Challenges of Application of the Big Data in Marketing: Case Study Croatia

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Abstract: - Exponential data growth requires new ways of processing data. In addition to size, challenges also bring diversity and changeability of data. The solution is offered in the Big Data concept. In this paper are given the basic features and applications of the Big Data in business. A special emphasis is given to the application of the Big Data in marketing with an overview of the fundamental challenges that Big Data technology brings to marketing activities. The paper gives recommendations on how to respond to these challenges. This paper also presents the results of preliminary research on consumer attitudes on the application of the Big Data in marketing conducted in Croatia in 2017.

Key-Words: - Big Data, Marketing, Consumer, Case Study

1 Introduction

Today, the amount of information is doubled faster and faster. This led to exponential progress in technology that began in the second half of the 20th century. More sophisticated data collection methods were developed, storage capacity and processing speed increased. All this has enabled the growth of the volume of collected information that could not be processed by traditional analytical tools, leading to the emergence of the Big Data concept. Their application is present in many business activities and industries, as well as in marketing. The topic of this paper is to identify and demonstrate the challenges in marketing that Big Data users are encountering.

The main goals of this paper are to present the basic features of large data, the advantages of using this technology in business, especially in marketing, as well as the main challenges, the dilemma of application in marketing activities and finally present the results of customer behavior research in Croatia.

The paper is divided into several chapters. After the introduction, follows the definition of the Big Data. Chapter 3 refers to the application of large data in general. Next, there are also illustrations and examples of the use of the Big Data in marketing. Chapter 5 explores the challenges of applying Big

Data in Marketing. Chapter 6 shows the user's opinion on the use of personal data in marketing. Finally, Chapter 7 gives the main conclusions of the problem of applying the Big Data in marketing.

2 The Big Data Defining

The term Big Data is not fully defined. It is a term that signifies the emergence of the ubiquitous growth of digital data from a variety of sources, such as social networks or sensors, and technologies and concepts to exploit of the Big Data [16]. We can say that Big Data is too large, complex and dynamic data to be recognized, stored, analyzed or controlled by any conventional data tool [15].

If we look at a traditional database as a collection of data then for the Big Data we can say that are collection of collections in different forms and shapes. Likewise, it is not easy to understand how to link them together to provide meaningful information. Datasets can be so complex that they do not have to be organized in columns and rows as in most databases but they can be represented by a series of unstructured data such as a series of information we receive regularly via Facebook or Twitter messages [14].

Looking at the sources of data from which Big Data is generated, structured (eg databases, tables, records) are still prevalent, while sources of unstructured data (eg text, audio, video) are significantly increasing. The highest growth is predicted to the unstructured data, while the lowest growth is estimated to machine-generated and scientific sources that are even now the least represented.

From the very definition of the Big Data is implied that technological developments will also change the sets of data that will be considered as big ones. For example, at the technological level of development, at which we are today, a data set of 1 petabyte is considered to be a Big Data, whereas for a few years this quantity will probably no longer be considered as Big.

Big data was created as an objective description of a technical problem: how to analyze data whose volume goes beyond the memory capabilities of a computer [5]. A large number of definitions of the term Big Data represented in the professional literature are based on the aforementioned fact. McKinsey Global Institute, therefore defines Big Data as datasets whose size goes beyond the ability of typical data programming tools to collect, store, manage, and analyze that data [2].

Giacalone and Scippacercola offer a more extensive definition. Big Data is a new technology model that works with a lot of different types of data (structured, partially structured and unstructured) different from the static data stored in the data warehouse. The data is collected by a variety of instruments and sensors, mainly through computer transactions. The data is continuously and frequently upgraded and become more credible and accurate over time [9].

Contrary to precise scientific approaches to the definition of the central term, some less professional, but very descriptive descriptions such as Big Data are the greatest tsunami of information humanity ever met [1] and Big Data are the fuel of economic growth [6].

Despite the many existing definitions, a large number of authors define a term based on the characteristics that characterize it the term Big Data refers to data too large to fit into one server, too unstructured to be recorded in a database consisting of rows and the columns and too fast to be able to be recorded in a static database [11]. In the above definition, we can see three central concepts in which Big Data exceed standard data: volume, variety, and velocity. The mentioned characteristics are known as the 3V model.

