Cluster Analysis of the "Trustworthy Product" Criteria, in the FMCG Sector - Aspects of the Hungarian Product Remuneration System in the FMCG Sector

Otília Dörnyei and Zsolt Tégla

Óbuda University, Keleti Károly Faculty of Business and Management,
Tavaszmező u. 17, H-1084 Budapest, Hungary
dornyei.otilia@kgk.uni-obuda.hu; tegla.zsolt@kgk.uni-obuda.hu

Abstract: The focus of this research is that a new reward system will be introduced for the evaluation of FMCG products, to be marketed in Hungary. Similar to the previously used Superbrands and MagyarBrands product awards, a new system is being developed called "Reliable Product". From a research point of view, the awarding of the Reliable Product award is conditional upon the development of a set of metrics that are acceptable to all, and which will allow a clear decision on the criteria for the award. This requires, however, a thorough understanding of the public's perception of the criteria by which an FMCG product is considered reliable.

The results of the study will be used for the development of a reliability award scheme in Hungary, the main criterion for the award of which, is a survey of consumer opinions. The main objective of this research was to understand the relationship between the 22 FMCG categories observed and their reliability. The importance of reliability was assessed using a Likert Scale from 1 to 5. Hierarchical clustering was chosen, because this method segments the variables, rather than the cases. In our case, product categories serve as a kind of variable, since we had 22 such categories. In our secondary research, we reviewed literature from other directions, for example, on consumer behavior and branding. Much of the literature describes brand equity in terms of value for money and does not explore reliability in depth. Therefore, in our primary research, we conducted an online representative survey with a large sample size (n=600) with the aim of gaining deeper insights into the opinions of the Hungarian population for the 22 most important FMCG product categories. The concept of trustworthiness is described in different ways by marketers, with the general approach being that products (brands, where relevant) are considered trustworthy if they meet the expectations of a majority of consumers, whether in terms of quality, functionality or other aspects, such as, value for money. Reliability is often expressed in terms of a consumers' willingness to repurchase a product or their confidence in recommending it to others.

Keywords: trustworthy product; product quality; importance; Cluster analysis Between Groups; Fast-Moving Consumer Goods

1 Introduction

There is a wide store of literature on the concepts of reliability and satisfaction. In many cases, synonyms for these concepts also appears in research, such as trust and loyalty, which are also relevant to the treatment of the topic.

Trust itself, in the traditional sense, is the belief that an individual will not abuse the vulnerability of his or her partner. [1] Trust is nothing more than the belief of the trusting party in a relationship that the other party (the trustor) will not exploit the trustor's vulnerability in the business exchange. [2]

The theoretical and empirical study of consumer loyalty has been popular in the international and domestic literature for more than two decades. There has been a long-standing debate on the importance of consumer loyalty and numerous scenarios have been developed on how to retain consumers and its positive effects on the performance of organizations in B2C markets. Unfortunately, the same cannot be said for business-to-business (B2B) loyalty surveys. There is much less theoretical discussion and much less empirical research in this area. [3]

The role of qualitative research in academic research has increased and changed, with new methods emerging and more intensive use of existing methods. This development has been prompted by the need to focus more on the why, the attitudes, the particular and the unique within the behavioral patterns, which also means, especially in practical research, to gain as many characteristics and as complete a picture as possible of individual consumer behavior and its driving forces [4].

The quantitative assessment of reliability criteria has become an increasingly important aspect of consumer evaluation and rating of products. At the same time, the orientation of our research was to identify and cluster the categories observed. Our primary goal was to find out how the product categories as observed categories are related to each other and which of them can be sorted into the same cluster.

2 Theoretical Background

2.1 The Literature on Reliability

Manufacturers are making increasing efforts to improve the reliability of their products in order to compete in the market. A high return rate is usually associated with reduced sales of products and a poor reputation of the manufacturer [5].

