

CONSUMER SEGMENTATION USING CLUSTER ANALYSIS AS A SOURCE OF DATA TO IMPROVE PRODUCT QUALITY

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Purpose: Identification of energy drink consumer segments in terms of assessing the importance of product quality attributes and variables formally characterizing the sample.

Design/methodology/approach: Cluster analysis was used to segment consumers. The Ward agglomeration method and then the k-means method were used. The scope of the analysis included detecting structure in the data by arranging the surveyed consumers into groups in such a way that the degree of their connection within the same group was as high as possible. This stage of the analysis was carried out on the basis of research results regarding the identification of consumer-preferred quality attributes of energy drinks, which was carried out among people buying and drinking these products in accordance with the IPA (Importance–Performance Analysis) implementation importance method.

Findings: The result of the analysis was to obtain a three-cluster model specifying the segmentation of consumers according to the assessment of the importance of the qualitative attributes of energy drinks and the formal characteristics of the sample.

Research limitations/implications: The cluster analysis method used to identify consumer groups allowed for the detection of structures in the data without explaining why they occur. Therefore, the research is open and it is assumed that it will be continued in this area.

Practical implications: Consumer segmentation may provide guidance for producers in the process of designing the quality of tested products and adapting their quality attributes to consumer preferences. In addition, it may also influence the modification of manufacturers' strategies, e.g. towards the implementation of a strategy of focusing on costs or differentiation and help achieve a competitive advantage.

Originality/value: Demonstrating the usefulness of the cluster analysis method in consumer segmentation on the example of energy drinks, i.e., a currently particularly fashionable and dynamically developing category of food products, and at the same time a controversial range of functional food.

Keywords: consumer segmentation, cluster analysis, quality, energy drinks.

Category of the paper: Research paper.

1. Introduction

Meeting customer needs is the primary goal for competing manufacturers. Buyers are constantly looking for something new, unique and personalized that allows them to stand out (Berbeka, 2016). This trend results from the needs of modern civilization and is also characteristic of the development of the fortified food market. Recently, the development of the food industry has focused primarily on the production of functional foods (Misra et al., 2021). The increase in interest in functional food is the result of increased consumer awareness in the aspect of nutrition, as well as the fashion for an active lifestyle and the development of sports passions (Marciniak et al., 2019). When making purchasing decisions, consumers are guided by various factors and willingly reach for food that reduces mental and physical stress or increases the body's efficiency. Therefore, among others Food manufacturers offer products that contain substances that have an impact on the human body beyond just the nutritional effect (Grudnowski et al., 2016).

The marketing activities of modern enterprises and the development of market strategies are determined by the growing role of consumers. In a company's strategy, information about the value of a given product for the consumer and, consequently, how much the customer is willing to pay for it is crucial. Decisions at the stage of building a strategy for a production organization must be made not only on the basis of one's own experience, but also on the basis of analyses of consumer behaviour models (Maciejewski, 2012).

There are currently eight categories of functional beverage types, including energy drinks, performance-enhancing drinks, weight-control drinks, and drinks that improve digestion, immunity, circulatory system and cognitive function (Gupta et al., 2023). Functional beverages are the fastest growing segment, especially in the development of new food products worldwide. The energy drinks market belongs to the dynamically developing food sector (Giri et al., 2023). There are at least 50 brands of these products available in Poland. Manufacturers maintain constant interest in this category by investing in introducing new products. For example, in 2017, 100 new products appeared on the market (Mroziak, 2018). Every fourth customer chooses energy drinks, and in 2022, Poles bought 800 million cans of heavily sweetened drinks with caffeine or taurine. According to Euromonitor data, in the last two years the increase in the value of the market for these products amounted to 46%, and it is estimated that in 2023 it will reach PLN 3,25 billion. The sector's advertising expenditure amounts to PLN 123 million (Ptak-Iglewska, 2023). It is also forecast that in 2027 the market value may reach nearly USD 154,8 billion, and in the years 2024-2032 this market will grow successively at the level of 7,5% per year (Expert Market Research, 2023).

