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Clustering consumers due to their awareness and beliefs towards sustainable products

Abstract

Research background and aim: From the standpoint of preserving civilization, it is crucial to prioritize sustainable social and economic development and the circular economy model. To support this economic approach, both scientific research and practical application must clearly outline development strategies and business models. One of the main ideas in this area is the concept of a sustainable product. Also in the case of these products, market segmentation is the basis for diversified marketing activities, enabling the adjustment of supply to demand. To build a framework for these activities, in this paper we aimed at identifying consumer segments due to their awareness and beliefs regarding sustainable products and determining the structure of these segments.
Design/methodology/approach: A quantitative approach was used. The questionnaire containing 24 variables was conducted using an online survey. 570 correctly completed records were obtained. The analysis used a multidimensional exploratory technique - cluster analysis: Ward's method and then k-means.
Findings: As a result, 3 consumer segments were identified. These are: (1) unaware and unconvinced (26% of the sample), (2) hesitant (35%) and (3) conscious believers (39%).
Value added and limitations: Based on the results obtained, it was found that there are consumer segments that differ in terms of awareness and beliefs regarding sustainable products. This classification can be the basis for differentiating marketing activities. Producers and distributors can create marketing strategies and use various marketing instruments to best tailor the message promoting the sustainability of products to specific consumer groups. The paper contributes into the development of the discipline by: (1) identification of clusters (segments) of consumers that differ in terms of awareness and beliefs towards sustainable products and (2) identification of the structure of these segments. The limitations are as follows: (1) the study was carried out only using the CAWI method, so it is not entirely representative and (2) the number of questionnaire items is quite limited. Therefore, the results should be generalized with caution.

Keywords: *sustainable product, circular economy, awareness, attitudes, segmentation, clusters*

JEL Classification: Q01, C38, M31

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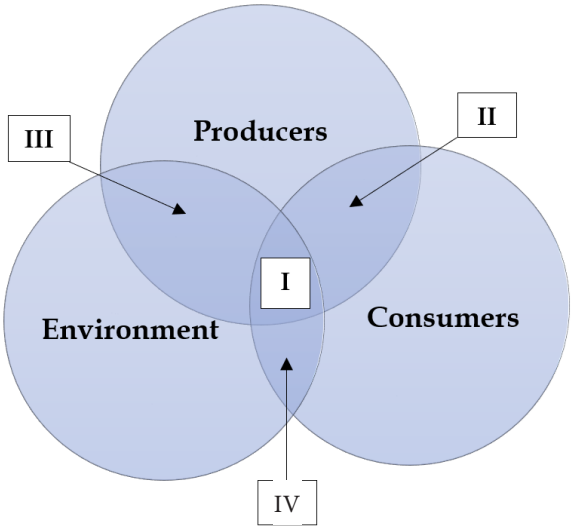
1. Introduction

From the standpoint of preserving civilization, it is crucial to prioritize sustainable social and economic development and the circular economy model (CE) (Gates, 2021; Archer, 2011; Markiewka, 2021). To support this economic approach, both scientific research and practical application must clearly outline development strategies and business models. The idea of a sustainable product, which both stems from and promotes sustainable development (SD), has become increasingly significant. Various methods can achieve sustainable products (Leleux & Kaaij, 2018; Żuchowska-Grzywacz & Żuchowski, 2020). Initial efforts to define these products focused on cosmetics and food (Żuchowski & Żuchowska-Grzywacz, 2018). Developing such products involves enhancing traditional ones with added values related to ecology, assured quality, innovation, social responsibility, ethical practices, high health and environmental safety standards, and other aspects that are continuously improved in line with legal regulations (Żuchowski & Paździor, 2022). For the purposes of this publication, products are balanced in their circular life cycle in accordance with the principles of ESG (Environmental, Social, Governance). Areas of product sustainability identified in the product sustainability model are presented in Figure 1.



Note: I – integrated sustainability of product; II – qualitative sustainability; III – ecological sustainability; IV – post-consumption stuff

Figure 1. **Product sustainability model**

Source: own elaboration

In Figure 1, the highest level of product sustainability is evident in area I, where added value is derived from three key factors: production methods, environmental impact, and consumer awareness. Products in this area fulfil the criteria for sustainable development and the circular economy by balancing economic, social, and environmental aspects. The second area emphasizes qualitative sustainability, which involves addressing customer needs through the product's functionality and quality. The Sustainable Products Initiative (SPI) advocates for enhancing product sustainability throughout its entire life cycle, beginning with the design phase (Wawak, 2019). The third area focuses on ecological sustainability, which is currently the most prominent in the market for sustainable products and is often recognized by special certifications (Kozik, 2020). Lastly, the fourth area pertains to post-consumer processes after a product's life cycle ends. This area stresses the importance of avoiding the term "waste" and instead concentrating on secondary raw materials.

In times of growing diversity of products and consumer preferences, it becomes necessary to adapt the marketing strategy to the individual needs and preferences of customers (Łobos, 2018; Inquiry, 2021). In particular, this model should take into account market segmentation in terms of consumer awareness and beliefs, which are still developing. The discussed model was firstly described in in co-authored publication (Żuchowski et al., 2024).

