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# Circular behaviours undertaken by Polish households – a preliminary analysis of research results

**Abstract:** The main aim of the paper is to analyse and evaluate the possible relation between circular behaviours undertaken by the households and the socio-economic features describing them. The paper presents the results of the author's research conducted among Polish households on the territory of two voivodeships: Podkarpackie and Małopolskie. In the article, the author presents the concept of circular behaviours (understood as an element of pro-ecological behaviours), as well as the result of the preliminary analysis of the frequency of exhibiting those behaviours in the households. This analysis is based on evidence regarding the possible differences between the households due to their distinct features. To indicate the possible differences the $Chi^2$ Test of Independence was used. Obtained results indicate that some socio-economic features may have an influence on the frequency of conducting circular behaviours. It could be important due to the establishment of supporting activities aiming at increasing the overall level of circularity among households (as an economic sector). This article is the fourth one in the publication series devoted to circular economy and sustainable development matters.

**Keywords:** circular economy; circular motives; statistical analysis; quality of life

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## Introduction

The present paper is the fourth one in the publication series devoted to circular economy and sustainable development matters. In this paper major attention will be focused on circular behaviours taken by the households. These behaviours are treated as part of a broader concept – pro-ecological behaviours. The concept of circular behaviours was described by the author in the previous publications (see i.e.: Szczygieł, 2020a,

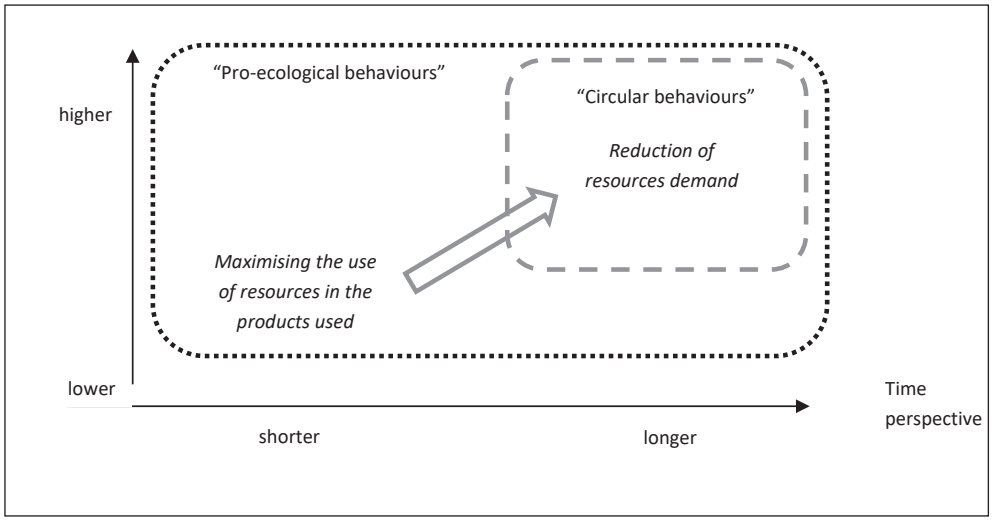
2020b). This concept is strictly related to the circular economy trend (or more precisely – economic system) which can be defined as *a closed loop economy that does not generate excessive waste and whereby any waste becomes a resource* (Geisendorf, Pietrulla, 2018). Although, for the first time the term *circular economy* was used by David Pearce and R. Kerry Turner in 1990 in their book entitled "Economics of Natural Resources and the Environment" (Pearce, Turner, 1990), the increasing popularity of this concept has been observed from 2015 (which is proved by the number of scientific articles or strategical documents relating to this subject). Circular economy can be treated not only as part of enterprises` approach to the production process, but also as a broad set of different actions undertaken by different economic entities at all economic phases of using a product or service (or in fact – using the resources).

The author differentiates between the pro-ecological and circular behaviours taken by the household members. The first group contains a wide range of activities, and it could be stated that circular behaviours are an element of them (Korsunova, Horn, Vainio, 2021; Lakatos et al., 2016, 2018; Nainggolan et al., 2019; Sinclair et al., 2018). Pro-ecological behaviours include activities undertaken by household members in relation to their daily life, starting from the most popular waste segregation system (see e.g. Concari, Kok, Martens, 2020; Rousta, Bolton, Dahlén, 2016; Shevchenko, Laitala, Danko, 2019); through avoiding food waste (Shaw, Smith, Williams, 2018) and ending with sustainability consumption (see e.g. Carrete et al., 2012; Costa Pinto et al., 2019; Figueroa-García, García-Machado, Pérez-Bustamante Yábar, 2018; Fisher, Böhme, Geiger, 2017; Heeren et al., 2016; Lee et al., 2016; Lin, 2013; Mancini, Marchini, Simeone, 2017; Matharu, Jain, Kamboj, 2020; Zrałek, Burgiel, 2020).

The main difference factor between them is the perspective of using the resources or – in other words – the level of circularity (Figure 1).