Since energy drinks have a relatively similar physicochemical composition, it can be considered that they belong to the market of products that are difficult to differentiate other than by using marketing tools (Kowalski, 2017). In the case of this type of products, differentiation

is possible at a level higher than the actual product or its additional functions, and an effective element of differentiation may be, for example, a brand, i.e. an element that creates a certain awareness, reputation and is important on the market (Keller, 2008).

Global producers declare that the consumption of their products meets the need to keep the body and mind active and therefore they are used by various groups of recipients, i.e. people working at night, drivers, athletes, students and young people. In addition, they also notice differences between customers and engage in adapting the marketing strategy to local or cultural conditions (Czernichowski, 2019). Cultural conditions and eating habits determine the preferences of consumers, who create requirements for food available on the market (Gurbuz, Macabangin, 2019; Ramya, Mohamed Ali, 2016). In order to meet consumer expectations, manufacturers must be open to innovation and, as a result, modifications to the composition of products (Mroziak, 2018). They must also adapt to the expectations of the target segment by, among others, name, taste and advertising, including packaging (Expert Market Research, 2023). A wide range of energy drinks and strong competition from producers competing for sales markets, acquiring and retaining customers, force constant diagnosis of the current characteristics of consumers and their functional expectations in relation to these products. Moreover, when analysing target groups, it is impossible not to mention health restrictions and even contraindications and legal restrictions in relation to the consumption of energy drinks for, among others: consumers of different ages. This fact is confirmed by the ban on the sale of drinks with caffeine or taurine (energy drinks) in Poland as of January 1, 2024 to people under 18 years of age (Dz.U.2023.1718).

Identifying differences in consumer preferences and defining groups of potential recipients should support product design and building a market strategy in the changing environment of the production organization. Therefore, the aim of this study is to: identify consumer segments in terms of assessing the importance of quality attributes and variables formally characterizing the sample of respondents. The study was carried out on the example of energy drinks, i.e. a currently fashionable and popular representative of functional food products. In accordance with the assumed aim of the study, a working hypothesis was formulated: the use of cluster analysis leads to the segmentation of energy drink consumers according to their quality preferences and supports the improvement of the quality of these products.

To achieve the assumed objective, the cluster analysis method was used. An element of the new approach presented in the work is the use of the cluster analysis method in the segmentation of consumers of energy drinks and focusing the conclusions on obtaining data allowing for improving the quality of these products. Of course, towards striving for product perfection and full consumer satisfaction. The undertaken task of segmenting consumers of energy drinks was carried out as a continuation of the analysis of our own research conducted among people buying and consuming these products, regarding the assessment of their preferred quality attributes. This study was carried out in accordance with the IPA implementation validity method (Importance–Performance Analysis) (Martilla, James, 1977).

2. Research method

The basis for this stage of work, i.e. segmentation of energy drink consumers, were the research results carried out using scales of implementation importance regarding the measurement and assessment of product quality. This is a group of matrix methods in which the analysed objects are divided into two IPA criteria, i.e. measuring the perception of importance and the degree of fulfilment of expectations in relation to factors - variables affecting the quality of the analysed product (Martilla, James, 1977; Abalo et al., 2007; Biesok et al., 2016; Lotko et al., 2018). The research was conducted using the survey method, the tool was a survey. The questionnaire included questions constituting a formal description of the respondents and a substantive part regarding the features characterizing the analysed product. The selection of the sample was purposeful. The baseline survey conducted using the IPA method covered 300 consumers and was conducted among consumers and users for a total of three groups of products and services (food, non-food and services). The stage of this study, i.e. customer segmentation using cluster analysis, was carried out for a food product based on the results obtained from respondents who declared consumption of energy drinks.

