Introduction

Educational goals for sustainable development, as described in the “Education Strategy for Sustainable Development” (2008), state that it should shape and strengthen the capacity to assess reality and make decisions for the sustainable development of individuals, groups, communities, organizations and states. It should change people’s way of thinking, enable them to create a safer, healthier and more prosperous world, shaping critical thinking and developing awareness.

Considering that this strategy was adopted at a high level meeting of the representatives of the Ministry of Environment and Education in Vilnius, on 17-18 March 2005, it seems that the postulates included in the strategy should spread and students of natural sciences should at least have a basic set of information about environmental education.

Students of the Biology faculty at the Pedagogical University of Cracow (UP) have the subject “Education for Sustainable Development” in their program of study and students of the Environmental Protection faculty – the subject “Environmental Education”. Issues related to environmental protection are also discussed during other courses, among others, chemistry, botany, biotechnology. Therefore, a decision was made to verify whether students of life sciences taught at the Pedagogical University of Cracow have a higher ecological awareness than their colleagues from the same academy who study exact sciences, engineering, humanities, arts or other fields of study where no such activity is conducted. Especially, whether there is a correlation between environmental awareness declared by the students and consumer attitudes – in this particular case: the choice of a means of commuting to school.

The Ministry of the Environment has been monitoring the environmental awareness of Poles concerning various aspects of the subject since 2011. It may be observed that the subject of the conducted research has not been distributed evenly. The most frequently researched issues were related to power engineering (as many as 29 publications). Quite often research was concerned with: nature conservation, environmental problems, waste management or climate change. Research rarely included: odour and noise, but also CSR, consumer behaviour, air quality, and the Natura 2000 Program. It focused mostly on emotional and cognitive aspects, and less on the behavioural aspect, i.e. the behaviour of the respondents (Fig. 1).

Summary:

Education for sustainable development ought, inter alia, to shape and strengthen the ability to make judgments and decisions in favor of safer, healthier and more prosperous world, and should develop critical thinking and develop ecological awareness. In this context the aspect of environmental awareness and the related choice of means of transport can be discussed.

This article presents the results of research regarding the choice of means of communication by students. The study was carried out by a questionnaire among students in Krakow. The results of the research are presented in context of available communication possibilities in Krakow, which are also characterized.

Studies have shown that the level of environmental awareness of students is still not satisfactory. Behind their declared concern for the environment do not follow the attitudes and behavior supporting this concern. The most important is their own comfort, even more important than their own health and condition. The care for the environment recedes into the background.

Key words: students ecological awareness, means of transport

The number of publications dealing with the various components of attitude

Source: Report on the analysis of the surveys on ecological awareness, attitudes and behaviours © TNS July 2015
The number of projects in selected target groups is presented in Fig. 2. The projects most often focused on one of the mentioned groups. It can therefore be concluded that our research complements, although to a small extent, the gap concerning the behavioural aspects of the student population.

Research

The research was conducted over a period of 2 years (from February 2014 to October 2015). The study involved 243 students of the Pedagogical University in Cracow. The study was conducted using the diagnostic survey method, with an online questionnaire. The questionnaire was included as an additional material for remote general university lectures implemented through the Moodle platform.

The survey questionnaire included 18 questions regarding the declared environmental awareness and various behavioural aspects, including:

- choice of the means of transportation;
- segregation of trash;
- consumer preferences;
- environmental behaviour.

This article presents the results of research on the choice of the means of transportation by the surveyed students.

Hypothesis

The choice of the means of transportation is affected by the environmental awareness of students. Students of life sciences, who study additional ecological subjects, have a higher environmental awareness than other students, therefore, it would appear that they should choose eco-friendly means of transportation more often than others – as one of the motives for their choice should be environmental care.

Profile of respondents

The survey was made available to 500 students, and 243 students participated in the study, which is a very high return of completed questionnaires. General return, calculated according to the following formula:

\[ r_o = \frac{p}{n} \times 100\%, \]

where \( p \) is the number of received completed questionnaires, and \( n \) the number of subjects in the sample is \( r_o = 48.6\% \).

