
Meeting Halfway - Understanding Circular Behaviours among Households as a Starting Point for Business Practices

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Abstract:

Purpose: The main aim of the article is to identify the households' behaviours that can be described as 'circular', as well as, the analysis of the possible facilitation of their implementation through the specific product and service offers prepared by the companies.

Design/Methodology/Approach: The article consists a systematic literature review (1), the analysis of data (2) from Authors' own research, which were conducted among citizens of two Polish regions (south part of Poland): Malopolska and Podkarpacie with using a questionnaire (N=400), as well as desk research analysis of practical examples come from business (3).

Findings: The results show that the circular behaviours could be described by a few most important behaviours undertaken by the households' members in everyday life. Surveyed people differed each other in the circular behaviours regarding the field of sex, age, place of residence, level of education, household personal composition an material status. The results analysis among business entities show that producer and consumer should cooperate in whole product's life cycle, not only during the sales transaction.

Practical Implications: Research allowed to identify crucial behaviours that help implement circular economy concept into the practice in households as well as allowed to form the recommendations for business. The research among households could be replicable for other groups/communities/countries.

Originality/value: The originality of the research consists of using of the methodology and questionnaire prepared by one of the Author for the first time in this field. The questionnaire join 9R's circularity concept (normally used in circularity assessments in business companies) with typically households behaviours. The added value of the research is elaboration of the main circular factors (with key behaviours) that can describe circularity in the best way and allows to propose appropriate products and services by the business side.

Keywords: Circular behaviours, sustainable consumption, responsible behaviours, households, firms.

JEL code: D11, D16.

Paper type: Research article.

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1. Introduction

Circular economy is defined as an economic system which replaces linear model of the economy into circular one. The essential part of this circularity is based on implementation of the 3R's concept (Manickam and Duraisamy, 2019) reusing, recycling and recovering materials in production, distribution and consumption processes (Kirchherr *et al.*, 2017). This system is operated at different levels, micro, meso and macro. The article concerns the first one (single product, company, consumer), and presents the possibility of reciprocal collaboration of business entities and households within implementation of circular economy. The role of the first element – business entities – in circular economy implementation process is widely described in the literature (Camilleri, 2019; Centobelli *et al.*, 2020; Cavallo and Cencioni, 2017; Diaz Lopez *et al.*, 2016; Teagarden, 2018). The analysis of households concerns mostly the description of the dimensions of sustainable consumption (Czaplicka-Kotas and Kulczycka, 2019; Goryńska-Goldmann, 2019; Hernandez *et al.*, 2020; Joshi and Rahman, 2017) or proecological behaviours (Concari *et al.*, 2020; Gkargkavouzi *et al.*, 2019; Hunter, 2000; Lemanowicz and Jasiulewicz, 2021; Nita *et al.*, 2017; Wang and Kang, 2019).

Circular behaviours in households are mentioned much less frequently (Borrello *et al.*, 2017; Lakatos, 2016; Korsunova *et al.*, 2021; Szczygieł, 2020a; 2020b; 2021; Wastling *et al.*, 2018). That is the reason, that an analysis of circularity of households' behaviours should be described and conducted, and the level of their circularity should be assessed. This issue requires the preparation of a set of indicators to describe circularity appropriate to the economic sector concerned. Many papers describes the propositions of that set of indicators, mostly suitable for business sector (Cayzer *et al.*, 2017; Haupt *et al.*, 2016; Huysman *et al.*, 2017; Howard *et al.*, 2019; Kayal *et al.*, 2019; Polverini and Miretti, 2019; Prieto-Sandoval *et al.*, 2018; Sánchez-Ortiz *et al.*, 2020) or – more general – economy development (Avdiushchenko and Zajac, 2019; Banaité, 2016; EASAC, 2016; Helander *et al.*, 2019; Kulczycka, 2018; Moraga *et al.*, 2019; Oliveira *et al.*, 2021; Saidani *et al.*, 2019; Smol *et al.*, 2017).

Analysis of implementation of circular economy concept into practice should take into account the perspective of different sectors, especially the cooperation between business sectors and consumers (Migliore *et al.*, 2020). Knowing the specifics of buyers' behaviours, especially in terms of the circular economy, makes it possible to determine what products and what delivery method they will need from suppliers. The special attention should be paid on cognition of the implementation of the circular economy in everyday life. It allows to describe the potential behaviours of the consumers and facilitate the preparation of adequate product and service offers. The main aim of the article is the identification of behaviours in households that can be described as 'circular', as well as, the analysis of the possible facilitation of their implementation through the specific product and service offers prepared by the

companies. This article is the fifth one in the publication series devoted to circular economy and sustainable development matters.