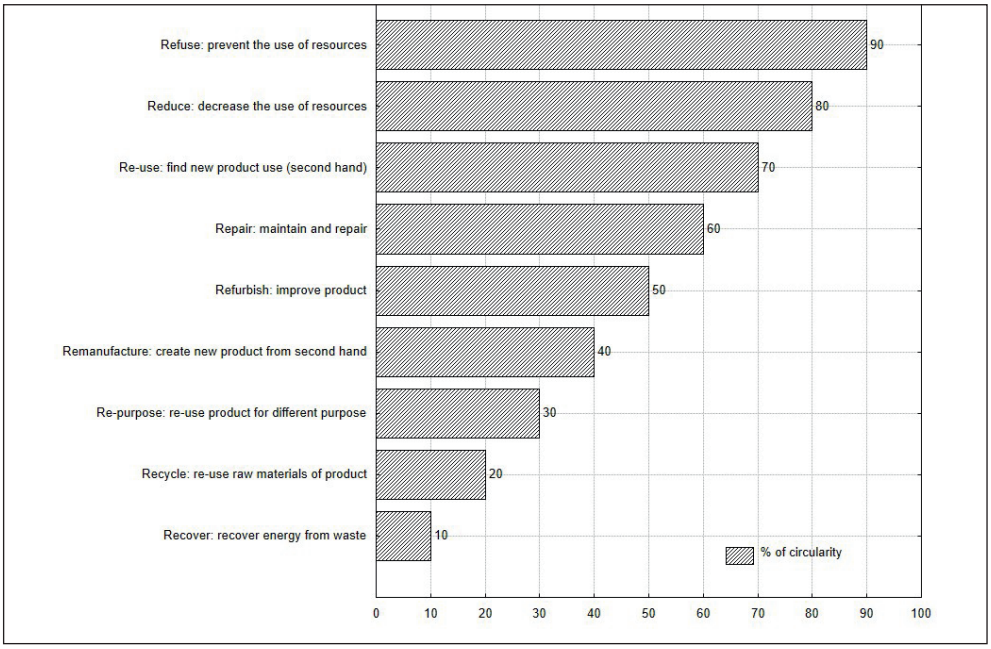
In circular behaviours, the main attention is placed on decreasing the need of resources by reducing the demand for products and shifting to meeting the need (sharing objects, using Internet of Things, etc.). Circular behaviours in households can therefore

*Figure 1.* Pro-ecological and circular behaviours




Source: author's own work

*Figure 2.* Levels of Circularity: 9R`s




Source: Czikkely et al., 2018: 3

be defined as those, although related to pro-ecological behaviours, whose main goal is to ensure the maximum use of resources used to produce already existing things and – in the long run – to reduce the demand for them. It is not possible to divide these two categories into separate groups, because the lower level of circularity is connected with some pro-ecological behaviours. The level of circularity means the amount of new resource needed to meet the need (Figure 2).

The concept of circularity assumes the possibility of its gradeability or measurement. The most popular ones are related to using the abbreviation of *R* – activities (i.e. in 3R's approach: *Reduce*, *Reuse* and *Recycle* or in 9R's concept: *Refuse* (as *R0*), *Re – think*, *Reduce*, *Re – use*, *Repair*, *Refurbish*, *Remanufacture*, *Re – purpose*, *Recycle*, *Recover*) (Kirchner, Reike, Hekkerts, 2017; Manickam, Duraisamy, 2019). Such a classification is convenient to elaborate the proposition of circular activities conducted by various entities of the economy, i.e. entrepreneurships or households (single users). The last mentioned economic entity is the subject of the analysis presented within the paper.

## METHOD OF RESEARCH

The main purpose of this study is to indicate the key features of the households that can influence undertaking circular behaviours by their members. As key features, the author understands the socio-economic characteristics of the households, i.e.: *Sex*, *Age group*, *Place of residence*, *Level of education*, *Labour market status*, *Household personal composition* and *Material status*. The main thesis assumed in the present article is the following: *the circular behaviours taken by the households are different due to the socio--economic characteristics of the households.*

On this basis, six hypotheses were accepted for testing:

- $H_1$ – The sex of the head of the household is the most important feature differentiating the undertaking of circular behaviours.
- $H_2$ – Women more often than men undertake circular behaviours.
- $H_3$ – With age, the frequency of undertaking circular behaviours increases.
- $H_4$ – Living in the countryside favours undertaking circular behaviour more frequently.
- $H_5$ – Higher level of education favours undertaking circular behaviour more frequently.
- $H_6$ – If the number of children in the household increases, circular behaviours are undertaken by its members more often.
- $H_7$ – If the household assesses higher its material status, circular behaviours are undertaken by its members more often.

To verify these hypotheses the $Chi^2$ Test of Independence was used ($\alpha=0.05$, $p<\alpha$). The data used in the article came from the original research conducted by the author within the internal grant of Pedagogical University of Krakow (no. BN.610 – 64/PBU/2020) entitled: "Circular behaviours in households and the quality of life of their inhabitants". The research was conducted in December 2020 on the territory of Małopolskie and Podkarpackie Voivodeships (N=400 households) (Figure 3).

The sample was selected in a way that is representative of the population structure in both voivodeships (245 respondents from Małopolskie and 155 from Podkarpackie; 208 women and 192 men; 149 respondents from villages and 251 from urban areas). The research was conducted by an outsourced research entity on the base of the author's own methodology (using a survey questionnaire carried out by means of the CAWI technique). The main scope of the research project concerned the undertaking of circular behaviours by the households and the influence on their quality of life.

*Figure 3.* The territory covered by the research


*Source:* author's own work using Excel Maps

In the research, the respondents were asked to assess the following statements concerning their circular behaviours (Table 1). This proposition is based on the division of circular behaviours due to the level of circularity. Within the scope of the paper, it was decided to use the 9R's concept (Kirchner, Reike, Hekkerts, 2017). This concept allows for presenting the level of circularity of undertaken behaviours and distinguishing them. It is possible to assign behaviours with a higher degree of circularity and those, with a lower one. However, although this procedure could be convenient, it has some limitation. First of all, the daily life of each household is very different and it is impossible to propose the closing catalogue of possible behaviours. Secondly, some of them could be assigned to two (or more) categories, i.e.: "No. 11. I buy used furniture and household appliances, repair or renew them for use" could be treated as an example of "R5. Refurbish: improve product" and "R6. Repair: maintain and repair". The same situation could concern the statement "No. 9. I use used plastic packaging for other purposes", which could be assigned to "Re-purpose: re-use product for different purpose" and "Re-use: find new product use (second hand)". The proposition based on 9R`s concept should be treated as a support to recognise the increasing level of circularity, not as a rigid division. Using 9R's concept in this article allows understanding the increasing impact of circularity in the analysed behaviours.