Numerous authors have added new dimensions to the model, such as variability, veracity, virality, and value, but those have not become a part of the model. The mentioned characteristics are the main elements of the diversity between the standard data and Big Data. However, the differences between standard data and methods of processing them in relation to Big Data are much more complex. All aspects of the differences between Standard and Big data are shown in the table 1 [27].

	STANDARD DATA	BIG DATA
OBJECTIVES	Give an answer to a specific question with a predetermined objective.	Have answers to a variety of questions with a customizable objective.
LOCATION	Are mostly located within one organization.	Can be split up at different locations.
STRUCTURE AND CONTENT	Structured data with a domain from one area, uniform forms.	Unstructured data that can come from different domains with additional links to data from other sources.

PREPARATION	Prepared mostly by users.	Prepared by a large number of people because the data is from different sources, users are seldom the people who have prepared the data.
LIFETIME	Limited lifetime (average 7 years after completion of the project).	They contain data without a lifetime limit because most are integrated into new data.
MEASURING	It is mostly measured by using one protocol.	Measured by using different protocols.
REPRODUCTION	Easy reproduction of projects.	There is rarely a chance to reproduce projects.
FINANCIAL INVESTMENT	Relatively small amounts of invested financial resources in projects.	Large amounts of financial resources invested in projects.
INTROSPECTION	Individual standard data can be identified by their location specified by the line and the column inside the table.	A much more complex identification procedure, with well-formatted resources, can be achieved by introspection technique.
ANALYSIS	It can be done over all data simultaneously.	Steps up in steps to extract, review, reduce, normalize, transform, visualize, and interpret data.

Table 1 Differences between standard and Big Data

According to Goes [10], the purpose of Big Data is to create knowledge that supports making decisions and setting strategic goals. This purpose can be achieved by the Big Data analytics, which includes visualization, exploration, clarification, and prediction by using statistical, econometric, linguistic, mathematical and simulation methods. A few authors emphasize visualization as the key to the four mentioned process elements, pointing out the importance of understanding the results of business managers rather than just data analysts [23].

Other mentioned elements of the Big Data analytics include exploration and clarification, which primarily relates to the identification of the linkage of particular data, that is, to their possible mutual interactions and causal relationships. The last element prediction merges the above-mentioned elements and, no doubt, in the most successful way supports better decision-making. Šebalj, Živković and Hodak confirm that this purpose defined by the fact that the collection and analysis of the Big Data increase the success of the organizations and enables management to make better business decisions [24].

3 The most common Areas of Application of Big Data

By analyzing numerous examples of the Big Data application we see that Big Data is used in a very wide range of activities such as medicine, education, public security, business, sports and so on. In the following paragraphs, examples of Big Data applications are presented in the above-mentioned activities.

Information present the most important aspect of medicine where the human body is their main source. Consequently, the challenge of medicine is to make valid and timely conclusions by dealing with unstructured information. The quantity and heterogeneity of such information are their main characteristics, for example blood pressure (numerical data), a description of the type of pain from the patient (text data), ultrasound (sound data that creates image data), and similar. The Big Data allow diagnosing the cause of the disease and opening the door to personalized treatment [9].

In the area of education, Big Data can be used to monitor the students and thus recognize their individual ways of understanding and mastering the subjects. The real power of Big Data lies in the ability to create future scenarios in order to timely take preventive measures, which in the context of education means the possibility of early observation of those parts of the subject that cause confusion to the student and are harder to overcome. Furthermore, by using Big Data, it is possible to create learning plans tailored to each student individually [9].

Big Data systems have shown efficiency in the field of public protection. In cooperation between Microsoft and the New York Police Department, a surveillance system was developed, by using Big Data, that collects data from the camera, street sensors, car detectors and police databases. By

collecting and processing these types of data, the police is able to locate real-time crime sites [2].

Hertz, a US car rental company, uses Big Data to make it easier to rent a car. The implementation of the Big Data involved the introduction of a real-time communication system with users. This made it possible for the user to recall the driver's license or credit card expiration, thus avoiding inconvenience for both sides if it expire during the car's lease [20].

