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Customer Requirements for Public Mass Transport During the COVID-19 Pandemic

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Abstract: In today's rapidly changing business environment, it is important for a company to succeed. This applies to companies that produce goods as well as to those that provide services, and public transport is not different. Nowadays, people prefer individual transport. In the Slovak Republic, individual transport is perceived as an expression of personal prestige and freedom. On the other hand, however, it places a heavy burden on road infrastructure and has a great impact on the environment. In this paper, the authors aim to present the information obtained through a questionnaire survey focused on customer satisfaction and preferences in public mass transport in the context of the COVID-19 pandemic. As part of the statistical evaluation, the interdependence of two quantitative variables (ownership of a passenger car versus the purpose of the public mass transport customer's trip) will be observed. Based on the research results, customer requirements and preferences were summarized and can be used by management of companies as a valuable basis for managerial decision-making and communication towards customers.

Keywords: Public passenger transport, preferences and customer needs, competitive advantage

1. Introduction

Currently, one of the basic problems of the transport sector in the Slovak Republic is the unfavourable development of the division of transport performance in favour of road, especially individual (non-public) transport. There is an increase in individual car transport, which places a burden on Slovak road infrastructure and has a negative impact on the environment [1]. In the transport sector, the European Union prefers public mass transport over individual transport. Individual transport has a significant impact on the environment, increases parking costs, and causes a reduction in travel speed

in cities, with a common occurrence of traffic jams [2-4]. In the Slovak Republic, individual transport is preferred; on the contrary, in the countries of Western and Northern Europe, the trend is not to own a car anymore; cars become unnecessary for inhabitants due to the availability and quality of public transport services [5-7]. This is a current trend in transportation. It needs to be built on a sufficient level of technology, social preferences, and intensified environmental protection. The pandemic has caused a significant drop in the number of passengers using public transport. This has been confirmed by various surveys. Some passengers were deterred from travelling by public transport by the perceived risk of infection during the COVID-19 pandemic [8,9]. Based on existing surveys, it can be stated that the number of passengers has decreased. The reason was not only people's fear of crowded spaces, but also working from home [10-13]. Several authors emphasize the importance of changes in travel behaviour and understanding during a period marked by a pandemic disease such as COVID-19 for the development of an efficient transportation system [14,15]. The possibility of development is conditioned by understanding that, during the pandemic, the decrease in demand for travel was inevitable. It follows from the characteristics of mass public transport. Due to the impact of the pandemic, the need for new transport policies has increased. [4,16,17].

2. Theoretical Definition of the Solved Problem

Customers currently have access to various information, based on which they can communicate with each other, compare prices, products, and other criteria [18-20]. Consumer behaviour has been addressed by many Slovak and foreign authors. They consider consumer behaviour to be the basis of contemporary marketing because they believe that understanding customer behaviour is the core of the marketing concept [21,22]. Nowadays, it is essential for companies to know their customers and their preferences [12,23,24]. This also applies to public transport. According to Poliak et al., public passenger transport has a character of a service provided to population [3]. Its main task is to meet the daily needs of inhabitants for transportation, whether it is going to school, work, medical facilities, or offices. Public transport is ensured by bus transport, rail transport, air transport, water transport, taxis, and others. The term "service" itself and its features do not need to be explained in detail. For the purposes of this paper, it is necessary to specify which services are in the public interest. Recent surveys show that the number of passengers using public transport in Slovakia is decreasing significantly [25,26]. The best solution to this situation seems to be an integrated transport system, which has proven to help divert passengers from individual transport back toward public passenger transport [22,26]. The COVD-19 pandemic has had a significant impact on public transport systems around the world. The number of customers of public mass transit has drastically decreased [3,27].

When analysing the impact of the COVID-19 pandemic on the public transport sector, it can be seen that every type of transport has experienced a significant decrease worldwide. Before the