2. Circular Behaviours in Households

The concept of circular behaviours is not well-known, and is joining relatively often with other environmental or sustainable categories of behaviours. As was mentioned in first part of the article, the scientific papers treats circular behaviours much less frequently and mostly only partially, focusing its attention on selected aspects of household functioning or consumers' behaviours. The special attention could concern, i.e.: reducing food waste (Borrello *et al.*, 2017), eco-friendly activities allowing implementation of circular economy (Lakatos, 2016), or meaning of examples of circular behaviours for young people (Korsunova *et al.*, 2021), or overall concept (Wastling *et al.*, 2018). The idea of circular behaviours in relation to 9R's concept was presented in a few articles so far (Szczygieł, 2020a; 2020b; 2021). The present one will be the continuation of the former reflections.

The circular behaviours could be defined as those that, in which the main attention is putting on decreasing the need of resources by reducing the demand for products and shifting to meeting the need (Szczygieł, 2021). The main different between circular and pro-ecological behaviours is in the reduction of the demand for the resources in long time. Both, pro-ecological and circular behaviours are focused on maximization of using the resources used to produce already existing things. These two kind of behaviours should not be divided into separate groups, but be considered as complementary.

3. Results and Discussion

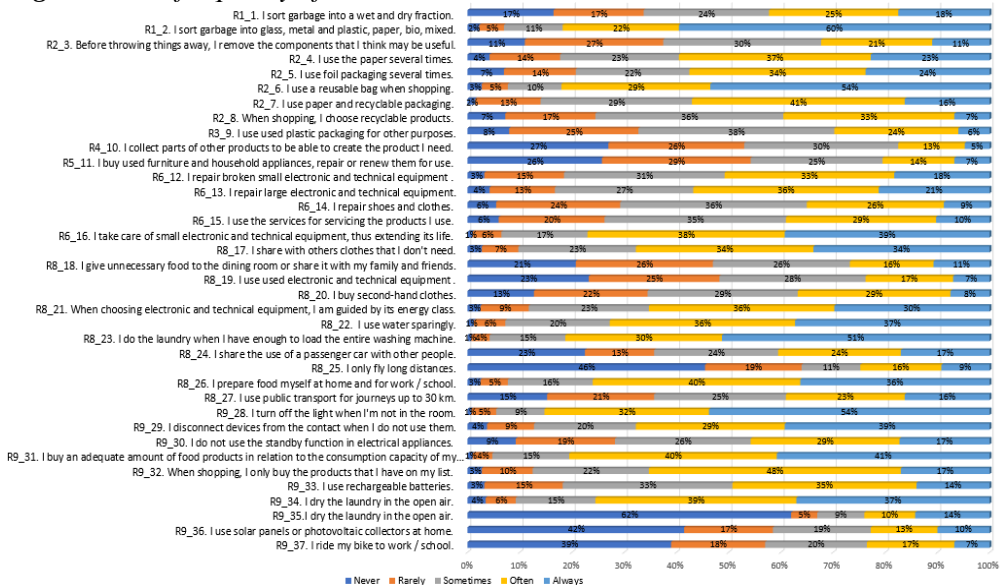
The data used in the article came from the original research conducted by the author within the internal grant of Pedagogical University of Krakow (no. BN.610-64/PBU/2020) entitled: "Circular behaviours in households and the quality of life of their inhabitants". The research were conducted in December 2020 among 400 citizens of two Polish regions: Małopolska (245) and Podkarpacie (155). The sample was representative ($\alpha=0.05$, max. acceptable error=5%). Women made up 52% of the total. The highest age groups were people in 60 years and more (27%) and people between 18 and 29 years old (22%). The vast majority of the respondents have secondary (39%) or higher education (41%). They mostly inhabited villages (37%) and cities over 500 thousand inhabitants (17%). More than a half of respondent were working (52%) and 22% of them were on retirement. 35% were marriages/couples with 2 children (19% each were marriages/couples with 1 child and no children). The structure of each socio-economic characteristics' groups was representative for Polish society.

