

Transport preferences of the students and employers in Lublin University of Technology

Ocena preferencji transportowych pracowników i studentów Politechniki Lubelskiej

Jakub Bis^{a,*}, Magda Kojro^b

^a*Department of Economics and Economic Management, Lublin University of Technology, Nadbystrzycka 38B, 20-618 Lublin, Poland*

^b*Zakład Zagospodarowania Odpadów, Wólka Rokicka 100, 21-100 Lubartów, Poland*

Abstract

The problem of movement is very important in the context of logistic management, which has been gaining importance in recent years with the increasing phenomenon of people moving to large urban agglomerations. The article presents the transport preferences of employees and students the Lublin University of Technology. IT tools were used for the analysis, such as the Analysis ToolPak add-on and PowerMap in Microsoft Excel.

Keywords: transport preferences; logistic management; PowerMap

Streszczenie

Problem przemieszczania się jest bardzo istotny w kontekście zarządzania logistycznego, które zyskuje na znaczeniu w ostatnich latach wraz z nasilającym się zjawiskiem przenoszenia się ludności do dużych aglomeracji miejskich. W artykule przedstawiono skąd dojeżdżają na Politechnikę Lubelską pracownicy i studenci oraz ich preferencje transportowe. Do analizy wykorzystano narzędzia informatyczne takie jak dodatek Analysis ToolPak oraz PowerMap w programie Microsoft Excel.

Słowa kluczowe: preferencje transportowe; zarządzanie logistyczne; PowerMap

*Corresponding author

Email address: j.bis@pollub.pl (J. Bis)

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1. Introduction

Management is a discipline of science, the task of which is to take actions and decisions regarding human, material, capital and information resources in such a way that their functioning is as effective as possible and leads to the achievement of the assumed goals. On the other hand, the dynamic development of cities and the mobility of society strengthens the importance of logistics, which is responsible, inter alia, for the effectiveness of the movement of people. The use of both of these sciences is necessary from the point of view of the topic discussed in this article, which is the transport preferences of students and employees of the Lublin University of Technology. The aim of this study is to identify the preferences related to travel to the university of students and employees of the Lublin University of Technology, and then, based on data analysis using IT tools, to develop proposals for changes in the area of logistics management at the university under study. The first part of the article reviews the literature research on student behavior and transport preferences. The second part discusses the results of own research conducted among students and employees of the Lublin University of Technology. The third part of the work consists of recommendations and suggestions from the conducted research.

2. Transport preferences and behavior in the light of research

Logistics management is a process of planning, implementing and controlling efficient, cost-effective flow and storage of raw materials, production inventories, final goods and the corresponding information, from the point of obtaining raw materials to the point of consumption, in order to best adapt to the requirements customers. Such management is an activity that creates the entire concept of logistics undertakings, taking into account their course both in the company and at partners, and coordinating the implementation of this concept by appropriate organizational units using appropriate management and control instruments [1].

One of the dominant functions of the city is to enable its inhabitants to move regardless of the premises and methods of traveling. In response to the constantly emerging transport needs or the emergence of other negative effects of the movement of people in cities, the concept of urban logistics was created, which is to be a solution to the emerging development and functional problems of cities (and other administrative units that are not formally cities). The concept of urban logistics has been given many definitions, among which it is worth quoting one, most relevant to the topic of the work: "urban logistics is all the processes of managing the flows of people, cargo and information within the

city's logistics system, in accordance with the needs and development goals of the city, respecting the protection of the natural environment, taking into account that the city is a social organization whose ultimate goal is to meet the needs of its users" [2].

As the research conducted by the Public Transport Authority in Gdynia has shown, the share of the use of passenger cars in passenger transport has been steadily increasing over the last 5 years, to the detriment of public transport. In 2008, 51.9% of respondents used public transport (bus, trolleybus and rail), and seven years later this number dropped to 39.8%. At the same time, the share of road transport increased by 10.8 percentage points. It is worth noting, however, that the inhabitants of Gdynia have become more willing to use the means of transport, which is a bicycle (in the last seven years, the share of bicycle trips increased by 1.4 percentage points) [3].