outbreak of COVID-19, it was estimated that passenger transport would grow by approx. 40 % worldwide between 2010 and 2050. However, due to COVID 19, passenger transport within all EU countries was partially or completely closed, with air transport being the most affected sector. In the EU, a 90% drop in passenger air transport was recorded. Many airlines shut down their operation of passenger transport and tried to use it for cargo transport. Road transport was also one of the sectors significantly affected by the pandemic. In March 2020, key border crossings for passenger traffic were closed and restrictions on suburban and urban transportation were also introduced. Before the pandemic, passenger cars accounted for more than 80 % of inland passenger transport in the EU (including all types of transport except air and sea). Buses and trolleybuses accounted for less than 10 %, and a significant percentage was also for railway transport (almost 18 %), as well as maritime passenger transport with an approximately 6% share [20,25,28]. In the established transportation strategy, the European Union gives priority to public passenger transport over individual transport. Public passenger transport meets the objectives of the European Union's road safety strategy to reduce noise and negative environmental impacts. On the other hand, it would lead to an increase in the flow of traffic and parking and relieve the burden on city centres [27,29]. In the context of the COVID-19 pandemic, attention must be paid to increasing safety in public transport [6,10]

3. Data and Methods

In this article, the authors will present the findings of a questionnaire survey aimed at determining customer satisfaction and preferences in public mass transportation in relation to the COVID-19 pandemic. Subsequently, there will be verified the hypothesis established on the basis of the analysis of theoretical knowledge of the solved problem concerning the dependence of variables using IBM SPSS Statistics. To determine the minimum sample, the following relationship was used [29]:

$$n = \frac{\left(z^2 * p * (1-p)\right) + e^2}{e^2 + z^2 * p * \frac{1-p}{N}} \quad (1)$$

where: *n* is sample size requirement, *N* is population size, *e* is acceptable margin of error in % (in this case, 5 % was chosen), *p* is variance in % (we substituted 50 %) and *z* is the level of confidence. For this survey, a standard value of 95 % was used [29].

The calculated required minimum sample size is 385 respondents. The sample is based on the permanently resident population in the Zilina Region as of January 1, 2021, which is 691,613 people. The questionnaire survey was conducted between 26 January, 2022, and 13 April, 2022. The number of responses received was 399, which can be considered sufficient given the required minimum size of the sample calculated above. The questionnaire was processed and evaluated electronically, via Google Forms, as well as in paper form, in order to reach the widest possible range of respondents and to allow people who do not have the opportunity to fill out the questionnaire electronically to

participate in the survey. The electronic questionnaire that was distributed via email was filled in by 322 respondents, the number of paper questionnaires handed out in person and filled in was 77 respondents. The questionnaire consists of thirty questions. Each of these questions were evaluated separately, and then, as already mentioned, the dependencies between the selected variables were statistically evaluated.

4. Results

A total of 399 respondents took part in the survey. Of those interviewed, 51.6 % were women, and 48.4 % were men. The respondents included students (36 %), the self-employed (30 %), entrepreneurs (14 %), the employed (7 %), parents on maternity leave (7 %), the unemployed (3 %), the retired (2%), and others (1 %). Of the total number of respondents, there were 8 people with incomplete primary education and 15 people with primary education; 68 respondents had secondary education without high school diploma (which accounts for 17.0 %); one hundred and sixty-nine have a high school diploma, which accounts for 42.4 % of all respondents. As for tertiary education, 87 respondents were university-educated people of the first degree, 49 respondents were university-educated people of the second degree, and 3 respondents with a third-degree university education.

316 respondents (79.2 %) own a car, and 77.5 % of the respondents are active drivers. Interestingly, passengers prefer public transport only when going to work. In all other cases, they prefer cars—for shopping, school, trips, and vacations, but also for visits to various events. They also prefer a car for medical check-ups and to go to various offices and the bank (see Figure 1).

