
Business Intelligence Systems

BUSINESS INTELLIGENCE AS A DECISION SUPPORT SYSTEM

Justyna Stasieńko

Abstract. Nowadays, we are bombarded with information which has an immense influence on our decisions. It is more and more difficult to use it effectively. BI systems are very helpful. They support enterprises while carrying analyses and conducting researches. They make it possible to reach unambiguous decisions in the right time, they minimize the costs and they also provide the opportunity to verify and correlate the decisions with the entire enterprise's strategy. BI Systems help to integrate and analyze the data coming from different sources and as a result they render it easier to reach decisions. This article presenting above issues aims at showing engines which have a positive influence on the management of information in different organizations.

Keywords: information, Business Intelligence, Management Information Systems, decision support

ACM Classification Keywords: K.6 MANAGEMENT OF COMPUTING AND INFORMATION SYSTEMS - K.6.0 General Economics

Introduction

Many organizations start to use IT applications in order to implement transaction systems supporting the current activity. As the organizations are in the constant process of development, the time is ripe for implementing integrated systems. The more data there is, the more difficult it is to keep it organized and coherent.

The automation of many processes makes gathering the data simple. The process of sorting them out, analyzing and making reports so that they can help us to make right decisions, especially strategic and long-term ones, is the most difficult task.

Nowadays, it is noticeable that our attitude towards the role and the meaning of information has changed. The information has been treated so far as a by-product or as a product common to some business processes carried out at a particular time. The information is now one of the most important constituent of organization. The information is a factor that increases our general knowledge about the surrounding reality [Flakiewicz, 2002] or a immaterial good, which along with the economic improvement and development of social communication becomes more and more important changing the structure of many traditionally organized economies in the world [Niedzielska, 2003].

The meaning of information in modern world should be analyzed in many aspects. We can even say that the information is a vehicle for each field of human's life. The increasing development of technology to large extent depends on the rapidity and quality of the information. The use of the information can tell us a lot about its quality. It should be easily accessible. The most characteristic features of a good solution, which fulfills the organization's needs of keeping and analyzing information, is the integration with computer science systems, the possibility of adjusting it to the organization's needs, distributing the protection on the organization scale and the opportunity to administer it via the Internet.

In theory, the information plays four roles: it supports the process of management, it enables the institution's members to communicate with each other, it enriches our general knowledge and establishes relations with the surroundings.

Currently, each organization has to deal with a vast amount of data coming from various databases. Starting with official information from sorted data sources to RSS channels the information is sent by electronic mail. The

excess of data, the lack of its coherence, as well as unclear and incomplete data makes it impossible to come to a decision. Each worker would like to have an access to the suitable information in the due time, analyze it and make reports which help us to keep up with the changing economic goals and use the tools which are helpful while making the right decisions. Unfortunately, the ERP systems existing in different organizations, data warehouses or any other systems do not provide the possibility of using the accessible information while reaching the decision. The effective decisions depend on if the events taking place inside and outside the organization would be interpreted properly. That is why, the search for and the improvement of methods and tools that streamline data processing, gathering and analyzing is so popular. Business Intelligence (BI) dating back to 90. provides the tools and technologies used for making reports and carrying out information either organized or unordered.

Business Intelligence is the most important point of contact between information technology and business which seems to be inevitable. BI environment combines the business's strategy with the strategic information and data with decisions.

In practice, BI systems are used with the aims of creating and improving the relationship with a customer, enhancing the effectiveness of management and the last one refers to the analysis and the correctness of operating efficiency.