The results of the research led by Sokołowicz in [4] show that the most frequently chosen means of transport was public transport (over 750 indications), the less frequently chosen passenger car (over 600 indications), while the least willingly chosen means of transport was public transport (approx. 300 indications). It is worth noting that people traveling to the university at least 3 times a week are more likely to travel by public transport (53%), while the less often students come to the university, the more often they choose to travel by foot, car, bike or use buses/trains.

Interesting results were brought by a study focusing on the traffic situation during rush hours in the most crowded Polish cities. For this purpose, travel time of the busiest streets in three seasons: off-peak (23 May), 8 August during the holiday peak and off-peak on 23 and 24 May. The results of the experiment showed that the 5-kilometer section in the city of Lublin was completed in 10 minutes at the time of the lowest traffic congestion, i.e. driving at a speed of 30 km / h, while during the greatest transport congestion the travel time was 40 minutes, i.e. only 7.5 km / h, which is slightly faster than human fast walking (it is assumed that this speed is approx. 6 km / h). In addition, the article contains information that the average speed of driving during the street rush in the city of Lublin was only about 8.1 km / h, only one city - Rzeszów - had a worse result [5].

More information on the transport preferences of commuters and residents is provided by a survey of the transport market in Lublin carried out in 2016, which covered 100 randomly selected people, and the tool that accompanied it was a questionnaire containing mainly closed questions. The study checked the frequency of using a given means of transport. The most popular turned out to be own vehicle, where almost half of the respondents indicated that it is used every day and which received the fewest answers "I do not use at all". About 20% of people used public and private transport (buses, buses) almost equally every day. The least frequently chosen means of transport were taxi rides, rail transport and private transport [6].

The research conducted in Gdańsk, which included 764 students from 12 schools in the 2013/2014 school year, allowed for the following conclusions:

1. A passenger car was owned by 83% of lower secondary school students' households.
2. According to middle school students, the most important features of public transport are: directness, frequency and speed. Secondary school students considered other important transport suggestions in the following order: information, rhythm and comfort.
3. During city trips, lower secondary school students mostly used public transport, which they made 79% of trips during the research.
4. The most popular means of public transport in the travel structure of middle school students was the bus, while travel by individual transport was led by a passenger car [7].

A review of international research on transport preferences shows that students at universities around the world prefer to travel by car [8]. Many university campuses are suffering from serious mobility problems resulting from excessive use of the private car by students, teachers and administrative staff [9]. The interpretation of data exposed a significant statistical hypothesis that the students would use public transport more often if made available in certain hours [10]. The survey findings support to the notion that bicyclists everywhere have similar attitudes about what the types of improvements required for increasing bicycling and enhancing their experiences. In addition, local conditions and practices have an impact on the relevance of specific issues [11]. Very important are the topographical factors. In Kobe University in Japan the authors determined if walking was included in the choice set. One striking reason for occasional walking rather than taking a bus was to meet friends who walked to campuses [12]. Research in Australia has found demographic and travel habit differences between native-born Australians and immigrants but the reasons for these differences are not clear [13]. Neighbourhood type of residence was an important indicator of a student's transportation life-style. Strong associations between travel attitudes, residential location preferences and a student's transportation life-style was also observed. Post-secondary students are at an important stage in their life-course where they begin to form habitual travel behaviour as young adults [14].

3. Research Methodology

In order to find out what are the transport preferences of people associated with the university, the authors conducted a study of full-time and part-time students as well as employees of the Lublin University of Technology. In data processing, an add-in to Microsoft Excel called PowerMap was used, when it was possible to visualize the spatial distribution of the studied group. PowerMap lets authors choose an entity in CRM, choose a view, and plots all of the individual records from that view on one map. Scientist using PowerMap

can set more than one entity, and more than one view at a time. They can also save their PowerMap preferences, including map configurations, zoom levels and views. The best features of this add-in are: support for any entity with an address field, click on a pin on a map, and a summary of the record will display, open a record directly from the map, by clicking on the name of the record in the summary view, choose a separate pin for each selected entity or view or put PowerMap directly on a CRM form. The Analysis ToolPak extension [15-17] allowed authors to calculate the median, and this tool uses appropriate statistical or engineering macro functions to calculate the results and display them in the result table. The survey questionnaire was the tool used during the own research using the Google Docs form in the second decade of 2019. The questions asked to the respondents were aimed at determining the popularity of various types of transport used by students and employees to reach the university, determining the reasons influencing the choice of the means of transport as well as factors encouraging and discouraging the choice of a given means of transport by the respondents. The aim was also to identify the problems that may be encountered during the trip to the university and get acquainted with ideas for improving commuting.

