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## **MARKETING APPLICATIONS OF CLUSTER ANALYSIS TO DURABLES MARKET SEGMENTATION**

### **1. Introduction**

Cluster analysis is unique tool, which can be widely applied on marketing area. This set of multidimensional statistical methods often finds practical use in marketing research area. Therefore cluster analysis is being used in order to solve the following marketing issues:

- market segmentation – segmentation of consumer market (products and services), as well as industrial market segmentation,
- identification relatively homogenous consumer groups in order to understand their behaviour,
- product positioning on market in the view of competition,
- identification of market structure,
- recognition of relatively homogenous markets for product testing,
- description simplification.

One of the most common uses of cluster analysis is marked segmentation. All segmentation research, regardless of the method used, is designed to identify groups of entities (people, markets, organizations) that share certain common characteristics (attitudes, purchase propensities, media habits, etc.) [Punj, Stewart 1983, p. 135]. The paper is attempting at showing specificity of consumer durables market segmentation. The main emphasis is put on application of cluster analysis on consumer durables market and the examples of practical uses of cluster analysis are brought up on bases of the extensive review of the literature. In addition there example of durables market segmentation procedure is described.

## **2. The definition of consumer durables**

Consumer durables mainly characterize their long lasting usage period or/and significant value. The definition of consumer durables goods includes:

- consumer electronics,
- home furnishings,
- homebuilding,
- household appliances, house wares and specialties markets,
- cars, motorbikes etc.

Durables typically cost substantially more than nondurable products and thus entail greater financial risk for consumers. Even though, consumers are in the market for a short period and after purchase stay away for a long time, they undoubtedly spend a substantial amount of money in that period. It is necessary to look for an explanation, which recognizes the particular respects in which consumer durables differ from most other items of consumer expenditure.

Among many different types of markets that have to be segmented – durables market segmentation is of extraordinary importance. The unique features of such markets are related to the impact of rapid technological innovation process and constantly growing level of life standard. On the consumer durable market, as on the any other consumer market, there are homogenous groups among companies and consumers, that can be distinguish. Hence, this market should be grouped into homogenous segments. Therefore, it is crucial to recognize specific issues of segmentation of durable goods market.

## **3. Issues of consumer durables segmentation**

Market segmentation of consumer durables is relatively rare object of concern. Literature on this area concentrates mainly on consumer market, service market or on industrial market. Unfortunately, durable goods market is neglected and does not attract so much interest. On the durable market, there are distinguishable differences from other types of market. Thus, it is important to recognize these particular respects in which consumer of durables differ. Moreover, not only identification of specific issues of consumer behaviour and segmentation of durable goods market, but also recognition of useful statistical tools is essential.

The main goal of market segmentation is to meet consumer needs, so segmentation process is oriented towards selecting the ideal product that could fully satisfy client's wants. Segmentation research process is designed to recognize groups of entities that have common characteristics, attitudes and expectations. There is a variety of segmentation procedures that differ in terms of goal and range of marketing research.

The literature example of consumer durables market segmentation is based on Kotler's segmentation procedure. According to P. Kotler there is a three-step procedure for identifying market segments: the first one is called survey stage, the second – analysis stage and the last one is profiling stage [Kotler 2000, pp. 181]. Every of three stages of this procedure are divided into separate steps. W. Muszyńska [Muszyńska 1999, pp. 237-242], on example of existing company, which offers household durables, shows that in the first part of segmentation procedure researcher must define his objectives, identify company customers and their behaviour. The definition of product and market is done in the second step (of the first, research part). Hence, consumer durables market characterizes:

- This market has typical features like every consumer market, where the main needs of individuals (and their households) are met.
- Important feature of the durables market is strong income elasticity of demand.
- Also price elasticity of demand is on high level therefore the price is one of the most important marketing instruments.
- Enterprises offering durables operate on large territorial space (usually on international markets), their number is increasing.
- The number of buyers is unlimited – as a rule, one item is purchased, normally in the retailers' stores.
- The market is complicated by the fact of strong substitution and complementarity. Additionally, the second hand market attracts numerous purchasers.
- Also seasonality deregulates durables market, fourth quarter of the year increases the level of demand.