The respondents were asked to assess 37 statements concerned their circular behaviours (Szczygieł, 2021). The statements were formulated as positive sentences,

contained 5 verbal statements referring to the frequency of undertaken behaviours: *Never, Rarely, Sometimes, Often, Always* (Figure 1). The number next to the letter R indicates the degree on the circularity scale according to the 9R's concept (Kirchner *et al.*, 2017; Manickam and Duraisamy, 2019), the number after that indicates the number of sentence, from 1 to 37. Due to the length of the article, the whole set of behaviours will be not described in details (Szczygieł, 2021), and the attention will be paid on the crucial ones, which emerged from the factor analysis:

- R1_1. I sort garbage into a wet and dry fraction,
- R3_9. I use used plastic packaging for other purposes,
- 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,
- R6_13. I repair large electronic and technical equipment,
- R8_19. I use used electronic and technical equipment,
- R8_20. I buy second-hand clothes,
- R8_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,
- R8_31. I buy an adequate number of food products in relation to the consumption capacity of my household,
- R8_35. I use solar panels or photovoltaic collectors at home,
- R8_36. I use renewable energy resources.

Figure 1. The frequency of circular behaviours



Source: Own study based on the conducted research.

Table 1 presents descriptive statistics concerning the statements chosen as the most important (as a result of factor analysis – shown in Table 3).

Table 1. Descriptive statistics of chosen circular behaviours

Behaviour	\bar{x}	Me	Mo	FMo	Q1	Q3	St.dev.	V
R1_1	3.10	3	4	99	2	4	1.33	43.05
R3_9	2.95	3	3	150	2	4	1.02	34.65
R5_11	2.47	2	2	114	1	3	1.20	48.67
R6_12	3.47	4	4	130	3	4	1.06	30.44
R6_13	3.57	4	4	142	3	4	1.09	30.40
R8_19	2.59	3	3	112	2	3	1.21	46.69
R8_20	2.97	3	4	117	2	4	1.15	38.72
R8_27	3.04	3	3	101	2	4	1.30	42.79
R9_28	4.33	5	5	215	4	5	0.88	20.44
R9_31	4.16	4	5	163	4	5	0.88	21.16
R9_35	2.09	1	1	248	1	3	1.54	73.72
R9_36	2.33	2	1	166	1	3	1.38	59.38

Note: \bar{x} – mean, Me – median, Mo – Mode, FMo – Frequency of Mode, Q1 – Lower Quartile, Q3 – Upper Quartile, St.dev – standard deviation, V – coefficient of variation

Source: Own study based on the conducted research.

On a 5-grade scale, adopted for the study and referred to the frequency of undertaken behaviours, the highest mean score was achieved by “R9_28. I turn off the light when I'm not in the room” (4.33) and “R9_31. I buy an adequate amount of food products in relation to the consumption capacity of my household” (4.16). These behaviours are ones of the most popular and simplest to implement in everyday life. The statement “R9_35. I dry the laundry in the open air” was chosen the least frequent (2.09). Probably it depends on the possibility of using open-space (i.e. in front of the house, on a balcony but not close to the street, etc.). The highest level of standard deviation for assigned scores was reached for: “R8_35. I use solar panels or photovoltaic collectors at home” (1.54), “R8_36. I use renewable energy resources” (1.38) and “R1_1. I sort garbage into a wet and dry fraction” (1.33). The respondents' answers were most varied and far from the mean value. The amount of coefficient of variation was the highest for the statements: “R8_35. I use solar panels or photovoltaic collectors at home” (73.72%) and “R8_36. I use renewable energy resources” (59.38%). The coefficient of variation points to the medium or high variability of the studied behaviours. Its value varies between 20.44% (the lowest) and 73.72% (the highest). The value of coefficient of variation is statistically significant in all cases.

Due to the length of the article, the Authors resigned for presentation all detailed results of Spearman's rank correlation between all variables (statements). It is worth to underline, that the vast majority of them were positively correlated between each other and the correlation was statistically significant (Table 2). Among analysed statements, which are statistically significant for the study, only the positive correlation was indicated. Between some of the statements, the medium or high relationship strength was noticed (the values bolded on red). Two of the statements

were positively correlated with more than one behaviour: “R8_19” and “R8_20”. The first one (“I use used electronic and technical equipment”) was correlated with buying used furniture and household appliances (R5_11), as well as with repairing broken small electronic and technical equipment (R6_12).