The essence of Business Intelligence systems

The new quality in the conception of the management is Business Intelligence, which does not have commonly accepted polish equivalent. The term "intelligence" consists of many factors. We can enumerate the following: the knowledge about the market and the possibility of gaining and using it, the flexibility of adjusting the changes taking place on the market, realization of the organization's aims, the creativity and involvement of a particular organization's members. Business Intelligence is also associated with the slogan which reads: "The management of knowledge" because it is more and more popular to say that organizations based on knowledge are able to resist the growing competition on the global market. J.Surma in [Surma, 2009] quotes the following definition: "BI is defined as the process of gathering, exploring, interpreting and analyzing the data, focused mainly on its users, which leads to improvement and rationalizing the decision-making process." According to Howard from Gartner Group[6] BI is a group of conceptions and methods used for improving the decision making process by the use of Consulting Systems. Searchdatamanagement.bitpipe.com portal gives another definition which is: "Business intelligence (BI) is a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions. BI applications include the activities of decision support systems, query and reporting, online analytical processing (OLAP), statistical analysis, forecasting, and data mining." [1].

The origin of Business Intelligence dates back to the biblical times. Joseph, Jacob's son sold by his brothers to Egypt, was the only one who could interpret pharaoh's dream about 7 fertile and 7 infertile years that were drawing near. He could use his supernatural knowledge while interpreting the information on the basis of which pharaoh came to a decision of putting some crops aside during the fertile years as reserves of food for the infertile years. Without this information, the decision of gathering the food would have been unjustified. However, knowing the information, Egypt not only could wade through this situation but also made money from selling the food to its neighbors.

The conception of Business Intelligence is similar. In order to benefit from business, we should make strategic decisions based on analyzed information we have, which is not commonly known. The difference concerns only the data sources. For many years experience was the only source of information. Then its place was taken by mathematics, mathematical, statistical and economic models and currently also the Internet.

Along with the growth of the amount and the need for keeping and analyzing the stored data the quality of supporting and reaching decisions becomes more important. Today it is the main element in competition. It is possible to win for those who know more and as a result are able to make right decisions quickly. We can even say that, this is the end of era in which business was run by intuition. The revolution of computer systems has

started a new chapter of quick decisions made on the basis of the analysis of the stored data. That correlation between the data, information and decision shows Figure 1.

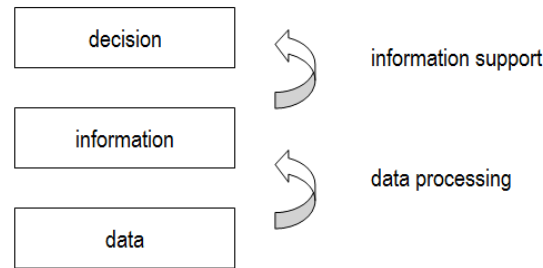


Figure 1. The correlation between the data, information and decisions. Source: Self-made research.

The main BI technologies

Business Intelligence applications aim at supporting the management of enterprise, its condition and efficiency, mainly by gathering, storing, making the data accessible managing the knowledge by using various analytical tools. In a word, they give the opportunity to look at the business as a whole and answer three main questions:

- What is the organization's situation like at the moment?
- Why is it happening so?
- What should be done to reach the goals?

The answers for these questions support the work of managers who are responsible for running the key areas of business.

Data Warehouses, Multidimensional Data, OLAP, Query and Reporting systems are basic constituents of Business Intelligence. Figure 2 shows the most common structure of BI.

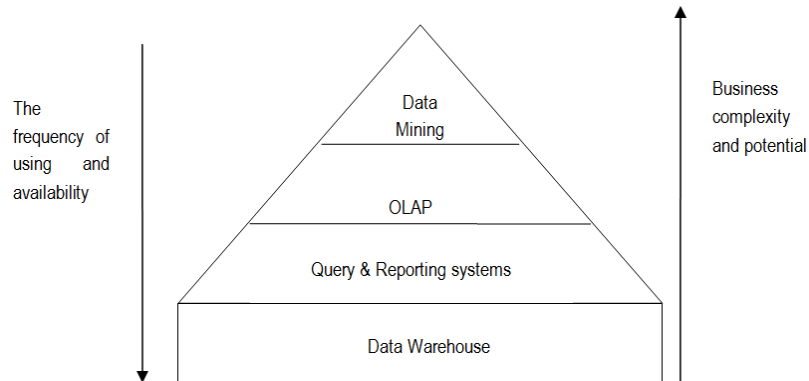


Figure 2. The structure of Business Intelligence. Source: [Januszewski, 2008, p.13]

Data Warehouse allows to sort out data gathered in the enterprise. It is the main source of information for the whole organization, the basics for analytical systems and the source of information that is necessary for reaching decisions in the organization. The data gathered in the organization is sorted out thematically, permanent, integrated and often redundant usually have time dimension.

