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NEW GENERATION OF ANALYTICAL TOOLS

The market of business intelligence systems is one of the most dynamic sections of software industry. The previous analytical solutions based on OLAP turned out not to be the only available and quickest ones. The aim of this article is to look through traditional methods of analyzing and presenting new technology — existing since 2008 — the so-called BI in-memory. This technology makes it possible to manage information in such a way as in human brain. The software, which is perceived in this field as being innovative, is QlikView by QlikTech.
Keywords: business intelligence systems; OLAP; data mining; BI in-memory.

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НОВЕ ПОКОЛІННЯ АНАЛІТИЧНОГО ІНСТРУМЕНТАРІЮ

У статті показано, що ринок аналітичних систем для бізнесу розвивається найдинамічніше з усіх секторів галузі програмного забезпечення. Аналітичні розробки попереднього покоління на основі OLAP виявились недостатньо доступними та швидкими. Зроблено огляд традиційних методів аналітики та представлення відносно нової технології, що існує з 2008 р., — т.зв. BI in-memory. Дана технологія дозволяє управляти інформацією аналогічно тому, як це відбувається у людському мозку. Найбільш інноваційним продуктом даної лінії можна вважати QlikView від QlikTech.
Ключові слова: системи бізнес-аналітики, OLAP, збирання та аналіз даних, BI in-memory.
Рис. 3. Табл. 1. Літ. 19.

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НОВОЕ ПОКОЛЕНИЕ АНАЛИТИЧЕСКОГО ИНСТРУМЕНТАРИЯ

В статье показано, что рынок аналитических систем для бизнеса — самый динамично развивающийся сектор во всей отрасли программного обеспечения. Аналитические разработки предыдущего поколения на основе OLAP оказались не самыми доступными и недостаточно быстрыми. Сделан обзор традиционных методов аналитики и представление относительно новой технологии, существующей с 2008 г., — т.н. BI in-memory. Данная технология позволяет управлять информацией аналогично тому, как это происходит в человеческом мозге. Самым инновационным продуктом данной линии можно считать QlikView от QlikTech.
Ключевые слова: системы бизнес-аналитики, OLAP, сбор и анализ данных, BI in-memory.

Tools for data analyzing. While taking an important decision each of us tries to analyze a problematic situation from different perspectives. In case of small amount of data it is enough to use just a sheet of paper. However, when it refers to vast amount of data it involves several analytical systems. The analytical system is an interactive system which possesses procedures and mechanisms to support managers in analyses. The best way to achieve it is to design short, usually one-page scorecard or a personalized portal. An analytical system has to provide a possibility of making particular areas of a report more detailed or carrying out more detailed analysis. The report generator is a programming language known as a report-building program on the basis of analysis and databases. It provides many possibilities of constructing the reports position. It makes it possible to define columns that are to be available in the report. It takes place

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in a special application in which we are informed about the existing reports and we are able to add new ones, modify or delete them. There are many functions in different applications used for generating reports according to certain patterns. These functions are also used to search for reports' definitions, for example, according to the time of their formation, the type or their activation. As a result of activating a certain template we receive a report containing a particular set of information. ERP systems and financial accounting systems are another kind of analytical tools. The data collected with the help of these tools are usually detailed whereas what is expected by managers is the aggregate information. The generated data are characterized by reporting. It is not effective for review analysis. The form of the data accessible within these systems is usually characterized by the limited extent. The access to archival data is also limited because in order to maintain the satisfying level of OLTP productivity the historical data must be deleted recurrently. In the second half of 90s it was realized that the data stored in databases of a given field's system were not convenient for analysts responsible for evaluating the financial condition of a company. The solution to this problem was to introduce analytical techniques executed within spreadsheet.

Spreadsheets are often used for processing and analysing the data. It offers some flexibility as far as definition of analysis' conditions and the possibility of easy handling are concerned. The complications appear in case of vast amount of data or the complexity of a model. The wide scheme of processing based on various macrocommands and spreadsheet must be created in order to receive analytical flexibility. Such solutions may cause some difficulties related to management of data processing and at the same time it is prone to users' mistakes. The spreadsheets' capacity of data is limited and consequently it eliminates their usefulness for analysis of the vast amount of data. This procedure consists of two steps: preparing the initial reports from the relational database into text files and importing them into a spreadsheet which has many functions referring to finances, economics, econometrics, statistics as well as Visual Basic programming language. The possibility of writing not only the macrolanguage but also all the programs in the form of procedures and functions resulted in programming any analytical aspects connected with data processing. In order to achieve the desired flexibility a broad scheme of processing has to be created, usually based on a couple of macrocommands and sheets. Nevertheless, such solution creates some difficulties in management of data processing and as a result it is prone to users' mistakes. Sheets have also the restricted capacity for the data which eliminates their usefulness for the analysis of the vast amount of data.