Market segmentation, as a stage in the development of the field of marketing after mass and assortment, began with a pioneering study nearly 70 years ago (Smith, 1956). Many authors draw attention to this (Pawlak, 1992; Kotler, 1994; Szulce et al., 2004; Dziechciarz, 2009; Wilk, 2015). This concept is based on the division of a diversified market into more homogeneous segments, which results from the heterogeneity of consumers, their diverse preferences, behavior and demand (Mynarski, 1993). In order to effectively influence various groups of consumers, it is necessary to identify common features characteristic of individual segments (Żuchowski, 2007). Market segmentation is the process of dividing it into uniform groups of buyers, i.e. market segments, which requires the use of various marketing strategies and tools (Kotler, 1994; Encyklopedia Zarządzania, 2023). This principle makes sense because it allows marketing resources to be tailored to the diverse needs of consumers (Assael & Roscoe, 1976). Consumers have different expectations and reactions to marketing strategies, which makes it necessary to adapt the offer to specific market segments (Pawlak, 1992). Market segmentation is therefore the basis for diversified marketing activities, enabling the adjustment of supply to demand (Szulce et al., 2004). As a result of considering the presented model, the aim of the analysis was:

A: *To identify consumer segments due to their awareness and beliefs regarding sustainable products and to determine the structure of these segments.*

According to this, the following research question was asked:

Q: *What are consumer segments in terms of their awareness and beliefs about sustainable products and what is their structure?*

We made an attempt to solve the posed problem using the quantitative approach described in the next section.

2. Method

A quantitative approach was adopted to achieve the goal. The survey questionnaire was posted on the Ankieteo website (https://ankieteo.pl) and conducted using the CAWI method between January 4-31, 2024. As a result of the empirical study, 570 correctly completed questionnaires were obtained and subjected to statistical processing. The survey questionnaire consisted of 24 items, where:

- items 1-5 concerned formal characteristics (profiles) of consumers,
- items 6-9 served to determine awareness (knowledge) of the concepts of sustainable development, circular economy, sustainable product and greenwashing,
- items 10-24 identified consumers' beliefs regarding sustainable products.

Selected variables were used in this analysis. Knowledge of concepts was measured on dichotomous scales: "no", "yes". Awareness was measured on a five-point scale, where 1 meant "definitely not" and 5 meant "definitely yes." A description of the variables used in the study is presented in Table 1, together with the sources which inspired for taking these variables into consideration.

Table 1. **Description of variables used in empirical research**

Var.	Description of variable	Source
P1	Gender of the respondent	-
P2	Respondent's age	-
P3	Respondent's place of residence	-
P4	Respondent's education	-
P5	Assessment of the respondent's financial situation	-

P6	Knowledge of the term „sustainable development”	UN (2015)
P7	Knowledge of the term „circular economy”	UN (2015)
P8	Knowledge of the term „sustainable product”	UN (2015)
P9	Knowledge of the term „greenwashing”	Riskos et al. (2021)
P10	Treatment of consumer leftovers in the household	Kim et al. (2020)
P11	Indication of whether the production of products affects climate change	Shi et al. (2018)
P12	Indication whether products should support eco-friendliness even at a higher price	Armenio et al. (2020)
P13	Indication whether products should support fast fashion trends	Centobelli et al. (2022)
P14	Indication whether it is advisable to deliberately shorten the life of products	Wieser (2017)
P15	Indication whether the products should be highly durable	Mashao and Sukdeo (2018)
P16	Indication whether products should be energy efficient	Waechter et al. (2015)
P17	Indication whether coal-based energy should be phased out in the production of products	Jewell et al. (2019)
P18	Indication whether it is advisable to allow testing of products on animals to increase consumer safety	Westmoreland and Holmes (2009)
P19	Indication of whether, given the choice, the consumer would give up disposable and plastic packaging	Nuojua et al. (2024)
P20	Indication whether packaging should strive to be biodegradable	Rhein and Schmid (2020)
P21	Indication whether eco-labels should be displayed and popularized in commercial transactions	Rubik and Frankl (2017)
P22	Indication whether the obligation to repair, maintain and dispose of products should remain with the manufacturer	Sims and O'Sullivan (2023)
P23	Indication whether products should be climate neutral and low emission	Chen et al. (2022)
P24	Indication of whether sustainable products improve living and working conditions	Almalki et al. (2023)

Source: own elaboration

Market segmentation includes several stages. These are the selection of a segmentation base, the collection of empirical material and the division of consumers into homogeneous subgroups using the selected method of multivariate statistical analysis. After the grouping stage, i.e. isolating segments, individual groups are described according to selected features. However, only understanding preferences and behavior on the market, i.e. the profiling stage, allows forecasting the demand for the offer addressed to selected segments (Dziechciarz, 2009).

The classic approach to market segmentation uses classification methods, primarily hierarchical methods (Wedel & Kamakura, 1998). Cluster analysis was used in this study. This method was introduced to modern statistics by Tryon (1939) and then developed by R. Cattell (1944). It includes several different algorithms and methods for grouping similar objects into similar categories. In recent years, there has been a significant increase in the use of cluster analysis methods (Gore, 2000; Stevens, 2009). This process includes various algorithms and methods for grouping similar objects into coherent categories (StatSoft, 1997; Jajuga, 1993). It is a type of undirected exploration method, which means that all relationships and regularities are discovered based on the input data. It is worth emphasizing that this is not a typical statistical test, but rather a set of various algorithms that allow for grouping objects according to precisely defined similarity rules. Importantly, unlike many statistical procedures, the cluster analysis method is often used at the exploratory stage of research, when the researcher does not formulate any a priori hypotheses. This method "inherently" reveals the structure of the set of studied objects.

Cluster analysis methods can be successfully used to solve a variety of problems. Whenever there is a need to classify a large amount of collected research data into a sensibly reduced set, these methods prove to be very useful. To analyze the study results, first the agglomeration method (Ward's algorithm) was used to identify the number of clusters, and then the k-means method was used to analyze the structure of the detected groups (Gore, 2000). This method was successfully used by the co-authors in previous consumer segmentation research (Lotko et al., 2020).