The technical reliability of a product (or service) is its ability to maintain its quality under certain conditions of use and operation, so reliability can be seen as the evolution of quality over time, i.e., product reliability should be considered as a component of product quality. According to one of today's approaches, the four basic conceptual components of reliability – fault-tolerance, repairability, maintainability and durability – together, determine the reliability of products, and these four properties should be considered together and separately in a wide range of tests to help define and verify the reliability characteristics of products [6].

Reliability and practicality of the product is a very important quality attribute for consumers. The consumer considers the quality and practicality of the product to be the most important factors in addition to reliability. Consumers expect a reliable product to be wholesome, to have adequate nutritional properties, to taste good, to be easy to use, to be packaged in a practical way that allows easy handling, to have stable organoleptic properties even after opening, provided of course that it is stored under the conditions prescribed in the instructions for use and storage and that it is not prepared for long periods.

Modern consumers are looking for food that they expect to:

- Be healthy and have good nutritional properties
- Taste good
- Easy to use
- Not take long to prepare
- Have stable organoleptic properties even after opening, provided, of course, that they are stored under the conditions laid down in the instructions for use and storage
- Packaged in a practical way that allows for accessibility

Therefore, food manufacturers are making great efforts and investing considerable resources in research and development of products to meet consumer needs [7-9].

Essentially, the reliability and practicality of a product is the result of the first and second intrinsic qualities of food quality. However, the success of selling a product depends on this intrinsic quality attribute, because if consumers do not accept it, the investment in product development will not pay off [10].

2.2 Consumer Behavior Literature

Consumer behavior is part of human behavior. The factors that determine our human behavior and choices also influence our purchasing decisions. Finding the ultimate drivers of our consumer choices is at the heart of marketing. Because if we know and understand the main motivations of the consumer, we can respond with targeted marketing activities [11].

The phenomenon of the conscious consumer in itself establishes knowledge, in this form the cognitive part of the attitude. Without it, we cannot talk about real conscious consumer behavior and preferences. In the absence of the cognitive part of the attitude, the phenomenon of cognitive dissonance would be reinforced, and we would at most be talking about fashion following, not about conscious behavior based on values and beliefs [12].

Food consumption behavior is part of the spectrum of human behavior. A number of cultural, psychographic and personal factors influence the consumer's final decision. As a result, in many cases it is important to take a multidisciplinary approach to the study of consumer behavior, so that only by considering these variables together can we understand and explore the underlying contextual framework of consumer decision-making [13].

On the other hand, research shows that the role of regional origin can also be detected at the different levels of the purchase decision process. A factor related to the concept of country-of-origin image is the so-called consumer ethnocentrism, according to which ethnocentric consumers rely more on information about the country of origin, considering the purchase of products from abroad as inappropriate because it threatens the domestic economy, while non-ethnocentric consumers judge both domestic and foreign products on the basis of their quality. This effect is strongest for food purchases, as consumers also develop a nostalgia-based emotional attachment to Hungarian food brands (e.g., Túró Rudi) [14].

Food consumption patterns in Hungary have changed dramatically in recent years, both internationally and domestically. The Covid19 pandemic has accelerated this transformation, which has contributed to the emergence of new trends in consumer behavior. The ethnocentric approach of digitalization and globalization has had a significant impact on food consumption and purchasing patterns.

In many cases, the preference for domestic and Hungarian products is a consequence of the consumer's values and beliefs. The consumer's decision to pay attention to the origin, provenance, local production and environmental impact of a product is an expression of awareness. [15]

Recent years have brought huge changes in the world, including in the life of financial and commercial institutions. These changes have largely been brought about by recent crises, regulatory changes, declining profits as a result of crises and changes in customer attitudes. [16] As a result of these changes, consumers have become increasingly price-sensitive, which has a major impact on consumers' purchasing decisions in the Hungarian FMCG market.