*Table 1.* The proposition of circular behaviours in households (research concept)

| Level of circularity | Example of circular behaviours in households |
|---|---|
| R1 | 1. I sort garbage into wet and dry fraction<br>2. I sort garbage into glass, metal and plastic, paper, bio, mixed |
| R2 | 3. Before throwing things away, I remove the components that I think may be useful<br>4. I use the paper several times (e.g. printed on one side, I use it for scrapbooking)<br>5. I use foil packaging several times<br>6. I use a reusable bag when shopping<br>7. I use paper and recyclable packaging<br>8. When shopping, I choose recyclable products |
| R3 | 9. I use used plastic packaging for other purposes |
| R4 | 10. I collect parts of other products to be able to create the product I need |
| R5 | 11. I buy used furniture and household appliances, repair or renew them for use |
| R6 | 12. I repair broken small electronic and technical equipment (e.g. telephone, electric kettle, iron)<br>13. I repair large electronic and technical equipment (e.g. computer, TV, washing machine, fridge)<br>14. I repair shoes and clothes<br>15. I use the services for servicing the products I use<br>16. I take care of small electronic and technical equipment, thus extending its life |
| R7* | – |
| R8 | 17. I share with others clothes that I don't need<br>18. I give unnecessary food to the dining room or share it with my family and friends<br>19. I use used electronic and technical equipment (e.g. a second-hand telephone, a leased laptop)<br>20. I buy second-hand clothes<br>21. When choosing electronic and technical equipment, I am guided by its energy class<br>22. I use water sparingly<br>23. I do the laundry when I have enough to load the entire washing machine<br>24. I share the use of a passenger car with other people (e.g. family, friends)<br>25. I only fly long distances (e.g. over 6 hours of travel)<br>26. I prepare food myself at home and for work/school<br>27. I use public transport for journeys up to 30 km |

| | |
|---|---|
| R9 | 28. I turn off the light when I'm not in the room<br>29. I disconnect devices from the contact when I do not use them (e.g. remove the phone charger after charging the phone)<br>30. I do not use the standby function in electrical appliances<br>31. I buy an adequate amount of food products in relation to the consumption capacity of my household<br>32. When shopping, I only buy the products that I have on my list<br>33. I use rechargeable batteries<br>34. I dry the laundry in the open air<br>35. I use solar panels or photovoltaic collectors at home<br>36. I use renewable energy resources<br>37. I ride my bike to work/school |

R7* – during the research, the respondents were asked about using the plastic packaging for other purposes (R3).

Source: author's own work

## Circular behaviours undertaken by household members in Poland

The evaluation scale contained 5 verbal statements referring to the frequency of undertaken behaviours: *Never, Rarely, Sometimes, Often, Always*. As the most frequent behaviours taken by the households were treated those whose periodicity was at least *Often* (finally, two assessments were taken into consideration: *Often* and *Always*). Table 2 presents the analysis result. The boundary condition was that a given behaviour was indicated by more than 100 households.

*Table 2.* Frequency of Circular behaviours – "Often" and "Always"

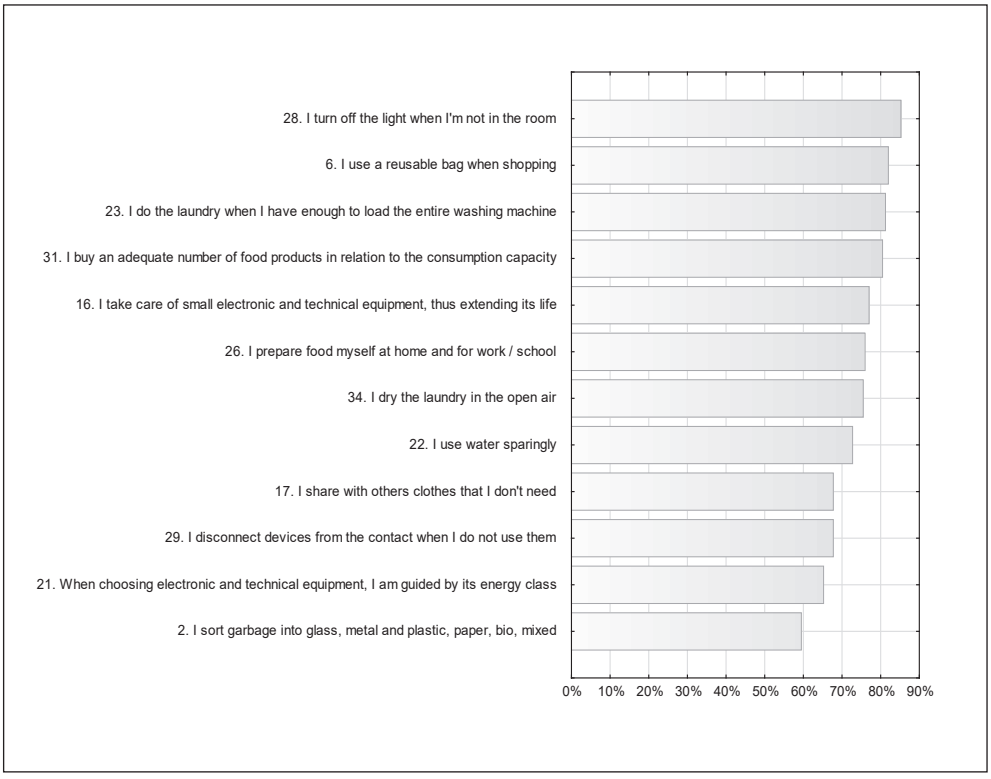
| Circular behaviours | Often | Always |
|---|---|---|
| 2. I sort garbage into glass, metal and plastic, paper, bio, mixed | | 238 |
| 4. I use the paper several times | 147 | |
| 5. I use foil packaging several times | 135 | |
| 6. I use a reusable bag when shopping | 114 | 214 |
| 7. I use paper and recyclable packaging | 163 | |
| 8. When shopping, I choose recyclable products | 131 | |
| 12. I repair broken small electronic and technical equipment | 130 | |
| 13. I repair large electronic and technical equipment | 142 | |
| 14. I repair shoes and clothes | 105 | |
| 15. I use the services for servicing the products I use | 115 | |
| 16. I take care of small electronic and technical equipment, thus extending its life | 151 | 157 |
| 17. I share with others clothes that I don't need | 136 | 135 |
| 20. I buy second – hand clothes | 117 | |
| 21. When choosing electronic and technical equipment, I am guided by its energy class | 142 | 119 |
| 22. I use water sparingly | 142 | 149 |
| 23. I do the laundry when I have enough to load the entire washing machine | 120 | 205 |
| 26. I prepare food myself at home and for work/school | 159 | 145 |
| 28. I turn off the light when I'm not in the room | 126 | 215 |
| 29. I disconnect devices from the contact when I do not use them | 114 | 157 |
| 30. I do not use the standby function in electrical appliances | 114 | |

