

# APPLICATION OF MULTIVARIATION METHODS IN ELECTRONIC MARKETING

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**Abstract:** *The subject of the paper is to analyze the theoretical and empirical assumptions for the implementation of multivariate methods and techniques of data analysis in electronic marketing. Information and telecommunication technologies have fundamentally changed the nature of marketing. The impacts of information technology are visible on the traditional methods of marketing, but it is also possible to speak of a totally new kind of marketing - e-marketing.*

*This paper is dedicated to the development of methodology for the implementation of multivariate methods of analysis of data in electronic marketing. So far, multivariate analytical instruments are not used in the electronic marketing in Serbia. When it comes to countries in the European Union and Eastern Europe, they made the first attempts at implementation and their experiences are used in this study. Quantitative data in the field of electronic marketing have multivariate nature, and a basic starting point in the study is that it is possible to represent matrices and studied the methods of multivariate analysis. The paper discusses the methods of multivariate analysis such as canonical correlation analysis, factor analysis, conjoint analysis, discrimination analysis and cluster analysis, both from a theoretical point of view, and empirical - on the data on the effects of business performance and the company's interactive media interests.*

**Keywords:** *multivariate methods, data analysis, electronic marketing*

## 1. INTRODUCTION

Data on the effects of business performance of the company and the interests of users on the Internet are very accurately measurable. The Internet makes it possible to monitor user behavior. A very precise analysis of tracking customer behavior through the website (e-Customer Clickstream Analysis) enables an understanding of their needs and the behavior of companies in accordance with those needs. By applying multivariate methods, it is possible to observe patterns of consumer behavior, as well as to predict their behavior in the future. The quality of the information system for monitoring the business of the company and the appropriate database are a prerequisite for the success of the search for data in electronic marketing. All data relevant to process management and decision making must be stored in a single database and information available to users in a visual and simple, understandable form at all times. An interactive dialogue is needed to support decision-making. Multivariate analysis methods allow individual differences in website preferences to be described by key components of site quality such as: site purpose, organizational comprehensibility, recognizable design, and site promotion system.

## **2. THE ROLE AND SIGNIFICANCE OF ELECTRONIC MARKETING IN ELECTRONIC BUSINESS**

The Internet has created a virtual and global market free of the boundaries of time and space. He also contributed to the change of the form of marketing, from traditional (mass) with "average consumer" and customized marketing instruments to a marketing mix, in the direction of individualized, customized, targeted (one to one) marketing. The new form of marketing is aimed at the individualized Internet consumer through direct interaction. Marketing communication adapts to changes dictated by the environment and the requirements of the new segment of Internet consumers. Instead of mass marketing on the Internet, mass marketing of individuals is emerging, and advertising is being transformed into a choice of information.

A new area of marketing with the same essence are the terms online marketing, Internet marketing, Internet marketing. It is most often defined as meeting the needs and requirements of consumers for information, products or services, with adequate financial compensation. The prerequisite for the successful application of online marketing is knowledge of the basics of the marketing system and process, or often now called traditional marketing. This includes knowledge in the field of marketing research, product planning and development, distribution and promotion as a marketing activity and about marketing instruments. Thus, the principles and methods of online marketing come from traditional marketing and the basic difference results in interactivity. Namely, entities on the side of consumption and supply realize two-way communication. The seller can reach the consumer anytime and anywhere: at work, at home and the like, just as the consumer has far greater opportunities to contact the seller.

Online marketing in its development goes through certain stages so that each has its own specifics by which they are differentiated. The first phase is characterized by technical specifics that indicate the equal possibility of applying text and graphics on the Internet. In the second, they still take precedence when the convenience of the world trade network is intensively emphasized. In the third phase, domination belongs equally to technical and commercial philosophy. The Internet is dominated by promotional and sales sites with mixed success, and the reason for that is not measuring the effects and researching the target segments. The fourth phase belongs to marketing managers who have taken over Internet marketing and measuring the effects of the same, in order to determine the maximum possibilities that can be achieved with this computer technique. At this stage, companies integrate the Internet into their plans so that marketing moves can help each other.