The 357 people participated in the survey, including 142 university employees (39.8%), 201 full-time students (56.3%; including 143 undergraduate students and 58 second degree students) and 14 part-time students (3, 9%). The gender structure of the respondents is almost proportionally distributed. Men constituted 51.3% of the respondents and women 48.7%. Women employed at the Lublin University of Technology constituted 45.8% of all surveyed employees, and female students made up a group of 50.7% of the surveyed students.

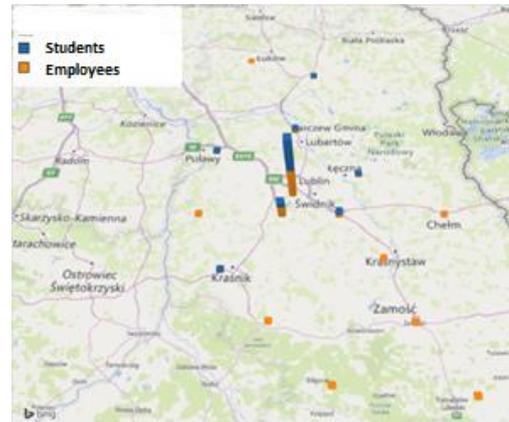
The questionnaire was completed by people, 73.1% of whom visit the university at least 4 times a week, 23.8% of respondents visit it 2 to 3 times a week, and the rest of the group less frequently.

4. Analysis and Result

People who took part in the survey were asked about where they come from. One full-time student and two extramural students declared that they traveled to the university from the Mazowieckie Voivodship. One part-time student comes from the Podkarpackie Voivodship and three people, including one employee and two full-time students, admitted that they come from the Świętokrzyskie Voivodship. The vast majority replied that they reached the Lublin University of Technology from the Lubelskie Voivodship (98%). The vast majority of respondents live in the city of Lublin (62.6%) and its neighbouring areas (18.9%). A significant number of people come from the county of Świdnica (6.3%) and Lubartów (4.0%). For the remaining areas, the ratios were equal to or less than 1.4%.

The structure of people commuting to the university from the Lubelskie Voivodship shows that the employees of the Lublin University of Technology are people living in the city of Lublin and its surroundings, in con-

trast to students who come to the university from closer and further distant communes of the Lublin Voivodeship.



Map 1: Number of university students and employees who travel to the university from the Lublin voivodeship
Source: Own study using PowerMap in Microsoft Excel based on own research.

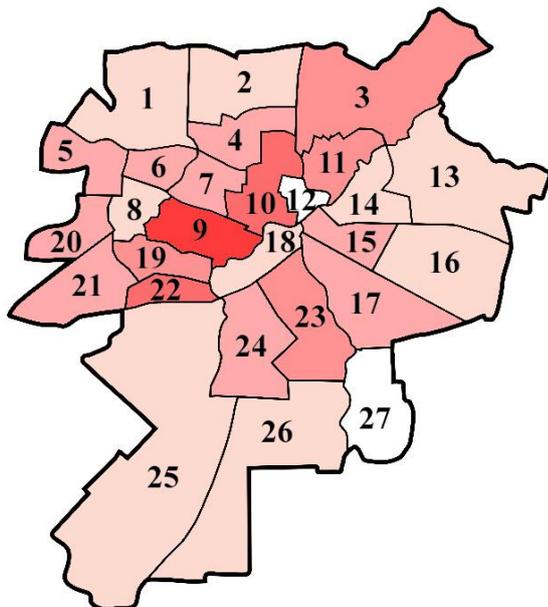
The respondents are mostly people coming to the university from the Rury district (19.6% of respondents living in the city of Lublin), which also includes the Lublin University of Technology. A large percentage of the respondents live in the neighboring districts, incl. Czuby Południowe (9.1%), Śródmieście (7.3%), Czuby Północne (6.8%), Dziesiąta (5.5%) and distant districts such as Ponikwoda (5.9%) and Kalinowszczyzna. The smallest number of respondents came from the districts furthest from universities, located near the city limits, and from the Za Cukrownia district, which is located directly behind the university. This may be due to the fact that the area is rather industrial in nature. None of the surveyed people do not live in the Old Town and Głusk districts. In the city plan presented below, the districts are marked with colors, taking into account the number of respondents living in the area (Map 2).