Table 2. Spearman’s rank correlation for chosen circular behaviours ($p < 0.05$)

	R1_1	R3_9	R5_11	R6_12	R6_13	R8_19	R8_20	R8_27	R9_28	R9_31	R9_35	R9_36
R1_1	1.00											
R3_9	0.20	1.00										
R5_11	0.22	0.21	1.00									
R6_12	0.19	0.19	0.37	1.00								
R6_13	0.23	0.17	0.21	0.58	1.00							
R8_19	0.20	0.23	0.49	0.38	0.19	1.00						
R8_20	0.19	0.24	0.45	0.24	0.17	0.44	1.00					
R8_27	0.12	0.18	0.24	0.21	0.12	0.19	0.16	1.00				
R9_28	0.14	0.17	-0.04	0.21	0.22	0.05	0.06	0.13	1.00			
R9_31	0.16	0.13	0.02	0.20	0.27	0.07	0.18	0.17	0.56	1.00		
R9_35	0.10	0.17	0.14	0.11	0.08	0.16	0.11	0.05	-0.06	-0.04	1.00	
R9_36	0.17	0.15	0.18	0.14	0.05	0.18	0.12	0.12	-0.02	-0.03	0.80	1.00

Note: on red – variable statistically significant

Source: Own study based on the conducted research.

These behaviours are similar to each other, so there is a high probability that they will be made together. In case of the second one behaviour (R8_20. I buy second-hand clothes), it was correlated with buying used furniture and household appliances (R5_11) and using used electronic and technical equipment (R8_19). These behaviours are also similitier to each other, and it can be stated, that using of used product and repair something it is a habit used on various occasions. The highest correlation (0.80) concerned the behaviours related with using natural sources of energy to drying and heating (R9_35. I dry the laundry in the open air; R9_36. I use solar panels or photovoltaic collectors at home). In order to detect the structure of the relationships between the behaviours used to assess the level of circularity, the factor analysis was applied (Table 3).

Due to the conduct the factor analysis the following statements were chosen, as those that, which can reflect the circular behaviour in the most appropriate way. These behaviours could be grouped into 7 categories:

- Factor 1 “Savings” – it reflects willingness to save the resources and money and includes: turning off the light when nobody is there and buying an adequate amount of food products in relation to the consumption capacity of my household.
- Factor 2 “Use of second-hand goods” – it reflects willingness to using used products and includes: buying used furniture, household appliances, electronic and technical equipment as well as second-hand clothes.

Table 3. Factor analysis of circular behaviours

	Savings	Use of second-hand	Use of natural energy for	Repairs	Re-purposing	Public transport	Garbage separation
R1_1	0.071	0.129	0.055	0.111	0.083	0.092	0.707
R3_9	0.080	0.144	0.102	0.006	0.728	0.165	0.164
R5_11	-0.054	0.770	0.086	0.204	0.063	0.159	0.098
R6_12	0.142	0.327	0.069	0.702	0.077	0.113	0.078
R6_13	0.186	0.077	0.033	0.832	0.093	0.017	0.092
R8_19	0.048	0.726	0.101	0.081	0.144	0.070	0.095
R8_20	0.188	0.723	0.036	0.070	0.054	-0.069	0.023
R8_27	0.108	0.163	0.025	0.095	0.116	0.715	0.009
R9_28	0.750	-0.050	-0.039	0.078	0.142	0.087	0.038
R9_31	0.756	0.022	-0.050	0.135	0.041	0.087	0.004
R9_35	-0.041	0.061	0.895	0.042	0.089	-0.032	0.006
R9_36	-0.031	0.096	0.886	0.024	0.060	0.061	0.053

Source: Own study based on the conducted research.

- Factor 3 “Use of natural energy for drying and heating” – it reflects willingness to using natural energy and includes: using solar panels, photovoltaic collectors and renewable energy resources.
- Factor 4 “Repairs” – it reflects willingness to repairing broken things and includes repairing small or large electronic and technical equipment
- Factor 5 “Re-purposing” – it reflects willingness to reuse things for another purpose and includes using plastic packaging for other purposes.
- Factor 6 “Public transport” – it reflects willingness to go by public transport and includes using it for journeys up to 30 km.
- Factor 7 “Garbage separation” – it reflects willingness to sorting the waste and includes sorting garbage into a wet and dry fraction.

The analysis of behaviours’ circularity in households could be limited into 12 elements (behaviours), which reflects the best the most important features of the phenomenon under study.