Multidimensional databases refer to data that can be analyzed according to many criteria. For example, the size of sale can be analyzed according to the type of product, the region of sale or to a particular period of time.

The analysis of OLAP is a technology which allows to build multidimensional sets of data on the basis of information coming from data warehouse. As a result, the data help us to find the answer for some complex business questions. It is organized in such a way that makes it possible to look over and compare the data in many aspects. OLAP systems are responsible for presenting and delivering strategic information for managers.

Reporting engines are very simple and used often among others BI applications. They answer the users' questions e.g. What was the sale of a certain product in a particular period of time like, how many customers have purchased a particular product etc. Reports contain also some tables and charts.

The exploration of data is a process of discovering the correlation, models and tendencies among the vast amount of data. It is done by the means of techniques used for recognizing models, artificial intelligence (genetic algorithms, neural networks), statistical and mathematical methods. This process makes it possible to predict the future. The data is the knowledge essential for the organization [Twardowski, 2009].

The main source of data for BI systems is Online Transaction Processing (OTP) for example: ERP/MRP, CRM, SCM or call center. Sometimes the data is taken from Excel files, Access, e-mail programs or any other Internet services. The data, on the basis of which it is possible to make reports and analysis complete, has to be placed in one point (Data Warehouse).

BI systems are another generation of the computerized information systems of management, which are classified by high standards of decisions support [Gontarz, 2008]. Figure 3 shows the location of BI systems.

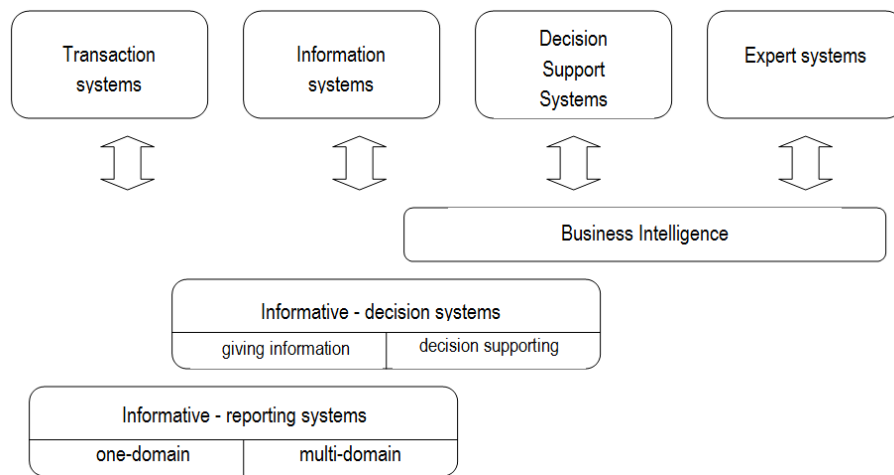


Figure 3. Management information systems. Source: [Niedzielska, 2003, p.55]

It is possible to distinguish within BI the following group of activities[6]: analytical (multidimensional-OLAP, business, geospatial), prognostic (supporting strategic decisions), monitoring and generating the knowledge, techniques used for presenting and visualizing or some more advanced techniques like preparing the balanced scorecard, managing the knowledge or implementing the enterprise's portal and others.