Women constituted a majority of the sample. The proportion of women to men among the respondents who completed the questionnaire was the same as in the group of students attending the general university lectures (Fig. 3).
It is true that all UP students can attend general university lectures, but they are compulsory only for students of first and second degree studies, so naturally these students were the main group of participants in the lectures and therefore respondents to the questionnaire. The smallest number of students were postgraduate students (Fig. 4).

The age of the respondents (Fig. 5) corresponded to the degree of study of the persons surveyed (a significant proportion of the students were those who started studying earlier in another field of study and then stopped and continued on another field of study at UP, therefore the age of the students is slightly higher than it would appear from the level of studies).

Students attending general university lectures represented all faculties of UP. Bearing in mind a higher clarity of the results, students’ education was assigned to 4 groups (Fig. 6): natural sciences, humanities, technical/exact sciences, others. The percentage of respondents in the respective groups corresponded to the percentage of students in particular groups among those listening to the lecture.

Local Context – organization of transportation in Cracow

The area of Cracow is 327 km² (which gives Cracow 2nd place in Poland, after Warsaw). Cracow is inhabited by about 762 000 inhabitants, during the academic year this number is increased by students of Cracow universities (approx. 180 0002). In such a large city the organization of public transport is of great importance.

In Cracow there operates the Municipal Communications Company (MPK) with trams and buses. There are also private carriers, but their role is limited mainly to the transportation of residents from the suburbs to the centre.

In 2015 there were 194 km of tram tracks in Cracow, and the total length of MPK bus lines was 2170 km (157 lines: 70 urban, 65 agglomeration, 15 night and 7 fast).

Cycling has also developed in Cracow – at the end of 2012 there were 145 km of cycle paths and pedestrian trails, and in 2013 – 3.9 km of new lanes were created.

The following maps (Fig. 7 and Fig. 8) show the location of the main UP building in relation to the MPK transport network and cycle paths. As can be seen, the building is located near the city centre and well connected by trams and buses. There is also a cycling path which goes through the UP area.

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The walk from the nearer dormitory to the UP building on foot takes up to 14 minutes (on the map of public transport UP dormitories are highlighted with red circles) and the walk from the further dormitory takes 54 minutes (more than half of the route runs through green areas: the Vistula boulevards, Planty). From the dormitory at Piekarska Street (Fig. 9) it is possible to go by bike (using only cycling paths and green areas it takes 21 minutes, while driving through the city using cycling lanes it takes 17 min) or by tram (26 min) or bus (38 min). Access by car (due to the exclusion of cars from the centre of Cracow is comparable to the bus or longer due to traffic jams).

The use of cycling routes from the dormitory to the university should also be encouraged by the “City Bike –
Fig. 8. Map of the bicycle paths in Cracow. The map shows the main UP building.
Source: https://www.openstreetmap.org/node/2984351165#map=13/50.0620/19.9501&layers=C; CC-BY-SA 2.0.
Fig. 9. Commuting time of trams and buses from the dormitory at Piekarska Street to the main building
Source: http://krakow.jakdojade.pl
Fig. 10. Map of bike rental stations in Cracow. The map shows the main UP building and the further dormitory.
Source: https://kmkbike.pl/panel/station-map/
Bike KMM.” Residents of Cracow have at their disposal 300 bicycles in 34 stations (Fig. 10). In this system, the first 30-minutes of the bicycle ride is free which allows to access the university from the dormitory (the bicycle station is next to the university and near the further dormitory).

It should therefore seem that the location of the university building should promote the use of environmentally friendly means of transportation, especially that in the close vicinity of the UP there are paid parking zones for cars and during the day it is difficult to find a free parking space (cf. arrangement of parking zones in Fig. 11).

The choice of public transport should also be encouraged by the fact that Cracow offers a variety of amenities for people traveling by public transport.

The most important include the so-called MPK dedicated lanes (Fig. 12 and Fig. 13). They were adopted by a resolution of the City Council on 8 January 1993, which was based on the principles of sustainable development in the field of the public transport system. The priority was to separate the traffic from the tram and bus traffic (to this end some tram tracks were used as bus lanes) and create traffic lights that would react to the emergence of public transport vehicles.

Dedicated MPK lanes allow buses and trams for a quick passage through the city, even during traffic jams, significantly reducing the travel time by tram or bus in comparison to the car.