As information systems were developing, BI systems appeared and became the tools used by managers responsible for analysis and strategy. BI systems generate standard reports or calculate key performance indicators on the basis of which hypothesis are made and verified through production of detailed data reviews. Each BI system consists of 4 basic elements: the tools used for extracting and sending data; data warehouses, analytical tools that give access to information and make it possible to analyse and share it. The presentation layer, which conveys information for a user in the most convenient form, is also included. Analytical tools used in BI are, for example data mining and OLAP (on-line analytical processing), HOLAP, MOLAP and ROLAP.

Data exploration makes it possible to use predictive analysis through data processing using various algorithms and carrying out statistical analysis. It helps to dis-

cover the most important possibilities for an enterprise and draw the right conclusions. The analytical tools based on OLAP cubes were appreciated until 2008 and the data analysis from various perspectives was possible through the mediation of OLAP. For many years they seemed to be the only advisable technology although the process of creating them is extremely time consuming. It is so because all the possible questions that a user may be interested in should be predicted at the first phase of this process. It is very difficult especially for organizations which are being overhauled. It may even happen that at the end of the implementation it will turn out that BI solution is not suitable for a new strategy.

The data-mining tool being used most often is STATISTICA. It is a universal and integrated system for statistical data analysis. This software includes not only statistical and graphic data but also versatile tools for analyzing and visualizing (e.g. for social, biomedical or technical research). Another type of tools aiming to analyze vast amount of data transformed into information and then into data are BI systems.

The Essence of Business Intelligence. The origin of business intelligence dates back to 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 on gathering the food would have been unjustified. However, knowing this information, Egypt not only could wade through this situation but also made money from selling food to its neighbors.

The conception of business intelligence is similar. In order to benefit from business, we should make strategic decisions basing on the 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.

The necessity of gaining knowledge and the ability to make right decisions are indispensable while developing a business activity because of the growing number of data, the influx of information, fast communication via the Internet and new requirements of the market, which are becoming more and more complicated. Computerised solutions existing in many enterprises play different roles supporting, for example, administration or management but unfortunately they have limitations. It can be noticeable especially while processing vast amount of various data and using information in many fields. BI solutions are created to provide tools that can satisfy analytical and information needs. Nowadays, BI is the most important and inevitable interface between IT and business. BI tools provide easy access to information, its

analysis and sharing within an organization and its business environment. They also make it possible to integrate and analyse data from the business viewpoint. The aim of BI is to support effective management of a company and to plan business through procurement of the proper data. In addition, they support the work of those who administer the main areas of an enterprise. BI tools can be identified as a computerised support for decision-makers in their everyday activities. In general, they may be presented as a process of converting data into information and then information into knowledge in order to increase competitiveness of an enterprise. This group contains either the systems responsible for data managing, the systems of reporting and analysis and also the solutions that help to control productivity. J. Surma [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 [Netografia 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: "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" [Netografia 5].

Nowadays, the notion of BI is overused in marketing by producers of business information systems. Nevertheless, these systems should not be treated only as nice and aesthetic charts presenting the parameters of an enterprise's functioning. Data warehouses, multidimensional data, OLAP, query and reporting systems are basic constituents of business intelligence [Stasienko, 2009]. Data exploration is the process of discovering correlation, models and tendencies among vast amount of data. It is done by 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.

BI unites in a company's finances, production, storing, logistics, shopping, sales, HR, planning, strategy etc. so it combines almost all the aspects of a company's functioning. That is why BI uses the common information repository − data warehouse. ETL processes store all the facts from different systems into DSA − data staging area of data warehouse. This information is used by the second part of BI system which converts this information into knowledge and makes it accessible for a user through the presentation layer. As a result, BI systems support managers effectively and make it possible to build for example "what-if" analysis, budgets and controlling systems. There is a wide range of tools supporting the process of converting information into knowledge. This group includes, for example, expert systems, artificial neural networks, fuzzy logic as well as statistical and econometrical methods. All these elements, when combined together, create business intelligence.

At the beginning BI systems were reserved only for supporting strategic and tactical decisions while producing and developing goods, managing finances and processes' efficiency.