| | | |
|---|---|---|
| 31. I buy an adequate number of food products in relation to the consumption capacity of my household | 159 | 163 |
| 32. When shopping, I only buy the products that I have on my list | 193 | |
| 33. I use rechargeable batteries | 141 | |
| 34. I dry the laundry in the open air | 154 | 148 |

Source: author's own work

Comparing these two groups allows one to notice that only one behaviour among the analysed belongs only to one group, the "Always" group (No. 2. *I sort garbage into glass, metal and plastic, paper, bio, mixed*; N=238). It could mean that the sorting behaviour of bigger products is relatively more popular and undertaken by the households as a normal behaviour. The remaining behaviours from the "Always" group belong also to the "Often" group. As a result, 12 of the most popular behaviours are undertaken by more than 60% of the analysed households (Figure 4).

*Figure 4.* Frequency of Circular behaviours – "Always" and "Often"




Source: author's own work

The frequency of undertaking circular behaviours by the household members may be satisfactory, but it is necessary to pay attention to the decision process (*how it is conducted?*, *who is responsible for it?*) and the factors that may differentiate them. The result of this analysis is presented in the next part of the article.

## The influence of socio-economic factors on undertaking circular behaviours

The analysis focuses on the differences between households based on their socio-economic features. The paper is an introduction presenting the possible profiles of households undertaking circular behaviours. The socio-economic factors taken into consideration in the analysis were the following:

- Sex [*Male; Female*]
- Age group [*18–29 years old; 30–39 years old; 40–49 years old; 50–59 years old; 60 years and more*]
- Place of residence [*Village; City up to 20k residents; City between 20k and 50k; City between 50k and 100k; City between 100k and 500k; City over 500k*]
- Education [*Elementary; Grammar school; Vocational; Secondary; During studies; Higher*]
- Labour market status [*A person during studies; Unemployed person; Working person; A person running a farm; A person running his/her own business; Retirees*[1]*; Pensioners*[2]]
- Household personal composition [*Single person; Marriage/couple without children; Marriage/couple with 1 child; Marriage/couple with 2 children; Marriage/couple with 3 or more children; Single parent*]
- Material status [*Very bad, Bad, Average, Good, Very good*]

The difference between circular behaviours due to socio-economic characteristics is statistically significant for the following categories (Table 3).

*Table 3.* The result of statistically significant differences between circular behaviours and the socio-economic characteristics (Chi$^2$ test, $p<\alpha$)

| Circular behaviours | p |
|---|---|
| Sex | |
| 1. I sort garbage into a wet and dry fraction | 0.02252 |
| 2. I sort garbage into glass, metal and plastic, paper, bio, mixed | 0.04680 |
| 4. I use the paper several times (e.g. printed on one side, I use it for scrapbook) | 0.00779 |
| 6. I use a reusable bag when shopping | 0.00131 |
| 7. I use paper and recyclable packaging | 0.00016 |
| 8. When shopping, I choose recyclable products | 0.00161 |
| 14. I repair shoes and clothes | 0.01322 |
| 16. I take care of small electronic and technical equipment, thus extending its life | 0.03327 |
| 17. I share with others clothes that I don't need | 0.00006 |
| 20. I buy second – hand clothes | 0.01242 |
| 23. I do the laundry when I have enough to load the entire washing machine | 0.00322 |
| 26. I prepare food myself at home and for work/school | 0.00037 |
| 28. I turn off the light when I'm not in the room | 0.00034 |
| 29. I disconnect devices from the contact when I do not use them (e.g. remove the phone charger after charging the phone) | 0.02861 |
| 30. I do not use the standby function in electrical appliances | 0.02086 |
| 34. I dry the laundry in the open air | 0.00947 |

[1] Retirees – households whose exclusive or main (prevailing) source of income is retirement pension on the basis of insurance in social security funds, including: early retirement pays for transferred farm, disability types of benefits (for inability to work, training or granted to individual farmers), and family retirement.