Subsequent improvements for passengers include the so-called Viennese stops (Fig. 14). These are built when the track does not stick to the pavement and between there is a lane for traffic – the Viennese stop is characterized by the fact that the street level is elevated to the level of the sidewalk at the entire length of the stop. This makes it easier for the passengers to board and disembark the vehicle (especially in the case of
the elderly, the disabled or, for example, mothers with prams). Secondly, it calms down the traffic in the vicinity of the stop (a natural obstacle for the driver in the form of a Viennese stop, which acts as a speed bump and the driver is forced to slow down in its vicinity). Additionally, such stops have been equipped with warning elements designed for the visually impaired, and reflective elements installed in the road before the arrival on the platform and marked with vertical marking (Fig. 15). Therefore, they are a great amenity for people using public transport.

Another amenity for people using public transport are electronic boards (Fig. 16). More than 250 boards are now installed at all tram stops in the city (with the exception of routes to Walcownia and Pleszów, where such boards occur only on the final stops).

To encourage residents of Cracow to stop driving in the city centre there are two more facilities. The first is a “Park and Ride” car park – parking lots located near the peripheral stops (Czerwone Maki, Giełda Balicka) designed for drivers leaving their cars in P+R parking lots and transferring to public transport. Two years ago, the first K+R “Kiss and Ride” car parks appeared on the streets of Cracow, now there are 4 car parks of this kind (Fig. 17). They are intended for drivers giving a lift to other persons who then switch to public transport.

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3 The first electronic boards in Cracow appeared in 2008 on Line 50.
Elevated platforms at the entrances for car drivers

Fig. 15. Marking of Viennese stops for car drivers

Elevated platforms at the entrances and exits are marked with a horizontal sign P-25 “speed limit” and at the entire length of the stop there is a horizontal sign P-17 “line of stop.” Additionally, the elevation of the road is preceded by a vertical sign in the form of A-11 signs “speed bump” (+ board with the distance) and the form of A-11 signs “speed bump” (+ board with the distance) and the form of A-11 signs “speed bump” (+ board with the distance). The entire length of the stop there is a horizontal sign P-25 “speed bump” and at

In addition, driving through the city centre is more difficult due to the one-way street system, which forces drivers to make major detours and discourages them from driving around the city centre.

Research results and conclusions

The survey contains 18 questions about environmental awareness in relation to various aspects of daily life. Below are the obtained results of selected aspects, primarily concerning the choice of the means of transportation in the city traffic. One of the questions contained in the survey related to the declared environmental awareness. The figure shows data which indicates that 45.1% of the respondents determines their awareness as good or very good, 43% as average, and only 9.9% as very poor or poor. Therefore, it would seem that such a high declared awareness and the public transport system in Cracow will affect the choice of environmentally friendly means of transportation.

The distribution of the declared level of environmental awareness among students is not homogeneous. Students of individual fields of study differed in assessing their knowledge of environmental issues.

It can be observed (Fig. 19) that among the students of humanities there are no people who declared that...
they have no knowledge about the environment, and
only individual persons assess their environmental
awareness at level 2. However, most of the students do
not consider themselves as professionals in this field –
therefore, out of all the compared groups, respondents
in this group identified their environmental awareness
at level 3. The results for students of natural and technical
sciences are similar. Approx. 10% of students of nat-
ural and technical sciences define their environmental
awareness as poor (2) or very poor (1), and about 10% as
very good (5). Students of natural science most often de-
defined their environmental awareness at level 4 (among
all the surveyed groups, this was the highest percentage
of choices at that level), while students of mathematical-
technical studies assessed themselves slightly lower (the
most common indication was level 3). Students of other
fields of study assessed their knowledge more critically
– as much as 25% of them defined their environmental
awareness as poor (2) or very poor (1). However, many
of them (approx. 18%) determined their knowledge as
very high (5) – this is the highest percentage in the sur-
vveyed population.

The analysis of the raw data from students’ respons-
es to the question concerning the choice of the means of
transportation seems to confirm this relationship (Fig.
20 and Fig. 21). Less than 20% of the respondents go to
university by car, and the vast majority (over 63%) use
public transport. The obtained data is coherent with na-
tionwide surveys, where 57% of respondents declared
that, whenever possible, they choose public transport or
the bicycle, instead of a car4.

The first criterion that was examined was the gen-
der criterion. It was examined whether the choice of the
means of transportation depends on the sex of the sur-
vveyed person, as shown in Figures 22-25.