An analysis of Hungarian consumers' food purchasing motivations revealed that over the past two years, the superior taste and consistently high quality of products have maintained their leading position in product choice, but the importance of well-known brands has declined. [17]

Consumers in economically developed countries have more confidence in products made in their own country, so ethnocentrism is stronger, while consumers in less developed countries have much less confidence in products made in their own country. [18]

The emergence of the informed consumer has been triggered by the emergence of increasingly accessible information. Informed consumers not only accumulate knowledge to represent and promote their own interests, but are also sensitive to community and environmental issues. [19] [20]

2.3 Branding Literature

The branding literature conceptualizes consumer-driven branding as a composite value of several values perceived by consumers, such as brand association, brand image, perceived quality and brand awareness. The construct includes aspects of consumer behavior such as preferences, loyalty and purchase intention. [21] [22]

Consumer perceptions are seen as a precursor to behavioral responses to brand equity. Brand equity is therefore a measure of the overall value of a brand. Which is primarily a function of consumer trust. [23] Brand equity is thus a measure of the overall value of a brand, which is mainly a function of consumers' trust in the brand (brand perception), that the brand will perform as expected, and consumers' willingness to prefer the brand (behavioral responses) over competing alternatives. [24-26]

Negative incidents such as brand abuse (actions by brands that violate the norms accepted by consumers); product failure crises (cases where products are found to be defective and dangerous for consumers); negative publicity (the appearance of negative information about a brand); and service failures (instances where service performance falls short of consumer expectations) threaten the legitimacy of brands, damaging or even destroying their reputation and weakening consumer trust in the brand [27] [28].

Marketing managers strive to retain high-value brands. However, negative events often occur that can damage brand equity. In a co-branding context, the brand is exposed to the risk of being pushed into a crisis by the partner brand and of being found guilty by association. It is essential that marketing managers act in a way that maintains the positive attitude, trust and purchase intentions of customers after the crisis. [29]

In today's global and dynamic market, companies recognize the need to increase their corporate social responsibility. [30] In line with this trend, researchers have turned to the notion of co-creation, which typically refers to interactions between firms and customers aimed at creating value. [31]

Some researchers [32] emphasize that "co-creation is rooted in the verb create, which is the verb to create as the act of making something exist, of making something happen, as the result of an action, and in co, which means to be with or to be with others. Co-creation can therefore be understood as to create together. Co-creation as a concept is used in various areas of marketing and management, including strategic management, service and relationship marketing [33], product innovation [34], advertising [35], retailing [36], information technology [37], consumer psychology and branding [38].

3 Material and Method

Our observed sample matches the Hungarian population, aged of 18+ years. Fieldwork was conducted during 2019/20 Autumn while sample is representing Hungarian adult population 18+ years old based on Central Statistical Office Census that time available.

In our primary research total sample reached n= 600 representative sample. Sample was drawn from an online panel as use of academic and business practice. Representative means that the sample drawn shows similar pattern to the whole observed population. The data and information found are subject to project out for the observed population with the sampling bias of +/-2,4 to +/-4 per cent at 95 per cent confidence level.

Table 1 shows the sample distribution reached matching share of Hungarian population at the time of fieldwork.

Table 1
Sample distribution

Male	49%
Female	51%
18-29 years old	14%
30-39 years old	17%
40-49 years old	19%
50-59 years old	16%
60+ years old	34%

The questions asked:

A03: We are going to show you many FMCG and OTC categories, please rate on your opinion, how important is to you choose/buy a trustworthy product for yourself and your family?