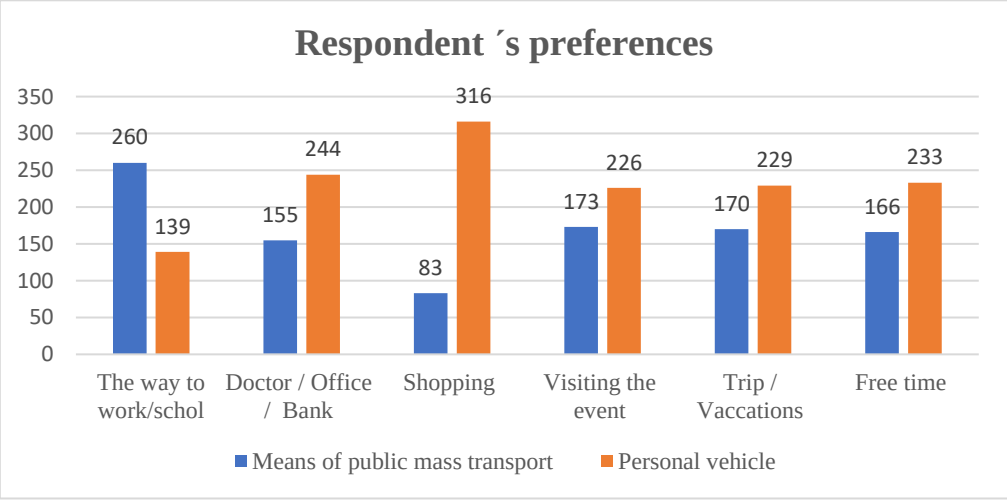

Fig. 1 Respondents' preferences. Source: authors

As many as 193 respondents rather believe that the decline was probably caused by the COVID-19 pandemic, and 75 respondents are completely convinced of this. On the contrary, 16 respondents do not agree that the drop in interest is due to COVID-19, and 115 respondents think that this is not the case. The respondents believe that the most likely reason for the drop in the number of passengers associated with COVID 19 is a fear of infection in public transportation. When asked about the

frequency of using public transport, the most common answer was “several times a week” (32.3 %, 129 respondents). Only 5.8 % use public transport daily (23 respondents). As many as 53 respondents do not use public transport at all. Suburban transportation was identified as the most preferred mode of public transportation., which accounts for 61.8 %). This was followed by public transport (28.6 %), and only 9.5 % of the respondents identified occasional transport as their most preferred service. The availability of stops was marked as satisfactory by 63.9 % of the respondents, partially satisfactory by 30.6 %, and unsatisfactory by only 5.2 %. When it comes to satisfaction with the road toll system, more than half of the respondents agreed (109 respondents said "yes" and 178 respondents said "rather yes") More than 50 % of the respondents were also satisfied with the price of transportation. As for the respondents' awareness of news, there is a difference between knowing it and using it. Only 10 % of respondents know and use "innovations" in public mass transportation. 33 % of respondents know about them but do not use them, and 57 % of respondents do not know about them. The respondents most often learn about news from social networks (40.7 % of respondents), from posters on different means of transport (20 % of respondents), from friends (14.7 %), and from the website of a given company (14 % of respondents).

The following question focused on the respondents´ satisfaction with selected factors of public mass transport. A total of 11 factors were included (see Table 1), which had been determined based on the analysis of theoretical knowledge as well as existing surveys.

Table 1 Selected factors of the quality of public mass transport. Source: authors

Designation	Factors
1	Level of service provision
2	Continuous improvement of service quality
3	Technical condition of vehicles
4	Provision of a replacement vehicle if necessary
5	Bus equipment (WIFI, air conditioning)
6	Punctuality of departures/arrivals of connections
7	Cleanliness of buses
8	Driving safety
9	Comfort while driving
10	Good communication with workers
11	Professional behaviour of drivers

It is clear from the following picture that the respondents are mostly satisfied with all factors. As seen from the picture, they are most satisfied with the safety of driving and the punctuality of departures and arrivals of connections. Dissatisfaction was mentioned mainly in terms of the equipment of the means of transport. According to the survey, passengers are also dissatisfied with the professionalism of drivers. The answers can be seen in the following figure 2.