3. Identifying segments

The analysis was carried out by identifying consumer segments using cluster analysis with the use of (1) agglomeration and (2) k-means methods. The k-means method is a non-hierarchical classification method (Gore, 2000). The advantages of these methods are simplicity (and therefore high efficiency), very high speed of operation (also on large data sets), large differentiation of objects between clusters and small within them (Gore, 2000; Guidici, 2003). However, the k-means method requires a priori specification of the number of clusters, therefore the agglomeration method was first applied. This is in line with the recommendations published in the literature

(Guidici, 2003). The idea is to first identify a reasonable number of clusters and then divide the set into segments using a hierarchical method, for example agglomeration, as it was done here.

The k-means algorithm starts the classification with k random clusters and then transfers objects between them to (1) minimize the variability within clusters and (2) maximize the variability between clusters (Hartigan & Wong, 1979; Lloyd, 1982). First, the number of clusters was set to 3, in accordance with the presented results of the agglomeration analysis. Then, the initial centers of these 3 clusters (the so-called centroids) were determined. A random selection of k observations was adopted. Then, the distances of individual objects from the centers of clusters were calculated. The most commonly used Euclidean distance was chosen as the metric (Gore, 2000; Singh et al., 2013; Ghazal et al., 2021). For each observation, the algorithm compares the distances from all clusters and assigns it to the cluster to which its center is closest. Then it establishes a new cluster center – most often it is a point whose coordinates are the arithmetic mean of the points belonging to a given cluster (Gore, 2000). The algorithm stops after performing the initially specified number of iterations. In this case it was the default value in the Statistica package - 50 iterations.

The horizontal, hierarchical tree diagram in Figure 2 shows the classification obtained as a result of the agglomeration (Ward's) algorithm. In turn, Figure 3 shows the increase in the bond distance in the subsequent steps of the algorithm.

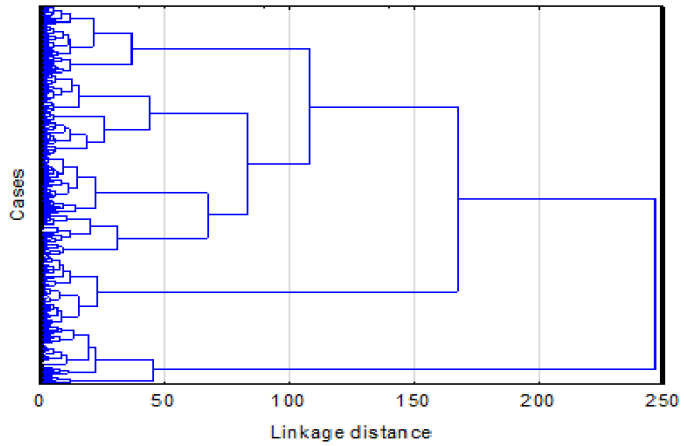


Figure 2. **Identifying segments using cluster analysis**

Source: own elaboration

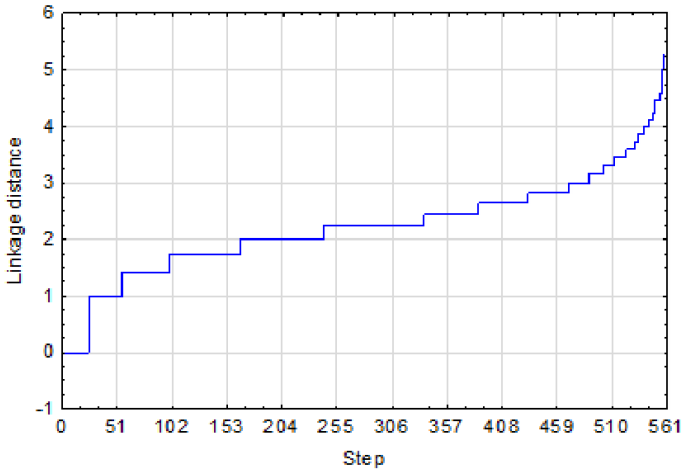


Figure 3. **Linkage distance in the next steps of algorithm**

Source: own elaboration

The analysis of Figure 2 shows that when cutting off the graph, for example, at the level of bond distance in the range of approximately 110-165, a clear increase in bond length is visible. There are then three horizontal lines on the diagram, i.e. 3 clusters have been identified. The reasonableness of this solution is confirmed by the significant increase in the bond distance visible in Figure 3. (Since cluster analysis is not a formal statistical test, other divisions can also be considered. For example, by cutting off the graph at the bond distance of 80-110, you get 4 clusters, and above 165 - clear 2 clusters). Nevertheless, taking into account the reasonableness, simplicity and practical usefulness of the results, an "intermediate" solution was adopted, i.e. with 3 clusters. In this way, the following classification was obtained:

1. **Segment 1** – groups 149 people, i.e. 26% of the respondents.
2. **Segment 2** – combines 200, or 35% of the sample.
3. **Segment 3** – includes 221, i.e. 39% of respondents.

Segment 3 turns out to be the most numerous, and cluster 1 is the least numerous, although the differences are not large. These identified segments provide a starting point for further considerations.

In Tables 2 and 3 the results of the differentiation tests were placed. For qualitative (non-numeric) variables this is the Chi-square test, while for the quantitative ones this is the ANOVA test. This was done to check, whether there are reasons to assume that the cases can form some heterogenic segments.