A significant number of organizations build high expectations in relation to online marketing. Namely, in anticipation of quick realization of big profits, many organizations entered the web, believing the statistics which showed that average Internet consumers are those who have above-average income and are highly sophisticated. However, most organizations are still aware that online marketing is as long and arduous a process as it is in the real world. However, the Internet is still the most economical of the available marketing media, because it works with the most efficient use of costs. In addition, the Internet enables the establishment of personal, long-lasting relationships. This makes it easier to "nurture your customers" and apply relationship marketing.

However, marketing managers have come to the conclusion that the problem that has arisen in the application of online marketing is aimed at the lack of marketing strategies for Internet technologies. In order to solve this problem, a new concept was formed in the form of integrated Internet marketing (I2M), which represents the possibilities of a combination of marketing strategies and Internet technologies. This seems to be an attempt to apply (use) different Internet technologies to achieve certain marketing goals.

The essence of the mentioned possibilities of technology is in the ability of the organization to coordinate the application of the Internet so that it develops and enables interconnection with marketing strategies.

Due to the possibility of mutual communication of a large number of interested consumer segments via the Internet or the web, it significantly affects the formation, maintenance or change of image. Many organizations display their environment and its specific atmosphere on the web, creating a sense of presence in interested Internet consumers even though they are physically distant. The web also provides new opportunities for expressing one's own experiences and for marketing public relations. The theory and practice of traditional marketing has found it relatively difficult to solve the problem of transmitting the same image to different segments, which is much easier to solve through the web.

The model of integrated Internet marketing is consciously or intuitively applied by a significant number of large companies in the world. Thus, for example, by applying various Internet technologies, companies communicate with customers, the media, marketing channels, investors and the like. One of the characteristics of a website is the impact on enhancing the image of the organization, which is achieved by symbols (text, logo, image, color, etc.) while the message can be sent by sound. It contains various information such as. notices to journalists about the date of the future press conference, information for creating an article, report or report, information to investors about the financial situation, a recording of the annual general meeting of shareholders and more.

In this area, expert assessments for the 21st century indicate the dominance of key technology in the form of nanotechnology. Similar to microelectronics and informatics, it will have a significant impact on products and the labor market. Nanostructures are a thousand times smaller in size than the current microstructures, they will have new characteristics based on which new product qualities and new technologies will emerge. The new formula will read: nanotechnology + marketing = nanomarketing. Its task will consist of a process of value creation through phases: research, product development, market creation and market penetration; with the assumptions of time to market launch and time to money.

### **3. APPLICATION OF METHODS AND TECHNIQUES OF MULTIVARIATE DATA ANALYSIS IN ELECTRONIC MARKETING**

Data Mining is most typically used for statistical data analysis and knowledge discovery. Statistical data analyzes detect patterns in data variations and apply statistical and mathematical modeling techniques to explain those patterns. The models are then used for forecasting and forecasting. Statistical data analyzes include linear and nonlinear analyzes, regression analyzes, methods of multivariate analysis, time analyzes. Knowledge discovery extracts implicit, previously known information from data. This often results in the disclosure of unknown business facts.

The subject of research in the dissertation is the study of theoretical and empirical assumptions for the implementation of multivariate methods and techniques of data analysis in electronic marketing in Serbia.

The author Herridge-Marsh (2004) concludes that e-marketing has not yet reached its full potential to completely replace traditional marketing. The Internet is becoming increasingly important as a means of marketing communication. Research shows that the Internet is often used by consumers in the United States as a research tool. When using the Internet as part of a marketing communications strategy, a company may send emails for which it has previously obtained approval, regular newsletters containing information on, say, the latest product features, and any promotional offers for which the customer has given consent. According to other authors dealing with the field of Internet marketing (Turban et al. (2006), Kalakota and Robinson (2002), Dole and Hunting (2004)), a major problem in the modern economy is that company management does not sufficiently use the obtained data from information sales promotion system. This paper seeks to show how appropriate multivariate data analysis can improve interactive marketing results. The Internet with its information services initially brings the ability to monitor customer behavior, which can be used to improve decision-making at the enterprise level. Knowledge about clients can enable the realization of a better e-business system in which management efforts will be targeted at the needs of clients. Nielsen (2006), with his eyetracking analysis and monitoring the behavior of Internet site visitors, also emphasized the importance of studying customer needs in electronic marketing. Zao and Nagurni (2005) on the other hand discovered specific paradoxes of internet marketing by implementing methods of quantitative data analysis and thus pointed out their importance in the field of internet marketing.