Business Intelligence – the manager's tool

BI systems support the decision-making process providing the access to the reliable information for the staff. The implementation of BI makes reaching the right, either operational and strategic decisions easier. It provides an easy access to necessary information for the users by means of the engines they use every day. It makes it possible to share the knowledge with other people, to cooperate on the whole enterprise scale and to increase its profits.

The effective planning, budgeting and forecasting decide about the organization's success. The planning, together with taking into consideration all elements that are being transformed, is the key and very often the most difficult process. Creating business models, compilation of budgets and plans has been a time-consuming process and it required handmade work. Computer scientists had to devote much time to try to adjust those applications to the organization's needs. Finally, the process of integrating the necessary data was completed by means of Microsoft Office Excel.

The functionality of BI application includes either scalable technological platform and some other applications supporting the decision making process designed for workers occupying all positions in the company. Apart from

the main components of BI systems we should enumerate these which implement various types of indicators, help to monitor the enterprise's results and determine its current condition or trends as well as key performance indicators. These are analyses, predicting analytics, scorecards and management dashboards.

The technologies of data exploration make it possible to use predictive analysis by means of processing data by using particular algorithms and carrying out statistical analyses. They allow to discover the most important possibilities and to draw conclusions – e.g. define market sections, reach decisions about carrying out economic analysis in order to estimate the probability of the rise in the sale of hot-dogs caused by the rise of promotion of crisps.

Finding the key data, which help to draw conclusions often requires looking over a vast amount of information. The scorecards and management dashboards render it easier to monitor the efficiency of work and show the enterprise's goals, its condition and also the trends in the form of accessible Key Performance Indicators (KPI). The management dashboard is a tool used in order to visualize the most important data clearly in the form of graphic index, charts and tables. Thanks to it, it is possible to put various data coming from different source on one screen. The management dashboard, available through a web browser constitutes an intuitive and flexible way of presenting the data. The scorecards provide rich graphic environment, in which all the Key Performance Indicators are organized according to the organization's aims and strategies. They show its current condition, plans and trends. They also help to adjust all workers to the organization's goals.

The only restriction of BI application is human's imagination, although it seems to cease to be a barrier.

The advantages of using BI depend to large extent on the skills and the possibility of using them effectively in the decision making process. We should bear in mind that BI technologies become useful while creating specialized business applications but they are not the means in itself. BI systems are most often used by mercantile firms, fuel concerns, means trade, administration, banking, telecommunication, controlling, real estates, power industry and insurances [Olszak, 2005].

The analyses offered by BI solutions in these lines of business bring significant business effects. Thanks to them it is possible to perform an analysis which supports the supplementing sale, segmentation and profiling the client, analysis of parameters validity, analysis of the length of client's survival period, analysis of the client's loyalty and joining their competitors, analysis and assessment of one's credit worthiness, detection of deceptions, logistic optimizations, prognostication of the development of strategic business processes, analysis and assessment of the functioning of the Internet services and their contents [Olszak, 2006].

According to the research made by press.teleinteractive.net, the advantages of implementing BI have been divided into two groups. The first group includes the advantages that can be measured such as: time saving (up to 60%), costs saving (38%), ROI (32%), new incomes (22%), total cost of ownership (21%) and shareholder's value (about 15%). The second group consists of the advantages that cannot be measured and these are better strategic planning (57%), better decision making (56%), the improvement of the efficiency of the processes (55%), value of the client's/deliverer's satisfaction (37%), and the increase of the workers' gratification (35%).

The reliable and up-to-date information concerning many aspects of the business activity run by a particular company give us better access to the company's activity and improvement of the decision making process. Readable and cross-sectional data about the company's activity help the managers to decide what measures should be taken in order to reach their business goals. The costs reduction of conducting the analysis is possible thanks to the use of intuitive business areas. The system is able to answer simple questions and use the drag&drop method to make reports. BI help also to save the time by the use of subscription and delivering the reports on time. In some alarming situations the system send the report with the information which is necessary to diagnose the problem and take indispensable actions. The scorecards verify the realization of the firm strategy. It is possible to read out the extent of the strategy realization and to trace the trends for each of the key performance indicators. BI systems help to enable us to plan and budget on the integrated Data Warehouse level. BI systems improve the company efficiency by means of data warehouses, the improvement of business processes and snatch so called "bottlenecks".