Table 2. The results of Chi-square test for qualitative variables

Var.	Chi-square	p-value
P1	213.864	0.000*
P2	12.445	0.014*
P3	60.135	0.000*
P4	98.488	0.000*
P5	6.035	0.196
P10	152.717	0.000*

* significant for =0,05

Source: own elaboration

Table 3. **The results of ANOVA test for quantitative variables**

Var.	Inter-group significance	df	Intra-group significance	df	F	p-value
P6	83.852	2	597.325	555	38.955	0.000*
P7	38.296	2	97.074	555	109.475	0.000*
P8	38.255	2	96.018	555	110.562	0.000*
P9	31.562	2	99.650	555	87.894	0.000*
P11	92.737	2	575.981	555	44.679	0.000*
P12	49.475	2	519.766	555	26.414	0.000*
P13	5.687	2	676.586	555	2.332	0.098
P14	15.437	2	773.933	555	5.535	0.004*
P15	42.702	2	453.491	555	26.130	0.000*
P16	84.266	2	413.785	555	56.511	0.000*
P17	70.830	2	629.355	555	31.231	0.000*
P18	125.290	2	766.580	555	45.354	0.000*
P19	88.870	2	486.579	555	50.683	0.000*
P20	72.855	2	456.428	555	44.294	0.000*
P21	71.705	2	446.932	555	44.521	0.000*
P22	34.754	2	437.625	555	22.038	0.000*
P23	103.989	2	402.922	555	71.619	0.000*
P24	75.253	2	419.492	555	49.781	0,000*

* significant for =0,05

Source: own elaboration

As can be seen from Tables 2 and 3, for each of the types of variables the differentiation turns out statistically not significant only for one variable. These are P5 for qualitative variables and P13 for quantitative ones. For all the other variables the differentiation is significant on a level α=0,05. This observation means that the cases differ meaningfully from each other concerning 22 out of 24 considered variables and forms a solid base for dividing them into clusters.

Then, distances between clusters were examined. These are shown in Table 4.

Table 4. Distances between clusters

	Cluster 1	Cluster 2	Cluster 3
Cluster 1	0.000	2.177	1.816
Cluster 2	2.177	0.000	1.648
Cluster 3	1.816	1.648	0.000

Source: own elaboration

Analysis of data in Table 4 leads to the conclusion that the longest distance is between clusters 1 and 2 (2,17). This means that the two mentioned segments differs most. Then cluster 1 differs from 3 (distance 1,82) in a little smaller degree. Because the distance between clusters 2 and 3 is the shortest (1,65), these segments turn out to be the most similar ones.

In the next step of the research procedure, they were subjected to a detailed analysis due to their structure.

4. Structure of the segments

Identification of the structure of the detected segments covered 3 areas. Therefore, the following tables show:

a. In Table 2 - the structure of detected segments according to variables measuring awareness of sustainable products,
b. In Table 3 - the structure of segments according to the variables measuring beliefs towards them,
c. In Table 4 - the structure of segments according to metric variables.

First, the structure of segments was considered in terms of awareness (knowledge) of concepts determined by variables P7-P9. The results are presented in Table 5.

Table 5. **Segment structure due to awareness of sustainable products (fractions)**

Variable	Value	Segment 1	Segment 2	Segment 3
P7	Yes	40%	40%	44%
	No	60%	60%	56%
P8	Yes	49%	57%	70%
	No	51%	43%	30%
P9	Yes	38%	39%	39%
	No	62%	61%	61%

Source: own elaboration

The analysis of the data contained in Table 5 leads to the conclusion that significant differences in awareness between segments occur only in the case of variable P8, measuring knowledge of the concept of "sustainable product". It is definitely the smallest in segment 1 (49% of "yes" answers) and the largest in segment 3 (70% of positive answers). For the remaining 2 variables, P7 (knowledge of the concept of "circular economy") and P9 (knowledge of the concept of "greenwashing"), the differences between the segments are very small, reaching a maximum of 4 percentage points in the case of P7. Therefore, it was noticed that individual segments differ only in the level of awareness of sustainable products, and this awareness is definitely the highest among people grouped in segment 3. In this segment, the awareness of the issues of the circular economy is also the highest, although not so clearly.

Then, the structure of segments was considered in terms of beliefs towards sustainable products, measured by variables P10-P24. The average values are included in Table 6.

Table 6. **Segment structure by beliefs towards sustainable products (average values)**

Variable	Segment 1	Segment 2	Segment 3
P10	2.72	3.86	4.56
P11	2.64	3.64	4.04

P12	2.41	3.38	2.36
P13*	2.39	3.03	1.85
P14*	3.47	4.10	4.60
P15	3.21	4.25	4.73
P16	2.69	3.73	4.07
P17	2.69	3.23	1.45
P18*	2.87	3.88	4.57
P19	3.11	4.08	4.66
P20	2.85	3.91	4.29
P21	3.05	3.99	4.42
P22	2.97	4.05	4.65
P23	2.98	3.95	4.36
P24	2.72	3.86	4.56

* - variables of a reverse scale

Source: own elaboration

Analyzing the data in Table 6, it was found that the respondents grouped in segment 1 are characterized by the lowest level of beliefs regarding most of the 10 variables (except for 5 variables P12, P13, P14, P17, P18). In turn, in segment 3, respondents most often declare the highest beliefs about sustainability. This happens for 11 variables (except variables P12, P14, P17, P18). The answers given by people classified in segment 2 in the case of 12 variables are higher than the level of belief of people in segment 1, but lower than the level of segment 3 (except for variables P12, P13, P17). This is therefore an "average" segment in terms of conviction towards the issue of sustainability.

Finally, Table 7 presents the structure (fractions) of segments according to the metric variables, i.e. variables P1-P5.

