented first. Then a further breakdown was made into loyal users or occasional users, that is, into a group of potential users or a group of those who are not (they did not use).

The results based on answers are such that out of 100 new respondents 60 of them are classified in the group of users, while the remaining 40 are classified in the group of respondents who are not users of the postal service. Discrimination scores of new respondents, pooled mean, and allocation are shown in the following Table 11.

Table 11: Discrimination of new respondents into the groups

Respondent's number	Discrimination score	Pooled mean	User/not user
1.	0.54	0.36	User
2.	0.29		Not user
3.	0.42		User
4.	0.51		User
5.	0.44		User
6.	0.46		User
7.	0.28		Not user
8.	0.33		Not user
9.	0.48		User
10.	0.35		Not user
…	…		…
100	0.42		User

After the new respondents have been classified (discriminated) in the manner shown in Table 11, their allocation is carried out using an alternative model, as described in subsection *An Alternative Approach to Group Separation*. The following tables show a further breakdown into subgroups. It is noticeable that 30 respondents were recognized as loyal users, as many as occasional users. Also, 30 respondents were classified in the group of potential respondents, while 10 respondents were classified in the group of respondents who are not users of postal services and whose attraction represents expenditure for postal operator (Table 12 and Table 13).

Table 12. Discrimination of users of postal services into subgroups

Respondents' number	Discrimination score	Pooled mean	Loyal user (1)/ occasional user (2)
1.	-16.04	-19.92	2
2.	-22.30		1
3.	-22.30		1
4.	-18.96		2
5.	-15.95		2
…	…		…
60.	-22.05		1

Table 13. Discrimination of respondents who are not users into subgroups

Respondents' number	Discrimination score	Pooled mean	Potential user (1)/ those who are not (they did not use) (2)
1.	9.83	10.89	2
2.	10.92		1
3.	17.84		1
…	…		...
40.	15.06		1

The overall success rate of correct discrimination was 0.6612, i.e. 66%.

Research Discussion

In the paper, based on the answers obtained from the conducted surveys related to the use of postal services, discrimination between groups was made. This phase included several stages. First, there was discrimination against the respondents who are users of postal services and against the respondents who were not. The most influential attributes in discrimination are the ''speed of the service provision'' and the ''attitude towards the users''. Such results can serve as a signal for managers to try to increase the quality of these attributes. Also, the fact that these two attributes are discriminating is an indicator for marketing managers that there is a difference between the perceived and expected quality of these attributes and that it is necessary to direct the operator's marketing activities toward building a better position in the minds of respondents who do not use postal services. Such activities would (probably) generate new users, without significant material investments.

Then, a model with an alternative approach was developed. As part of it, Fisher's approach was used for the case with two groups. Then, when discriminating into subgroups, the attributes that most influence the separation were selected again. An analogous procedure was used to separate respondents who were recognized as respondents who were not users of postal services.

When separating the respondents who are classified as users, the key attributes are ''security of transport of postal items'' and the ''time of waiting for service''. Loyal users rate these variables significantly higher, so they can be considered very important when choosing a postal operator. The allocation success rate, in this case, is 0.81 and 0.85, respectively, while the overall success rate of correct discrimination is 0.82.

In the case of separating the group of respondents who are classified into the group of respondents who are not users, the discriminating variables are the ''effective procedure of collection and delivery'' and the ''number of counters''. The average rating of both subgroups for these variables is low, but the subgroup of respondents who

never use postal services rates these quality parameters drastically worse. The overall success rate of correct discrimination is 0.85, while the partial ones are 0.86 and 0.83.

Such high ratings of classification success indicate the need to develop an alternative model with more iterations and provide it with validity because they are drastically higher than the case when discrimination is immediately performed on all four defined groups.

In the end, the procedure of allocation of new respondents using Fisher's discrimination analysis is shown and the overall success rate of correct discrimination is 66%.

Conclusion

In modern business conditions, any postal operator is forced to behave like all other companies in other markets. This means that it is necessary to make comparisons with operators in other countries, to examine the needs, wishes, and preferences of users (and potential users) to improve business in, above all, the most important qualitative criteria. It is necessary to monitor quality criteria whose changes would generate an increase in the use of postal services, i.e. business improvement that refers to qualitative changes implemented in a way to maximize profit growth while minimizing investment. This is of particular importance for the public postal operator now, when due to the liberalization of the postal market and the abolition of monopolies, the state governments will have no obligation or opportunity to save and strengthen it with large subsidies.