Fig. 18. Declared level of environmental awareness among the surveyed students

Fig. 19. Declared level of environmental awareness among the surveyed students depending on the field of study, while calculating the group sample at 100%

Fig. 20 and Fig. 21. Less than 20% of the respondents go to university by car, and the vast majority (over 63%) use public transport. The obtained data is coherent with nationwide surveys, where 57% of respondents declared that, whenever possible, they choose public transport or the bicycle, instead of a car4.

4 https://www.mos.gov.pl/g2/big/2014_12/3cd08c737106bd35c7a6
c3128c9abbd.pdf
Fig. 20. Percentage of indications about the type of transport chosen by students to go to university (the sum of responses is greater than 100 because it was possible to choose several answers). Further analysis will be based on the above chart.

Fig. 21. The percentage of indications about the type of transport chosen by students to go to university – detailed student choices.
Ecological awareness of students of life sciences and their choice of the way of transport

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Fig. 22. Percentage of persons going to university on foot by gender

Fig. 23. Percentage of persons going to university by bike by gender

Fig. 24. Percentage of persons commuting by public transport by gender

Fig. 25. Percentage of persons commuting by car by gender
However, raw data did not provide the answer to the question whether women or men are more likely to choose more ecological means of transport. To verify this, the received data was compared to the percentage of men and women in the study population (Figure 26).

A comparison of the percentage of women and men in the surveyed population and their choice of means of transport indicates that men are more likely, than their share in the study population, to drive a bicycle and use public transport. Conclusion: this seems to deny the widespread belief that men are more likely to drive a car than women, and that women are more likely to travel by public transport – but it should be remembered that the research concerned young people.

The second criterion that was examined was the field of study. It was compared whether the choice of means of transport depends on the field of study (and conducted courses, for example, on the environment). The results are shown in Figures 27-30.

After equating the obtained results to the percentage of students in different fields of study in the surveyed population (Fig. 31, Table 1), it can be observed that students of natural sciences, more often than their representation in the student population, choose public transport and walking. They rarely drive.

Leaving the analysis of the received data at this level would undoubtedly demonstrate the influence of the environmental attitudes of students on the choice of means of transport. However, if we observe how the choice of the means of transport changes with the level of studies (Fig. 32) and the age of students (Fig. 33), we notice a disturbing tendency: the older the students are and the better educated, their declared interest in environmental protection and the type of education has less influence on their pro-ecological choices.

Conclusion: It seems that the lack of a car or lack of funds for its maintenance decides about the preferences...
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Fig. 27. Percentage of people going to university on foot with regard to their studies

Fig. 28. Percentage of people riding a bike to university with regard to their studies

Fig. 29. Percentage of people commuting to university with regard to their studies

Fig. 30. Percentage of people driving to university with regard to their studies
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Fig. 31. Alignment of the obtained results to the percentage of students of particular fields of study in the studied population

Fig. 32. Alignment of the obtained results to the percentage of students at a given level of study in the studied population

Fig. 33. Alignment of the obtained results to the percentage of students of a given age in the studied population

Table 1. Comparison of the obtained results of individual groups with the mean in the population

<table>
<thead>
<tr>
<th>Humanities</th>
<th>Natural science</th>
<th>Technical/exact</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>On foot</td>
<td>≈</td>
<td>↑↑</td>
<td>↓</td>
</tr>
<tr>
<td>Bike</td>
<td>↑</td>
<td>↑↑</td>
<td>↓</td>
</tr>
<tr>
<td>Public transport</td>
<td>≈</td>
<td>=</td>
<td>≈</td>
</tr>
<tr>
<td>Car</td>
<td>↓</td>
<td>≈</td>
<td>↑</td>
</tr>
</tbody>
</table>

Symbols used in the table:

↑↑ much more than the average in the surveyed population
↑ more than the average in the surveyed population
= the average in the surveyed population
≈ nearly as the average in the surveyed population
↓ less than the average in the surveyed population
of environmental means of transport among students. This concept is supported by the motivations of choosing the means of transport.

In the remainder of the survey, students were asked to provide, in an open question, three expressions to justify their choice of a particular means of transportation.