Table 7. **Segment structure due to control variables (fractions)**

Variable	Category	Segment 1	Segment 2	Segment 3
Sex	Woman	51%	52%	73%
	Man	49%	48%	27%
Age	Up to 34	52%	35%	47%
	35-54	28%	20%	36%
	55 and over	20%	45%	17%
Domicile	Village or city up to 5 thousand	20%	27%	29%
	City from 5 to 50 thousand	34%	25%	27%
	City from 50 to 500 thousand	37%	38%	26%
	City over 500 thousand	9%	10%	18%
Education	Basic	12%	10%	5%
	Medium	60%	60%	48%
	Higher	28%	30%	47%
Assessment of the financial situation	Bad	16%	14%	12%
	Average	65%	61%	66%
	All right	19%	25%	22%

Source: own elaboration

As a result of the analysis of the data presented in Table 7, it was noticed that a much larger fraction of women was classified in segment 3 (73%) than in the other two groups. In segments 1 and 3 there are significant percentages of the youngest people, aged up to 34 (52% and 47%, respectively). In turn, in segment 2 there is clearly the largest percentage of people aged 55 and over (45%). In terms of place of residence, in segment 1 there are relatively few inhabitants of the smallest (villages and cities with up to 5 thousand inhabitants - 20%) and the largest (over 500 thousand - 9%) towns. Segment 3, on the other hand, combines the largest fractions of residents of the smallest and largest towns (29% and 18%, respectively). As the segment number increases, the fraction of people with primary education decreases (from 12% in segment 1 to 5% in segment 3), and at the same time the percentage of respondents with higher education increases (from 28% in cluster 1 to 47% in cluster 3). The differences in the assessment of the financial situation between the groups are not large, although in segment 1

relatively the largest number of respondents assess their situation as bad (16%) and the least as good (19%). Most people assessing their situation as good are in segment 2 (25%), and slightly fewer in segment 3 (22%).

Analyzing Tables 5, 6 and 7, all three ranges of characteristics of the detected segments were discussed. In this way, two stages of cluster analysis have been completed, i.e. (1) identification of segments and (2) determination of their characteristics. As a result, taking into account the results of these considerations, the structure of the detected segments turns out to be as follows:

1. **Segment 1** (26% of the sample - the smallest group) was called the **unaware unconvinced**. This segment includes people:
   a. With a low level of awareness of both the concept of a sustainable product and the circular economy,
   b. Least convinced of the issue of sustainability (lowest average responses for 10 out of 15 variables),
   c. Both sexes, often young, living mainly in medium-sized cities, with an average level of education, in a poor or average financial situation.
4. **Segment 2** (35% of the sample - a medium-sized group) was defined as **hesitant**. This group includes respondents:
   a. About an average level of awareness of sustainable products and a low level of awareness of the circular economy,
   b. Moderately convinced (undecided or indifferent) towards the issue of sustainability ("intermediate" responses for 12 out of 15 variables),
   c. Both sexes, clearly the oldest, living in towns of various sizes, with an average level of education, in an average or good financial situation.
4. **Segment 3** (39% of the sample - the largest group) was marked as **conscious believers**. This group includes respondents:
   a. Aware of the issues of sustainable products and circular economy,
   b. Definitely the most convinced about the issue of sustainability (the highest average answers for 11 out of 15 variables),
   c. The vast majority are women, often young, residents of small towns, but also the largest cities, with higher education, in an average or good financial situation.

In general, taking into account the number, abundance and nature of the detected segments, it can be concluded that the conducted study showed a significant polarization of attitudes towards sustainable products (visible between clusters 1 and 3), but also considerable indecision (or indifference) in this area. The optimistic conclusion is that the segment of conscious and convinced consumers is the largest, and the segment of unaware and unconvinced consumers is the smallest. However, the significant number of sample clustered into the hesitant segment indicates the need for intensive consumer education and promotion of sustainability issues. It is

worth paying special attention to the structure of this cluster, which includes people of both sexes, the oldest, living in towns of various sizes, with an average level of education. It is primarily worth directing educational campaigns to them in order to transform indecision into conviction. This completes the analysis of the segment structure.

5. Discussion

The library query revealed the existence of a small group of publications whose authors examined consumer segmentation in the sustainable products market (Boyer et al., 2021; Vazquez et al., 2023; Zander et al., 2015; Kaczorowska et al., 2019; Jansen & Langen, 2017; Lucas et al., 2023; Emery, 2012; DEFRA, 2008; Gul, 2022; Finisterra do Paco et al., 2008; Jaiswal et al., 2020). A synthesis of the results of the analyzes conducted by these researchers is given in Table 8.

Table 8. **Consumer segmentations towards sustainable products in the literature**

Author(s)	Number of segments	Segment name	Description
Boyer et al. (2021)	6	Circularity enthusiasts	Willing to buy sustainable products, less concerned about price, the sustainability of products strongly motivates them to purchase.
		Sensitive to price, open to circularity	They are willing to buy sustainable products provided they are easily available and low price.
		Price sensitive	They definitely prefer the cheapest products.
		Aesthetes	They attribute the highest utility to the appearance of products, and are much less interested in the price and sustainability of the purchased goods.
		Risk avoidant	They expect certainty, predictability of operation and durability from products, they are aware of their expectations and are not very sensitive to the price and sustainability of products.
		The newest model	They are simply looking for the latest product models. Less interested in their appearance, price or warranty

Vazquez et al. (2023)	7	Moderates	Aware of the importance of product sustainability, but taking few actions on the market.
		Skeptical	Knowledgeable about sustainable products, but distrustful of them and considering them to be a marketing „invention".
		Interested	A group with a basic level of knowledge, but understanding the role of sustainable products in the economy and open to them.
		Neutral	They accept sustainable products, but declare that they purchase them carefully, as price is very important to them.
		Convinced	They have a high level of knowledge about sustainable products, but this does not translate into the intensity of their choices on the market.
		Unmotivated	They see no reason to learn about sustainable products and are not interested in changing it.
		Experts	The group with the highest level of knowledge in the researched area, at the same time, consciously purchases sustainable products and actively promotes them.
Zander et al. (2015)	4	Committed	Emotionally involved in purchasing sustainable products, positive attitude, but with a lower level of knowledge in this area.
		Pragmatic	They have a high level of knowledge in the area of sustainable products and are guided primarily by it, to a lesser extent by emotions.
		Skeptical	Not committed to sustainable products and skeptical about them.
		Not interested	They show a complete lack of interest in sustainable products.
Kaczorowska et al. (2019)	2	Skeptical	Unconvinced that sustainable products are of better quality. They believe that the sustainability of products mainly means their higher price. They have a low level of knowledge about sustainable products. They often believe that eco-labels are a marketing trick. The factor that decides about the purchase is usually the lowest price.
		Conscious	Convinced of the higher quality of sustainable products. They are aware of the sustainability of production processes. They believe that product sustainability improves the manufacturer's image, but also brings tangible benefits to buyers. Eager to try new products. They do not believe that sustainable products are harder to obtain. They declare loyalty to them even in the event of a significant price increase.