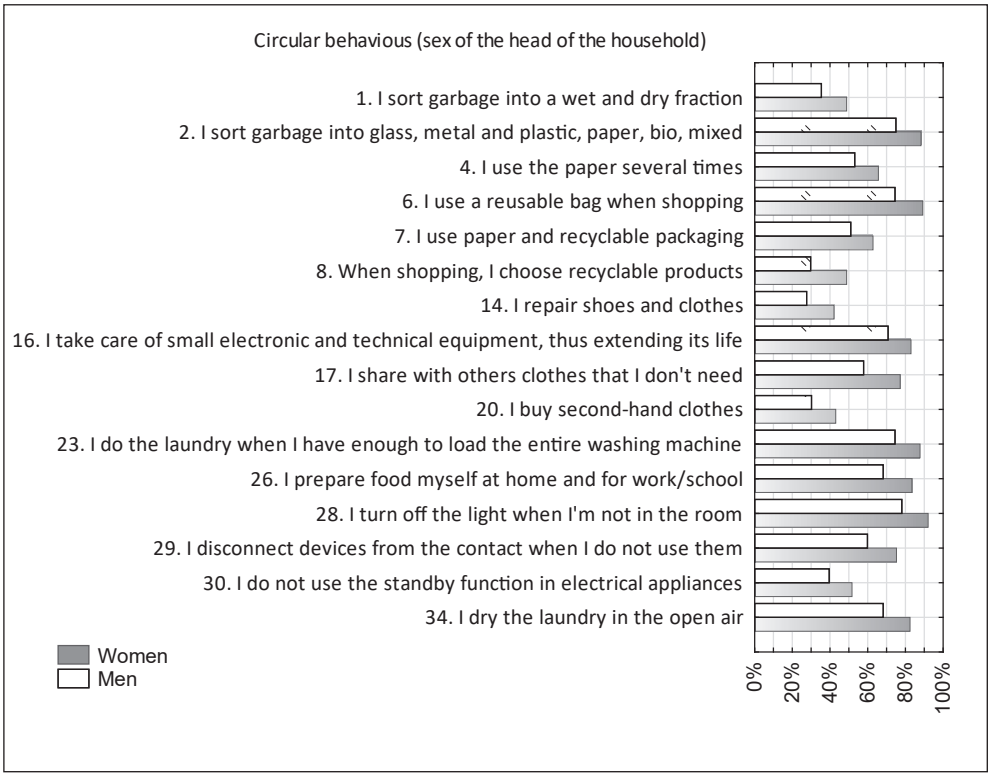
[2] Pensioners – households whose exclusive or main (prevailing) source of income is any type of pension, received by the insured persons (or their families) after working for the statutory number of years and after reaching a certain age.

| Age group | |
|---|---|
| 2. I sort garbage into glass, metal and plastic, paper, bio, mixed | 0.02064 |
| 7. I use paper and recyclable packaging | 0.02699 |
| 9. I use used plastic packaging for other purposes | 0.01818 |
| 21. When choosing electronic and technical equipment, I am guided by its energy class | 0.00688 |
| 23. I do the laundry when I have enough to load the entire washing machine | 0.03047 |
| 26. I prepare food myself at home and for work/school | 0.04891 |
| 27. I use public transport for journeys up to 30 km | 0.01346 |
| 33. I use rechargeable batteries | 0.03231 |
| 36. I use renewable energy resources | 0.04723 |
| Place of residence | |
| 3. Before throwing things away, I remove the components that I think may be useful | 0.02162 |
| 18. I give unnecessary food to the dining room or share it with my family and friends | 0.01860 |
| 19. I use used electronic and technical equipment (e.g. a second – hand telephone, a leased laptop) | 0.03953 |
| 25. I only fly long distances (e.g. over 6 hours of travel) | 0.00681 |
| 27. I use public transport for journeys up to 30 km | 0.02999 |
| 30. I do not use the standby function in electrical appliances | 0.03488 |
| 36. I use renewable energy resources | 0.00128 |
| Education | |
| 1. I sort garbage into a wet and dry fraction | 0.02068 |
| 24. I share the use of a passenger car with other people (e.g. family, friends) | 0.01562 |
| 26. I prepare food myself at home and for work/school | 0.02471 |
| 27. I use public transport for journeys up to 30 km | 0.00692 |
| 33. I use rechargeable batteries | 0.01326 |
| Labour market status | |
| 32. When shopping, I only buy the products that I have on my list | 0.01489 |
| 33. I use rechargeable batteries | 0.04101 |
| Household personal composition | |
| 7. I use paper and recyclable packaging | 0.04636 |
| 20. I buy second – hand clothes | 0.03710 |
| 21. When choosing electronic and technical equipment, I am guided by its energy class | 0.04852 |
| 36. I use renewable energy resources | 0.04418 |
| 37. I ride my bike to work/school | 0.02655 |
| Material situation | |
| 2. I sort garbage into glass, metal and plastic, paper, bio, mixed | 0.00059 |
| 4. I use the paper several times (e.g. printed on one side, I use it for scrapbook) | 0.02457 |
| 7. I use paper and recyclable packaging | 0.04946 |
| 28. I turn off the light when I'm not in the room | 0.04087 |
| 29. I disconnect devices from the contact when I do not use them (e.g. remove the phone charger after charging the phone) | 0.01154 |
| 25. I only fly long distances (e.g. over 6 hours of travel) | 0.00012 |
| 37. I ride my bike to work/school | 0.02015 |

Source: author's own work

This summary allows to confirm the first hypothesis ($H_1$ – *The sex of the head of the household is the most important feature differentiating undertaking of circular behaviours*). Substantially, from 37 tested behaviours, 16 were taken up in different ways due to the decision of the household's head. Whereas, as women spend more time in domestic activities (GUS, 2013), it is assumed that women more often than men demonstrate circular behaviours ($H_2$ – *Women more often than men undertake circular behaviours*). Analysing the results, among women, the total frequency of taken behaviours which are the most wanted (*Always* and *Often*) are from 11 to 19 percent higher than in men's group (Figure 5).

*Figure 5.* Frequency of "Always" and "Often" of circular behaviours undertaken by women and men




Source: author's own work

Within the survey, the third hypothesis ($H_3$ – *With age, the frequency of undertaking circular behaviours increases*) could only be partially confirmed. Some of the circular behaviours taken up by the elder age groups (i.e. *50–59 years old* or *60 years and more*) are not as frequent as in other groups (assessment was conducted in a similar way for each feature, with responses for *Always* and *Often* summarised) (Table 4).