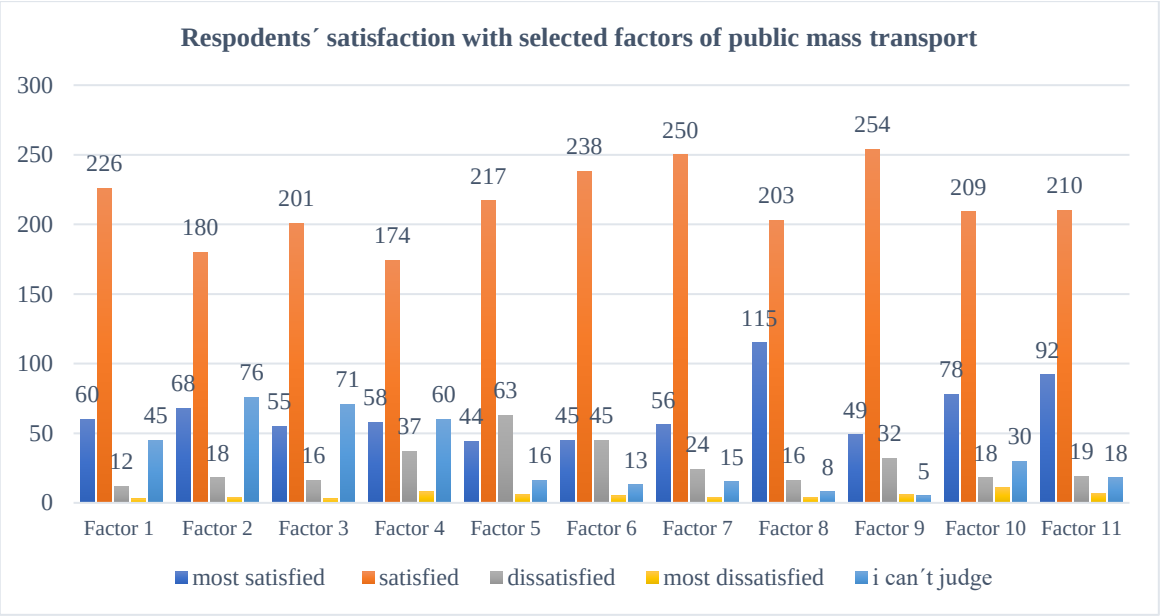

Fig. 2 Respondents' satisfaction with selected factors of public mass transport. Source: authors

The questionnaire survey was supplemented with a statistical evaluation of the dependencies between the selected variables. The authors relied on information from the Ministry of Transport of the Slovak Republic that there was a "disproportionate increase in individual car transport" in Slovakia during this period. They tried to find out a possible existence of a relationship between being an active driver and the preference for using a car or public transport for commuting to work/school. The potential dependence was verified using IBM SPSS Statistics. A contingency table of double sorting of the sample was created based on a pair of qualitative variables. The contingency table of actual empirical frequencies is presented in Tables 2 and 3. It shows, e.g., that out of two hundred forty-four active drivers, 120 prefer a private car for commuting to work or school.

Table 2 Contingency table of real - empirical abundances. Source: authors

Are you an active driver? Which of the two listed groups of means of transport do you prefer on individual occasions (commuting to work, to school) Contingency table				
	Count			
	Which of the two listed groups of means of transport do you prefer on individual occasions (commuting to work, to school)			**Overall**
You are an active driver		Personal vehicle	Means of public mass passenger transport	
	YES	120	124	244
	NO	12	60	74
Overall		132	184	316

Table 3 Contingency table of theoretical frequencies. Source: authors

Are you an active driver? Which of the two listed groups of means of transport do you prefer on individual occasions (commuting to work, to school) Contingency table				
	Count			
	Which of the two listed groups of means of transport do you prefer on individual occasions (commuting to work, to school)			Overall
You are an active driver		Personal vehicle	Means of public mass passenger transport	
	YES	101.9	142.1	244.0
	NO	30.1	41.9	72.0
Overall		132.0	184.0	316.0

In the contingency table of theoretical frequencies, it can be seen that the conditions for a 2 x 2 format table are met - all theoretical frequencies are ≥ 5 and the range of the sample set is > 20. Therefore, the following hypotheses were formulated:

- null hypothesis: H0: Being an active driver has no influence on which of the two mentioned groups of means of transport the respondent prefers when travelling to work / school.
- alternative hypothesis: H1: Being an active driver has an impact on which of the two mentioned groups of means of transport the respondent prefers when travelling to work / school.
- significance level: $\alpha = 0.05$.

The test of independence (Pearson's x2 - test of independence) was used to verify the existence of a relationship between the two variables. The test results are presented in Table 4.

Table 4 Chi-Square Test. Source: authors

Chi-Square Test					
Person Chi-Square	**Value**	**df**	**Asymptotic meaning 2-sided**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
continuity correction	24.163[a]	1	0.00		
	22.845	1	0.00		
Odds ratio	26.402	1	0.00		
Fisher´s exact test number of valid cases	316			0.00	0.00

[a] 0 cells (.0%) have an expected number less than 5. The minimum expected number is 30.08
[b] calculated only for the 2*2 table

We followed the Pearson Chi-Square p-value, which is 0.000. P value < significance level α. This indicates that the null hypothesis has to be rejected and the alternative hypothesis H1: Being an active driver has an impact on which of the two groups of means of transport the respondent prefers when travelling to work/school is accepted.

Next, the strength of the dependence between the variables was evaluated using the contingency coefficient. We calculated the Cramer coefficient (see Table 5).