BI applications of a new generation aim at making information necessary for operational decisions available. They are meant for the workers responsible for operational processes based on decisional rules and using a technology adaptive identifying the models. This technology uses neural networks with mechanisms of learning which are responsible carrying out the prognostic analysis regularly. It also makes it possible to personalize a company's operational process being used at the moment. BI tools play an important role in supporting employees who stay in direct touch with customers. The contemporary BI system being accessible is Google service. Its task is to go through the Internet resources and make the information concerning these resources available. "Google Intelligence" identifies the type of the Internet services' contents. It classifies and determines its attractiveness for people looking for information. It is also able to associate facts, subjects, similar meanings of single words or longer phrases. It can also look for the information in other languages than the given question. In addition, Google can interpret the user' questions. For example, if we enter a text as: $4 \times 5 - 5 =$ Google would calculate it and would not search for websites. If we enter 164 cm in inches Google would present the result in inches. The same would be for currencies and exchange rate. The essence of BI system is that it aims at interpreting a question and providing an answer even if a question is not precise enough.

QRAP (query, reporting, analysis, publishing) is a class of the systems implementing BI solutions. This group of applications was created in order to prepare business reports. The main advantage of QRAP is the possibility of using different data sources which as a result make it possible for them to support other systems and their analytical and reporting abilities. This trend is the result of changes of managers' needs.

Nowadays, people responsible for company management should decide about strategies and interfere in decisional processes only in exceptional situations. On the other hand, a computing system must monitor the current state of affairs and show all the abnormalities through short reports, e-mails or SMSes. The systems, which are designed properly, may also support managers out of company via the Internet, WAP etc.

BI in-memory. BI systems and their market develop rapidly. They are crucial in the process of supporting analyse, reports and managers' decisions. Clients have rising demands, they require to receive such tools that are capable of analyzing vast amount of data immediately. In-memory technology, invented in 2007, proves to be helpful in loading and data processing in operational memory. As a result, analytical solutions can be used faster than any other traditional applications. BI architecture is influenced by the use of operational memory in the process of analyzing and making reports.

It reduces the need of building relational databases and the use of OLAP. In-memory technology is cheaper since it does not require changes of equipment and more reliable as far as the number of successful implementations is concerned. The only significant restriction can be expensive memory and as a result high costs of data loading. In this technology there is no need to build data warehouse and the old OLAP technology such as the number of dimensions being simultaneously analyzed, are eliminated. The process of implementing such tools takes usually a few weeks and

costs less. Requirements connected with equipment are also lower than traditional BI ones. After fetching and compressing the data it is being analyzed in the operational memory. In addition, the new technology may contribute to popularization of analytical tools among small and medium enterprises that cannot afford BI applications. Lower requirements in competence of SQL, database, data warehouse and of the software language are big advantages especially for small and medium enterprises which have no IT experts. The most crucial disadvantages are expensive memory and as a result the cost of loading the retail data.

1. QlikView — the new generation of BI. QlikView is the leader in the new generation of BI tools. It is flexible enough to be profitable for every organization. This software is appreciated by those in a company who are responsible for the data. In comparison to other analytical tools like MS Excel, MS Access or even BI based on OLAP, QlikView application presents the analyzed data in a simple and fast way. It is illustrated by Fig. 1a and 1b which present average income. QlikView makes it possible to impose criteria on the data by clicking, to go back to previous data or to add other criteria (Fig. 2a and 2b). QlikView is a modern and extremely efficient application because of its simplicity in use, the impressive interface, the time of delivering new analysis unattainable for other solutions, computing power and flexibility. Software flexibility means the lack of restrictions concerning the number of dimensions and measures. The software power is connected with an instant system reaction to queries even in the case of databases including about half a billion of records. It also enables a user to move on to the level of a single transaction.

The analyses in QlikView can be moved to another computer still remaining totally functional. The results can be printed in the form of reports, exported to MS Excel or saved in PDF. QlikView enables a user to integrate all the data formats — from standard relational data to texts reports, data from Excel and XML.

To sum up, Table 1 presents the differences between traditional BI systems and BI in-memory, e.g., QlikView.

Nowadays the new version of QlikView is available (QlikView 10). The implementation of software in any platform is a novelty. It can be done locally, in cloud computing and with the use of mobile devices. Amazon Elastic Computer Cloud (EC2) mediates in cloud computing. It possesses giantic analytical power that allows processing vast amount of data with access to details. It is not restricted by the number of dimensions, time of implementation is expressed in weeks, and changes in designed applications can be carried out quickly and it does not require any advanced software knowledge. There are more and more applications based on QlikView. Many companies try to use analytical tools within their structures. Among such companies existing in Poland we can distinguish, for example, Dukato which specializes in distribution of alcoholic and non-alcoholic beverages, EGIS Poland — the drug distributor and Antalis Poland — the paper distributor.