There are many BI systems existing on the market (Comarch Business Intelligence, SAS Business Intelligence, Oracle Business Intelligence Standard Edition One, Cognos 8 Business Intelligence, PROPHIX, Qlik View). These systems, apart from Qlik View, perform the same roles. Qlik View start to became the next cell evolving in BI systems.

An ideal situation is when each worker can see their decisions in the context of the whole organization's activity and when each decision is consistent with its goals and strategy.

BI is one of the elements in the process of extending availability and function of computerized systems which support decision-making process [Twardowski, 2008]. These systems are different from the past models because of the technology and the way of reaching decisions. The changes taking place in the field of technology refer mainly to Data Warehouse, advanced analytical techniques, and techniques used for data visualization. The integration of these solutions creates an intelligent environment for taking decisions.

Broader and broader use of BI application brings different point of view on the problems connected with reaching decisions, looking for new solutions and the need for new equipment and technologies. The next step in the development of BI is the improvement of prognostic engines and equipment. By means of gathering and standardizing the data from many sources, BI tools help to analyze the trends and predict the changes. They make it possible to carry out a cross-section analysis through different departments, products and clients. This analysis helps to make a statement about the level of development, condition and the direction in which a particular organization is heading for. The next move is to reach decision which can be sometimes difficult. A great volume of reports, the excess of data, a vast amount of possible answers, the complexity of decision-making process and the level of complication slow down the process. BI systems should help to reach good decisions which are connected with a particular set of features related to them. Such decision should be unambiguous, taken in the right time and based on gathered information. Each choice should be explained if the effects are consistent with the assumptions accepted at the moment of taking decision. The costs of these processes should be adequate to their consequences in case of making wrong decisions.

BI systems support the business process in its key moments and minimize the risk taken by the organization on operational and strategic level. The use of BI solutions while supporting decisions reaching process makes it possible to introduce the high level of automation of the systems in which workers' participation is very important. It should be stressed that the human indicator is the main element of creating the operational risk in the context of decisions which are taken and mistakes which are made. Getting rid of it makes it possible to increase the volume of decisions that we make use of and minimize the risk of making errors and the costs connected with the operational use of data. BI solutions make the decision making process automated. They work effectively in the environment in which the goal of the function is complex and consists of many criteria. The conclusion is that it is possible to polish the business application up in order to preserve an individual attitude towards the client while increasing the amount of the decisions that are taken and making the business system automated. Such relations with the customers help to build unique bonds that bring profits and give us advantage over our competitors.

The new generation of BI applications

At first BI systems were reserved only for supporting tactical and strategic decisions while creating and developing products, the management of finances and the processes' efficiency. The goal of new generation of BI applications is to make accessible the information which is necessary to take decisions on the operational level. They are also designed for these employees who realize the operational processes based on decisional rules and those using technology of adaptive recognition of patterns. This technology uses neural networks and the learning mechanisms which carry out the prognostic analysis. It makes it possible to personalize the current operational activity of the organization. BI application play a very important role while supporting the employees who stay in touch with the customers.

The second tendency in the development of informative and operational systems is the use of the Internet technologies and setting the BI applications in the corporate intranet, especially while presenting and making it accessible.

The basic elements of BI systems of new generation are Enterprise Information Portals. They constitute informative and application platform which is responsible for presenting the results of analyses and supporting the workers. Www website makes many data and information about the enterprise and its surrounding accessible. The goal of new generation of BI applications is to get information from the network. It requires new, "intelligent" mechanism of searching and selecting the information which is important for the decision making process. It is tried to be done by the means of Artificial Intelligence – intelligent agents. The assumption of BI applications is individualization of the knowledge for people making decisions, creating the electronic marketplaces and new branches in the decision making process and also the recognition of new skills important for the workers' knowledge.

