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BIG VS SMALL DATA IN MICRO AND SMALL COMPANIES

This article deals with the challenges that are faced by micro and small enterprises using data. After naming main hypotheses of the research, the attention is paid to definitions of big and small data and to their comparison. In the paper, analyses of the connections between big data and Internet are given. The main attention is paid to the use of big data in micro and small enterprises through the analyses of needed skills, organizational changes and big data management including possible pros and cons. As a special item, the analysis of risks and implementation is given. The analyses are supported with a lot of research results and numerous literature sources. At the end of the article there are conclusions about directions how micro and small enterprises should use big data and how to invest rationally in big data.

Keywords: *Big data, small data, micro enterprises, small enterprises, cloud computing.*

1. Introduction

Today's globalized society is developing together with the development of information and communication technologies. Development of information technologies, especially in the fields of big data, cloud computing and data mining is very dynamic. This is well doccumented by publications of Asay, M. [1], Thomas, J. W. [2], Carter, K. B. [3] which defines technical and technological aspects of big data, cloud computing and datamining. These technologies are gradually used in real life and all institutions and companies try to implement these technologies.

Every company, independently of its size, tries to collect as much information as possible, not only in the field of its activities, counting that the possession of data is a capital that will pay off sooner or later. Possession of data represents significant potential. So one can conclude that, based on reliable data, manager is able to timely make right decisions. However, is it always possible? Many companies, although able to collect a number of relevant data, are not able to successfully exploit them. In their analyses, there remain a lot of unused data, not only from the group big data, but, even, data from the group small data.

In the very beginning of the collection of big data, the main beneficiaries were big companies, which used data primarily for the prevention of fraud, or for tracking and retail management. Big companies had to develop complex sophisticated methods and software for processing of big data. Nowadays, big data are available also to micro and small enterprises (next MSEs) and they also have to develop systems and procedures for their proper and effective exploitation. Due to their sizes and the limited area of interest, it is quite possible that MSEs find a new specific, and more convenient and efficient methods to benefit from the data collected. Computer resources are no longer a challenge, because MSEs can use cloud computing at an affordable price. The main challenge is now of the strategic and organizational nature. MSEs do not need to deal with creating of their own systems to handle big data. It is enough to properly choose open source software that will suit their current needs and be scalable enough to accommodate their future growing needs. Although it looks so simple, the challenge lies in the word „properly". The question is, whether the MSEs are able to „properly" choose and apply the software.

In this paper, after a brief comparison of small and big data, here will be discussed micro and small enterprises' abilities to use big data and the Cloud.

Microenterprises are categorized here in accordance with the Commission Recommendation 2003/361/EC [4] as: "A microenterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million". According to the same recommendation, "A small enterprise is defined as an enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million" [4].

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In Serbia 95% of all enterprises are micro enterprises, with more than 270,000 private entrepreneurs and micro companies [5]. According to Forbes: "Small businesses are driving the U.S. job recovery"... "Small businesses have led our comeback from the downturn," Bagley writes. "For 15 straight quarters, small firms have contributed to employment growth – accounting for as much as 80 percent of job gains in any given quarter" [6]. For this reason, this issue is becoming more important.

2. Research question – hypotheses

The creation and organization of infrastructure largely depends on the type of activities of the company and may be substantially different from industry to industry. This is why it can be difficult to formulate general conclusions. In order to obtain more general and realistic picture, this paper will deal with the general principles of using small and big data.

The working hypothesis was that MSEs due to their limited resources are not able to effectively use big data for the benefit of their business.

$\mathbf{H_0}$ The null hypothesis of this analysis is: MSEs are not able to form their own infrastructure in order to be able to take advantage of big data in order to form their strategies of development and doing business.

$\mathbf{H_1}$ The alternative hypothesis is: There are MSEs that can form their infrastructure so that they are able to take advantage of big data in order to form their strategies of development and doing business.

In the research, there were applied methods of induction and generalization, as explained in [7].

3. Small and big data definition and comparison

From the definition of small and big data arise their essential differences, but also achievements that by their use can be achieved. According to Techopedia [8]: "Small data describes data use that relies on targeted data acquisition and data mining", and "Big data refers to a process that is used when traditional data mining and handling techniques cannot uncover the insights and meaning of the underlying data."