The Big Data Prediction Power also manifested itself in the sport used by Paul Podesta. Podesta could predict the performance quality, by collecting and analyzing data, of one of the players more successful than traditional statistics data about the players. That is why the relatively unknown baseball club Oakland Athletics turned into winners [5].

4 Big Data in Marketing

Kotler, Wong, Saunders, and Armstrong point out the difference between the Old and the New Economy. The old economy was made of production companies that focused its efforts on standardizing business processes. In the marketing sense, they invested large amounts of financial assets to build a brand whose task was to promote a standardized market offer. By this marketing strategy, the economy of scale was aimed to achieve. The New Economy's era is characterized by information companies that have become aware of the importance of business information. By the development of information technology they have become more convenient in collecting, storing and processing consumer information, and thus in analyzing, individualizing and distributing information [18].

Such modern marketing campaigns are called micromarketing. It is no longer important to know which products and services to sell (how much was sold, who bought it), but when these services and products were purchased, after what were purchased, when could be purchased again, what is the customer's profile affecting certain buying trends and how to maintain and increase their trust [17].

Finding answers to these questions also led to the development of digital marketing. A large number of companies have recognized the potential and necessity of introducing digital marketing in their business. Research shows that 90% of businesses have allocated at least part of the budget devoted to marketing activities in digital marketing. One of the trends in digital marketing is exactly Big Data [12].

According to a study by two professors from Columbia and Harvard, data-based marketing in the United States of America in the year of 2012 generated 675,000 jobs and $ 156 billion in revenue [26]. Speaking of data-based marketing professions, it's easy to see how the Cheif Marketing Officer and Cheif Information Officer coexist. According to research, marketing and information specialists have expressed awareness of the importance of mutual cooperation (85% of marketing and 85% of IT specialists). Marketing directors need accurate and timely information provided by information specialists, while information managers see marketing as a partner in improving analytics and decision-making based on data at the organization level. Both sides believe that Big Data is a key business differentiation element and that they represent the core of business culture directed to the consumer [21].

The fundamental differences between traditional marketing and Big Data marketing can be in the simplest way looked through marketing data processing and activity. Traditional marketing analyzes data relying on traditional tools that can only analyze structured data. Gained knowledge often comes in a significant time lag, which is why traditional marketing handles with past data, but rarely possesses knowledge of the current market situation and even less has the potential for predicting future actions.

Thanks to the development of digital marketing and Big Data, marketers today have the opportunity to monitor the digital footprint of their target consumers. In this way, they get detailed insights into the behavior of consumers as well as the impact of their own marketing efforts on the mentioned [8].

However, there are many challenges in using Big Data in Marketing. Grensing-Pophal defines Big Data in Marketing as managing relations with consumers on steroids. He points out that consumer expectations are increasing each day and that the bidders are expecting the right offers at the right time. Therefore it is not uncommon for small businesses to think that Big Data Technology is only intended for large companies with resources and knowledge to implement Big Data in their own business. This conclusion is not necessarily accurate but certainly, plays an important role in seeing the advantages and disadvantages of Big Data in Marketing [12].

Despite its technical complexity, Big Data relies on a simple idea: to gather enough data from the past and to use the proper analytical tools to detect the connectivity and interaction that would then enable extremely accurate predictions of the future. If the data collected have a starting point in an

individual consumer then they gain values such as name, age, race, sexual orientation, family relationships, health status, location, internet search terms, social networking images, website cookies, purchases and the similar. Big Data in marketing has enabled us to change understanding from "consumer as a part of a demographic group" to "consumer as an individual" [26].

If we move this idea into marketing frameworks, we get the basic principle of Big Data activity in Marketing: enormous amounts of data about the user in every form of his/her personal interest expression is collected. Using Big Data Methods and tools gives you valuable insight into user's desires and needs, ie generating answers to questions about who the customer is, what he wants and when and why he wants it. This creates a unique image of the consumer's identity. This information is then used to create an individual marketing offer [19].

The need for such an individual consumer setting in the center of business activity was created by the development of technological achievements such as mobile technology, social networks, cloud storage, and Big Data. These technologies contributed to the mobility and availability of real-time information sources, thus reinforcing the consumer by making the consumer loyalty more difficult and achievable [25].

