

ANALYSIS OF THE MOST POPULAR INTERURBAN TRANSPORT MODES AMONG CRACOW STUDENTS OF STATE UNIVERSITIES

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Abstract:

Travelers communication behavior are influenced by many factors, such as motivation, direction of movement and distance of travel. This paper presents survey results conducted on Cracow students of State Universities. Among the various groups of fields (economic and administration, social, technical and engineering, humanist, pedagogical, medical, and others), students were randomly selected. Subsequently they answered a number of questions connected with the most elected intercity transportation. The research group consisted of 3008 people and corresponded in a quantitative way the percentage structure of the different fields groups of Cracow students. The test results have been included both socio-demographic, as well as qualitative factors. The results provide a basis for shaping the appropriate strategies of interurban transportation development.

Keywords:

interurban transportation modes, transport development strategy, transport services accessibility, quality of interurban transport, intercity communication

1. INTRODUCTION

Nowadays an increasing share of cars during traveling both in the city and beyond can be noticed. Due to the type of roads on which cars move, roads can be divided into national roads (including motorways and expressways, international roads, roads constituting links to ensure the national road network, roads of defense implications), regional roads (roads that combine the towns, which have relevance for the region and they are not included in the national roads), county roads (roads owned by the relevant local government districts) and municipal roads (roads of local importance not classified into other categories, which supplement the roads servicing local needs, excluding internal roads).

In Malopolska region in 2010, the growth factor of traffic on the network of regional roads in comparison with this factor in 2005 was 1.26 [1]. Recorded then the highest traffic loads amount to an average of 5500 vehicles / day concerned the region of Malopolska. Similarly, as in the case of a network of provincial roads in the area of Malopolska, growth rate of traffic on the national roads has also increased compared to 2005. The average number of vehicles per day was 12,953 and represented the second largest value indicating the traffic load of national roads (including international roads) in Poland [2].

The predominant percentage of travel is made by cars. Participation in the car traffic on national roads is about 70%, and on provincial roads about 80% of all motor vehicles [2]. Significant

differences can be seen in relation to the percentage share of buses, which account for about 1% of vehicles on the national and provincial roads. Less congested traffic in both urban and its circumscision can be achieved by changing the modal split in the movement towards environmentally friendly transport. In the city, change the mean of transport from a car to a bus or a tram, and during interurban travel moving by train or bus, reduces the number of vehicles on the road. Depending on the assumed rate of filling the car can be concluded that one bus replaces from 30 (using only seats) up to 70 passenger cars.

2. SOCIO-DEMOGRAPHIC AND QUALITATIVE FACTORS

The choice of means of transportation is dependent on a number of socio-demographic and qualitative factors. Communication behavior among travelers are influenced by the motivation, direction of movement and distance. Factors such as gender, age, car ownership, employment status and number of children belonging to the socio-demographic factors influence the motivation of traveling people [3]. The research of mutual influence of these factors on motivation and choice of means of transport, have been presented among others in the papers [3–7]. The choice of means of transport is also dependent on the qualitative factors. The assessment of these factors is subjective evaluation made by each traveler. These factors can be divided into time criteria, spatial criteria, criteria related to weather conditions and the availability of transportation means. The criteria of time can include such factors as the total travel time, time to come to the means of transport, the waiting time for a means of transport and the time to reach from the means of transport to the destination. Distance between start and target, as well as the distance that need to be overcome to get to mode of transport—usually to the stop (bus, rail), and then from the stop to the destination, they belong to the spatial criteria. Important for traveling is also the number of transfers, time of a day, and whether parking space is close to the destination—these are the factors which belong to the criterion of the accessibility. Factors such as the ability to decide by a traveler about the route of travel, the possibility of door to door transportation, the availability of a place to seat during the journey, the safety of the vehicle and the habits of a traveler to the mean of transport are also a very important factors which have an impact on a final decision [7,8]. The dilemma of the mode of transport choice requires knowledge of factors generally referred to as the communication behaviors of people traveling. Proper diagnosis of the causes of choice may allow the formation of these behaviors in terms of alternatives to car transport.