By sublimating the results in this paper, it can be concluded that discriminant analysis is a useful tool in the ''hands'' of a good manager, that is, it can be of great help when making management decisions and formulating marketing strategies primarily through level of customer satisfaction. As already stated, discriminant analysis can have a dual purpose. It can be used to discriminate groups of respondents (canonical discriminant analysis), as well as to classify subsequently added respondents into one of the groups (linear discriminant analysis). In this paper, both were used, to determine the extent to which the application of discriminant analysis fulfills its goals through the main hypothesis.

The survey research collected information about respondents' attitudes regarding the quality of postal services. The longitudinal design of the survey, use of different survey channels, (theoretical) validity, and reliability check (internal consistency method) ensured satisfactory research quality.

The main hypothesis that was developed within the paper is that there are significant differences between the responses of respondents who are users of postal services and those who are not. Also, within the framework of this hypothesis it has been proven that by applying discriminant analysis it is possible to separate these two groups. The overall success rate of correct discrimination is 69%. The devel-

oped model within the main hypothesis of the paper can indicate to the management of postal operators which quality attributes should primarily be influenced, that is, incremental changes in these variables can attract respondents who are not users of postal services to become so. The obtained knowledge will influence the improvement of user satisfaction with postal services.

In addition to the main hypothesis, it should be emphasized that an alternative approach was developed in the paper, which provides a significant improvement if one wants to further differentiate respondents, according to the frequency of use of postal services, as well as according to the possibility of attracting potential users.

Also, the paper showed that by applying discriminant analysis it is possible to classify new respondents into one of two groups, as well as into one of four subgroups, with an overall success rate of correct discrimination of 66%.

Research of this kind is a necessity, and this paper can serve as a guideline for future scientific research because based on everything previously presented, it can be determined that discriminant analysis gives the desired results in market segmentation. Papers with the application of discriminant analysis in transport, and above all in the postal industry, are very rare and almost non-existent, so this paper can be considered a contribution in the mentioned field.

Declarations

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Conflicts of interest/Competing interests

There is no conflict of interest/Competing interests

Availability of data and material

The data that support the findings of this study are available on request.

Code Availability

The computer program results are shared through the tables in the manuscript.

Authors' Contributions

Mladenka Blagojević: Conceptualization, Methodology, Investigation, Data curation, Writing – original draft, Writing – review and editing, Project administration. Nikola Knežević: Conceptualization, Methodology, Investigation, Writing – original draft. Dejan Marković: Methodology.

REFERENCES

Aksoy, S., Atilgan, E., and Akinci, S. (2003). Airline services marketing by domestic and foreign firms: differences from the customers' viewpoint. Journal of Air Transport Management, Volume 9, Issue 6: 343-351, https://doi.org/10.1016/S0969-6997(03)00034-6.

Bielawa, A. (2011). Przegląd najważniejszych modeli zarządzania jakością usług [Review of the most important models of service quality management]. Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania 24; 7-23. (in Polish)

Bitner, M.J. (1990). Evaluating Service Encounters: The Effects of Physical Surroundings and Employee Responses. Journal of Marketing, 54(2): 69–82, https://doi.org/10.1177/002224299005400206

Bolarinwa, O. (2015). Principles and methods of validity and reliability testing of questionnaires used in social and health science researches. Nigerian Postgraduate Medical Journal, 22(4): 195-201, https://doi.org/10.4103/1117-1936.173959

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika 16: 297–334 https://doi.org/10.1007/BF02310555

Crosby, P. (1989). Let's talk quality, McGraw-Hill, New York.

Diabelkova, M. (2013). Prieskum spokojnosti zákazníkov Slovenskej pošty, a. s. s kvalitou poštových služieb vo vybranom meste. bakalárska práca, Žilina: Žilinská univerzita v Žiline. P. 118

Dziadkowiec, J. (2007). Model zarządzania jakością usług [Service quality management model]. Problemy Jakości, 8: 21-25. (in Polish)

Feigenbaum, A.V. (1999). The new quality for the twenty-first century, The TQM Magazine, Vol. 11 No. 6: 376-383, https://doi.org/10.1108/09544789910287656

Fisher, R. A. (1936). The use of multiple measurements in taxonomic problems. Annals of Eugenics 7(2): 179-188, https://doi.org/10.1111/j.1469-1809.1936.tb02137.x

Gronroos, C. (1988). Service Quality: The six criteria of good perceived service. Review of Business, 9(3), 10- 13.