The given options for answering covered standard Likert scale of local language: (1: not at all important, 2: not important, 3: cannot decide/neutral, 4: important, 5: very important)

Observed categories:

1. Soft drink, mineral water
2. Alcoholic drinks
3. Sweets, biscuits
4. Frozen foods, canned products
5. Coffee, tea
6. Household cleaning (cleaning, washing, air freshener)
7. Hygiene products (incl. papers and tissues)
8. Bio and natural food products
9. Vitamins, food supplements
10. Make-up products (incl. eye lash, mascara, nail polish, lip stick, etc.)
11. Hair care (incl. shampoo, conditioner, comb, etc.)
12. Hair coloring
13. Facial care (incl. face creams, make-up remover, facial tissues)
14. Tooth care (incl. tooth cream, brush, mouth wash)
15. Body care (incl. deodorants, body wash, body cream, soap, sponge, etc.)
16. Perfume
17. Hair removal (incl. razors, waxes)
18. Hand and leg care (incl. creams, sole insert, etc.)
19. Basic foods (flour, sugar, salt, rice, etc.)
20. Meat and meat products
21. Milk and dairy products, cheese
22. Bakery and bread

Our primary research focused on measuring reliability of an FMCG and OTC product categories.

In our research we applied 1-to-5-point Likert scale to understand importance of being reliable in case of observed product groups, (standard 1= not at all important, 5= very important).

We applied IBM SPSS Version 22 which is the mostly used software in segmentation. We firstly applied K-means what is used usually in academic and practical based segmentation. Why we have chosen hierarchical clustering, is the reason that with this method we do not segment cases but the variables. In our

case the product categories serve a kind of variable as we had 22 of them. Our main aim during analysis was to understand what is the linkage between the 22 observed categories to understand existing linkages or to decline some of them. In the current section we started our quantitative analysis based on the above question with the help of hierarchical clustering as the second most used method.

4 Results and their Evaluation

Our research focused on combining approaches, as we wanted to understand what product category shows similar impact as regards reliability with the other ones ending up - with dendrogram outputs to show how to be from many to less and in what imprint.

Running our analysis we started the Ward method, as a basic tool to use quadratic average between two-groups to understand how the measured 22 categories link to others. Based on the above, we found that cluster definitions are closer to business rankings what Ward-analysis delivered. This was the case when we analyzed non-food categories later on.

Based on the above, we found that cluster definitions are closer to business rankings what Ward-analysis delivered. Perhaps this was the case when we analyzed non-food categories. Hygiene and basic non-food come as pair, in any of the clustering analysis later on.

Based on the Likert-scale approach we come to below results, 1-to 5 Likert scale – Fresh products lead the agreement scale.

Table 2

Distributions of average importance observed categories by age groups and gender

Observed categories		**Average values by age**						
	Total	**18-29**	**30-39**	**40-49**	**50-59**	**60+**	**male**	**female**
Meat and meat products	4.4	4.3	4.3	4.3	4.6	4.6	4.4	4.5
Bakery and bread	4.4	4.3	4.3	4.3	4.6	4.5	4.3	4.5
Milk and dairy products, cheese	4.3	4.2	4.2	4.2	4.3	4.4	4.1	4.5
Basic foods (flour, sugar, salt, rice etc.)	4.2	4.0	4.2	4.2	4.3	4.3	4.1	4.4
coffee, tea	4.2	4.0	4.1	4.1	4.3	4.2	4.1	4.2
Tooth care (incl. tooth cream, brush, mouth wash)	4.1	4.0	4.1	4.0	4.1	4.2	3.9	4.3
Vitamins, food supplements	4.1	4.1	4.2	4.0	4.2	4.1	3.9	4.3