Dool and Lov (2004) point out that the success of direct e-marketing programs is much easier to measure (quantify) than is the case with measuring the performance of traditional marketing, and this advantage is insufficiently used. While mass propaganda reaches a wide range of people, some of whom are not in the target audience, and may only make a purchase at a later indefinite stage, direct e-marketing uses media that can target customers with greater precision and require an immediate, direct response, which means that the effectiveness of most direct e-marketing campaigns can be assessed quantitatively. Some of the criteria most commonly used for quantitative analysis of results using multivariate methods are: response rates (percentage of those who responded to the direct e-marketing campaign), total sales, sales rate (percentage of respondents who made purchases online), inquiry rate, cost per contact, inquiry, or sale and repurchase rate.

Every research in the field of electronic marketing achieves its full purpose if it fulfills the most important goal, which is to increase the "conversion rate", ie. increase the percentage of visitors who, after the usual browsing of the website, take specific actions (for example, purchase) or respond to the marketer in the required way (for example, response to the promotion after sending an e-mail).

The company "The Web Marketing Group" from Great Britain has so far taken the most serious steps in the application of multivariate methods in electronic marketing in the European Union, and represents the avant-garde in this insufficiently researched domain in Europe. Their efforts and research are focused on the essence - increasing the "conversion rate", ie increasing the number of visitors to the website who become Internet customers, and thus to directly increase the profits of marketers on the Internet.

The prevailing view that determines their research is that multivariate methods are an untapped potential for improving electronic marketing. According to the same source, multivariate methods and techniques have been unjustifiably neglected in significant segments of e-marketing, such as site optimization according to search engine requirements (SEA).

#### **4. CREATING A BASIS FOR WIDER APPLICATION OF MULTIVARIATE DATA ANALYSIS METHODS IN ELECTRONIC MARKETING**

In recent years, we have witnessed the widespread application of multivariate data analysis methods in almost all scientific fields. There are two main reasons for this. First, the development of computer technology and software products that have enabled the relatively simple application of multivariate analysis methods, and second, understanding the need for many scientific studies to analyze simultaneous interdependencies between three or more variables.

In the current practice of electronic marketing in Serbia, it is not possible to find more serious traces of the application of multivariate analysis methods. In general, practical and academic research and experience are limited to the application of basic statistical analysis in electronic marketing.

Statistical analysis itself has a number of shortcomings compared to multivariate analysis and cannot make a full contribution to the demands of modern electronic marketing and the Internet market for several reasons.

Statistical analysis is not independent, because it depends on the scientific discipline in which it is applied, so it, as such, cannot be fully applied to all areas and phenomena of electronic marketing.

Its cognitive power is very limited, so statistical analysis cannot provide complete and accurate data that are extremely important for the company's business on the Internet. This is especially pronounced in the process of predicting future events and trends.

The results obtained by statistical analysis do not speak about individuality in phenomena, and therefore statistical analysis does not explain all the complexity of the origin, change and development of a phenomenon.

#### **5. POSSIBILITIES OF APPLICATION OF MULTIVARIATE ANALYSIS METHODS IN ELECTRONIC MARKETING**

Electronic marketing is a relatively young scientific discipline that developed in the early 1990s, thanks to the increasing use of computer and Internet technology.

At the very beginning of the development of electronic marketing, there was a need for quantification and interpretation of the mutual influence between a large number of the most diverse data. In accordance with the trend that has emerged, certain techniques of basic statistical analysis are beginning to be applied in electronic marketing. Like any young scientific discipline, electronic marketing used the experience of an older scientific discipline - traditional marketing - in the application of these techniques.

Already in the first research and business experiences, it was realized that the Internet, as the basic medium for e-marketing, has its own specifics, which significantly complicate the classical marketing analysis, and thus adequate interpretation and application of analytical findings.