The questionnaire was started with the question about the distance that students and university staff have to cover in order to reach it. The smallest indicated value for the entire research sample was 100 meters, and the highest was 120 kilometers. Both numbers were indicated by full-time students. For university employees, these values were respectively 200 meters and 86 kilometers. 25% of the total value for the studied population is or is lower than 3.4 km, and the median is 6.5 km.

This means that half of the respondents reach the university from places located 6.5 km or less away from it, for the remaining people the distance is greater. In the case of university employees, half of the respondents live in areas 6 km or less from the Lublin University of Technology, and half of all surveyed students reach the university from places located up to 8 km away. Further data analysis shows a discrepancy between the presented results. It turns out that 75% of the surveyed students have to travel 25 km or less to get to the university, while the same number of employees come from areas 10.8 km or closer.

Table 1: Number of respondents in the city of Lublin.
Source: Own study based on the results of the conducted research.

Number on the map	City district	Number of respondents living in a district
1.	Sławin	5
2.	Czechów Północny	5
3.	Ponikwoda	13
4.	Czechów Południowy	6
5.	Szerokie	6
6.	Sławinek	8
7.	Wieniawa	6
8.	Konstantynów	4
9.	Rury	43
10.	Śródmieście	16
11.	Kalinowszczyzna	12
12.	Stare Miasto	0
13.	Hajdów-Zadębie	1
14.	Tatary	3
15.	Bronowice	8
16.	Felin	3
17.	Kośminek	6
18.	Za Cukrownią	1
19.	Czuby Północne	15
20.	Węgliń Północny	6
21.	Węgliń Południowy	7
22.	Czuby Południowe	20
23.	Dziesiąta	12
24.	Wrotków	8
25.	Zemborzyce	3
26.	Abramowice	2
27.	Głusk	0



Map 2: Distribution of the surveyed people in the city of Lublin.
Source: Own study based on the results of the conducted research.

The maximum distance of residence for learners is 120 km, and for university employees it is almost twice as small, at 86 km. In addition, part-time students have to cover a longer distance to reach the university campus than full-time students. The above information coincides with the respondents' declarations related to the place of residence, which proved that the employees of the education centre mainly live in the city of Lublin and its neighbouring areas, and that students often come from other municipalities of the Lublin voivodship, remote from Lublin. The average commuting distance of learners is 17.5 km and is 3 percentage points higher than the average for the studied sample, which is 14.5 km. The average travel distance for university employees is 9.9 km.

The next question in the questionnaire concerned the travel time from the place of residence to the Lublin University of Technology. The respondents were to enter the number of minutes corresponding to the average one-way travel times, including the shortest and the longest, e.g. during rush hours. The smallest indicated value for the shortest journey time was equal to 1 minute, and the highest - 90 minutes. For the longest time of reaching the university, the indications were equal to 3 minutes and 180 minutes, respectively. Correlation coefficients were calculated for the data, which show that in the case of the shortest route times, there is a very large relationship between the distance to the place of residence and the travel time, where the correlation coefficient is 0.8. The slightly lower correlation coefficient between the route length and the longest travel time, amounting to 0.68, proves that there is also a fairly high relationship between them. 75% of the respondents believe that the shortest travel time takes them equal or less than 30 minutes, the remaining part of people reach the university in more than half an hour but less than 90 minutes. One-fourth of the respondents travel between their place of residence and the university in an average of 10 minutes or less under the most favourable conditions. Under unfavourable conditions, 25% of respondents declare that the travel time from their place of residence to the Lublin University of Technology is a maximum of 23 minutes or less. 75% of the respondents believe that their longest journey to the university is on average an hour or less, and the rest that this time is longer than an hour but less than 3 hours. The minimum average travel time to the university for all respondents is 22.2 minutes, while the maximum travel time in the street rush is 42.8 minutes. Generally speaking, it can be said that commuting to the Lublin University of Technology takes more time for people studying there than for the employed. The reason for such a situation may again be that the places of residence are far from the place of study of students. Detailed data on travel times to the university by individual groups of respondents are presented in the table 2.