Big data acquisition is a result of the desire of the company to gather as much information as possible about anything and everything, and then to process the data collected to come to the conclusion what its customers want, may want and when. A company wishes to get an opportunity to project needs and desires of its customers in the future and define its own strategy and action. A very demanding task in every respect: in collecting data, in resources for data storage and processing, and in the models and software for processing and presentation of results. This task can be compared with the weather forecast. As with weather forecasting, on some level, collecting of data must be stopped, because the further collection of data, below this level, brings enormous costs and practically no impact on the result obtained. In weather forecasting, there will not be taken into account, for example, the impact of heat given by individual buildings, or damping the wind by a single tree, or causing of air movement from a single man breathing. Consequently, when processing mass data, data with minor impacts will not be considered. Or, maybe, they will? The answer depends of the decision of one who defines the strategy. In contrast to this approach, companies may limit the collection to the specific data which will allow them, according to their beliefs, to make the right decisions with considerably less effort and cost. Big data provide a greater potential to drive business intelligence in key ways, but no one can guarantee that the results won't be similar to the results of weather forecasts. Because of the sudden changes in business environment, it is possible that the predictions won't be met.

Reviewing small data IBM concluded that small data are connected with [9]:

- low volumes,
- batch velocities,
- structured varieties

On the other hand, big data are characterized by [9]:

- into Petabyte volumes,
- real-time velocities,
- multistructured varieties.

Both, small and big data, must be first brought under control. There is no doubt, that using of small data has a longer history and is better developed. The use of big data is recent date task and tools for their processing are still in the phase of developing with implementing the best practices. According to [9] in using small data dominant data platforms are OLTP &EDW built on relational DBMS. For big data it is recommended to use big transactional, data warehouse systems. And it is a current state of development. In the near future it is to expect the massive use of emerging platforms: Apache Hadoop[1], NoSQL[2], stream computing[3], in-memory[4].

4. Big data and cloud computing

Each company has its own specifics in resources and in the organization of work. Therefore, it is impossible to find an ideal technological solution that would satisfy everyone, but from past experiences it is possible to clarify some guidance. For small data it is easy to obtain appropriate tool, but the technological ways of big data utilization can vary from company to company. Often,

[1]About Apache Hadoop see in [10]
[2]About NoSQL (originally referring to "non SQL" or "non-relational" database) see more in [11]
[3]About stream computing see in [12]
[4]About In-memory computing see in [13], [14], and [15]

standard software packages are not good enough and customized solutions are better to use to wholly utilize the data potentials.

When we talk about the cloud, we consider it as a whole, as the Internet. But, there are several deployment models of clouds. According to NIST [16], there are: private, community, public, and hybrid clouds. Each of them can be a good solution for MSEs. According to Microsoft, as shown in Fig. 1, in the year 2014 most of the companies ran dedicated servers (48%), but this percentage is expected to decrease to the end of 2016 with an increase of hosted private cloud users [17].

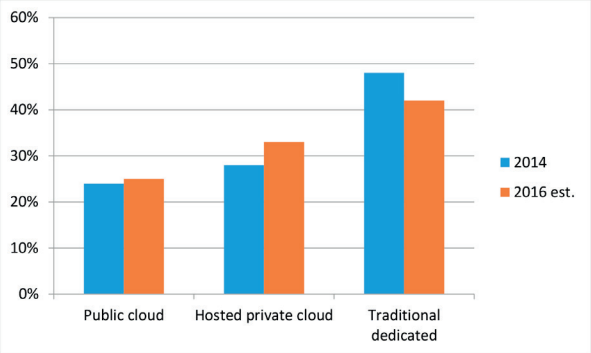

Fig. 1 Hosted infrastructure services of deployment models Source: [17]

A company needs to choose which of the service models it will use, and who will be a provider. As well as the other companies, MSEs can use three service models, three classes of services: Infrastructure (IaaS), Platforms (PaaS), and/or Software (SaaS). In the case of IaaS, beside the pure infrastructure, MSEs can expect plenty of common software that can be used for preparing of company's own databases, and software. Consumer "has control over operating systems, storage, and deployed applications; and possibly limited control of selected networking components (e.g., host firewalls)" [16, 18]. Using PaaS, MSEs have an environment where they can create and deploy desired applications without any concern about the hardware, but such environment can be usually too wide for their needs. "The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment" [19]. By using SaaS MSEs can have at their disposal different software, which can be accessed through Web portals. Instead of traditional desktop applications end user can use them as a service in the Cloud. Full control of the hardware and software is on the provider's side. User can in some cases change specific application configuration settings.