*Table 4.* Frequency of "Always" and "Often" of circular behaviours undertaken by the members of analysed age groups

| | 18–29 years old | 30–39 years old | 40–49 years old | 50–59 years old | 60 years and more |
|---|---|---|---|---|---|
| 2. I sort garbage into glass, metal and plastic, paper, bio, mixed | 76.7 | 86.8 | 70.8 | 86.4 | 86.0 |
| 7. I use paper and recyclable packaging | 47.7 | 67.1 | 56.9 | 60.6 | 55.1 |
| 9. I use used plastic packaging for other purposes | 31.4 | 28.9 | 29.2 | 34.8 | 26.2 |
| 21. When choosing electronic and technical equipment, I am guided by its energy class | 53.5 | 69.7 | 73.8 | 72.7 | 61.7 |
| 23. I do the laundry when I have enough to load the entire washing machine | 68.6 | 86.8 | 87.7 | 86.4 | 80.4 |

| | | | | | |
|---|---|---|---|---|---|
| 26. I prepare food myself at home and for work/school | 62.8 | 81.6 | 76.9 | 84.8 | 76.6 |
| 27. I use public transport for journeys up to 30 km | 40.7 | 36.8 | 26.2 | 43.9 | 43.9 |
| 33. I use rechargeable batteries | 76.7 | 86.8 | 70.8 | 86.4 | 86.0 |
| 36. I use renewable energy resources | 23.3 | 22.4 | 18.5 | 22.7 | 25.2 |

Source: author's own work

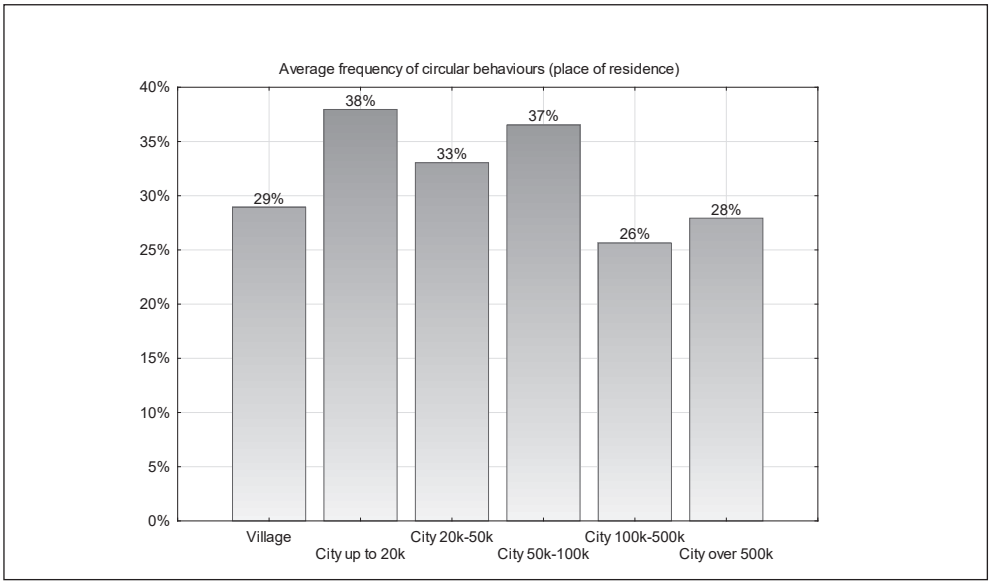
The frequency of the behaviours undertaken is not a simple linear model. It is observed that some behaviours that are not so complicated, e.g. No. 2. *I sort garbage into glass, metal and plastic, paper, bio, mixed* or *No. 23. I do the laundry when I have enough to load the entire washing machine* are related directly to their popularity over time. Before 1989, using a deposit for bottles was a standard procedure during the purchasing process; similarly, within the economy of scarcity, doing the laundry not so often was due to the lack of washing machines or appropriate detergents. The frequency of some behaviours could not be so often, due to the fact of necessary support of other people, i.e.: No. 21. *When choosing electronic and technical equipment, I am guided by its energy class* – the decision could be taken collectively by the members of the household; No. 7. *I use paper and recyclable packaging* –the daily purchase could be taken by other household members; No. 26. *I prepare food myself at home and for work/school* – meals could be prepared by other, younger household members. It is possible to say, that in the elder age groups the *saving motive* in taken behaviours can be observed and, as an effect, these groups are oriented on saving resources through saving personal finances. On the other hand, the in – depth analysis of this problem is needed due to the fact that in some research the assumed hypothesis is totally confirmed (Lakatos et al., 2018). However, in the cited study, the authors analysed sustainable behaviours between Generation X, Y and Z (therefore, the age groups were more diverse than in the present paper).

The fourth hypothesis ($H_4$) assumed that living in the countryside favours taking up circular behaviours. Within the research results this hypothesis was rejected (Figure 6).

Traditionally, there is a belief that village inhabitants have the possibility to take up circular behaviours more often than those who live in cities. It could be related to using worse clothes when working around the home or in a farm or the possibility of using excess food for feeding animals. Unfortunately, it was not approved within the research. The difference for the mentioned behaviours was not statistically significant (No. 7. *I sort garbage into a wet and dry fraction* – $p$=0.72345; No. 8. *I sort garbage into glass, metal and plastic, paper, bio, mixed* – $p$=0.08230; No. 9. *I share with other clothes that I don't need* – $p$=0.73534; No. 15. *I repair shoes and clothes* – $p$=0.38055). It is interesting, because the results from other research proved the existing connection between living in a countryside and the consciousness of nature and its products, respecting the seasonal food cycles, which could have a potential influence on taking up circular behaviours (Mancini, Marchini, Simeone, 2017).