Table 2: Summary of the respondents' travel times to the university. Source: Own study based on the results of the conducted research.

		Total	Employees	Students
Average fastest one-way travel time to the university (in minutes)	Minimum value	1.0	2.0	1.0
	The first quartile	10.0	10.0	10.0
	Median	20.0	15.0	20.0
	Third quartile	30.0	22.3	30.0
	Maximum value	90.0	90.0	90.0
	Average	22.2	18.3	24.8
	Average longest one-way travel time to university (in minutes)	Minimum value	3.0	3.0
The first quartile		23.0	20.0	25.0
Median		40.0	30.0	40.0
Third quartile		60.0	45.0	60.0
Maximum value		180.0	180.0	120.0
Average		42.8	36.8	46.7

The frequency of choice of means of transport by the surveyed clearly indicates the two most popular ways of traveling, which are passenger car and public transport. According to research, 70% and 50.4% of respondents use these vehicles, respectively, and in both cases, for over 32% of respondents, they constitute a permanent means of movement. Other ways of traveling are not chosen so many times. Very often, only 9.0% of the respondents travel to the university on foot, 26.6% do it less frequently, and 64.4% of the respondents never do it. Intercity rides by public transport are chosen by slightly over 21% of respondents, and 13.2% use the services of railway operators. 18.8% of respondents prefer commuting by bicycle, and only 1.4% declare that they are used very often. One person believes that from time to time they reach the university using the services provided by taxi drivers and 7 people declare that they use a motorcycle to get to the university.

For students and employees, the most important transport preferences are related to the travel time, no need to change trains and the frequency and punctuality of commuting. So the conclusion is that the trip to the university should be quick and direct to the destination. Although for 28.9% of respondents the number of parking spaces does not matter or is not to a large extent

important, over 70% see the need for availability of parking spaces for comfortable travel. For 79.8% of students and employees of the Lublin University of Technology, the motivator when choosing the means of transport is the possibility of choosing the route independently and the independence of traveling, which is also reflected in the large number of votes for the importance of having your own means of transport (73.7% of respondents believe is a significant or very important factor). Respondents believe that safe travel is an important factor that they pay attention to. Only for a group of 3.4% of people it is an irrelevant postulate at all, and 3.1% have no opinion or the issue does not concern them. Less important for travellers are issues related to the comfort of driving or other types of movement, convenience, the ability to easily get to the means of transport and transport luggage with it. Costs incurred in connection with travel to the university are of significant importance for 73.9% of the respondents, but 18.8% is of secondary importance and for the rest of the group they are irrelevant. The factors assessed by the surveyed group as negligible are undoubtedly related to physical health and environmental protection. For 43.4% of students and employees participating in the survey, the type of travel should have a positive effect on health, for 34.7% it is of little importance and the group of 14.6% of respondents does not follow health postulates when choosing the method of travel to the university. When it comes to environmental performance, only 34.7% of respondents take into account the dangers of using less environmentally friendly means of transport, while 20.7% are indifferent to it, and 9% believe that this problem does not concern them or refrain from voice. The information received shows that for 10.9% of the respondents it is important how and what they travel and how others perceive it. The most numerous group of respondents, 53.2%, answered that the prestige and respect of the environment related to the way they move around did not matter to them.

5. Recommendations and suggestions

A significant proportion of respondents noticed that the problem is the poor condition of infrastructure, including no bicycle paths (eg. Tomazna street, Aleje Kraśnickie, Czechów district have been mentioned) or no collision-free intersections for cyclists. The problem of obstructed bicycle traffic along Bystrzyca was also taken into account, which could be solved by creating two lanes for people traveling in opposite directions in this place. Bad infrastructure conditions for cyclists force cyclists to cycle on the pavement or road, which is not only uncomfortable and dangerous for themselves, but also poses a threat to pedestrians and makes it difficult for car drivers to ride. Employees and students also perceive the shortages or poor quality and bad placement of bicycle stands. This is related to the unwillingness to leave bikes in places where they are at risk of being stolen or damaged. The problem could be solved by new, better guarded parking spaces for bicycles, e.g. located near cameras and properly protected against

weather conditions. Another factor that discourages cycling is the lack of space for students and employees to refresh and change clothes. In the case of university employees, such a solution would allow them to freely change their clothes from sports clothes to more formal ones, because cycling in the clothes they wear to work is not only uncomfortable but also not very hygienic.