Jansen and Langen (2017)	3	Price sensitive	They are guided by the price of the product, regardless of any sustainability attributes.
		Choosing a label	They do not prefer specific product sustainability attributes, but they declare their willingness to pay a higher price for a product marked as sustainable
		Price conscious, rejecting labels	When choosing products, they are guided primarily by price. Some product sustainability labels have a negative utility to them.
Lucas et al. (2023)	6	Super positive	They have a high level of knowledge and, not accidental, a very positive attitude towards sustainable products. They declare their willingness to regularly pay higher prices for such products more often than in other segments.
		Adventurous	They have a lower level of knowledge about sustainable products, but they have a positive attitude towards them. They mainly take into account health benefits.
		Committed	Well informed, aware, open, positive towards sustainable products.
		Indifferent	Uninformed, uninvolved, but quite positive towards sustainable products.
		Skeptical	Informed but unconvinced about the advantages of sustainable products.
		Rejectors	Uninformed, uninterested and unconvinced of the benefits of sustainable products.
Emery (2012)	6	Truly green	Pro-ecological activists, strong supporters environmental protection, they do not perceive any barriers to adopting sustainable behavior.
		The Greens are not us	They display a strong pro-ecological attitude, but not behavior, they only engage in consumer behavior that requires little effort.
		Greens going with the flow	Moderately positive towards sustainable activities and products.
		Dreamy greens	Limited in sustainable decisions and behaviors. They would like to follow ecological path, but they are limited by the low level of knowledge.
		Greens „business first"	Quite weakly convinced of the concept of sustainability. They believe that it is primarily enterprises that should undertake sustainable activities.
		Non-greens	Cynical and distrustful of sustainable initiatives and products.

DEFRA (2008), from: Wilk (2015)	7	Positive greens	Most motivated towards sustainable actions. They willingly buy sustainable products and are willing to pay a higher price. Ready to make sacrifices for sustainability.
		Waste observers	More focused on minimizing consumption than buying sustainable products.
		Concerned consumers	They have a broad pro-ecological attitude towards the doctrine of sustainability, but they do not take much action.
		Supporters standing on the sidelines	They do not see themselves as operating in a sustainable way. However, there is a difference between their declared pro-ecological attitude and their actual, positive behavior.
		Cautious participants	They are aware of sustainability problems, but are pessimistic about them. They take action mainly for cost-saving reasons.
		Making excuses	A group with a low level of knowledge believe that the problems of sustainable development are exaggerated and that they have no influence on them.
		Honestly uninvolved	They show a complete lack of interest and concern for the environment and have no excuses for their behavior. They don't want to be told how they can change it.
Gul (2022)	5	The Earth first	Aware of the impact of our own choices and actions on the world around us. They look for brands that share these values. They understand the need for trade-offs in achieving sustainable development goals.
		Affordable prices first	A group with high price elasticity of demand. He is primarily interested in purchasing the cheapest products. Does not pay attention to sustainability issues.
		Health first	Conscious consumers pay attention primarily to the impact of purchased products on their own health, and secondly on the environment.
		Experience first	A hedonistic group that puts its own needs ahead of the well-being of the community and the environment. Interested in sustainable products only if they contain the utilities she is looking for.
		Society first	They understand the importance of the choices they make for the present and future of the world, and they favor the good of the community and the environment over their own.

Finisterra do Paco et al. (2008)	3	Uncommited	They have negative positions in relation to some environmental aspects (like environmentally friendly buying behaviour, recycling, resource saving, willingness to pay more for ecological products), despite the fact that they claim to have knowledge about the issue.
		Green activists	They have a favourable position in relation to all environmental aspects, particularly towards perceived efficiency, environmentally friendly buying behaviour, recycling, but they show themselves to be sceptical about the promotional activities in this area.
		Undefined	They have negative positions towards environmental issues, although they often are activists, which is untypical. They have a positive attitude towards recycling, and are highly sceptical about the promotional claims made by producers. They claim to have little knowledge about environmental issues. They consider that their individual action does not contribute to the improvement of the environment.
Jaiswal et al. (2020)	3	Keen greens	They have great environmental concern, high level of environmental knowledge, as well as perception of eco-labels and eco-brands. Their high green purchase intention is realized by numerous green purchasing behaviours.
		Moderate greens	They have lower environmental concern, as well as moderate level of environmental knowledge, perception of eco-labels and eco-brands. Their green purchase intention behaviours are more rare.
		Reluctant greens	They have low level of environmental concern, as well as the lowest level of environmental knowledge, perception of eco-labels and eco-brands. They do not manifest green purchase intention nor display green behaviours.

Source: own elaboration on a basis of sources given in the table

Based on the analysis of the data presented in Table 8, it was found that most of the analyzed publications suggest that the classification of consumers on the scale of belief in the issue of sustainability involves placing them on a continuum of the scale. However, what clearly differs the quoted results is the number of identified segments, which ranges from 2 to 7.

Comparing the obtained results with those available in the literature, it can be concluded that the three-segment classification identified in this study most closely resembles the framework proposed by Zander, Padel, and Zanoli (2015). Their work offers a foundational perspective on segmenting consumer groups, including the undecided, which they further divided into two distinct subsegments: pragmatic and skeptical. This nuanced approach emphasizes the complexity of consumer beliefs and attitudes, highlighting the varying degrees of certainty and skepticism within the undecided category. By introducing this additional layer of segmentation, Zander

and colleagues provide a more granular view of consumer typologies, illustrating how belief systems can diverge even within seemingly similar groups.