Frozen foods, canned products	4.0	4.0	4.0	4.0	4.2	4.0	3.8	4.2
Body care (incl. deodorants, body wash, body cream, soap, sponge etc.)	4.0	4.1	4.1	3.9	4.0	3.9	3.8	4.2
Household cleaning (cleaning, washing, air freshener)	3.9	4.0	4.1	3.9	4.0	3.9	3.8	4.1
Hygiene products (incl. papers and tissues)	3.9	4.0	4.0	4.0	3.9	3.9	3.8	4.1
Soft drink, mineral water	3.9	3.8	3.9	3.9	4.1	3.8	3.8	4.0
Sweets, biscuits	3.9	3.9	4.0	3.9	4.0	3.8	3.7	4.0
Hair care (incl. shampoo, conditioner, comb etc.)	3.8	4.0	4.0	3.6	3.9	3.6	3.4	4.1
Hand and leg care (incl. creams, sole insert etc.)	3.8	3.8	3.9	3.7	3.8	3.7	3.5	4.0
Facial care (incl. face creams, make-up remover, facial tissues)	3.7	3.8	3.8	3.6	3.8	3.6	3.3	4.0
Perfume	3.5	3.8	3.8	3.5	3.6	3.3	3.2	3.8
Hair removal (incl. razors, waxes	3.4	3.7	3.8	3.4	3.5	3.2	3.2	3.7
Alcoholic drinks	3.4	3.5	3.3	3.4	3.6	3.2	3.5	3.3
Bio and natural food products	3.4	3.5	3.5	3.1	3.4	3.4	3.2	3.6
Hair coloring	3.4	3.5	3.6	3.3	3.5	3.2	2.9	3.8
Make-up products (incl. eye lash, mascara, nail polish, lip stick etc.)	3.3	3.6	3.6	3.2	3.4	3.0	2.8	3.8

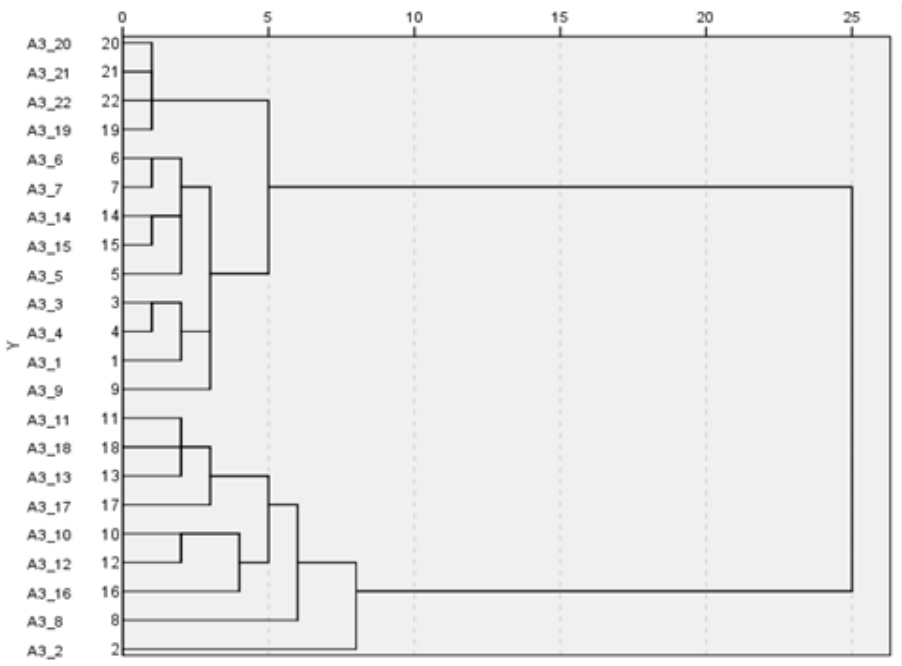

Figure 1
Dendrogram using Ward Linkage (Rescaled Distance Cluster Combine)

Technically after running Ward, we found good correlations with observed categories: basic food (19), meat (20), milk (21) and bakery (22) also household cleaning (6) and hygiene (7), mouth (14) and body care (15). Even sweets (3) and frozen 4) could have been proven, but when soft drinks, water (1) and vitamins come to one cluster we decided to re-test again. In case of Ward analysis personal care product categories showed an approvable correlation, while bio and natural products (8) and alcoholic drinks (2) were not linked to any of the observed categories.