The most noticeable problem is the permanent traffic jams at Nadbystrzycka Street and partly at the exit from Wapienna Street, which leads to the university car park behind the Faculty of Management. This is due not only to the reprehensible condition of the roads, but also the lack of an additional driving lane for cars turning both from Nadbystrzycka Str. towards Wapienna Str. and from Wapienna Str. in Nadbystrzycka Str. Along with the planned renovation of this section of the road in the future, the creation of additional lanes should be considered, which would contribute to smoothing the traffic at the intersection.

According to the respondents, commuting by car is an alternative to commuting by public transport, because it is inefficient and often faces problems related to e.g. with long waiting times for the bus, delays and, above all, the lack of convenient connections. First of all, the respondents are of the opinion that commuting by bus often costs them as much as the cost of refuelling a car, therefore they choose to travel by car. Ticket prices should be competitively low to increase interest in collective travel. For this to happen, it would be possible to create special discounts on journeys for people working and studying at the Lublin University of Technology to make it more profitable for them to use the services offered by public transport in Lublin. Another solution would be the introduction by the university authorities of special financial allowances for employees using such journeys and the creation of an additional form of scholarship for students. Payments would be made upon presentation of relevant documents entitling to receive a given benefit, e.g. a monthly ticket for a given person.

Among the respondents studying at the Lublin University of Technology, the small number of parking spaces turned out to be the biggest problem. First of all, they notice that at least half of the people commuting to the university come from Lublin or its vicinity and choose the most convenient solution instead of using other means of transport. This, in turn, leads to a congestion in the parking lot behind the Faculty of Management, which is also wanted by people commuting from places far away from Lublin or those that have no other access than by car. In addition, parking spaces should be arranged in a more optimal way and then carefully marked so as to solve the problem of parking on several parking spaces or in a way blocking the exit of other drivers. Better organization and supervision of correct parking would certainly contribute to increasing the parking capacity and increasing the satisfaction of drivers. On the other hand, they would encourage people to travel to the university by car, which is not entirely consistent with the concept of sustainable develop-

ment. The availability of a car park at the university is undoubtedly an advantage that encourages young people to choose one of the Faculties of the Lublin University of Technology. Therefore, it is not worth limiting students from using the car park, but it is worth promoting behaviours aimed at implementing the principles of caring for the environment.

One of the solutions in this case may be the activities carried out by the university authorities to increase self-awareness among students and employees of the Lublin University of Technology in the field of ecology and principles of sustainable development, familiarizing them with the consequences of using various types of transport and promoting alternative solutions. As part of the program, an application could be created for drivers and other people commuting to the university, which, based on the entered data, would create groups of people arriving at the university at similar hours living in a given area. Such a program would operate on the basis of a sharing strategy (CarSharing) and its aim would be to enable shared journeys by students and university staff. This solution makes more people would reach the university, but with fewer cars. People who so far had to use uncomfortable public transport travel would travel in a much faster and more comfortable way, and since the cost of the trip would be spread among all passengers, it would be a win-win for them and for the driver.

6. Conclusions

Research on the transport preferences of students and employees of the Lublin University of Technology has drawn many conclusions regarding the perception of commuting to the university and the introduction of necessary changes to improve travel. Free access to the university, which is a place of work or study for the respondents, is certainly a factor that the respondents pay attention to and which encourages them to return to this place. Providing proper travel conditions is, on the one hand, a challenge for university and city authorities, and on the other hand, an obligation and an expression of caring for the needs of its clients. Students at Lublin University of Technology as at universities around the world prefer to travel by car [3] The conclusions from the study refer not only to transport preferences, but also realize that there is a need to conduct research on the opinions of people associated with the university, because it is they who often notice where the problems are and propose rational ways to solve them, due to the fact that they experience them themselves. In turn, the detection of existing problems and their repair contributes to the improvement of the functioning of the Lublin University of Technology, and this has a positive effect on its image and functioning.

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