Beside the three service models mentioned above, MSEs can use outsourcing and collocation services, as well. Figure 2 shows the use of current IT services for companies with less than 100 Emps, based on the sample of n=480 micro and small companies. It can be seen that the use of SaaS and IaaS are dominant with more than 60% each. The use of other models is far less pronounced. According to the same research, website hosting is leader between services. 70% of participants confirmed that their companies pay for this service. The next in line of the most common services are storage and backup/restore services with 64% each.

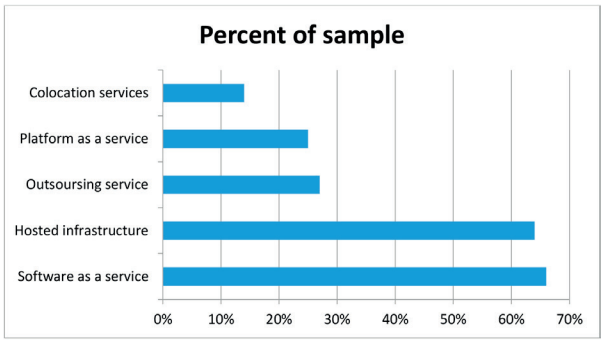

Fig. 2 Current IT Services for companies with less than 100 Emps (n=480) Source: [17]

Figure 3 shows the use of IT services by region. It is easy to see that SaaS and IaaS are the most used services in all continents, and that North America and Asia are leaders. Among all continents, outsourcing services are the most popular in South America.

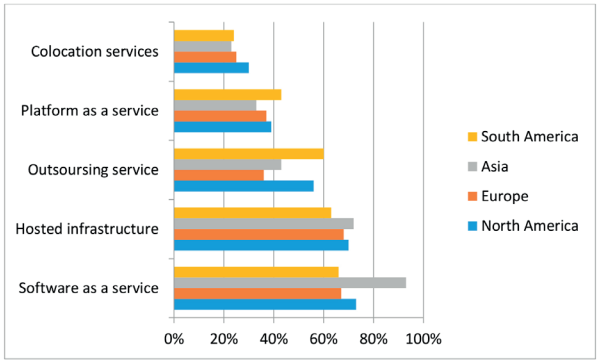

Fig. 3 Current IT services by region (n - the number of respondents in the poll) Source: [1]

According to Asay [10]: "Big data is all about the cloud". Cloud can offer:

- multiple ways to store big data from S3 storage to data warehousing solutions;
- real time analytics; and
- dedicated task clusters.

With all these components, Cloud gives to users an opportunity to choose right tool for their job. Using Cloud there

is no single choice "or". Clients have to their disposal the option "and". They can always choose appropriate tool for their current job [1, 20].

5. BIG DATA and MSEs

Good comparison between big and small data was given by Thomas [2]: „You are not feeling well, so you visit your friendly family doctor. He puts you in a new electronic scanner and generates 28 trillion measurements of your temperature all over the surface of your body. He then saves all of these measurements and, using advanced statistical algorithms and supercomputers, announces that your temperature is 98.6 degrees Fahrenheit. What a relief! Big Data to the rescue." From our experience, it is to expect that the very similar data can be obtained by classic measuring of temperature in one single point, e.g. under the armpit. It is obvious that the application of big data in this case is not practical. Is it the same and in doing business? Why do big data attract the companies, and where are the micro and small enterprises in such environment? The answers are not so simple. MSEs can also use basic premises of big data:

- more is always better;
- data by their quantity create new sources of knowledge and possibilities for predictions; and.
- by using big data, one can answer all questions.

According to Bagley [6] 75% of small businesses, in 2015-6, plan to invest in analytics of big data. Because of big interest of small businesses, even powerful software packages intend to become available at very moderate prices. At the same time they will be easy to use by any employee. It can give an opportunity to micro and small enterprises that by using advanced analytics techniques they can analyze previously untapped data sources. Using the analysis of big data independently or together with their existing data, MSEs will gain new views on their doing business which can consequently result in more appropriate decisions.