Next we ran, **within groups average linkage,** with SPSS, where we found the below correlations:

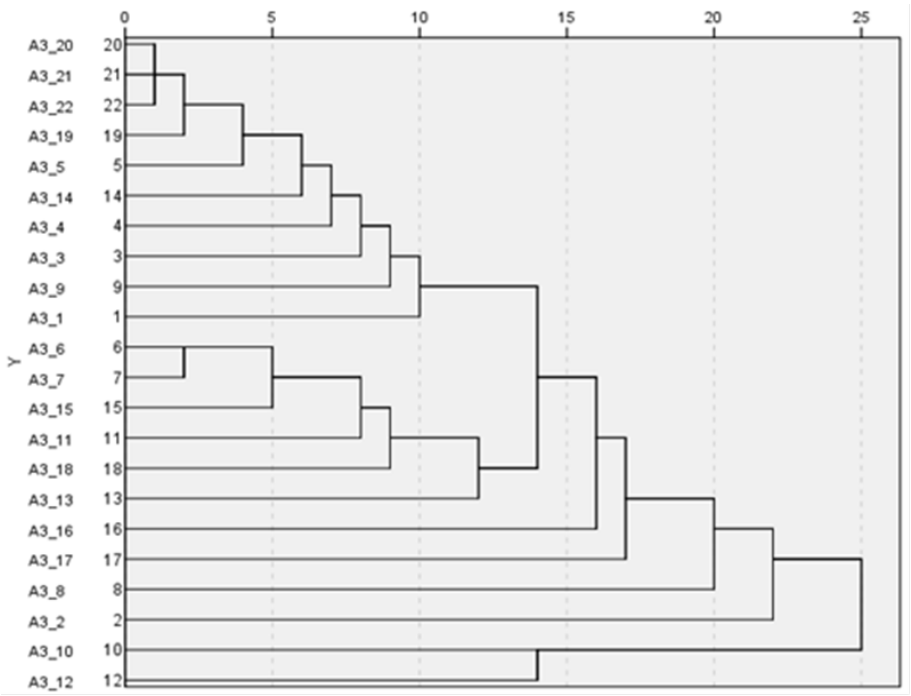

Figure 2
Dendrogram using Average Linkage (Within Groups), (Rescaled Distance Cluster Combine)

Correlation with basic food (19), meat (20), milk (21) and bakery (22) coffee and tea (5) came as kind of a rational linkage. Personal care categories show a logical clustering again while bio and natural products (8) show a correlation with so-called fancy categories, meaning that it may work as part of beauty care but not really as a food category. As mouth care (14) paired with basic food categories we decided to re-test with the next method.

As a third step, we opted for **between-groups linkage analysis**, as a result, we concluded:

Table 3
Average Linkage (Between Groups) Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	20	21	304,000	0	0	2
2	20	22	329,000	1	0	4
3	6	7	341,000	0	0	6
4	19	20	364,000	0	2	8
5	14	15	393,000	0	0	6

6	6	14	439,000	3	5	10
7	3	4	449,000	0	0	10
8	5	19	459,000	0	4	12
9	11	18	488,000	0	0	11
10	3	6	518,750	7	6	12
11	11	13	529,000	9	0	16
12	3	5	535,967	10	8	13
13	3	9	587,091	12	0	14
14	1	3	599,000	0	13	19
15	10	12	601,000	0	0	18
16	11	17	682,000	11	0	17
17	11	16	759,500	16	0	18
18	10	11	786,500	15	17	19
19	1	10	980,033	14	18	20
20	1	8	1182,550	19	0	21
21	1	2	1263,238	20	0	0