Students choosing to walk to university on foot (Fig. 34) most frequently mentioned the following advantages of walking: it’s close, healthy, fast, cheap, comfortable, they like sport/fitness/physical activity, safety.

The provided expressions may be grouped into three categories. One of the dimensions of motivation is the broadly understood concept of comfort – this may include the following: it’s close, fast, cheap, comfortable (highlighted in blue in the chart). The second dimension of motivation has a pro-health/pro-ecological aspect – it is represented by: health, I like sport, physical activity, fitness (highlighted in green in the chart); the third is safety (highlighted in red in the chart). If we segregate the data in this way we will observe (Fig. 35) that pedestrian communication as a method of reaching the university is chosen because of comfort (64% of indications). The pro-health aspect amounts to only 34% of responses (Safety 2%).

Students choosing a bike to go to university mentioned the same eight advantages of this type of transportation (it’s close, healthy, fast, cheap, comfortable, I like sport/fitness/physical activity, safety).

Identically as in the previous example, the expressions provided by students were grouped into three categories (Fig. 37). And as in the previous example, students choose cycling as a means of transport to get to university mainly because of comfort (62% of indications). The pro-health aspect amounts to only 31% of responses (Safety 8%).
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Fig. 35. Expressions listed by the student to justify walking on foot, grouped into 3 categories

Fig. 36. Expressions listed by students to justify the reasons for cycling, grouped into 3 categories

Fig. 37. Expressions listed by the students to justify reasons for cycling, grouped into 3 categories
Students who choose public transport as a way of commuting to university mentioned as many as 28 different expressions motivating their choice (Fig. 38): fast, cheap, convenient, it’s far away, no car, safe, it’s close, the only possible means of transport, accessible, ecological, traffic jams, direct access, problems with parking, it’s packed, without stress, because I can, frequency, necessity, I like it, I do not have a driving licence, I do not have a bike, straight, friendly, no choice, punctual, relaxing, efficient, healthy, I’m cold.

Conclusions: It is difficult to agree with some of these expressions (e.g. relaxation, stress free), other motivations are not fully understood (e.g. healthy, friendly), still other reveal personal preferences of the respondents (e.g. it’s packed). Sometimes the choice of public transport is a necessity or the only possibility (e.g. lack of bike, driving license, car). Some of the opinions of the surveyed students confirm the earlier analysis of the authors about the ways of moving around Cracow (e.g. traffic jams, parking problems, punctuality, efficiency, comfort).

Students who chose public transport were the only ones to point directly to the ecological aspect of the choice of means of transport (3.8%). It is worth noticing that some student responses are contradictory (e.g. 6.4% of students argue that they use public transport because their destination is close, and 10.3% that it is far away).

Expressions listed by students were grouped into three categories (Fig. 39). Like in the earlier cases, the choice of public transport as a method of commuting to university was due to comfort reasons, but in this case it amounted to as much as 91% of indications. The health / environmental aspect amounts to only 5% of the responses and safety 4%.

Students who chose the car as a means of transportation to go to university listed 11 different motivational choices (Fig. 40): fast, convenient, it’s far, independ-
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Influence, children to be transported, better, more efficient, direct access to the place of destination, safe, economical, laziness. Conclusions: This is the only group which mentions “children” (which in Cracow is not quite true given the number of parents with children on buses or trams and children travelling with cyclists), and the only one where people admit to laziness. The responses concerning “independence” and “direct access to the place of destination” – are somewhat stretched because of the parking difficulties in Cracow, usually the only available parking place is located far away from the destination. Also, the economic aspect in this case seems unlikely.

Fig. 39. Expressions listed by students justifying the use of public transport, grouped into 3 categories

Fig. 40. Expressions listed by students justify driving a car
Expressions listed by students were grouped into two categories (Fig. 41). There is no pro-health / environmentally friendly aspect here. Convenience amounts to 92% of responses, and safety to only 8%.

The summary of the results presented in one graph (Fig. 42) leads to the following conclusions:

- on foot: close and healthy,
- the bike is used by people who like it,
- public transport is cheap and ecologically sound,
- the car is fast and convenient

The grouping of the results into 3 categories (Fig. 43): convenience, ecology, safe shows that the convenience of walking and cycling is comparable for the respondents (slightly more than 60%) and similarly, the convenience of using public transportation and the car is also comparable (just over 90%). The pro-health/ecological aspect is demonstrated by slightly more than 30% of respondents riding a bicycle or walking on foot.
Safety, as a motivating factor for the choice of the means of transport, is the lowest (below 10%) – the highest in the case of the car and bike5 (8%).