Heco, S. (2015). Raising the quality of postal services and competitivness by adaptation to contemporary trends of eu regulations. TEC – Traffic Engineering & Communications, Vol. 1: 84-90.

Huberty, C.J. (1994). Applied discriminant analysis, Wiley-Interscience, New York

Johnson, R.A., and Wichern, D.W. (2007). Applied Multivariate Statistical Analysis, New Jersey: Pearson Education Inc.

Juran, J.M. (1979), Quality Control Handbook, Third Edition, McGraw-Hill, New York.

Khairunnisa, N., Munandar, J., and Najib, M. (2018). Customer Satisfaction and Loyalty on Customer Delivered Value of Postal and Shipping Service. International Journal of Research and Review, Vol. 5(11): 15-27.

Kotler, P., and Keller, K.L. (2016). Marketing management, 15th ed., Harlow

Kovačić, Z. (1994). Multivarijaciona analiza, Ekonomski fakultet, Beograd (in Serbian)

Kowalik, K. (2019). Quality assessment of the postal service - the chosen problems. Archives of Engineering Knowledge, VOL. 4(1): 12-14

Kowalik, K. (2020). The importance of chosen attributes of a digital postal service in shaping its quality in the opinion of customers at the age of 18-30. Journal of Education, Health and Sport, 10(7):56-65, DOI http://dx.doi.org/10.12775/JEHS.2020.10.07.005

Kuljanin, J., Paskota, M., Kalić, M. (2015). Tržište vazdušnog saobraćaja u Srbiji: nove aviokompanije – novi putnici. Tehnika – saobraćaj 62(2015): 315-323, Beograd (in Serbian)

Lai, P.L., Jang, H., Fang, M., Peng, K. (2022). Determinants of customer satisfaction with parcel locker services in last-mile logistics, The Asian Journal of Shipping and Logistics, Volume 38, Issue 1, pp. 25-30, ISSN 2092-5212, https://doi.org/10.1016/j.ajsl.2021.11.002.

Lečić-Cvetković, D., and Kostić-Stanković, M., (2012). Research of Customer Satisfaction with the Electronic Postal Services in Serbia. METALURGIA INTERNATIONAL, 17(7): 176-183.

Lee, Chi-Kang, Lin, Tzuoo-Ding, and Lin, Chao-Hui (2005). Pattern analysis on the booking curve of an inter-city railway. Journal of the Eastern Asia Society for Transportation Studies, Vol. 6: 303 – 317.

Li, H., Wang, K., Yu, K., and Zhang, A. (2020). Are conventional train passengers underserved after entry of high-speed rail?-Evidence from Chinese intercity markets. Transport Policy, Volume 95: 1-9, https://doi.org/10.1016/j.tranpol.2020.05.017.

Likert, R. (1932). A Technique for the Measurement of Attitudes. Archives of Psychology, 22 140, 55.

Lovrić, M., Stanković, M., Stamenković, M. (2009). Diskriminaciona analiza, studijsko istraživanje, Ekonomski fakultet u Kragujevcu, Univerzitet u Kragujevcu, Kragujevac (in Serbian)

Mahalanobis, P.C. (1936). On the generalised distance in statistics, National Institute of Sciences of India

Manly, B.F.J., and Navarro Alberto, J.A. (2016). Multivariate Statistical Methods - A primer (4th Edition), New York: Chapman & Hall/CRC

Marković, D., Dobrodolac, M., Blagojević, M., Čupić, A. (2011). Stavovi korisnika o post ekspres usluzi. Dvadeset deveti Simpozijum o novim tehnologijama u poštanskom i telekomunikacionom saobraćaju – PosTel 2011, str. 109 – 118, Beograd (in Serbian)

Noordin, A., Hasnan, N., and Osman, H. (2012). Service Innovation of Postal and Courier Services in Malaysia: Will It Lead to Customer Responsiveness. International Proceedings of Economics Development & Research, Vol. 42.

Parasuraman, A., Zeithaml, V.A., and Berry, L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. Journal of Retailing 64(1): 12-40.