In the next step of the segmentation procedure, the needs and expectations of potential products purchasers are to be identified. Even though, consumers usually declare their readiness to buy products, consumer durables are relatively low in the needs hierarchy. The position of those products in the hierarchy is usually behind food items, cloths and mandatory payments.

In respect in which consumer durables differ from most other items of consumer expenditures, the number of distinguishing features can be identified. Among these differences are determinants of the demand for consumer durables. Important determinants of the demand for consumer durables can be listed as follow: socio-economic status of household (occupational group, age of household and existing durable ownership), depreciation level of existing equipment, general economic confidence and availability of bank loans, real estate market prosperity and specific triggers and hindrances to purchases. Consumer durables differ from most other items of consumer expenditure in the characteristics of purchasing process:

- buyer acquires a product and then stays away from the market for a long period, only to return to the market for a short time either to purchase an additional item or to replace an existing durable,

- consumers are in the market for a short period and spend a substantial amount of money in that period,
- the purchase of durable product, which cost substantial amount of money, is usually well thought-out, planned long ahead and marked carefully searched for suitable offer.

The crucial issue of the segmentation task is to find an appropriate combination of variables that will measure changes in purchase intentions as an aid for forecasts of demand changes. Segmentation bases which are used to segment durables market are often similar to those employed on consumer market. The difference lays in the way how they are adjusted to this market unique characteristic. A set of segmentation variables used to assign potential to homogeneous groups can be classified into following groups of characteristics:

- demographics and geographic characteristics: age, gender, marital status, size of household, family lifecycle, income, occupation, education, social class, region, density,
- psychographics: life-style, personality,
- behavioural: occasions, benefits, user status, loyalty status.

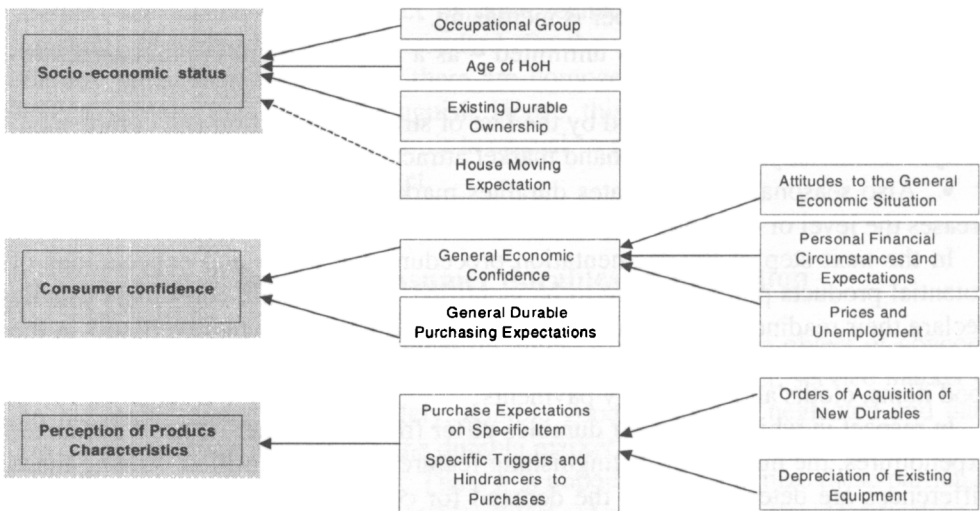


Fig. 2. Factors Influencing the Durables Purchasing Behaviour of the Household

Source: based on [Pickering 1978, pp. 178-193].

There are three major approaches to segmentation of consumer durables market. It may be based on:

- socio-economic status of household,
- general consumer confidence,
- consumer behaviour – perception of product characteristics.