3. AVAILABILITY OF TRANSPORT SERVICES IN THE REGION

The authorities of the Malopolska Region correctly point out that in the Malopolska province transport sector in recent decades has been underfunded and underinvested. As a result, it does not conform to the needs resulting from the economic development of the country, as well as the Polish membership in the European Union. This applies to both goods and passenger transport. Transportation and Communication Department of the Marshal's Office has issued the document specifying the strategies for the development of transport in the years 2010–2030 [9]. It defines the vision, aims and strategic assumptions for the long-term development of the Malopolska transport system. This is the first such a study prepared by the authorities of the Malopolska Region. Transport Development Strategy takes into account such aims as, for example, increase share of rail in passenger and freight services. To make this possible there must be a significant increase in the quality of rail services by improving the operational parameters of the main transport routes, a parallel improvement in the standard of rolling stock, supporting the construction of the rapid rail integrating Polish metropolises, elimination of “bottlenecks” on lines with high traffic, that is between bigger urban agglomerations, and the replacement

and modernization activities. The existing configuration of the transport system is concentrated around Cracow, rail and road transit East-West routes and a number of smaller in terms of number of passengers and quantity of goods North-South connections. In such a situation it is necessary to elaborate a system which ensure more effective access to Cracow and regional clusters of people. This is confirmed by the analysis of social variables, which shows that in the current spatial configuration it is necessary to ensure effective access to the units of education and healthcare, as well as administrative centers [10]. Unfavorable trends such as the acquisition by road transport most of the freight transport, high levels of traffic (especially on the national roads), as well as the constantly growing number of cars do not have a positive influence on transport infrastructure. An additional decrease in passenger rail transport explains the need for change.

Ensuring the competitiveness of road passenger transport and railway transport is one of the criteria for changes. It will require, of course, investments in railway infrastructure and rolling stock, as well as the reduction of rail access rates to infrastructure. Transport Development Strategy for the years 2010–2030 also assumes that it is necessary to adapt the supply of transport services to the changing conditions of their provision, and the size of the demand. Noticeable trend in the movement of the population from the metropolitan areas and surrounding towns requires the protection of the existing infrastructure, but also creation appropriate infrastructures and efficient public transport systems. In addition, the volume of supply of public transport services must be adapted to social and economic goals and assumptions of the spatial development of the region [9, 10]. As seen transport must be taken into account during forecasting socio-economic development, as it is one of the critical factors determining the possibilities and assumptions of the spatial development of the region. Authorities of Malopolska underline that it is necessary to conduct research of the current and the planned distribution of passengers streams and goods, as many decisions on the development of infrastructure (including other than transport), it must be taken from regards to, and based on coherent concept of development of the transport system.

4. RESEARCH METHODS

Cracow is the capital of Malopolska (Poland) and simultaneously it is an important point of cultural and tourist activities. Currently in Cracow lives about 765 thousand people. According to recent studies of the Statistical Office, the number of higher education students in Cracow is about 166 thousand. They represent a large group of residents who creates significant traffic flows in the city and beyond. In this article data from the conducted for this purpose questionnaire surveys relating to interurban traveling has been used. The research include both Internet and direct questionnaire surveys. Taking into account the division into groups of study fields, tested population was a statistical representation of Cracow students (representative sample). Figure 1 shows the real structure of the students number according to groups of fields in 2014/2015 [11]. On the basis of this division the survey has been prepared. Conducted survey included the division into fields of study, as follows (Figure 2):

- economic & administration (also include business studies);
- technical-engineering. (in this group of fields have been included architecture and construction fields and fields related with information and communication technologies);
- social;
- production and processing;
- medical;
- pedagogical;
- humanistic & law (this group include linguistic fields of study);
- others.

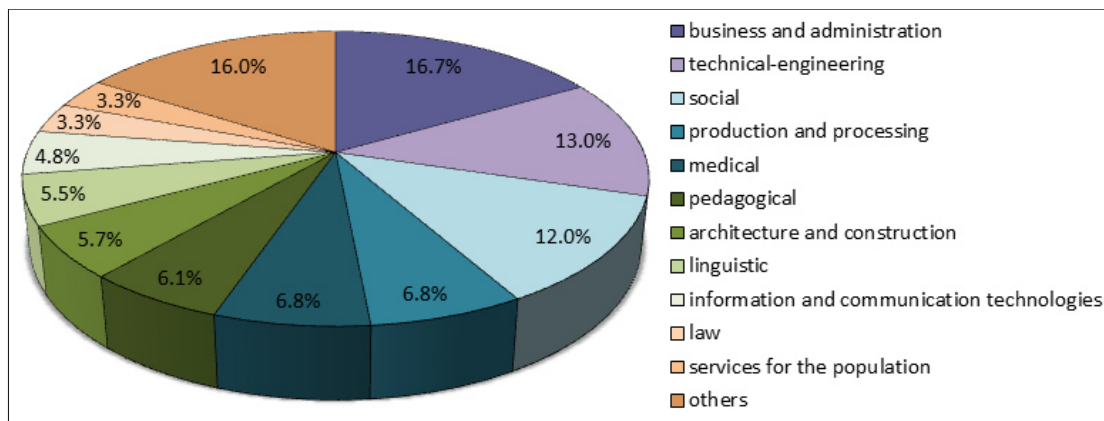


Figure 1 – Structure of the students number according to groups of fields in Malopolska in 2014/2015 [11]

Students answered on a series of questions related to the factors affecting the motivation of the interurban traveling. Questions concerned the aspects of socio-demographic and qualitative aspects determining the choice of the means of transport. Due to the study of interurban travel, the students beyond questions about the chosen mode of transport were asked to indicate which road they use to leave the city. Figure 3 presents the map of Malopolska in which the roads, with corresponding numbers, are marked. Among these roads the respondent made a selection.