4.1. Some examples of using Big Data in Marketing

In 2009, Sony asked support from Six Speculative Media Company to promote the launch of action movie Takers more successfully on the market. Sony previously conducted a market research and set the target the target audience: men in the age group of 18 to 25 years. However, the results of the rented company's own research were significantly different. Using data collected from Twitter and Facebook social networks, Six Spoke Media has come to the conclusion that Sony will achieve greater success if its marketing efforts direct towards the female population. Although because of the film genre that the movie belongs to does not seem obvious, the analysis of the posts on the aforementioned social networks has shown that behind them are mostly women, commenting on the physical attractiveness of the actors [3].
One of the examples of successful use of Big Data in Marketing is found in the business of the US merchant chain Target. Target Audience Statistics Analysts found a way to identify their users'

pregnancies as early as the beginning of the second quarter in order for these users to submit individualized marketing ads and coupons related to the baby's forthcoming birth. Among other new habits of pregnant users, they found that during the first twenty-seven weeks of pregnancy, they are inclined to buy large amounts of dietary supplements abounding with calcium, magnesium, and zinc. Those users are offered special offers for pregnant women's clothing, toys, diapers and similar. The negative side of the Target Marketing Campaign manifested itself in the agitation of recipients of coupons for pregnancy necessities, despite the fact that they were the only one to know for their pregnancy. This outcome forced Target to reconsider the outcomes of marketing actions caused by using Big Data and pay attention to the negative sides of the same [6].

5 Challenges of Application of the Big Data in Marketing

The application of Big Data generates many challenges in the field of marketing activities. Most of them related to privacy, data protection and ethics. The most important challenges of applying Big Data in marketing are:

- preserving privacy,
- data protection,
- making accurate conclusions,
- respecting the freedom of the individual and
- responsible use of Big Data

5.1 The challenge of preserving privacy

Basic privacy theory defines privacy as control of personal information. In his book of privacy Alan Westin defines this control as the right of individuals, groups or institutions to independently determine when, how and which personal information they exchange with others [22].

Advanced features of Big Data have led to increasing interest in the challenge that marketing experts face when it comes to their use - the challenge of privacy. Marketing experts and consumers may both benefit from the precise reference of the marketing messages to those most likely to be interested, but the thin is the boundary between useful and creepy [12].
Pan describes an imagined situation where the viewer publicly reveals the ratings he has awarded to the films in Netflix's online video library. After analyzing the algorithm, it determines the high

probability that the viewer is a homosexual. From a traditional view, the viewer voluntarily gave the film ratings to the public, but did he retain the control of his personal information and did Netflix respect his private interests as the viewer never agreed to reveal his sexual orientation? There is no simple answer to this question [22].

Enterprises should, therefore, be aware that their point of view on the accessibility of data and privacy is not necessarily the same as the point of view of those from who this data is collected from. Furthermore, privacy is perceived differently in different cultures [28].

5.2 The challenge of data protection

Over the last century, the cost of digital storage is halved every two years, while storage options are constantly increasing. It is expected that the trends of cost reduction and the capacity increase will continue with the consequence of an increasing number of accumulated and stored data. Such a development of the events brings at least two potential challenges: first, ensuring that the collected data will not have access to unauthorized persons or that they will be stolen and the second, ensuring that the data will not be damaged [7].

Confidentiality is the preservation of the information entrusted to a person who has created a data set, ie to prevent access to unauthorized third parties. Almost 90% of the connected devices we use collect and transmit personal information and 70% of these devices transmit personal information without encryption [4]. Whoever was the victim of a computer virus understands how vulnerable computer systems are. Secure data storage is currently a serious problem and will remain so as the development of security systems is being developed in parallel by hackers, too [7].
Everson [6] encourages businesses using Big Data in their business to think about whether or not to compromise on promises before given to consumers - promises not to share the data collected with third parties, to allow consumers the right to share their data with third parties or to keep their data from malicious alien attacks.

5.3 The challenge of making accurate conclusions

Identity can be defined as the relationship between our real and Internet life [3]. One of the limitations of social networks as a source of data is precisely that difference between consumer's behavior in the digital world and in the real world. Hilbert Manovich claims that when using social networks, we tend to carefully choose our own profile pictures to create the image of ourselves that we want to project to the public [13].