One of the measures used are socio-economic features. A number of variables widely used are general, observable bases [Wedel, Kamakura 1998, pp. 7-16] such as: age, income, employment status, home ownership, family size and ownership of durables. For instance, age is important determinant of behaviour and therefore, age is critical variable for understanding variations in individual behaviour e.g. M. Strober and C. Weinberg. In their study was proved that younger households purchase earlier than older ones. Likewise, J. Morgan, S. Nickols and K. Fox found income to have a significant non-negative effect on the probability of purchase, as it could be intuitively expected. Moreover, empirical evidence indicated that the working status is significant determinant which increases family's likelihood of owning major durable goods. On the other hand, some different segmentation bases also are considered, thus very often used is a variable that measures the consumers general economic confidence. For instance, the current status of the economy, as well as personal financial situation contributes to consumer confidence. Another form of measure is based on household intentions or expectations to buy a specific durable product within a stated period [Strober, Weinberg 1980, pp. 338-348; Morgan 1965, pp. 289-306; Nickols, Fox 1983, pp. 197-208; Kim 1989, pp. 391-409; Winner 1985, pp. 175-184].

To segment chosen market (continuing discussed W. Muszyńska's example) sex, age of head of household, size of the family, family status, economic status, occupational group and place of living were used as a segmentation variables.

The analysis of sample consisting of 1200 respondents (company clients), has been done in the next stage of segmentation procedure. To assign customers to homogeneous groups, six segmentation variables were employed. Clients were described according to their occupational group, correlated to their sex, age and economic status. As a result three customer profiles were identified and characterized: the first one, called young purchasers, second profile, professionally active, and third profile, retired purchasers.

In the last stage of a segmentation process segment profiling was carried out. The basic profile that company decided to target on was the one which can be called as professionally active, its main characteristics may be formulated as follow:

- is easily identifiable, homogenous, numerous and measurable,
- is stable and accessible for marketing efforts.

#### **4. Classification of Methods Used for Segmentation**

There are two ways of classifying segmentation approaches [Wedel, Kamakura 1998, pp. 17-18; Walesiak 2000, pp. 191-201]. In dependence on which statistical method is employed one can distinguish between descriptive and predictive approach. Descriptive methods analyze the associations across a single set of segmen-

tation bases, with no distinction between dependent and independent variables. Predictive methods analyze the association between two sets of variables (one set consists of dependent variables to be predicted by the set of independent variables). Secondly, segmentation approaches can be classified into *a priori* and *post hoc* approaches.

In the literature there is a comprehensive discussion completed by various segmentation methods applications in each of the four classes<sup>1</sup>.

Table 1. Classification of Methods Used for Segmentation

	<i>A priori</i>	<i>Post hoc</i>
Decriptive	<ul style="list-style-type: none"> <li>- Contingency tables</li> <li>- Log-linear models</li> </ul>	<ul style="list-style-type: none"> <li>- Clustering methods</li> <li>- Nonoverlapping</li> <li>- Overlapping</li> <li>- Fuzzy techniques</li> <li>- Mixture models</li> </ul>
Predictive	<ul style="list-style-type: none"> <li>- Cross-tabulation</li> <li>- Regression</li> <li>- Logit analysis</li> <li>- Discriminant analysis</li> </ul>	<ul style="list-style-type: none"> <li>- Aid, chaid, maid</li> <li>- Cart</li> <li>- Conjoint analysis</li> <li>- Ann</li> <li>- Clusterwise regression</li> <li>- Mixture models</li> </ul>

Source: [Wedel, Kamakura 1998, p. 18].

## Examples of Cluster Analysis of Durable Goods Segmentation

Cluster analysis is a statistical method for classification. Unlike other statistical methods for classification, such as discriminant analysis and automatic interaction detection, it makes no prior assumptions about important differences within a population. Cluster analysis is a purely empirical method of classification and as such is primarily an inductive technique [Gerard 1957, pp. 429-433].