Among many other software based on this new technology there are for example such applications as Kick IT & Qlik IT generated by QlikTech. This application is the example of BI in-memory mobility and the possibility of processing vast amount of data. It also gives answers to questions connected with football and it allows to make comparison with clicking and dragging.
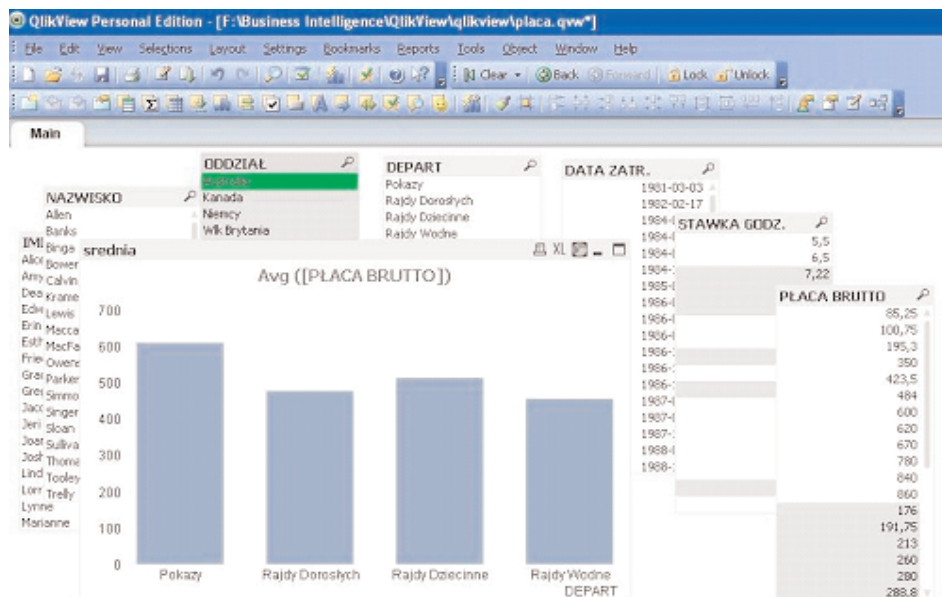
a) in Qlik View application
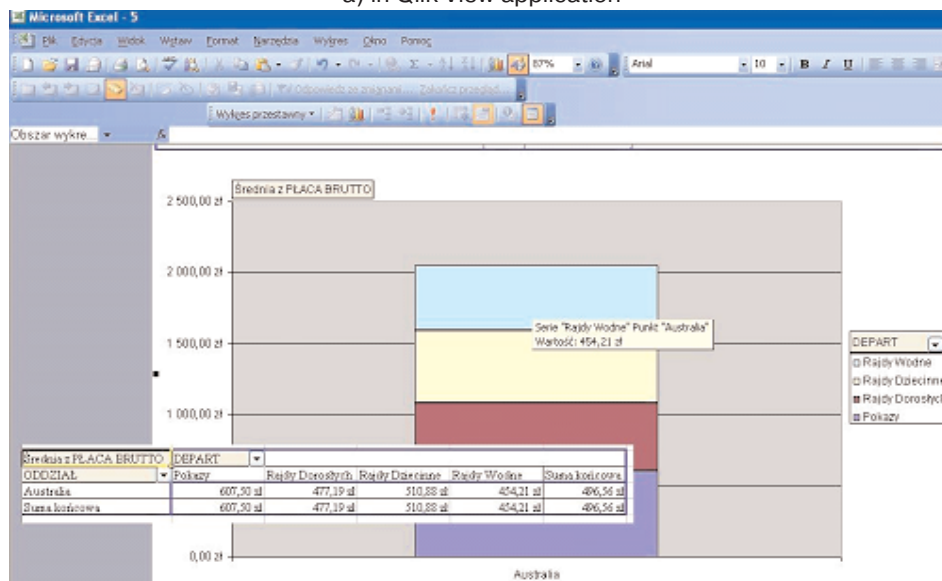
b) in MS Excel

Figure 1. **The data analysis connected with the account
of an average gross profits in "Australia" section**
Source: Authors' research

Kick IT & Qlik IT application is the example of mobility of BI in-memory and the possibility of operating on the vast amount of data. This application provides answers to the questions connected with football and allows making comparison by clicking. Fans have an unlimited access to the statistics concerning the World Cup.