In contrast, the findings of Kaczorowska with colleagues (2019) present a simpler dichotomy of consumer segments, identifying only two groups: skeptical and aware consumers. This binary classification omits an intermediate group, such as the undecided individuals prominently featured in the present study. The lack of an intermediate segment in Kaczorowska et al.'s framework underscores a key divergence between their analysis and the findings discussed here. The undecided group, which is significant in both size and importance in this study, serves as a bridge on the continuum of consumer awareness. It represents individuals who are neither fully skeptical nor entirely aware but occupy a transitional space characterized by varying levels of indecision or ambivalence. The omission of this segment in Kaczorowska's model may limit its ability to capture the full complexity of consumer behavior.

Further insights into the polarization of consumer beliefs and awareness can be drawn from the more detailed classifications offered by Vazquez et al. (2023) and Lucas et al. (2023). These studies extend beyond the simple segmentation of consumers into broad categories, providing a deeper and more nuanced understanding of consumer behavior along the continuum of belief scales. By incorporating additional dimensions and criteria, such as intensity of belief, openness to change, and contextual influences, these frameworks enhance our ability to comprehend the diversity of consumer attitudes. Their work demonstrates how belief systems can be positioned on a finely tuned spectrum, allowing for a more precise identification of consumer typologies.

The analysis of the obtained results also allows us to observe their similarity to the two classifications, each containing three consumer segments. In the first one (Finisterra do Paco et al., 2008) the following groups were distinguished: (1) uncommited, (2) green activists and (3) undefined. The first segment, uncommited, is similar to the cluster 1 – unaware unconvinced revealed in our research. Then the second segment, green activists, corresponds to our cluster 3 – conscious believers. However, respondents identified by Finisterra do Paco with the team seem to be even more engaged in environmental matters. The third cluster, undefined, is similar to our cluster 2 – hesitants, encompassing consumers not sure about environmental matters, their awareness, beliefs, intentions and behaviours.

Also another three-cluster model, suggested by Jaiwal and colleagues (2021) is worth paying attention to. These researchers identified groups of (1) keen, (2) moderate and (3) reluctant greens. Again, this classification responds to our clusters, respectively cluster 3 - conscious believers, cluster 2 - hesitants and cluster 3 – unaware unconvinced. Discussion of these two models shows that three-clusters classifications can be very useful, as they show segments of the customers on easy to understand scales of awareness, beliefs, intentions and behaviours. These scales clearly distinguish respondents accordingly to

their level of "green engagement" and can form good basis for differentiating marketing strategies and tools targeted at them.

Overall, the classification proposed in this study, with its inclusion of an undecided segment, aligns with and builds upon existing literature. It highlights the importance of recognizing intermediate groups and their role in the broader landscape of consumer awareness and behavior. The detailed segmentations presented in other studies underscore the value of a multifaceted approach, providing a comprehensive framework for understanding the diverse and dynamic nature of consumer belief systems.

6. Managerial implications

The literature has long emphasized that contemporary markets are not homogeneous (Smith, 1956; Allenby & Rossi, 1998; Ruiz et al., 2007). They consist of narrow niches, narrowly defined groups with clearly defined expectations, looking for specific benefits. Often, these small segments are even separate submarkets (Kotler et al., 2021). At the same time, the segment must be large enough and absorbent enough to be operated profitably. Therefore, in order to effectively influence various groups of consumers, it is necessary to identify common features characteristic of individual segments (Żuchowski, 2007). It is emphasized that the separated segments should (Encyklopedia Zarządzania, 2023):

- be easy to identify and measure,
- be relatively large,
- differ from each other and at the same time be as internally consistent as possible (homogeneous),
- available (possibility of handling them),
- segments should respond differently to marketing instruments.

Typically, there are 4 types of segmentation (Altkorn, 2006; Dębowska, 2010; Encyklopedia Zarządzania, 2023):

1. Single-segment concentration - this is the simplest strategy, where the company focuses only on one market segment, adapting all marketing activities and the offer to its needs. This enables the company to gain deep knowledge of a given segment and adapt its products or services to its requirements. This is especially effective for small businesses. The disadvantage of this strategy is the high risk associated with dependence on one market segment.
2. Selective specialization - this is a strategy in which the company selects several partial markets and adapts various marketing strategies and product offers to each of them. This is a less risky approach because the risk is spread over several segments and profits from one segment can be used to support other less profitable segments.

3. Product specialization - focuses on producing one product and delivering different versions of that product to different markets. Such specialization allows the company to develop a reputation in a given product area. However, there is a risk of a new technology or alternative product emerging from a large market player.
4. Market specialization - means reaching only one market segment, providing it with most of the products it needs. Although such specialization makes it easier to achieve a strong position in the segment, there is a risk of a decline in sales if the purchasing power of this segment decreases.

It seems that, taking into account the considerations presented here, derived from both the literature analysis and the results of empirical research, in the case of consumer segmentation in the sustainable products market, the implementation of a selective specialization strategy may be considered. Taking into account the not yet fully developed and constantly changing attitudes and beliefs of consumers, it is desirable to distribute risk between different consumer segments. At the same time, the increase in positive attitudes among consumers allows them to count on market success in many segments in the near future.

Another issue is the benefits that can be obtained through effective market segmentation. The literature indicates the following (Dziechciarz, 2009; Grzywacz, 2014; Kotler et al., 2021):

- facilitating the identification and selection of profitable markets, which supports the planning of marketing strategies and activities,
- improved adaptation to customer needs, enabling better satisfaction of their expectations,
- easier monitoring of changes taking place on the market, which allows you to react on an ongoing basis to the evolution of the situation,
- simplifying communication between the manufacturer and customers, thanks to better understanding and adapting the message to specific segments,
- better observation of market changes, allowing for faster reaction and adaptation
- more effective reaching of consumers whose preferences were taken into account when shaping marketing activities.