Table 5 Symmetric measures. Source: authors

Symmetrical measures			
		Value	Approximate meaning
Nominal after nominal	Phi	0.277	0.00
	Cramer´s v	0.277	0.00
Number of valid cases		316	

Cramer's V value is 0.227. This value is in the interval 0-0.3.

It follows that there is a weak dependence between these variables. Next, a coefficient significance test was performed and the following hypotheses were formulated:

- null hypothesis: H0: The contingency coefficient is not statistically significant.
- alternative hypothesis: H1: The contingency coefficient is statistically significant.
- significance level: $\alpha = 0.05$.

P-value is 0.000, which means that the p-value is lower than the chosen significance level of $\alpha = 0.05$.

Therefore, it is necessary to reject the null hypothesis and accept the alternative hypothesis H1: The contingency coefficient is statistically significant. Based on this, it can be concluded that there is a weak dependence between the variables and the contingency coefficient is statistically significant.

5. Discussion

Based on the results of the questionnaire survey, it can be concluded that the demand for public passenger transportation services is influenced by the opportunity for which the passenger requires transportation. For individual occasions such as shopping, trips, vacations, going to the doctor, offices, banks, etc., the respondents prefer a private car to public passenger transport. The only difference was in the case of commuting to work or school, where more respondents prefer the means of passenger public transportation.

After processing a pair of qualitative variables using a contingency table and evaluating the existence of a dependency between them, it was found that whether being an active driver has an impact on which of the two mentioned groups of means of transport the respondent prefers for commuting to work / school. A total of two hundred and sixty-eight respondents claimed that public passenger transport services are less used due to the current COVID-19 pandemic. Most of them consider the fact that people prefer personal transportation because of the fear of infection on public transportation being the most serious reason for this.

The majority of respondents use public transport several times a week, and the majority of respondents identified suburban transport as the most frequently used transportation service. Most people believe that the way to work or school is the occasion when they most often use the mass transport company's services. The availability of bus stops or stations is most often perceived as satisfactory, and the majority of the respondents are rather satisfied with the timetable. Passengers

are also satisfied with the price of the fare. It was found, however, that passengers are insufficiently informed. Driving safety is perceived by the respondents as the most important factor, which was also reflected in the period of the pandemic in its significant decrease. Customer preferences were summarized into 11 factors, which are assumed to be important for managerial decision-making. The authors are aware of the fact that this survey is broadly focused on all public transportation. In the future, it would be interesting to extend it with specific questions tailored specifically to each type of public transportation. Nowadays, it is essential to know the demands and preferences of customers. Every company providing public transportation services has a clear strategy, mission, and goals. It is advisable that they are properly connected with the requirements and preferences of customers. On the basis of this connection, a competitive strategy is created in the fields of control, planning, and management, passenger awareness, communication with the passenger, positive perception of the carrier, marketing approach in the creation of travel schedules, design of new products, renewal and maintenance of the vehicle fleet, and an increase in the quality of the services provided.

6. Conclusion

The article was aimed at finding out customer preferences and needs of public mass passenger transport during the recent pandemic. Based on the analysis, a number of findings and knowledge were gained through a questionnaire survey. It shall be noted that during this period, customers preferred individual transport over public transport due to the perceived safety of individual transport. According to the findings, suburban transportation is the most commonly used mode of transportation. The respondents use public transport most often for going to work or school. There were also identified 11 factors that, from the point of view of the authors, affect the quality of travel. The respondents positively evaluated driving safety and the punctuality of departures and arrivals for connections. Additional attention should be paid to another factor from the point of view of transport companies. Above all, it concerns the condition of the means of transport and the professionalism of the drivers of the means of transport.

In this article, there was also highlighted the importance of statistical evaluation. The authors focused on public transport in comparison with individual transport due to its recent increase. The formulated hypothesis stating that being an active driver influences the choice of the means of transport of the respondents was confirmed. The authors believe that the questionnaire survey can be used in a relatively short time to obtain a lot of valuable knowledge necessary for the correct setting of processes in public mass transport. Customer needs and preferences provide an excellent basis for managerial decisions for every company providing transportation services. From the authors´ point of view, it is advisable to constantly analyse the requirements and preferences of customers. Currently, it would be appropriate to focus on customers and their preferences in connection with the

current economic situation. The authors believe that customer needs and demands summarized in this way are beneficial for the management of companies providing public transport services.

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