According to Microsoft research [17] more than one third of MSEs don't plan to add any service from service providers until the end of 2016. From the rest, 26% plan to invest in PaaS, 12% plan to invest in IaaS, 12% in colocation services, 16% in outsourcing services and 14% in SaaS. Percentage is given to the number of 480 MSEs. Total sum is bigger than 100% because some of MSEs respondents planned to invest in more than one service.

People transform resources into products or services. Data-savvy employees are critical for creating value from big data. Data experts are in huge demand and in low supply [21]. Enterprises must adapt to this quickly changing landscape to establish an analytical competitive advantage [22]. This raises several questions:

No. 1. How can MSEs act in order to obtain the necessary skills?
No. 2. How can MSEs organize themselves to extract value?
No. 3. How is information obtained, and governed?

5.1. MSE obtains necessary skills

The answer to the question No. 1 is very unfavorable for MSEs. According to Davenport, Barth and Bean [23] a big data company does not need a "data analyst", but a "data scientist". That it is not just the mere change of the name of the workplace, Davenport and Patil told us in their article [24]. They describe a data scientist as a hybrid of data hacker, analyst, communicator, and trusted advisor. David Sims suggested three main skills that a data scientist needs [25]:

- The first skill is a base in statistics, algorithms, machine learning, and mathematics;
- Second, a good data scientist is handy with a collection of open-source tools – Hadoop, Java, Python, among others. Knowing when to use those tools, and how to code, are prerequisites.
- The third set of skills focuses on making products real and making data available to users.

In his discussion about these skills, Iqbal R. J. [26], from different points of view, considered a possible scenario: "Shop-Mart and Bulk-Mart are two competitors in selling retail. Some higher up in the management chain asks this question: 'How many Shop-Mart customers also go to Bulk-Mart?'" He discussed how different data-related roles could approach the problem. The discussion included: traditional BI/reporting professional; data analyst; business analyst; data mining or big data engineer; statistician (a traditional one); and program/project manager. "A data scientist should have the skills of all the mentioned individuals. In addition to the skills mentioned above, a data scientist should have rapid prototyping and programming, machine learning, visualization and hacking skills" [26]. Because of many reasons, for MSE it is difficult to hire some data scientist. If a company wants to use big data it seems that the best solution is to find someone from the staff who's willing to deal with it. Even when MSE wants to find such employee, there is a big probability that it can't find appropriate person. Then there are two possibilities: outsourcing or reduction of demands to the acceptable level.

5.2 MSE organizes itself for big data

The answer to the question No. 2 demands a deeper analysis. Can MSE be organized in a manner different from large enterprises, and be effective? Who in a company deals with big data? According to Bean and Kiron [27] "ownership for big data initiative sometimes resides within the business side

and sometimes within the technology side". In the former case business management manages big data, and IT only receives and executes orders. In the latter case the entire responsibility about big data lies on the IT department. It is easy to conclude that there exist also two extreme possibilities: That no one cares about big data, and, the most favorable one, that a company is organized on matrix principle where business and IT work together in the way that follows the company's strategy. It is logical that each Head of MSE wants to apply the best variant, but practice shows that this is often not feasible. Problems may lie in the lack of strategy, in inability of competent managers, in lack of personnel, in lack of knowledge...

5.3. MSE manages big data

"Many organizations are setting their big data analytic efforts up for failure by plunging ahead without proper planning upfront" [3]. Many MSEs as well as big companies move in collecting of data that are directly related to doing business, but soon appetites are growing and small data in short time exceeds the class of big data. It is possible that the speed of data collection becomes greater than the capacities for their systematization and analysis. This way, the company continues to collect data making costs, but (practically) doesn't use them. The accumulation of data, as well as their placing into the databases and creating of spreadsheets provides no better picture of the analyzed occurrence than in the case of small data.

What to do with that data? The company can filter them out, arrange them, and classify. Although the picture will be clearer, it is unlikely that the information will be able to be used to solve some specific problem. The reason is simple. It's hard to find a real situation which will coincide with the data entered in the database.

6. Riks and implementation of BIG DATA

In general, big data and cloud services provide new functionality to users, can improve utilization of resources, and can help to generate revenue faster. But a lot depends of the kind of business that MSE conducts. According to International Data Corporation (IDC), the top 5 industries to benefit from the Cloud are [28]: IT operations (52%), Operations (35%), Financial and Accounting (33%), Customer support (31%), and Program Management (29%). The benefits are specific for each of the segments.