It can be assumed that these advantages will also occur in the case of positioning promotional messages regarding the sustainability of the offered products to specific segments.

7. Conclusions

As a result of the analysis, the existence of three consumer segments on the sustainable products market was detected. Their names, numbers, characteristics and formal structure are as follows:

1. **Segment 1** - **unaware unconvinced**, grouping 26% of respondents. These are people with low awareness of the issue of sustainability and the least confidence in it, often young people, from medium-sized cities, with an average level of education, and in an average financial situation at best.
2. **Segment 2** – **hesitant**, consisting of 35% of the sample. They have average or low awareness of the issues under consideration and are averagely convinced about it. These include clearly the oldest people, with an average level of education and in at least an average financial situation.
3. **Segment 3** – **conscious believers**, connecting 39% of respondents. These are people with a high level of awareness of the issues of sustainable products and the circular economy, clearly committed to sustainability issues. This group most often includes women, often young, from the smallest towns, but also the largest cities, with higher education, in at least an average financial situation.

An optimistic conclusion is that the segment of conscious and convinced consumers is the largest (39%), and the segment of unaware and unconvinced consumers is the smallest (26%). However, the significant number of sample clustered into hesitant segment (35%) indicates the need to intensively educate this group of hesitant consumers and promote the issue of sustainability among them.

Taking into account the number, abundance and nature of the detected clusters, the results obtained are most consistent with the classification suggested in their publication by Zander et al. (2015). However, in their study, the undecided segment is divided into two segments: pragmatic and skeptical. This is the opposite situation to the one presented in the study by Kaczorowska et al. (2019), where only two segments were identified: skeptical and aware consumers. However, there is no "intermediate" segment, which is numerous in this study - undecided people. Therefore, it can be assumed that the identified classification "fits in" between the cited studies.

Because of the number of the identified clusters, the obtained results are similar to the ones presented by Finisterra do Paco, Raposo and Filho (2008) and Jaiswal et al. (2020). These studies show that three-clusters classifications can turn out especially useful. They show segments of the customers on easy to understand descriptive scales of awareness, beliefs, intentions and behaviours. These scales clearly distinguish respondents accordingly to their level of "green engagement" and can form good basis for differentiating marketing strategies and tools targeted at them.

Overall, taking into account the number, size and nature of the detected segments, it can be concluded that the analysis showed a significant polarization of attitudes towards sustainable products, but also considerable indecision in this area. Therefore, it is clear that educating consumers and promoting the issue of sustainability is justified. The presented application of the multidimensional classification method allowed for the identification of heterogeneous consumer groups, providing the basis for building

diversified marketing strategies and using various instruments promoting the issue of differentiation.

8. Research limitations

Like any research, this one is limited by various methodological and practical factors. First, there is the test. It is numerous, but the study was carried out only using the CAWI method, so it is not entirely representative. However, over 80% Poles uses the internet (Puls Biznesu, 2024), so the range of the research was quite broad. Likewise, the number of questionnaire items is quite limited. The idea was to avoid being discouraged by excessively long response times, but a larger number of variables would have made it possible to measure the concepts under consideration more precisely. Therefore, the results should be generalized with caution.

9. Directions for future research

Particularly interesting directions for developing the analysis presented here may be the use of other multidimensional analysis methods in the classification procedure, for example classification trees, also recommended for developing market segmentation (Dębowska, 2010). Substantively, it seems interesting to examine the declared price elasticity of demand in relation to the prices of sustainable products, which is signalled in the literature as one of the most important problems (Gul, 2022; Saha et al., 2002; Rutkowski, 2011). It is also worth examining consumer attitudes towards the issue of sustainability in the division introduced by F. Reichheld (2003) into promoters (spreading positive opinions), neutrals (refraining from expressing opinions) and destructors (spreading negative opinions). In this way, you can gain valuable knowledge about informal messages created by consumers in social networks.

Another promising direction of continuing this research can employing qualitative methodologies. Thanks to these it is possible to obtain information about the way in which the respondents perceive and construct a given fragment of reality basing on language or text analysis. Typical techniques used here are in-depth interviews or focus groups (Rutledge & Hogg, 2020). However, it should be noted that qualitative methodologies, as opposed to qualitative ones, are now an accepted feature of consumer research, their application in the truest sense is still in its infancy within the broader field of marketing. Researchers (Goulding, 2005) propose a number of possible contexts that may benefit from in-depth qualitative enquiry. It can be performed on a basis of grounded theory, ethnography and phenomenology. Also other authors (Nuttavuthisit et al., 2019) suggest consideration of theoretical research methods and practical uses of qualitative consumer and marketing research. This is because qualitative research is

currently having a major impact upon the marketing process (Bellenger et al., 2011). What is more, as Austrian (2000) suggests, both quantitative and qualitative methods can coexist fruitfully. With a large and still increasing scale of quantitative marketing research, qualitative studies play an increasing role in drawing hypotheses, developing research strategies and interpreting the results (Bellenger et al., 2011).

Authors' contribution

J.Ż. developed the theoretical formalism and model approach. **A.L.** performed the computational framework and analysed the data. He also took the lead in writing the manuscript, with the input from all authors. **A.L.** translated the manuscript. **M.L.** performed literature analysis and contributed to the design of the research. She also concluded from data analysis, formulated limitations of the research and directions for future research. **M.P.** carried out the empirical research, collected and prepared data for calculations. She also supervised the project. All authors provided critical feedback and helped shape the research, analysis and the final manuscript.

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