For analysis of the reliability of scale, the Cronbach's coefficient *Alpha* was used. For the whole test, it amounted 0.9032, what means that the variables were chosen well. For each indicated factors’ group, the amount of Cronbach's *Alpha* was also high (Factor 1: 0.94; Factor 2: 0,91, Factor 3: 0,92; Factor 4: 0,91; Factor 5: 0,91; Factor 6: 0,92; Factor 7: 0,91). It allows to state that the behaviours included into each group were appropriate to describe the circularity of behaviours in households.

The analysed behaviours were compared with the characteristics describing the socio-economic and demographic structure of the households. To indicate the possible difference the Chi² test of independence was used ($\alpha=0.05$, $p<0.05$). The

most significant dependencies in relation to the examined dimensions were revealed in the case of sex, age group and place of residence (three in each case) (Table 4).

Table 4. *Chi² test of independence results*

	Sex	Place of residence	Education	Household composition	Age group	Material situation
R1_1	0.02252*		0.02068*			
R3_9					0.01818*	
R8_19		0.03953*				
R8_20	0.01242*			0.03710*		
R8_27		0.02999*	0.00692**		0.01346*	
R9_28	0.00034***					0.0408*
R9_36		0.00128**		0.04418*	0.04723*	

Note: $p < 0.05$ - statistical significance; $p < 0.01$ - high statistical significance; $p < 0.001$ - very high statistical significance

Source: Own study based on the conducted research.

(R1_1) Women sort the garbage more frequently than men (48% of them do it *always* or *often*, while the same habits have only 35% of men). In case of education the result is not unambiguous, because 42% of respondents who have secondary education sort the garbage *always* or *often*, while 40% with higher.

(R3_9) 34% of people in age between 50 and 59 years old use used plastic packaging for other purposes *always* or *often*, while 26% of them with 60 years and more. Younger groups are also less focused on undertaking that behaviour (29% people between 40 and 49 years old).

(R8_19) Mostly people from cities up to 20k residents use used electronic and technical equipment *always* or *often* (36.6%) as well as people from cities from 50k to 100k (32.6%). The lowest interest rate was declared by the inhabitants of cities over 500k (13.5%).

(R8_20) Women more often buy second-hand clothes - 42% of women do it *always* or *often*, while only 30% of men. If the number of children increase in the family, the frequency of buying of second-hand clothes increases. 33% of families with one child do it *always* or *often*, while 42% with two children. However, the result for families with 3 children may be somewhat surprising – 35% of them do it *always* or *often*.

(R8_27) If the level of education is higher, the frequency of using public transport increases. The highest groups which do it *always* or *often* are people between 50 and 59 years old and over than 60 years old (both 43%). This behaviour is also popular among the youngest group of respondents (18-29 years old) and could be related with studying. 53.3% people who live in cities from 50k to 100k inhabitant do it *always* or *often*, while 31.8% inhabitants of cities from 100k to 500k. The frequency of using public transport is also higher in the biggest cities (over than 500k) and amounts 47.8%, which could be related with traffic jams.

(R9_28) Women more often turn off the light than men (61% of women do it *always*, while only 45% men). 88.2% of the households which assess their material

situation as *good* turn off the light *always* or *often*, while 62.5% of those which assess their situation as *very bad*. In case of *very good* status, 87.5% of the households turn it off *always* or *often*.

(R9_36). The inhabitant of cities up to 20k residents have much often a possibility to use renewable energy resources (41,5% of them do it *always* or *often*). Among the oldest and the youngest groups the number of respondents is the highest (25.2% among people over 60 years old and 23.3% among people between 18 and 29 years old who use them *always* or *often*). Marriage or couple with 3 or more children were more often interested in using renewable resources than other households. 43.6% of them used them *always* or *often*, while marriage or couple with 2 children – in 22,5%. Also single parents were interested in it (37.5%).

The other researches in the field of circular behaviours in households focus the attention mostly on specific aspects, so it is impossible to compare the presented results with another ones. For example (Lakatos *et al.*, 2018), confirm, that with the age the frequency of taking up circular behaviours increases in the households. Similarly, Mancini *et al.* (2017) confirm the existence of the connection between living in a countryside and the consciousness of nature (and its products, respecting the seasonal food cycles). It is not strictly the same situation as was analysed (buying an adequate amount of food products in relation to the consumption capacity of the household), but could be the starting point to the in-depth analysis in that field. Similarly, in the same research (Mancini *et al.*, 2017) and other (Figueroa-García *et al.*, 2018), the level of education increased awareness and therefore the need to have “good behaviour”, what was confirmed partially in the present research. With comparison to the results received by Brooks and Wilson (2015), the material status in present research was not the negative determinant (if the status is worse the need to be circular increases). All that factors and received results indicate the need for further research.