On the Internet, due to the relatively easy access to a large amount of information about related and different products, consumers do not make a decision to buy a product based on only one of its characteristics, such as the price or brand of the product. Instead, they reconsider when buying between a large number of features of a given product, with all possible different combinations of features, and make very complex comparisons between different combinations, before making a purchase decision.

In the efforts of marketers to segment this market based on individual consumer differences, it was clear that the application of the Internet in marketing has made consumer behavior and the general marketing environment much more complex than was the case with these categories in classical marketing. Even then, it was noticed that univariate and bivariate methods are not suitable for marketing analysis in such changed conditions.

E-marketing by its nature imposes the need for most research "tools" to be multivariate, and for each problem or phenomenon to be viewed multivariate. If this is not the case, it is concluded that marketing problems and phenomena are understood and interpreted superficially, which can lead to a number of undesirable consequences.

Each of the techniques of multivariate analysis has a certain area of research work in which it can be adequately applied. It is necessary to emphasize that each technique has its methodological advantages and disadvantages, so it is necessary for the analyst to understand them well before interpreting the results obtained by applying a certain technique. It is true that the existing software packages for multivariate analysis significantly simplify the analysis procedure, but without understanding it, the results obtained in this way can be misinterpreted, which results in their misapplication.

The following presentation will list the methods of multivariate analysis that are reasonably considered to be applicable in electronic marketing, and in the later stages of the work will determine which of them are most suitable for application in this area.

Cluster analysis is a multivariate analysis technique that is suitable for segmenting customers on the Internet. The purpose of applying cluster analysis in e-marketing is to reduce a large amount of data on the Internet, and classify them into meaningful groups - market segments. By applying this method, the volume of sales of products and services on the Internet would be increased, because different types of customers would be more successfully met.

Discriminatory analysis is extremely useful when a sample is divided into known groups based on a classification variable (criterion), and the goal of the research is to understand the differences between groups, or accurately predict the affiliation of a new sample to one of the groups. This method can be successfully applied to visitors to Internet sites for their classification, for example: to those who buy and those who do not buy.

Factor analysis as a technique of multivariate analysis is the most widely known and applied technique in classical marketing. It can successfully find its application in a certain form in electronic marketing. It allows individual differences in website preferences to be described by key components of site quality such as: site purpose, organizational comprehensibility, distinctive design, and site promotion system.

Canonical correlation is the most flexible technique of multivariate analysis. This technique is very powerful because it indicates the simultaneous interconnection of several dependent and independent variables, such as: the level of product sales on the Internet, consumer satisfaction, usability of products, the quality of the company's Internet presentation, etc.

Conjoint analysis is a multivariate research analysis used to model the customer's decision-making process regarding the purchase of a given product. Using conjoint analysis can improve the understanding of consumer preferences, which will enable more effective sales of products on the Internet.

## **6. USE OF MULTIVARIATE DATA ANALYSIS TECHNIQUES IN ORDER TO IMPROVE THE MARKETING PERFORMANCE OF THE COMPANY**

Today, the goal for marketers is to know and serve every customer at all times, and to build long-term relationships with them. Data mining is the key to knowing customers and getting closer to them. For years, marketers have been using databases to get a picture of their customers. Using data mining tools, they can create a unique profile in order to predict whether their customers will buy the offered product and service or respond to the offered types of communication. Technologies based on artificial intelligence in the form of data mining use, for example:

- Mobile telephony companies to stop the outflow of users,
- Financial institutions, for portfolio and risk management,
- Credit card companies, to detect fraud,
- Companies for creating email catalogs, for raising ratings,
- Internet marketers, to analyze the consumer basket.

These companies typically store customer information in huge databases, where they use it to support decision making and direct marketing. To improve the quality of internal databases, they combined their internal and transactional user data with demographic and other data purchased from data dealers such as Acxiom, Equifax, Metromail, Polk, and others. They did this in order to increase the knowledge about the lifestyle of their consumers, and in order to find out what types of products and services they consume. These companies are trying to anticipate consumer behavior - whether they will be interested, whether they will avoid, whether they will pay, and most often, whether they will buy, and if they want, what, when and where.