In a local referendum, held on 25 May 2014, 85% of Cracow residents were in favour of the construction of bicycle paths. Whereas students were asked the following question: If there were good and safe bicycle paths in your area, would you ride a bike to work / school? More than half of the respondents answered NO (Fig. 44). Therefore, it is not the lack of safe bicycle paths that affects the use of the bicycle as a means of transportation.

As a justification of the answer “NO” (Fig. 45), students mentioned the following reasons: far away (18%), I do not like it (12%), I do not have a bike (9%), no stamina (3%), I prefer to walk (3%) and I can’t ride a bike, I prefer to drive a car, I prefer to ride a bike on the street than on a bicycle path, when cycling I cannot dress elegantly, I do not have time, I have to take children to the kindergarten (about 1%).

As justification for answer “YES” (Fig. 46), students mentioned the following reasons: it’s healthy (17%), I like it (11%), fast (5%), cheap, pleasant, safe, comfortable (2%), it’s close, ecological, independence (1% each). Other justifications (fear of cycling, the road, no traffic, far away, well-being, oxygenation, it’s easy, fitness, contact with nature, relaxation, movement, training, less traffic in the city) were below 1%. It can therefore be said that the motivations for “Yes” are more diverse. However, both in the case of the reasons for “YES” and “NO”, there appears the justification: I like it/ I do not like it, so it seems that people have to get to like riding a bike... maybe the school, maybe some actions...

5 Wydaje się, że jednak ścieżki rowerowe w Krakowie spełniają swoją rolę i rowerzyści czują się na nich bezpiecznie. It seems that bicycle paths in Cracow fulfil their role and cyclists using them feel safe.
Conclusion

Based on the above findings, it can be stated that the level of ecological awareness among students is still not satisfactory and the declared care for the environment is not supported by attitudes and behaviours. Students of natural sciences have identified their ecological awareness as one of the highest, but although students of this particular field of study, more often than it would appear from their representation in the student population, choose public transport and walking, and less frequently the car, their own comfort is most important to them, even more than health and stamina, and not care for the environment. In situations where they have the choice of convenience or care for the environment, they choose their own comfort. Also, in situations where they have the choice of saving money or engage in pro-ecological actions which involve increased spending, saving money is also a priority. As the study shows, only one in three Poles (36%) is willing to spend more money on ecological solutions.

As concerns education for sustainable development more emphasis should be placed on the ability of students to properly assess the reality and make decisions that enable them to take care of their health and the environment.

Research also shows that without changing the students' attitudes, further development of cycling networks in Cracow will not affect more frequent use of bicycles as a means of transportation. It seems, therefore, that the construction of bicycle paths postulated by the inhabitants of Cracow has a recreational purpose rather than a communication purpose.

Research also shows that men are more likely to ride a bicycle and use public transport than women. This contradicts the general belief that men are more likely to drive a car than women and that women are more likely to travel by public transport – but we must remember that the study concerned young people.

References


The report on the analysis of the surveys on ecological awareness, attitudes and behaviour of Poles conducted in Poland in 2009-2015 was prepared for the Ministry of the Environment by the Social Research Team at TNS Polska. The project was financed from the National Fund for Environmental Protection and Water Management

Fig. 46. If there were good and safe cycling paths in your area, would you go to work / school? Justification for choosing answer “Yes”

contradicts the general belief that men are more likely to drive a car than women and that women are more likely to travel by public transport – but we must remember that the study concerned young people.

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(Raport z analizy badań świadomości, postaw i zachowań ekologicznych Polaków przeprowadzonych w Polsce w latach 2009-2015 przygotowany został na zlecenie Ministerstwa Środowiska przez Zespół Badań Społecznych w TNS Polska. Projekt sfinansowany został ze środków Narodowego Funduszu Ochrony Środowiska i Gospodarki Wodnej.)

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(Raport z analizy badań świadomości, postaw i zachowań ekologicznych © TNS Lipiec 2015)

http://kmkrakow.pl/informacje-o-systemie-kmk/infrastruktura.html

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