The primary use of cluster analysis in marketing has been for market segmentation and it became a common tool for the marketing researcher. Hence, illustrative

<sup>1</sup> An application and theoretical discussion of *a priori* descriptive methods such as contingency tables is provided by Stanimir A. [2001; 2006]. Description of *a priori* predictive approaches such as e.g discriminant analysis is given in Gatnar E., Walesiak M. [2004], Lawson R. [1980] works, regression in Wildt A. McCaann J. [1980] research. Many authors also discuss main areas of cluster analysis application to market segmentation. Among them are works of Walesiak M. [1996], Beane T. and Ennis D. [1987], Punj G. and Steward D. [1983] and Frank R. and Green P. [1968]. *Post hoc* predictive methods are often employed to many studies, for instance Automatic Interaction Detection (AID), and other AID-like algorithms like Multivariate AID (MAID) MacLachlan D. Johansson J. [1981] and Chi-squared AID (CHAID) could be find in Rószkiewicz M. [2002] and Dziechciarz J., Walesiak M. [1995] works, Classification and Regression Trees (CART) methodology can be find in Kurzydłowski A. [2002], Artificial Neural Network (ANN) in Boone D., Roehm M. [2002], conjoint analysis [Walesiak, Bąk 2000] and clusterwise regression [Wedel, Kistemaker 1989].

applications of cluster analysis to market segmentation (also to consumer durables market segmentation) have been provided by many authors. There are many studies that use agglomerative hierarchical clustering methods. Among them, J. Claxton, J. Fry, D. Portis [1974], in their study the task was to classify furniture and appliance buyers in term of their information search behaviour. Authors employed complete linkage cluster analysis (nature of data used: attribute scores on several prepurchase activity measures). Average linkage cluster analysis method was used [Kiel, Layton 1981] to develop consumer taxonomies of search behaviour by Australian new car buyers (nature of data: factor scores derived from several search variables).

In the interesting example of hierarchical clustering shown in the study by D. Furse, G. Punj and D. Steward [1984], the cluster analysis of questionnaire data was used to identify six distinctive external information search patterns among purchasers of new automobiles. Researchers employed Ward's and *k*-means Howard-Harris method. Data were obtained from over one thousand respondents, customers who had purchased new automobile in 1978. In the next stage, forty-eight sales personnel, representing various dealerships participated in the study.

Common tool for the marketing researchers became *k*-means Howard-Harris method, one of degglomerative hierarchical clustering method. P. Green and F. Carmone [1968] employed this clustering method to identify similar computers (strata in the computer market) using performance measures for different computer models. The example of forming hierarchical clusters by means of the Howard-Harris algorithm is study by V. Rao and F. Winter [1978]. In their exercise, respondents selected for the study were MBA students, who owned cameras. In order to find homogenous groups, authors surveyed characteristics describing general photography and camera preferences. One of the early illustrations where the Howard-Harris algorithm was employed was by P. Green, D. Tull, G. Albaum [1988], they used the Howard-Harris techniques to identify similar computers. Forty-seven different computers were characterized by 22 variables describing computer's features. P. Green, F. Carmone and S. Smith [1989] also used *k*-means Howard-Harris method for identifying homogenous groups of cars with similar characteristics. Using ten variables, authors described 90 types of cars, which in 1987 were on the market with price ranging from 5 to 168 thousand dollars.

An illustrative application of non-hierarchical cluster analysis to market segmentation has been provided by A. Mazur and I. Staniec [2000], they segmented polish automobile market with use of *k*-means method. The same, *k*-means method was applied to segment PC and cars buyers [Morwitz, Schmittlein 1992]. Authors investigated an issue whether the use of segmentation could improve the accuracy of sales forecasts based in stated purchase intent. In the study four different methods for segmenting households were applied. One of them was cluster analysis based on demographic and product usage variables. The three waves of surveys (from 1986 to 1989) were conducted with a consumer panel of as many as one

hundred thousand U.S households. Eventually, they used 24 000 responses for PC and over 28 000 for automobiles users. As a result, consumers were segmented into five homogenous groups.