4. The Examples of How Business Meets Customer Expectations in the Field of Circular Economy

The influence of customers and firms on the circular behaviour of market actors is two-way. The conscious customer is committed to responsibility, creates competitive pressure based on the environmental factor. On the other hand, companies' practices throughout the product life cycle have a key impact on consumers' choices, their consumption standards and the reality they co-shape for themselves and future generations. Innovation for the circular economy does not necessarily mean a complete novelty - it can, for example, be a new application of existing products or services. They can also mean new ways of doing business, new ecosystems of products and services, new types of interaction between businesses and their stakeholders. These innovations can have different effects on consumer

environmental awareness. This is related to the type of innovation implemented (Deloitte, 2018):

A good example of such innovation is the business model used by Vigga, which is based on the philosophy of sharing clothes (Deloitte, 2018). The company offers high quality organic clothing (an innovative process of producing organic, durable clothes), for pregnant women and children for a monthly subscription fee. The customer receives a bundle of clothes, which are exchanged for their larger counterparts after time. Returned clothes are repaired and passed on to the next recipient of the service. It allows to reduce environmental footprint by approx. 80% compare with traditional production of clothing. The great value in the context of circular economy, in the case of Vigga's strategy, is that it is based on the environmental sensitivity of customers, directly translating into their engagement and perception of the brand.

Business innovations outside of brand and brand perception are also important areas of circular activity for companies. An example is the process innovation of using ECONYL® nylon to make things by Tchibo. The company creates its own collection of materials from waste. To do so, it uses valuable resources such as ECONYL® nylon, which consists of 100% nylon waste. Thanks to the circular actions taken, Tchibo saved 183 tonnes of greenhouse gases in 2018 (production of clothing from recycled PET bottles and pre-consumer textile waste) (Tchibo, 2021).

Another circular solution (product innovation), is an ecologically designed Class AAA high-rise building with office space: Rondo 1 in Warsaw. Although it is an office building, the solutions adopted are applicable in the segment of developer buildings. They can improve the quality of life of the residents, minimise the costs of daily functioning and change the quality expectations (including the selection criteria) of the users of residential premises. The building has a DALI system relating to lighting control. The system is based on the individual adjustment and control of each light bulb and louvre, allowing the light to be optimally adapted to the external conditions. The use of additional energy-saving bulbs contributes to the environmental aspect of the building and improves working conditions by optimising light levels. The building uses state-of-the-art ventilation and air conditioning systems, which increases the building's energy efficiency and saves money. Rondo 1 operates entirely on wind power and the use of low water consumption equipment, which has reduced water consumption by 30%. An important element here is also the cooperation with the tenants of the building, which is connected with waste segregation. As part of the Rondo 1 building, employee education has also been undertaken. This resulted in a decision to choose public transport as a means of commuting to work by the majority of the building's tenants. The result of applying such solutions was obtaining the LEED Gold environmental certificate in the "Existing Buildings" category (Rondo 1, 2021).

The above business practices are only examples of specific solutions. From the customer's point of view, the most crucial issue is close cooperation between the household and the company supplying a particular product or service. The product or service should be the connecting element, not only during the sales transaction, but during its entire life cycle. The customer should have a say in the functionality of the product/service from the point of its using, and the producer should be responsible for all raw materials used in production.

5. Conclusions

The implementation of the circular economy idea in Poland encounters many barriers. In this context, it is crucial to increase the circularity of behaviour and interaction between businesses and households. The close cooperation already mentioned is based on producers' knowledge of specific user behaviour. It is in this context that knowledge of consumer behaviour can facilitate the proposal of products and services whose use will increase overall circularity. This is important for companies that care about their image, but also for consumers who are sensitive to environmental issues. A circular product is one that is both economically and ecologically produced and used in this way.

However, its use is limited by its designed functionality. Therefore, it is important to know the mechanisms governing the use of the product/service in order to design it correctly. In this respect, cooperation between producers and consumers must be increasingly intensive, so that the combined action of both market players can increase the overall circularity of the economy.

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