Cluster analysis (data segmentation or clustering) used for customer segmentation has been gaining popularity in recent years (Gore, 2000; Stevens, 2009; Lotko et al., 2018). The method belongs to the group of undirected exploration methods, which means that all relationships and regularities are detected based on the input variables. It includes algorithms and methods for grouping similar objects into similar categories. The cluster analysis method is useful when it is necessary to classify a large amount of information collected during research into a reasonably reduced set. Technically popular methods used in cluster analysis are: agglomeration (hierarchical tree), grouping of objects and features, k-means, EM (expectation maximization) (StatSoft, 1997).

There are two types of clustering algorithms distinguished in the literature: hierarchical and non-hierarchical. Hierarchical methods lead to obtaining a tree structure of the elements of the analysed set, which in the horizontal version is a hierarchical tree diagram, while in the vertical version - an icicle diagram. The analysis results are presented as a tree showing subsequent steps of the algorithm (Migut, 2009). In this way, the final segmentation was obtained in this analysis. Importantly, because the method does not require making prior assumptions as to the number of clusters obtained, the graph could be cut off at the appropriate height from the researcher's point of view to enable a meaningful interpretation of the results. It should be noted that among the hierarchical methods, the most popular method is the agglomeration method. Unfortunately, this method also has some disadvantages, including: for large data sets, significant computational power is required for hierarchical algorithms. In turn, non-hierarchical methods are computationally fast, but they require declaring a predetermined number of clusters, which significantly affects the resulting segmentation. The k-means method

is popular here (StatSoft, 1997; Stevens, 2009). In developing the results of this study, first the agglomeration method (Ward's algorithm) was used to identify the number of clusters, and then the k-means method was used to analyse the structure of the detected clusters.

3. Results and discussion

3.1. Characteristics of respondents

Four criteria were adopted to characterize the respondents, i.e. gender, age, education, and average monthly income. Detailed characteristics of the research sample are presented in Table 1.

Table 1.

Characteristics of the sample

	Metric variable	[%]
sex	female	60
	male	40
age	<25	55
	25-40	18
	41-55	15
	>55	12
education	elementary	0
	secondary education	61
	higher education	39
income	<1000	21
	1000-2500	34
	2501-4000	20
	>4000	25

Source: own elaboration.

It should be noted that women constituted almost two thirds of the respondents. Moreover, more than half of the respondents were young people under 25 years of age. The remaining respondents are groups with a much smaller size. People aged 25-40 years accounted for 18%, and the percentage of people aged 41-55 years was 15%. The smallest group of respondents were people over 55 years of age (total 12%). Such a large number of young respondents in the study who are consumers of energy drinks can be considered consistent with the research (Zucconi et al., 2013), in which we found that 68% of young people (of the European Union Member States) drink energy drinks. Similarly, according to research by the consulting company KPMG Polska, consumers of these products are usually people under 30 years of age, most often students (KPMG, 2016).

Respondents with secondary or higher education constituted 61% and 39%, respectively. The lack of participation of respondents with primary education in the study may probably be due to the fact that the study was carried out only among adult respondents. Moreover, there is

a constant increase in the education level of society and there are fewer and fewer people (consumers) who do not continue their education after primary school. According to data from the Central Statistical Office, only 11.7% of the Polish population aged 13 and over have primary education (GUS, 2022).

The characteristics of the sample were complemented by a variable - average monthly income. The largest surveyed group were respondents declaring an income of PLN 1,000-2,500. The relatively low indication (25% in total) of income above PLN 4,000 can be explained by the fact that many young respondents took part in the study and may still be studying or at the beginning of their professional career.

3.2. Segmentation of respondents

In order to segment the surveyed respondents, cluster analysis was used twice (first, agglomeration using Ward's algorithm, and then the k-means method). Figure 1 shows the results of grouping cases (rows) obtained using the agglomeration method in the form of a tree diagram (Ward).