The same clustering method was applied by S. Lonial, D. Menezes and S. Zaim [2000] in their study. Paper focused on the use of cluster analysis for identifying the target segments of the university students as PC buyers. For the study *k*-means was used to cluster respondents on the basis of similarity of their utility functions for five PC related attributes and the corresponding attributes levels.

## References

- Beane T., Ennis D. (1987), *Market Segmentation: A Review*, „European Journal of Marketing” 21.
- Boone D., Roehm M. (2002), *Retail Segmentation Using Artificial Neural Network*, „International Journal of Research in Marketing” 19.
- Claxton J., Fry J., Portis B. (1974), *A Taxonomy of Pre-Purchase Information Gathering Patterns*, „Journal of Consumer Research” 1.
- Frank R., Green P. (1968), *Numerical Taxonomy in Marketing Analysis: A Review Article*, „Journal of Marketing Research” 5.
- Frank R., Massy W., Wind Y. (1972), *Market Segmentation*, Prentice–Hall, Englewood Cliffs.
- Furse D., Punj G., Stewart D. (1984), *A Typology of Individual Search Strategies among Purchases of New Automobiles*, „Journal of Consumer Research” 10.
- Gatnar E., Walesiak M. (eds.) (2004), *Metody statystycznej analizy wielowymiarowej w badaniach marketingowych*, AE, Wrocław.
- Gerard R. (1957), *Units and Concepts of Biology*, „Science” 125.
- Green P., Carmone F., Smith S. (1989), *Multidimensional Scaling. Concepts and Applications*, Allyn and Bacon, Boston, London, Sydney, Toronto.
- Green P., Carmone F. (1968), *The Performance Structure of the Computer Market: A Multivariate Approach*, „Economic and Business Bulletin” 20.
- Green P., Tull D., Albaum G. (1988), *Research for Marketing Decisions*, Prentice–Hall, Englewood Cliffs.
- Kiel G., Layton R. (1981), *Dimensions of Consumer Information Seeking Behaviour*, „Journal of Marketing Research” 18.
- Kim C. (1989), *Working Wives' Time-Saving Techniques: Durable Ownership, Convenience Food Consumption and Meal Purchases*, „Journal of Economic Psychology” 10 (3).
- Kotler P. (2000), *Marketing Management Milenium Edition*, Prentice-Hall, Boston.
- Kurzydłowski A. (2002), *Klasyfikacja nabywców czekolady z wykorzystaniem algorytmów CHAID i C&RT*, [w:] K. Jajuga, M. Walesiak, *Klasyfikacja i analiza*