Another important change takes place in the OLAP tools which have been very successful on the market. These multidimensional data bases have made it possible to analyse the data from different perspectives. For many years OLAP have seemed to be the only possible and good solution. However, we have to bear in mind that creating it is one of the most time-consuming design stage of implementing BI systems. The first stage of the implementation should predict and include all questions for which the users may want to have an answer in the future. It is a very difficult task especially when the enterprises reorganize themselves and then it may happen that implemented BI solution does not suit to the new strategy.

The current economic crisis and the necessity of getting savings have changed the way we look at BI systems. As a result many new modified BI systems have been created – analytic tools of new generation working without OLAP applications and calculating in their own operational memory. The implementation of such tools takes only few weeks and do not require proportionate lower expenditure. The most modern analytic tool existing without OLAP applications is Qlik View. It does not require complicated equipment and is able to integrate itself with other systems, such as ERP and CRM. As a result the time of implementation is shortened and the data is analysed in the operational memory.

Conclusion

The development and implementation of BI solution require the changes in the organization itself. It is difficult to differentiate between the benefits resulting from implementing analytic applications and data bases and the effects of the organizational changes accompanying the implementation of computerized solutions. The direct connection between the decision and the result of using BI systems hardly ever exists in the decision making process. It should be emphasized that the impact which BI solutions have on the quality of the decisions that are made should be considered in long-term perspective. While talking about benefits we should pay our attention to their quality rather than quantity.

BI systems give the possibility of increasing the competition on the market and taking proper and quick decisions. The solutions of a particular form help also to expand the functional possibilities of ERP forms that have been used so far and CRM systems. BI systems help also to combine the initiative connected the enterprise's future with the branch of conducted business activity in order to understand and sort out the data in such a way that helps the managers to receive the crucial information in the due time and as a result increase the enterprise's efficiency.

BI systems use regression analysis, decision trees, neural networks and other artificial intelligence tools for data mining.

Created prognostic analysis systems are able to learn the rules based on the existing data whose role is to look for the connection between the data and the later behaviour. The modules of knowledge management in organization are more often included in BI applications. It is noticeable that the knowledge and the information have been spread among the large group of employees in a readable form by the means of visual techniques. The effect is the integration of information which is not structural.

Nowadays, the attitude toward BI changes in many organizations. It is the end of era in which the business is run by intuition. The organizations which are going to be successful are those which will be able to manage the information and use it in the decision making process.