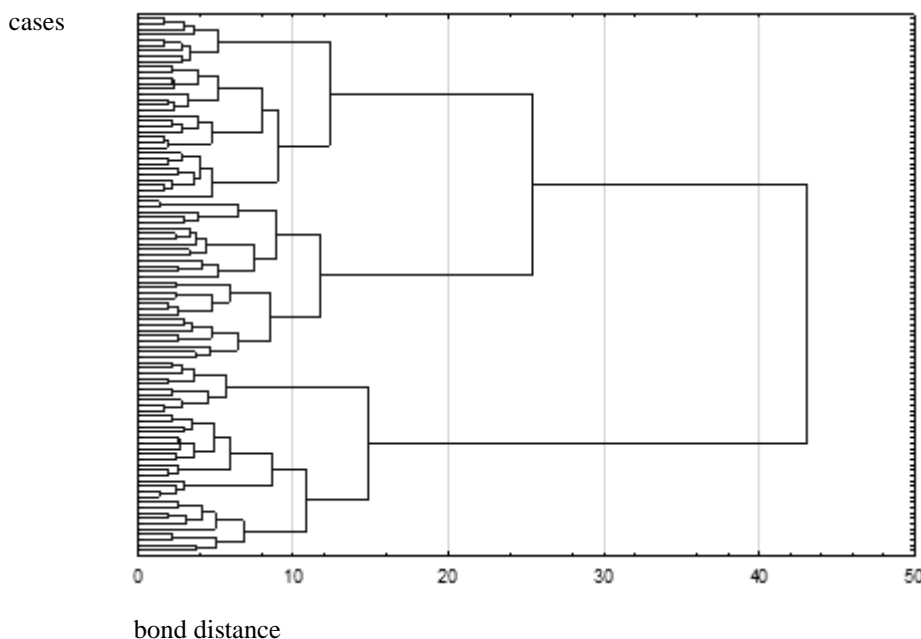


Figure 1. Grouping cases in clusters with the use of the agglomeration method (Ward).

Source: own elaboration.

The analysis of Figure 1 shows a clear division into 3 clusters, resulting from a significant increase in bond length in the range of 15-25. Therefore, a solution with 3 clusters was adopted as the basis for the proposed segmentation model.

Then, the cluster analysis was performed again, this time using the k-means method. In this way, information was obtained about the assignment of cases to clusters and the average values of variables in the clusters. The latter are summarized in table 2.

Table 2.*Average values of quality attribute weights for identified clusters*

Attribute	Cluster 1	Cluster 2	Cluster 3	Total
taste	4,72	4,67	4,17	4,54
smell	4,30	4,37	3,80	4,17
colour	3,40	3,63	3,37	3,46
caloric value	4,42	4,07	2,87	3,85
sugar content	4,40	4,10	3,00	3,89
CO ₂ saturation	4,10	3,83	2,87	3,65
content of active substances	4,28	4,00	3,43	3,94
health safety	4,67	4,60	4,20	4,51
packaging	3,38	3,10	2,93	3,16
price	4,47	3,33	3,73	3,91

Source: own elaboration.

3.3. Characteristics of consumer clusters due to the assessment of the importance of beverage parameters

Based on the results obtained, customer profiles were identified from each segment due to the quality features of the analysed product. On the basis of data contained in Table 2 regarding individual attributes, it can be seen that in cluster 3 the weight of the attribute taste is much lower than in the other two (4,17 vs. 4,72 and 4,67). Therefore, it was found that the attribute taste is less important for consumers assigned to cluster 3. In turn, smell turned out to be the most important for consumers belonging to cluster 2 (4,37). However, there is a clear difference in the importance attached to this feature by consumers of cluster 3 (3,80). It is possible to notice a relatively similar level of importance of the colour attribute for all respondents, practically regardless of which cluster they belong to.