The fifth hypothesis ($H_5$), assuming that higher level of education favours taking up circular behaviour more frequently, was only partially confirmed. There is no linear dependency between the level of education and taking up circular behaviours more frequently by the respondents (Table 5). However, results from other studies show that the level of education increases awareness and therefore the need to have "good behaviour" (Mancini, Marchini, Simeone, 2017). On the other hand only partial confirmation of this hypothesis could be explained by the detailed knowledge of topics. Overall

*Figure 6.* Average frequency of "Always" and "Often" of circular behaviours undertaken by inhabitants of villages and cities




Source: author's own work

education does not mean that the circular aspects are familiar. Other research confirms the dependence between undertaking sustainable consumption and taking courses, attending workshops or holding talks about environmental issues (Figueroa-García, García-Machado, Pérez-Bustamante Yábar, 2018).

*Table 5.* Frequency of "Always" and "Often" of circular behaviours undertaken by the members of the analysed educational groups

| | Elementary | Grammar | Vocational | Secondary | During the studies | Higher |
|---|---|---|---|---|---|---|
| 1. I sort garbage into a wet and dry fraction, | 25.0 | 50.0 | 56.8 | 42.9 | 25.0 | 41.8 |
| 24. I share the use of a passenger car with other people (e.g. family, friends) | 25.0 | 50.0 | 21.6 | 41.0 | 65.6 | 39.4 |
| 26. I prepare food myself at home and for work/school | 50.0 | 50.0 | 70.3 | 76.9 | 62.5 | 80.6 |
| 27. I use public transport for journeys up to 30 km | 75.0 | 16.7 | 32.4 | 38.5 | 59.4 | 37.0 |
| 33. I use rechargeable batteries | 25.0 | 33.3 | 43.2 | 59.0 | 40.6 | 44.2 |

Source: author's own work

Some circular behaviours could be taken more often by the respondents with a lower level of education due to their material status or personal situation (e.g. No. 33. *I use public transport for journeys up to 30 km*), or place of living (e.g. No. 1. *I sort garbage into a wet and dry fraction*). In the present research, the respondents with lower levels

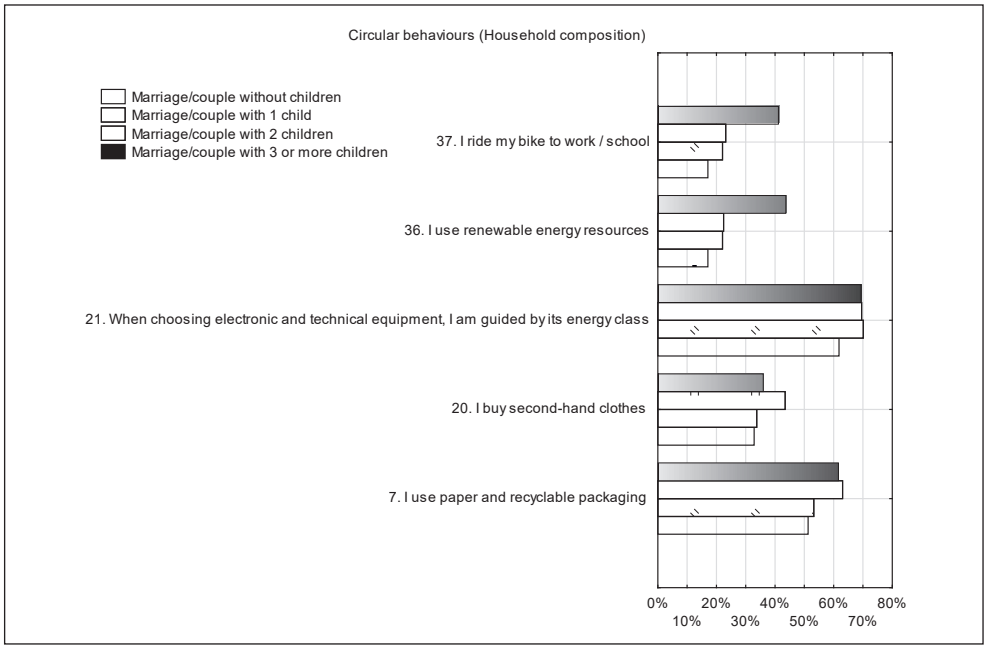
of education (*Elementary*, *Grammar* or *Vocational*) lived generally in villages. Only for behaviour No. 26 *I prepare food myself at home and for work/school*, it was observed that a higher level of education was related with the higher result.

The number of children in the households could have a positive effect on the frequency of taking up circular behaviours ($H_6$) (Figure 7). It is observed, that in households with *two* or *three or more children* circular behaviours are taken more often than in the households with *one* or *no children*. The explanation of this situation could be the material situation of the households. If the number of children increases, increases the necessity of expenditure without other sources of income. Households try to save money through e.g. riding a bike instead of using a car or through buying second – hand clothes. Using renewable resources, which is most popular among families with *three or more children*, could result from living in their own house, where the installation of photovoltaic collectors is an option.

According to the seventh hypothesis ($H_7$ – *If the household assess higher its material status, circular behaviours are undertaken by its members more often*), this dependency is observed in the overwhelming majority of behaviours (Figure 8). More wealthy households demonstrate circular behaviours more often. It could be explained by the hierarchy of importance of certain values for the households. It seems, that for the poorest households the main value could be guaranteeing access to a satisfactory level of financial resources (the ecological motive of conducting behaviours could be treated as less important). On the contrary, households with sufficient income, could devote their attention on environmental aspects.