Viewing an image on Instagram has different consequences than watching the overall image history that a certain person has revealed. Should an image on Instagram be interpreted as approving or disapproving of a phenomenon? Is it simply an observation or an attempt to improve status within a friend's network? Each of these scenarios can be accurate, but what prevents identification is the correct lack of context [28].

5.4 The challenge of respecting the freedom of the individual

People are discovering and creating themselves throughout their lives. However, some of them face complex issues of identity - gender, race, or sexual orientation. In order to develop their own identity, people need the space to try different roles with the possibility of giving up and returning to the starting point and be free from external condemnation. Big Data can make consumer conclusions based on data collected during the experimenting period. Such conclusions may be inaccurate in the future, and consumer's awareness of them may affect their desire for further experimentation [7].

For example, a consumer may not publicly mark Facebook's "Sephora" page with "I like" if he knows that such an action is associated with a low intelligence quotient [22]. Also, a person may be watching less action movies if he suspects that Netflix will mark him/her as violent. Emotional freedom also includes the freedom to go beyond the social standards without fear of disapproval - from visiting a former partner's Facebook profile, to the Google search for unpleasant questions. Big data analysis does not leave room for temporary or minimal misconduct [7].

Conclusions obtained by generalization and probability of Big Data are often presented as safe outcomes. This creates the impression that the behaviors and traits of each individual are predictable, and that impression is opposed to the fact that people act freely. If people continue to make decisions about other people using Big Data, this could lead to the deepening of prejudices that exist in society as a whole. We can say that the conclusions obtained by generalization hinder

autonomy and undermine the belief that every individual has the right to shape their own life [22].

This challenge is of particular importance given that the freedom of individual development is particularly important in a democracy, where society is based on diversity of views and independent thoughts [7].

5.5 Responsible use of Big Data

The implementation of privacy and system protection is a serious problem and requires the introduction of complex social, legal and ethical norms in the equation [6].

Influence of past but also future data leaks will continue to create tensions between marketing experts' efforts to gain knowledge and consumer efforts to protect the information they consider to be personal. The challenge for marketing experts is to find the balance that will enable them to use the insights that data can provide them and to maintain a solid, sincere and transparent relationship with customers [12].

Responsible use of the Big Data does not require the prevention of collection and analysis, but the assurance that the actions carried out are accurate and secure, and that they increase the welfare of society and reduce the damage. The problems and choices that the data scientists face are real, complex and challenging, and therefore must be part of our concern as a consumer. We need to treat the Big Data with the respect they deserve and recognize that the unethical use disables knowledge creation. Extraordinary opportunities for a better understanding of society and the world we live in, but with these possibilities comes the responsibility to consider ethics behind their procedures [28].

6 Reasearch on the consumer' behaviour: collecting personal data for marketing purposes in the Republic of Croatia

By researching consumer behaviour about collecting personal data for marketing purposes, we wanted to gain insight into the Big Data Challenges issue from a consumer perspective. The subject of the research is to identify the current consumer awareness of collecting their personal data and assessing future consumer behavior models. The purpose of the research is to establish patterns of action before and after informing the respondents about the challenges of collecting personal data for marketing purposes.

The goals are to investigate the level of awareness of an individual on the impact that Big Data has on consumers, to familiarize them with relevant facts related to the topic and to give them a thought on possible consequences. No similar research has been carried out on the territory of the Republic of Croatia.

From the above subject and the objectives of the research also arise the relevant questions related to the assessment of the past, present, and future conditions. The questions are the following:

Have consumers been aware of collecting their personal data while using the Internet and the fidelity card, and the information obtained by the survey?

Do consumers believe that collecting their personal information is compromising their privacy?

Will the information provided by the survey in the future affect their use of the Internet and the loyalty card?

6.1 Research methodology

Investigating consumer attitudes about collecting personal data for marketing purposes is a primary research conducted on a random sample of 200 respondents. The research was conducted one-time through August 2017 electronically by submitting a survey to forums, groups, social networks and the similar. In order to inform respondents about the challenges of using Big Data in a short time, an example of Target Pregnancy Prediction Campaign was mentioned in the fourth chapter of this paper. The aforementioned example serves to inform respondents who were unaware of data gathering in order to prove hypotheses.