Comparison of the perception of the importance of the parameter caloric value of the product indicated a clearly different position of the respondents from cluster 3. For them, the weight assigned to this parameter is the lowest (2,87 vs. 4,42 and 4,07). Similarly, the same segment of respondents did not attach much importance to the sugar content in energy drinks (3,00 vs. 4,40 and 4,10). However, the parameters such as caloric value, sugar content, carbonation and the content of active substances were the most important for consumers from cluster 1. According to the respondents (regardless of which segment they belong to), the packaging turned out to be the least important attribute of the product. It should be noted that the question about the importance of packaging was a generalization because the respondents' attitude to packaging features (e.g. material, functionality, aesthetics) was not examined. It can be assumed that specifying the aspect of the beverage packaging in terms of its characteristics would perhaps indicate a greater differentiation in the assessment of the importance of this attribute among the respondents.

Generally, for all respondents, taste and health safety are two key quality parameters of the analysed products, and the respondents assigned the least importance to packaging. A comparative analysis of the weight values of the considered attributes in the identified clusters also indicated that taste is particularly important for consumers from clusters 1 and 2,

while consumers from cluster 3 put health safety first. In this aspect, the presented research results are partially consistent with similar ones already published and confirm that the main parameter important for consumers is safety and that consumers mainly associate the quality of the analysed group of drinks with this attribute (Gupta et al., 2023; Osmólska et al., 2022).

It was noticed that consumers from cluster 3 indicated the lowest weights for all assessed attributes, which means that this segment includes consumers with low requirements for the quality of the analyzed product. However, generalizing the perception of the importance of quality attributes of energy drinks by consumers of cluster 1, it turned out that they are the opposite of cluster 3. Cluster 1 includes consumers for whom quality attributes are important (color and packaging the least), while at the same time the price of the product is important. These may be people who are not willing to pay a high price for high quality, or price is an indicator of quality for them. In turn, for consumers of segment 2, the price of the product is the least important (compared to the other clusters), and in terms of the level of weight assigned to quality attributes, this group is placed between the other two clusters.

Since price plays an important role in the consumer's perception of product features, i.e. it shapes consumer expectations regarding their quality (Shiv et al., 2005), taking into account the results of this study, it was possible to name the identified consumer clusters using characteristics and nomenclature individual price segments of consumers proposed by Szczepański (2005). Therefore, in the context of quality features versus product price, based on this stage of this study, the following names were proposed for three distinguished clusters of consumers drinking energy drinks: cluster 1 - economic customer (important quality features - important price), cluster 2 - premium customer (important quality features - not important price), cluster 3 - customer standard (similar level of importance for quality features and price, and awareness that "quality costs money").

3.4. Characteristics of consumer clusters according to their birth features

Whereas:

- price is not the only means of communication with the customer (Kotler, 2002),
- the process of shaping the product image in relation to the price image depends on a number of factors (Łukasik, Schivinski, 2014),
- energy drinks are difficult to differentiate products (Kowalski, 2017),
- for a group of products that are difficult to differentiate, buyers generally do not consider price as an indicator of quality (Bondos, 2016),

the structures of the identified clusters were analysed according to individual metric variables, i.e. gender, age, education and income level of the respondents. This approach will help adjust the product specifications in terms of preferred quality parameters to the characteristics of consumer segments. The results of the obtained cluster structure are presented in Table 3.

Table 3.
Structure of clusters according to metric variables

Metric variable		Cluster 1 [%]	Cluster 2 [%]	Cluster 3 [%]	Total [%]
sex	female	83	60	47	60
	male	17	40	53	40
age	<25	79	75	33	55
	25-40	10	15	24	18
	41-55	7	5	24	15
	>55	3	5	20	12
education	elementary	0	0	0	0
	secondary education	76	80	45	61
	higher education	24	20	55	39
income	<1000	34	40	6	21
	1000-2500	41	35	29	34
	2501-4000	17	10	25	20
	>4000	7	15	39	25

Source: own elaboration.