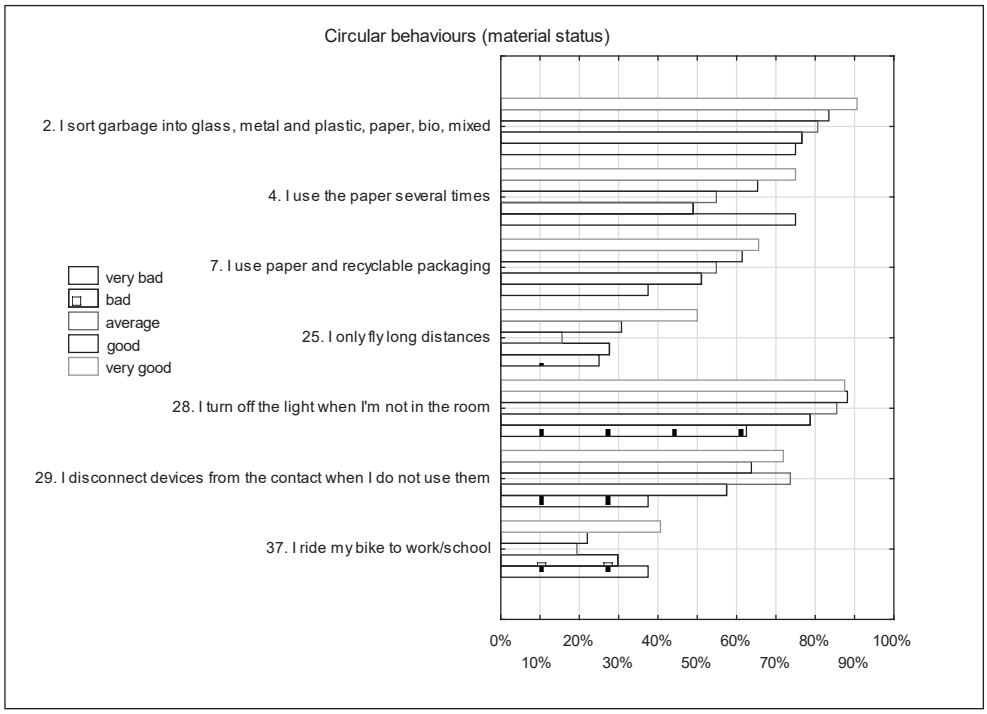
It is necessary to differentiate between behaviours conducted due to the *ecological motive* and those taken due to the *saving motive*. This can be justified by the labour

*Figure 7.* Frequency of "Always" and "Often" of circular behaviours undertaken by households with children




Source: author's own work

*Figure 8.* Frequency of "Always" and "Often" of circular behaviours undertaken by households due to the material status




Source: author's own work

market status, as analysis results have shown. Within that analysis, only two behaviours were different due to the labour market status: No. 32. *When shopping, I only buy the products that I have on my list* and No. 33. *I use rechargeable batteries*. The first one proves the correctness of the explanation, that households at a worse labour position try to save money and, occasionally, undertake circular behaviour. People running farms most often only buy products from the list (75%), similarly – unemployed persons (69%). Only 57% of the households of people running their own business do the purchase with the list (these households are the richest, so they do not have to limit the expenses). It is worth noting that in this case, the material status is not only a causal factor, but the behaviours undertaken are indicative of it. The results of the study by Brooks & Wilson (2015) confirmed this relationship, but the authors indicated the need to examine the motives of specific behaviours.

## Conclusion – the leitmotif of circular behaviours

The present preliminary analysis allows to state that households take different behaviours due to their socio-economic features. All those which were examined within the analysis differ in various ways. The author is aware that due to the fact that only two voivodeships of South-Eastern Poland were included in the study, the representativeness of the research results may be partially limited. Nevertheless, considering that the sample selection procedures were followed, the presented research results may be

a significant contribution to understanding the analysed issues. The most important seems to be the sex of the head of the household. It is related to the *decision centre in the household* and probably, with the role of that person in the structure of the household. To indicate the detailed factors influencing the undertaking of circular behaviours due to the respondent's sex, an analysis of the position of that person in the household, their main values and real activities during daily life is needed. Similarly, the age of the respondent is related not only to the position in the household hierarchy but also to the real possibility of conducting chosen activities (purchasing, preparing the meals, travel, etc.) and habits (past experiences). Living in different places (villages, cities) influences undertaking different behaviours. It seems that the key factor could be also be related also to consciousness and access to the infrastructure (public transport, garbage disposal infrastructure, Selective Municipal Waste Collection Points, garbage incinerator, etc.). Referring to the educational level, the ecological consciousness rather than formal graduation mostly prevails. This being said, nothing stands in the way for the success of information campaigns among various recipients, when the provided message is tailored to their needs. Moreover, the number of people in the households could be related to the household structure, as confirmed within the analysis. The role of each member (i.e. breadwinner, dependent) could justify each undertaken behaviour. Then, the material status is a factor which could be related directly to some attitudes of household members. Due to the research results, it can be stated that the differences between households could concern both socio-economic factors and the intention of undertaken behaviours. The second feature allows to propose two potential circular profiles of households. It should be noted here that the *circular profiles* is a kind of mental shortcut, enabling to underline the intensity of the circular behaviours undertaken by the households. Intended by the author, they should allow for different support activities (approaches, strategies, tools, etc.) dedicated to each profile and aiming at increasing the overall circularity in households. In simple terms, the solution should start from the essential motives for undertaking circular behaviours. The first one is based on the *saving motive*, when households undertake circular behaviours due to saving resources, especially financial ones. Resulting from this, the households reduce the consumption, saving financial assets. When saving resources, households join the mainstream of environmental behaviours. This type of attitude is older and it took shape in situations of scarcity. The second essential motive is the *ecological motive*, and the reasons for it are strictly related with the pro-ecological attitudes of households members.

Based on the research results, it is possible to define which proposed behaviours could be related with each motive and to describe the socio-economic features influenced by them. The author realises that the detailed description of the household profiles should be preceded by appropriate analysis, and due to the limitation of the present article, the result of the full analysis will subsequently be presented. Currently, in the presentation of circular profiles, it is necessary to describe the main features differentiating behaviours: *material status of the household*, *available income* and *tangible benefits from undertaking circular behaviours.* The last feature to mention is the set of benefits observed by the households (both economic and social) and related with the real confirmation of accepted attitudes related to being circular by the household members.

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