Parasuraman, A., Zeithaml, V.A., and Berry, L.L. (1985). A conceptual model of service quality and its implications for future research. Journal of Marketing, 49(4): 41-50.

Pavlović, M., Milunović, M., Pavlović, Đ. (2021). Investicije u Pošti Srbije na osnovu marketinških pokazatelja. Oditor, Vol. VII, Br. S01: 135-160. (in Serbian)

Pishgar, F., Dezhkam, S., Ghanbarpoor, F., Shabani, N., and Ashoori, M. (2013). The impact of product innovation on customer satisfaction and customer loyalty. Arabian Journal of Business and Management Review (Oman Chapter) Vol. 2(7): 1-8.

Post of Serbia (2021). Report on the state of quality of the universal postal service (in Serbian)

Ratković, M., Pavlović, M. (2017). Komparativna analiza zadovoljstva korisnika poštanskih usluga u Srbiji, Crnoj Gori i BiH (Republika Srpska) – rezultati anketnog istraživanja. Vojno delo 3/2017, str. 317-341, DOI: 10.5937/vojdelo1703317 (in Serbian)

Roopchund, R., and Boojhawon, S. (2014). Applying the SERVQUAL Model in Postal Services: A Case Study of Mahebourg Mauritius Post Services Ltd. The International Journal Of Business & Management, Vol 2(7): 222-235.

Rostasova, M., Padourova, A., and Corejova, T. (2020). KANO model as a tool of effective customer satisfaction diagnostics of postal services. Enterpreneuship and Sustainability Issues 8(2): 811-828, http://doi.org/10.9770/jesi.2020.8.2(49)

Saffan, A.F., and Rizki, M. (2018). Exploring the Role of Online 'Ojek' In Public Transport Trips: Case of Jakarta Metropolitan Area Rail Users. IOP Conf. Series: Earth and Environmental Science 158 012024, DOI 10.1088/1755-1315/158/1/012024

Šarac, D., Unterberger, M., Jovanović, B. Kujačić, M. Trubint, N., and Ožegović, S. (2017). Postal network access and service quality: Expectation and experience in Serbia. Utilities Policy, Vol. 48: 69-75, https://doi.org/10.1016/j.jup.2017.09.004.

Sengazani Murugesan V., Sequeira A.H., Jauhar S.K., and Kumar V. (2020). Sustainable postal service design: integrating quality function deployment from the customers perspective. International Journal of System Assurance Engineering and Management 11: 494–505, https://doi.org/10.1007/s13198-019-00906-6

Stojanović-Višić, B., Simić, M., and Krivokapić, Ž. (2012). The importance of communicationof the Post of Serbia with its customers. International Journal of Economics and Law, pp. 114-119.

Stuart, J.M. (1969). Utilitarianism, in Collected Works of John Stuart Mill, Toronto, London.

Tenjović, L. (2021). Kanonička i kvazikanonička diskriminaciona analiza. Filozofski fakultet, Beograd (in Serbian)

Timm, N.H. (2002). Applied Multivariate Analysis, Springer-Verlag Inc., New York.

Urban, W. (2013). Jakość usług współtworzona z klientem- koncepcja i wyniki badań jakościowych [Quality of service co-created with the client - concept and results of qualitative research]. Polityki Europejskie. Finanse i Marketing (58); 577-587. (in Polish)

Walde, L. (2014). Discriminant anaysis, University of Innsbruck, Innsbruck

Webster, C., and Sundaram, D.S. (2009). Effect of service provider's communication style on customer satisfaction in professional services setting: the moderating role of criticality and service nature'', Journal of Services Marketing, Vol. 23(2): 103-113, DOI: 10.1108/08876040910946369

Yang, Z., and Fang, X. (2004). Online Service Quality Dimensions and Their Relationships with Satisfaction: A Content Analysis of Customer Reviews of Securities Brokerage Services. International Journal of Service Industry Management, 15: 302-326, https://doi.org/10.1108/09564230410540953

Zhang, J. (2019). An empirical study on the evaluation of Sichuan rural express service quality based on SERVQUAL. Modern Business, 8, 14–16.

Zeithaml, V., Parasuraman, A., and Malhotra, A. (2002). Service Quality Delivery Through Web Sites: A Critical Review of Extant Knowledge. Journal of the Academy of Marketing Science, volume 30, No 4: 362-375, doi: 10.1177/009207002236911