- danych – teoria i zastosowania, *Taksonomia* 9, Prace Naukowe AE nr 942, AE, Wrocław, s. 258-271.
- Lawson R. (1980), *Discriminant Analysis – an Aid to Market Segment Description*, „European Journal of Marketing” 7, s. 387-396.
- Lonial S., Menezes D., Zaim S. (2000), *Identifying Purchase Attributes and Market Segments for PCs Using Conjoint and Cluster Analysis*, „Journal of Economic and Social Research” 2.
- MacLachlan D., Johansson J. (1981), *Market Segmentation with Multivariate AID*, „Journal of Marketing” 45.
- Mazur A., Staniec I. (2000), *Classification of Car-Buying Clients: K-Means and Neural Network Approach*, „International Advances in Economic Research” 6 (4).
- Mazurek-Łopacińska K. (red.) (1999), *Badania marketingowe. Podstawowe metody i obszary zastosowań*, AE, Wrocław.
- Morgan J. (1965), *Housing and Ability to Pay*, „Econometrica” 33, s. 289-306.
- Morwitz V., Schmittlein D. (1992), *Using Segmentation to Improve Sales Forecasts Based on Purchase Intent: Which “Intenders” Actually Buy?*, „Journal of Marketing Research” 29.
- Nickols S., Fox K. (1983), *Buying Time and Saving Time: Strategies for Managing Household Production*, „Journal of Consumer Research” 10, s. 197-208.
- Pickering J. (1978), *The Durable Purchasing Behavior of the Individual Household*, „European Journal of Marketing” 12, s. 178-193.
- Punj G., Stewart D.W. (1983), *Cluster Analysis in Marketing Research: Review and Suggestions for Application*, „Journal of Marketing Research” 20.
- Rao V., Winter F. (1978), *An Application of the Multivariate Probit Model to Market Segmentation and Product Design*, „Journal of Marketing Research” 15.
- Rószkiewicz M. (2002), *Metody ilościowe w badaniach marketingowych*, PWN, Warszawa.
- Stanimir A. (2001), *Analiza korespondencji jako metoda wyodrębniania segmentów rynku*, [w:] *Taksonomia* 13, Prace Naukowe AE nr 988, AE, Wrocław.
- Stanimir A. (red.) (2006), *Analiza danych marketingowych. Problemy, metody, przykłady*, AE, Wrocław.
- Strober M., Weinberg C. (1980), *Strategies Used by Working and Non-Working Wives to Reduce Time Pressures*, „Journal of Consumer Research” 6, s. 338-348.
- Walesiak M., Bąk A. (2000), *Conjoint analysis w badaniach marketingowych*, AE, Wrocław.
- Walesiak M. (2000), *Segmentacja rynku. Kryteria i metody*, [w:] A. Zeliaś (red.), *Przestrzenno-czasowe modelowanie i prognozowanie zjawisk gospodarczych*, AE, Kraków, s. 191-201.
- Walesiak M. (1993), *Statystyczna analiza wielowymiarowa w badaniach marketingowych*, Prace Naukowe AE nr 654, AE, Wrocław.

- Wedel M., Kamakura W. (1998), *Market Segmentation. Conceptual and Methodological Foundations*, Kluwer, Boston.
- Wedel M., Kistemaker C. (1989), *Consumer Benefit Segmentation Using Cluster-wise Linear Regression*, „International Journal of Research in Marketing” 6, s. 45-59.
- Wildt A., McCann J. (1980), *A Regression Model for Market Segmentation Studies*, „Journal of Marketing Research” 17, s. 335-340.
- Wind Y. (1978), *Issues and Advances in Segmentation Research*, „Journal of Marketing Research” 15.
- Winner R. (1985), *A Revised Behavioural Model of Consumer Durable Demand*, „Journal of Economic Psychology” 6 (2), s. 175-184.

## **PRZYKŁADY MARKETINGOWYCH ZASTOSOWAŃ METOD KLASYFIKACJI W SEGMENTACJI RYNKU DÓBR TRWAŁEGO UŻYTKOWANIA**

### **Streszczenie**

W opracowaniu podjęto problem zastosowań metod analizy skupień. Szczególną uwagę poświęcono zastosowaniom marketingowym. Metody klasyfikacji oferują szereg możliwości aplikacyjnych w zagadnieniach marketingowych, również w segmentacji rynku dóbr trwałego użytkowania. W pracy przeanalizowano specyfikę zastosowań do segmentacji rynku konsumentów dóbr trwałego użytkowania jako ilustrację możliwości aplikacyjnych. Na podstawie literatury przedmiotu przytoczono przykładową procedurę segmentacyjną oraz przedstawiono typologię metod stosowanych w segmentacji rynku. Zestawiono wybrane przykłady praktycznego wykorzystania tej grupy metod wielowymiarowej analizy statystycznej w segmentacji rynku dóbr trwałego użytkowania.