But, the use of big data brings some risks. There is only one convenient scenario, when business department and IT are headed by a single leader, competent in both areas, and numerous negative scenarios. Let us consider some of them:

- IT department possesses appropriate technical skills, but IT experts may suffer from the lack of the business knowledge. So, they can focus on the improving the technological solution. Such activity doesn't provide a business value.
- For alignment of business strategy with big data can be responsible a business group. In that case it is very likely that the business group may not fully be able to leverage the technology, and there is the risk of silo mentality or bad architectural solutions.
- Even in the currently positive scenario, which possesses the highest potential, there are risks from an organizational view. It is difficult to keep interdisciplinary collaboration on the demanded high level. Such organization demands a complex and expensive structural setup. Also, if cooperation between business and IT departments is not standardized and well-established, problems can arise at any change or absence of a responsible manager.

„It isn't surprising to find that 55% of big data projects aren't completed and many more fail to achieve their objectives – often those charged with implementation are the last consulted," said Jim Kaskade, CEO [29]. According to the survey of the same source, the reasons lie in: inaccurate scope (58%), technical roadblocks (41%), and 39% in siloed data and non-cooperation.

Why the majority of big data implementation tends to fail? Sicular [30] has quantified eight causes of failures, and she framed the problem in: "Learning Hadoop is easier than learning the business". People want to be driven by data, but first of all they must understand doing of business. Which data will be collected depends from the decision of men. If the decision is not based on understanding of business needs, there is big probability that data will be useless.

Many companies collect data indiscriminately, but raw data couldn't say anything to most business users, and provides no value to them. Even when company categorizes data it is hard to make a business case if the data doesn't provide answers to real business questions [3].

Also, all data are historical data, independently of their kind: financial -, sales -, customer behavioral -, or inventory data. All data are connected with the past, and they naturally tend to be backward-looking. Their use is analogous to watching in the rearview mirror when driving a car forward. This is an omnipresent limitation. Data analysis can give only trends, and some prediction of the near-term future, „but most historical data are of limited value in predicting the future" [2].

While collecting data, one tends to see them as equal, of the same value and trust, but rarely is that true. The world and Internet are awash in data. The amount of information rises constantly, and this flood means more confusion. How to extract trusted, correct and useful information? This is a problem that needs permanent monitoring and troubleshooting.

7. Conclusions

The research didn't disprove the alternative hypothesis H_1: "There are MSEs that can form their infrastructure so that they are able to take advantage of big data in order to form their strategies of development and doing business". The research gave a lot of possibilities for MSEs to use big data.

This research disproved the hypothesis H_0 and has shown that there are some micro and small enterprises that can successfully use big data when certain conditions are met. Many MSEs just starts to use big data, data mining and cloud computing technology. Therefore it is very important task of ensure a high level of security for sensitive data.

Bearing in mind the whole analysis, one can certainly conclude that many managers in decision making prefer to work with small data and already proven tools, rather than to rely on the illusion obtained from complicated, often „black box", software tools and uncontrolled vast mass of data. And these managers can be right because, as Thomas claimed, it is proven that an analysis of a poll with the sample of 1,500 is enough precise to predict who will be a next president. A poll with the sample of 300 is sufficient to predict how much the whole population will like a new product or service. A sample of 200 users can test a new product in-home for a week, and from that it can be precisely determined whether it is optimal and what its market share will be.

But why do companies of all sizes intend to use big data? Today's data processing platforms allow to big data users tools to work with very different types of data easily, so MSEs don't need highly specialized staff. Working in the Cloud MSEs can obtain speed, capacities and scalability without big investments. Big data tools allow creating of dashboards that can visualize data in a friendly and appropriate way. Big data analytic tools are still not fully developed and that is a great new business opportunity for MSEs to participate in new tools creation. There are big expectations from new tools close to artificial intelligence, use of natural language, text mining etc. There is only one big data challenge: New people, data scientists.

When a company decides to go into the big data environment, it has to ask itself: Which is the right way to use big data? The answer can be in forming of business strategy, and then in starting to acquire data needed to support this strategy. And finally, for MSEs it is of crucial importance to start with small investments and to form scalable system that will satisfy MSEs' needs in every moment.

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