The data in Table 3 show that cluster 1 can be considered highly feminized. There is a clear predominance of women here (83% of them compared to the fraction in the sample of 60%). As stated earlier, this focus attaches great importance to the quality parameters of products, and at the same time, price is also particularly important for them. Therefore, taking into account the characteristics of women consumers (Gemnius Polska, 2020), it is advisable that producers, when adapting the product to this group of recipients, should send a message regarding the impact of the product (beverage) on improving their quality of life. Hence, as the obtained research results indicate, health safety and caloric value are the main two quality parameters on which the manufacturer should focus on improving, and which respondents from this segment indicated as one of the most important quality features (apart from sensory values, i.e. taste and smell). Researchers Gupta et al., (2023) also reached similar conclusions regarding the correlation between diet and health for the protection of consumers' overall well-being.

Identified clusters 1 and 2 are mostly young people (79% and 75% aged up to 25, respectively, compared to 33% for cluster 3), and middle-aged and older people belong to cluster 3. Therefore, clusters 1 and 2 are clearly "youthful" in nature and cluster 3 groups mature consumers. In cluster 3, there is a clearly higher share of people with higher education (55% compared to 39% in the sample and 24% and 20%, respectively, in clusters 1 and 2). Therefore, the third of the identified segments groups clearly better educated people than the other two, which corresponds to the results regarding the age structure of the respondents.

Taking into account the respondents' income, it was found that in the first cluster there is a clearly larger fraction of people with an income below PLN 1,000 and in the range of PLN 1,000-2,500 (34% and 41%, respectively) compared to 21% and 34% in the sample). At the same time, cluster 3 included by far the largest fraction of people with the highest income, i.e. above PLN 4,000 per month (39% compared to 25% in the sample). Cluster 2 contains a proportionally larger fraction of people with average income.

4. Conclusions

Knowing the product quality attributes that are important for customers, the manufacturer knows which features important for the recipient must be improved in order to best adapt the offer and marketing communication to the expectations of individual customer groups.

Comparison of respondents' preferences regarding the importance of quality features of energy drinks showed that for none of the distinguished consumer groups the content of active substances is a key quality attribute. The respondents mainly declared that they expected products to be safe for health. Apart from this attribute, the most important parameters, according to the identified consumer clusters, are related to sensory sensations (taste, smell), but they also attach importance (especially cluster 2) to the sugar and calorie content.

However, the results of our own research also allowed us to identify the features of energy drinks that all respondents considered the least important, regardless of the segment they belonged to. These are the packaging and color of the product. Knowledge regarding consumers' perception of the importance of these attributes is of practical importance. It can be a valuable guide for manufacturers when deciding on areas for improvement and will allow them to focus on attributes that are important to consumers and invest more in this area, while preventing over-investment in improving product features that are less important to consumers and which they do not expect to improve. Therefore, this line of reasoning leads to a rational improvement in product quality and at the same time has an economic aspect. This approach is especially important in the current reality of market and price competition and the trend of product sustainability.

It should be noted that the research tool used has some limitations. The cluster analysis method is dedicated to exploratory research. The grouping method is used to create taxonomies and does not make it possible to confirm the validity of defined segments. Its significant limitation is its subjective nature. This is a typical problem for social research. However, this method makes it possible to identify clusters for cases (consumers) and, among others, this was the reason for using it to analyze the results. Another limitation of the presented study resulted from the fact that the knowledge of beverage consumers regarding the quality categories of these products was not analyzed. This limited a deeper analysis of the differences in the importance of the quality criteria indicated by the respondents. This was taken into account when developing the survey questionnaire, where the focus was on measuring attribute weights. However, as a result of the study, it was possible to confirm the universal nature of the analysis method used.

The conducted study opens new directions for future research. The next step may be, for example, the continuation of the analysis in the following areas: whether the answers provided result from the respondents' conscious knowledge and to what extent the answers are given at the level of minimum involvement of the respondents. The research results encourage

the continuation of the use of deeper statistical analyzes to test cause-and-effect models, which will be the direction of subsequent research.

Based on the results of the study, it can be concluded that energy drink producers actually have two options to build product value and meet consumer demands: either lowering the price or providing product features that are important to customers and expected by them. By choosing a specific concentration strategy option, manufacturers can serve their customers and at the same time strive for market leadership.

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