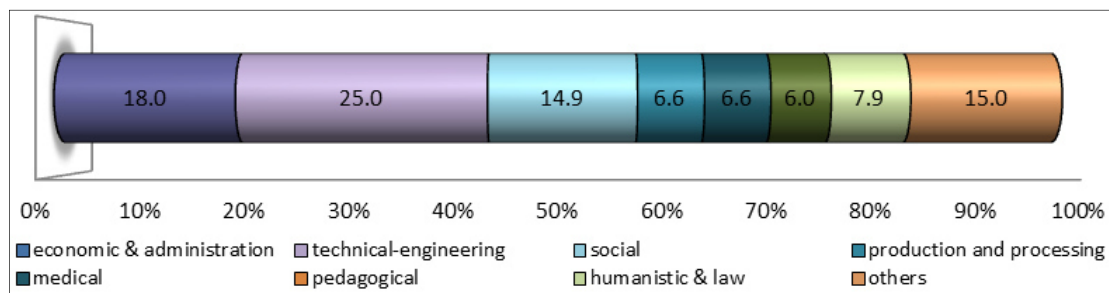


Figure 2 – Structure of the students according to groups of fields in conducted surveys

In the first four tables, 2, 3, 4 and 5, it presents the impact of PM in the four fundamental processes of the model of Nonaka, Toyama & Konno [18]: Socialization, Externalization, Combination and Internalization. In the table 6 the relationship of PM with the Ba will be shown and in the last four tables, 7, 8, 9 and 10, will analyze the impact of the PM in the four above mentioned knowledge assets: Experiential, Conceptual, Systemic and Routine.



Figure 3 – National roads in Małopolska

5. RESULTS

In order to best illustrate the results, they have been presented in the form of bar (Figure 5) and circular charts (Figure 4). Taking into account the economic aspect should be noted that approximately 31% of the respondents have their own car (Figure 4). Among car owners up to 85% use it to travel a long distance. The percentage distribution of student who participate in the carpooling as driver is only 28% (carpooling means sharing of car journeys so more than one person travels in a car, it means that car driver take passengers), it makes up to 72% of moving cars only with a driver.

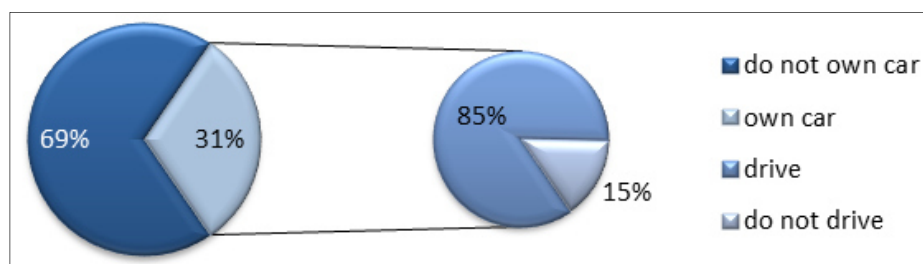


Figure 4 – The percentage distribution of car owners among students in Cracow

Figure 5 shows the percentage share of the most popular means of transport during interurban travels. This diagram takes into account a division into groups of study fields. In total, up to 46.4% of students is traveling by bus, 25.9% choose to travel by car, about 16.3% travel by train, 11.2% choose carpooling.

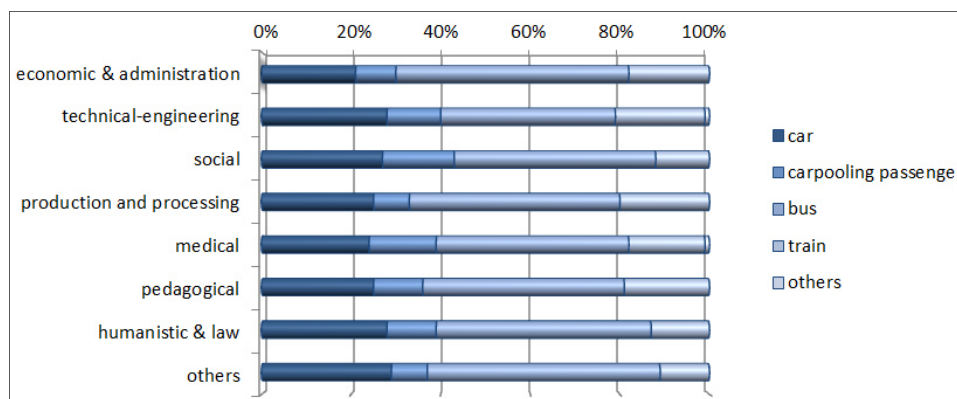


Figure 5 – The percentage share of the most popular means of transport during interurban travels included division into groups of study fields