Depending on the type and detail of customer data available to the company, such as ZIP code, date of birth, additional information, etc., intermediary data may be added to the basic data. For example, the results (indices) of a particular

industry can be obtained (bought) from companies such as Fair, Isaac or Experian, which can determine the risk or value for individuals. Banks, insurance companies and Internet companies use these indices on a daily basis in order to determine which services to offer to clients, or to create a development strategy.

Given the increasing amount of customer information, these companies use multivariate data analysis techniques to more efficiently and effectively manage that knowledge and make optimal decisions.

Data mining analysis involves the use of multiple techniques for data analysis. In practice, it is common to use separate tools, but also groups of them, to identify significant variables in databases with a multitude of data, and later to use multivariate data analysis techniques, in order to make the best use of this data.

Classifications / predictions

Questions about who will buy, what they will buy and how much they will spend can be answered with the help of data mining. The answers to these questions involve the application of classification and prediction. These methods can be used in the construction of predictive models, if you want to adapt to the wishes of consumers and their preferences to respond to certain banners, ads and offers, as well as their wishes when shopping online. These prediction models are designed to monitor the behavior of today's customers, with the goal of predicting future reactions.

Segmentation

Segmentation analysis can classify all visitors into separate groups with common features. Grouped in this way, it is easier to use them for strategic projections, such as possible future purchases. Business principles can be obtained directly from web data, obtained by segmentation analysis.

Merge

This type of data mining looks for hidden links in relevant data such as gender, age, address. Special data mining and software for visualization and web analysis produce such connections as output.

Grouping

One of the uses of data mining refers to grouping, ie. extracting a rounded group from a data set. They are commonly used by manufacturers and retailers when analyzing the consumer basket to link products whose sales pull together. However, they are also used to differentiate visitors on the web, ie their grouping, according to common characteristics.

Visualization

The human eye can be crucial in finding answers, so significant space must be devoted to data visualization. One of the available explanations for the term visualization is "mental image". In the technical sense, visualization deals with the presentation of behavior or condition, especially in complex conditions, in a way understandable to the human eye. One of the very popular methods of getting to know data, and even simpler data analysis, is visualization.

In general, visualization is used to:

- data search,
- confirmation of a certain hypothesis,
- data view manipulation.

Optimization

Multivariate data analysis techniques can be used in an attempt to meaningfully reduce thousands of sets and their combinations in an appropriate way. Multivariate techniques can further be used to design and optimize layouts as well as site offerings. A file that contains hundreds of variables can be reduced to just a few inputs, for example, predicting online sales.

## **7. CONCLUSION**

Today, almost every company has a website and with it you can get a lot of information about visitors. Of course, there is very important information about potential, realized and regular customers. Similar to the former data warehouses, today's commercial sites are faced with an incredibly large amount of data for the processing of which data mining tools and methods of multivariate analysis are particularly suitable.

With the advent of the web and e-commerce, almost every company, whether large or small, has become very sensitive to information and forced to be very competitive, so it can benefit greatly from the application of appropriate methods of multivariate data analysis.

The web is an ideal marketing environment where any change can be noticed, memorized and later used as a strategic advantage. The invention and development of information technology has caused a revolution in scientific research, especially in multivariate statistical analysis, where, thanks to the speed and accuracy of calculation techniques, multivariate analysis has become much more accessible and easier to use.

Multivariate data analysis in electronic marketing enables:

- building separate market segments by identifying “value” for the consumer,
- identification of key attributes of web consumers for each individual product,
- choosing the online promotion strategy that will most easily reach the target market,
- analysis of online shopping to improve the identification of "best customers",
- testing and determining which online promotional activities give the best results,
- identifying consumers who will be interested in a new product on the Internet,
- reducing costs and improving relationships with online customers,
- product promotion on the Internet,
- increasing knowledge about online customers,
- identifying the best layout of the site,
- understanding the reasons why customers leave a particular brand,
- establishing connections with online customers,
- improvement of online marketing and sales,
- Maximize online ad acceptance.

In a dynamic and highly competitive environment such as the web, e-merchants need to realize that they can gain a competitive advantage with better understanding and greater care for their most frequent visitors and best customers.

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