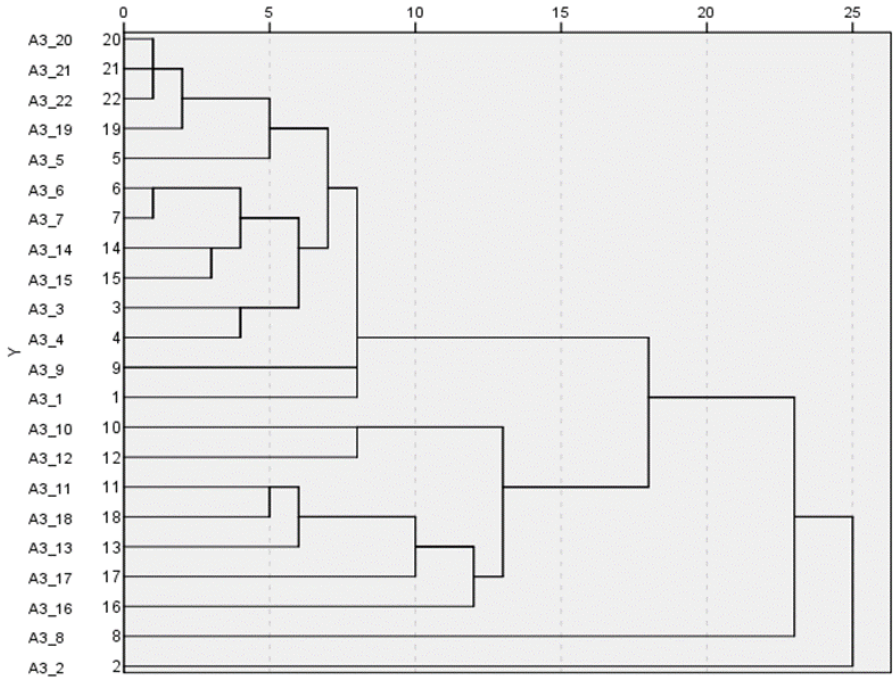

Figure 3
Dendrogram using Average Linkage (Between Groups) (Rescaled Distance Cluster Combine)

When running Between groups linkage analysis we concluded that correlation with basic food (19), meat (20), milk (21) and bakery (22) coffee and tea (5) came

as rational linkage like by within Groups Linkage, while household cleaning (6) and hygiene (7), mouth (14) and body care (15) show similar patterns like by Ward method.

Even sweets (3) and frozen (4) paired again could have been proven, but when soft drinks, and at this point we accepted that water (1) and vitamins (9) come to one cluster. Make-up (10) and hair-coloring (12) make a reasonable cluster as well hair-care (11), hand-care (18) and facial-care (13) adding to them hair- removal (17) a-d perfume (16). As by all the other two above mentioned clustering analysis we concluded that bio and natural products (8) and alcoholic drinks (2) do not link to any of the observed categories.

Based on our market knowledge we came to a decision that between groups linkage delivers the highest explanation on category linkage.

As a disaster check we run the fourth clustering analysis, the Centroid linkage cluster method, where we could not find any other relevant difference versus the between groups linkage. Therefore, we deny Centroid linkage as the most relevant method.