Figure 6 shows that the most popular roads are route No. 4 (which is part of the motorway A4) and national road No. 7. Road No. 4 enables to connect city with the East and leads in the Tarnow direction, or is one of the possible routes to Nowy Sacz. Up to 37% of the respondents pointed to this road. Another often selected road was national road No. 7. This road travels about 21% of the respondents. It enables connection with Zakopane, and is another possible link with Nowy Sacz.

The surveyed students also assessed a chosen mode of transport in terms of quality. Highest grade they could give was 3, assessment of 2 meant the average grade of a given factor, and the mark 1 was the worst assessment. The results are presented in Table 1. As seen, the best assessed was journey by car. Not only drivers but also carpooling passengers largely gave the highest rating. Only in the case of the financial aspects, car has been the worst evaluated. The situation is slightly better in the case of car-sharing, but the best assessed in financial terms have buses and trains. Unfortunately, these means of transport are relatively low-assessed because of the travel time and distance that must be overcome.

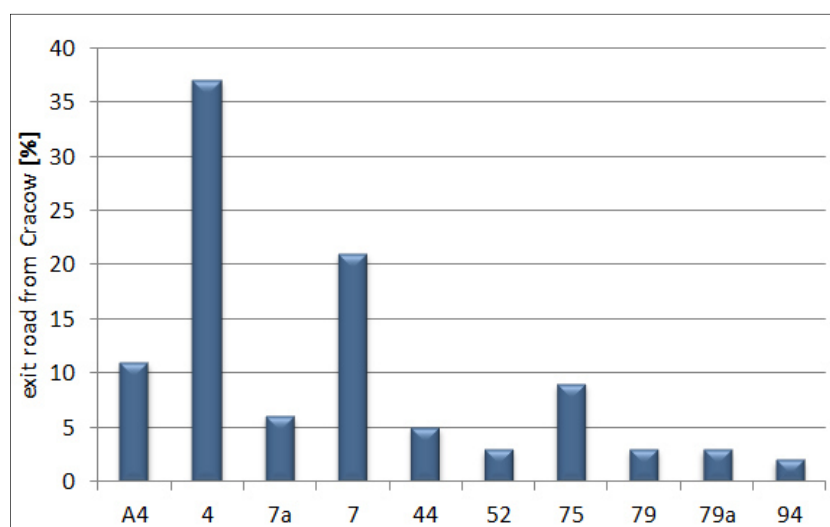


Figure 6 – The percentage share of the most popular exit roads from Cracow among students

Table 1 – Assessment of interurban transport modes among students of Cracow universities

	time	distance	availability	finance	atmospheric conditions	safety	comfort	\bar{x}
car	3.0	2.8	3.0	1.2	3.0	2.4	2.8	2.6
carpool	2.1	2.5	2.4	2.4	2.7	2.8	2.8	2.5
bus	1.2	1.5	2.2	2.9	1.5	2.4	2.1	2.0
train	1.1	1.4	1.5	2.8	1.9	3.0	2.5	2.0

6. CONCLUSIONS

Results of conducted questionnaire surveys make it possible to better understand the existing traffic flows. Although students often choose the public transport during intercity travel, it has an average grade. Therefore, improvements especially currently the lowest evaluated travel time and distance that must be overcome, could encourage a greater number of students to choose bus or train instead of the car. It should be remembered that one bus can replace from a few to a dozen cars so even a small number of traveling by car can cause significant traffic congestion. An interesting alternative to public transport can be a carpooling because it can provide comfortable conditions at an affordable price. Despite the high assessments of this form of transport given by students, a small part of them is choosing this mode of transport. This may be caused by the fact that only about 30% of drivers who choose to travel by a car propose a place and take a passengers. However, among the students it may be notice a growing interest in this form of travel. To reduce the share of cars on the roads, not only in the city but also on its outskirts, should be more widely promoted environmentally friendly public transport. Improving the comfort of traveling by bus or train and proposing adequate price and the appropriate promotion of ecological traveling, can significantly affect the choice of transport mode.

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