Bibliography

- [Dudycz, 2004] Dudycz H. Przetwarzanie analityczne podstawą rozwiązań informatycznych klasy Business Intelligence. Materiały konferencyjne SWO, Katowice, 2004. http://www.swo.ae.katowice.pl/_pdf/138.pdf
- [Flakiewicz, 2002] Flakiewicz W. Systemy informacyjne w zarządzaniu (uwarunkowania, technologie, rodzaje). Wydawnictwo C.H.Beck, Warszawa, 2002.
- [Gontarz, 2008] Gontarz A. Zintegrowany ogląd. ComputerWorld nr 35/829, 2008.
- [Januszewski, 2008] Januszewski A. Funkcjonalność Informatycznych Systemów Zarządzania, t.2 Systemy Business Intelligence, PWN, Warszawa, 2008.
- [Matouk, 2004] Matouk K., Owoc M. Rola integracyjno-kooperacyjna business intelligence w systemach informatycznych zarządzania. Materiały konferencyjne SWO, Katowice, 2004. http://www.swo.ae.katowice.pl/_pdf/142.pdf
- [Niedzielska, 2003] Niedzielska E.(red.). Informatyka ekonomiczna. Wydawnictwo Akademii Ekonomicznej we Wrocławiu, Wrocław, 2003.
- [Nycz, 2008] Nycz M., Smok B. Business Intelligence w zarządzaniu. Materiały konferencyjne SWO, Katowice, 2008. http://www.swo.ae.katowice.pl/_pdf/421.pdf
- [Olszak, 2007] Olszak C. M., Ziemia E.: Approach to Building and Implementing Business Intelligence Systems. In: Interdisciplinary Journal of Information, Knowledge, and Management. Informing Science Institute. Santa Rosa. USA. Volume 2, 2007. <http://ijikm.org/Volume2/IJKMv2p135-148Olszak184.pdf>
- [Olszak, 2006] Olszak C., Ziemia E.: Systemy Business Intelligence w rozwoju holistycznej infrastruktury wspomagającej podejmowanie decyzji w organizacji. W: "Roczniki, Kolegium Analiz Ekonomicznych", nr 16. Pr. zb. pod red. J. Golińskiego, A. Kobylińskiego, A. Nowickiego. SGH. Warszawa, 2006. <http://www.ae.katowice.pl/images/user/File/katedra%20informatyki%20ekonomicznej/NTIE2006-Olszak-Ziemia.pdf>
- [Olszak, 2004] Olszak C. Systemy Business Intelligence we wspomaganii decyzji zarządczych organizacji. W: Komputerowo zintegrowane zarządzanie. Praca pod redakcją R. Knosali. WNT, Warszawa, 2004, s. 241-248.
- [Olszak, 2005] Olszak C. Wspomaganie decyzji w erze informacji i wiedzy. W: Systemy wspomaganie organizacji. Praca zbiorowa pod redakcją H. Sroki i T. Porębskiej-Miącz. AE, Katowice, 2005, s.346-353.
- [Stefanów, 2009] Stefanów P., Zając A., Kajrunajtyś D., Kuraś M. Narzędzie zarządzania. Raport Specjalny Business Intelligence, ComputerWorld nr 09/848, 2009.
- [Surma, 2007] Surma J. Wsparcie strategicznych decyzji zarządczych z wykorzystaniem Business Intelligence. Innowacyjne Aspekty Strategii Przedsiębiorstwa pod red. Lidii Nowak. Politechnika Częstochowska, Częstochowa, 2007. <http://www.surma.edu.pl/wp-content/czestochowa-jerzy-surma-2007.pdf>
- [Surma 2009] Surma J. Business Intelligence – Systemy Wspomaganie Decyzji Biznesowych, PWN, Warszawa, 2009.
- [Twardowski, 2008] Twardowski Z., Stanek S.: W poszukiwaniu efektu synergii. Raport Specjalny ComputerWorld Systemy ERP/BI grudzień, 2008.
- [Twardowski, 2009] Twardowski Z., Stanek S.: Miedzy możliwościami a efektami. Raport Specjalny Business Intelligence, ComputerWorld nr 09/848, 2009.

Net

- http://searchdatamanagement.techtarget.com/sDefinition/0,,sid91_gci213571,00.html [10.08.2009]
- <http://accre.pl/index.php?solution/businessintelligence/narzedzia> [10.08.2009]
- <http://www.businessintelligence.com/> [09.07.2009]
- http://www.comarch.pl/pl/industries/smb/offer/produkty/cdn_xl/zarzadzanie [10.08.2009]
- http://www.erp-view.pl/business_intelligence/bi_government.html [09.07.2009]
- <http://www.informationbuilders.com/new/magazine/v11-2/pdf/DRESNERI.PDF> [05.05.2010]
- [Kwasek, 2009] Kwasek A.: Zarządzanie wiedzą w organizacji: Business Intelligence; http://www.wsz-pou.edu.pl/biuletyn/?p=&p=&strona=biul_kwas14&nr=14 [10.09.2009]

Authors' Information



Justyna Stasińska – PhD, lecturer, The Institute of Technical Engineering, The Bronisław Markiewicz State School of Higher Vocational Education, Czarnieckiego Street 16, 37-500 Jarosław, Poland; e-mail: justyna.stasienko@pwszjar.edu.pl

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