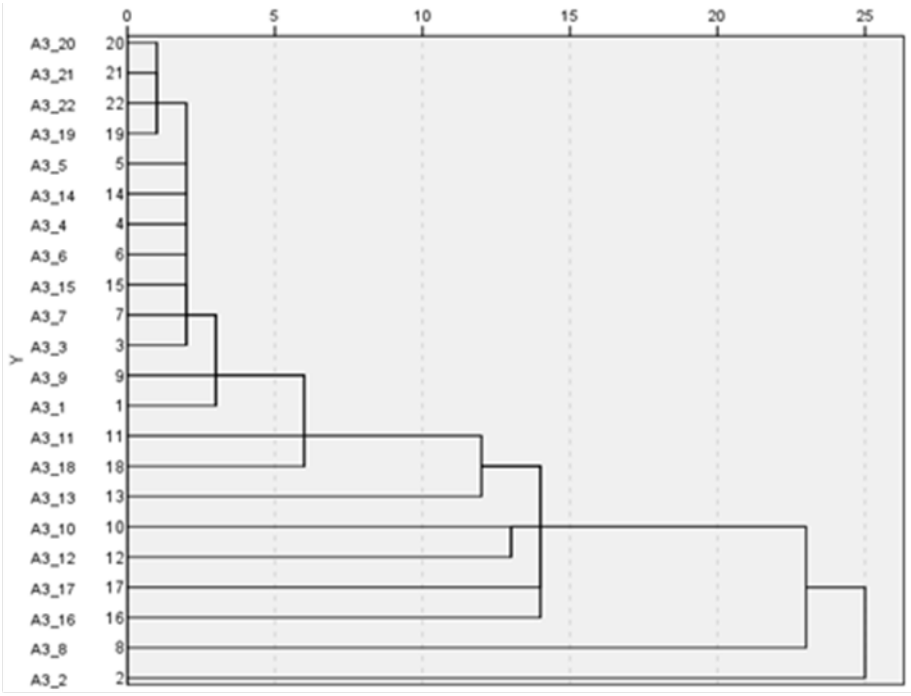

Figure 4
Dendrogram using Centroid Linkage (Rescaled Distance Cluster Combine)

Conclusions and Summary

Exploring the various studies, we concluded that measuring average and running, over standard Ward-analysis, does not deliver a reliable result, explaining our former expectations. Therefore, we opted for a deeper understanding in the literature review and statistical analysis as a deep dive. Running Ward methods and Within groups, average linkage as a Disaster Check Centroid cluster, we came to a conclusion that Between groups linkage, delivers the highest support on category linkage on the FMCG and OTC categories that were observed.

After performing Between groups linkage analysis, we concluded that correlation with basic food (19), meat (20), milk (21) and bakery (22) coffee and tea (5) came as rational linkage like by within groups linkage, while household cleaning (6) and hygiene (7), mouth (14) and body care (15)

Even sweets (3) and frozen (4) paired again could have been proven, but when soft drinks, and at this point we accepted that water (1) and vitamins (9) come to one cluster. Make up (10) and hair coloring (12) make a reasonable cluster as well as, hair care (11), hand care (18) and facial care (13) adding to them hair removal (17) and perfume (16). As by all, the other two above mentioned clustering analysis, we concluded that bio and natural products (8) and alcoholic drinks (2) do not link to any of the observed categories.

The main objective of the research was to find out how the 22 product categories studied, can be grouped together and whether there are any links within each cluster. Ward's analysis was used to determine the average of all variables, in order to better define the relationships between each category. Following the Ward's analysis of the products, we determined the definitions of each cluster and concluded that the cluster definitions were closer to the business rankings, provided by the Ward's analysis. We then also conducted a linkage analysis between each cluster, concluding that basic FMCG food products (19) (meat, milk, bakery, coffee, tea) (20, 21, 22, 5) show a significant degree of linkage with household cleaning products (hygiene, oral care, personal care) (6, 7, 14, 15). Our analyses showed that sweets (3) and frozen products (4) were clustered with soft drinks, water and vitamins (1, 9). Make-up and hair dye (10, 12) formed a reasonable cluster with the category's hair care, hand care, facial care, hair removal and perfumes (11, 18, 13, 17, 16).

Based on the cluster analysis, it was found that organic and natural products, and alcoholic beverages are not related to any of the observed categories, which means that they have completely different parameters compared to the other FMCG products.

Our analysis also shows that the products that can be clustered have the same parameters in terms of reliability. Therefore, for the purposes of this research, these FMCG products should be treated in the same way in terms of the Reliable Product Award Scheme metrics and criteria.

The propensity of consumers to repurchase these products exhibit similar characteristics, so they can be measured by the same parameters for the purpose of developing a product charge. Products in the same clusters are expected to have similar consumer expectations in terms of quality, functionality or value for money, and therefore similar criteria will be taken into account in the process of assessing the premium.

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