The aforementioned example serves to inform respondents who were unaware of data gathering in order to prove hypotheses.

6.2 Results of descriptive analysis

Research has shown that out of 99% of people using the Internet, 81% of them see the correlation between ads shown to them and their interests or the internet searches they have been using in the past. The percentage of positive response to this question points to the spread of the Big Data, that is, shows that the ultimate effects of their use for marketing purposes do not go unnoticed by consumers. Similarly, out of 79% of respondents using fidelity cards, 72% note the correlation between their marketing material (such as coupons) with previous purchases, but to a lesser extent, as the Internet

users notice the connection of internet ads with previous searches.

The survey question by which the level of user awareness was questioned about collecting their personal data while using the Internet and loyalty cards is similar to the question about noticing personalized marketing activities, but this scenario represents a "step forward" in consumer awareness. Namely, if a consumer perceives such an ad type, this does not necessarily mean that he also contemplates the activities that led to it. However, most respondents (73%) reported that they were aware of such an event. This identifies the state of the past, ie the attitudes of respondents who were formed before completing the questionnaire. The aforementioned indicates that the answer is YES to the first research question.

The consumer's view of the possible perception of privacy threats, as well as the current attitudes of respondents, was examined. 73% of respondents believe that collecting their personal data by companies is threatening their privacy, while 27% of respondents believe it is the opposite. Such a conclusion suggests that YES is the answer to another research question. These results are the backbone of the entire research and represent the shadow of the use of Big Data in Marketing. The obtained results point out the need to provide more detailed information to consumers about the challenges that companies face when collecting, processing and using their personal data.

It is believed that by surveying, consumers have been able to gain insight into a part of the Big Data challenges in marketing and it is verified whether the information obtained will have an impact on the future behavior of Internet users and loyalty cards. This will consider the future intended activities of users related to the above-mentioned issue. Although most respondents expressed concern about their own privacy, 69% of them did not plan to take any measures that would affect it in the future. The answer to the third research question is NO.

Finally, although most respondents confirmed that the information obtained would not affect their future use of the Internet and loyalty card, 81% of them attributed the information obtained from the survey as very useful.

7 Conclusion

At the very beginning of man's development as a thoughtful kind, a tendency to collect data has evolved, as well as an effort to try to predict the future in a number of ways. Through the centuries that followed, these two disciplines were mutually interwoven in many ways, ultimately affecting Big Data. Big Data Technologies transform individual data into knowledge that helps to make quality business decisions within the business.

One of the business areas where Big Data plays a significant role is marketing. They have irrevocably changed the way businesses interact with consumers. Contemporary companies try to tailor the offer to the subjective wishes and needs of each customer and to provide timely and accurate marketing programs. In order to gain information about its customers - connections, causes and trends, companies use Big Data. There are insignificant issues of privacy, data protection, human rights and ethics.

This paper presents the major challenges of Big Data in Marketing: Challenges of Privacy, Data Protection, Accountability and Respect for Individual Freedom. These challenges describe the issues of confidentiality and data interpretation, consumer consent and possible discrimination as a result of the analysis. Once identified challenges create distrust of the public and need to protect the personal space. Has this really been the case, it can be seen from the survey of consumer attitudes about collecting personal data in the Republic of Croatia.

The results of the research are as follows: Most consumers notice the link between internet ads and marketing materials with online searches and purchases and are considered to be a violation of privacy, but will not change their learned user behavior. We can say that awareness of Big Data challenges in marketing is growing, but a large number of consumers are still not familiar with the challenges mentioned. It is also apparent that a part of the consumer "does not want to know", that the acquired knowledge does not change their perspective.

As a conclusion, it is imposed the fact that Big Data faster get the characteristics of a "big brother" without space for the privacy, mistakes and individuality. It is, therefore, necessary to take precautionary measures that include responsibility, which is reflected in the self-control of companies and users. These measures will be crucial in the following days and represent the last opportunity in which potential problems can be prevented, as we would not have to cure them in the future.

Future Research on the Challenges of Application of the Big Data in marketing can focus on examining the relationship between the structure of respondents with particular attitudes and the challenges of applying Big Data to Marketing. Likewise, research can also be extended to neighboring countries and make a comparison of results.

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