This application, available on-line, helps football fans go through more than 80 years of World Cup history in order to analyze historic data, get to know interesting facts and monitor World Cup2010 taking place in RPA, where the data were analyzed every hour from June to July (Fig. 3).
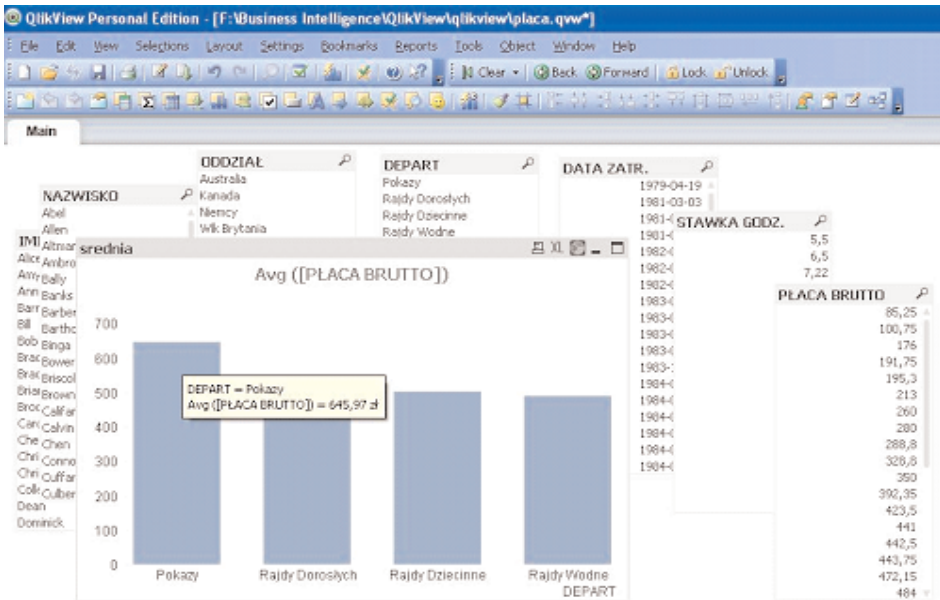
a) in all sections and departments
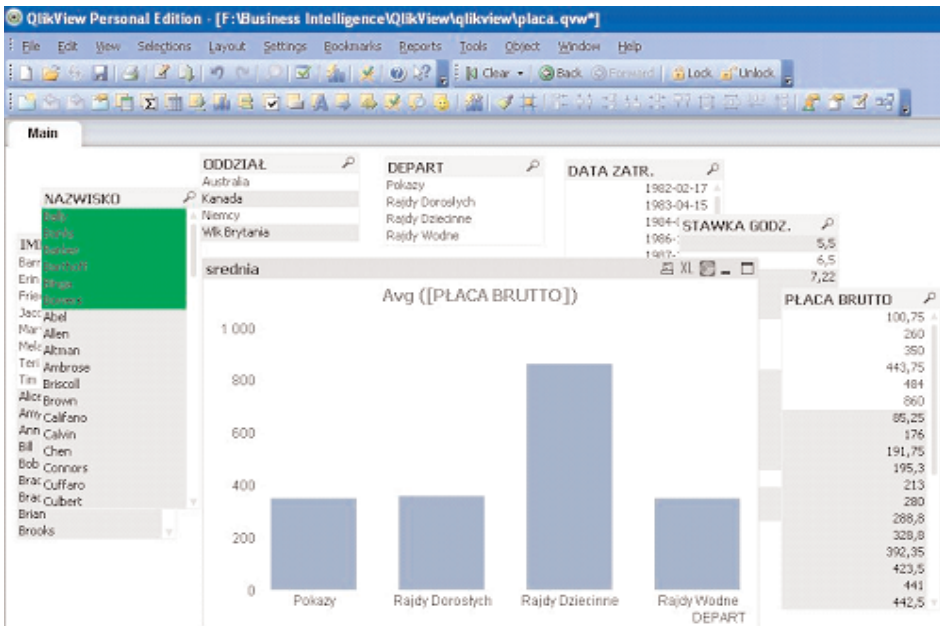
b) in all sections and departments but only for the workers marked in grey color
Figure 2. **The average gross profit for workers**
Source: Authors' research

Table 1. **Differences between traditional BI systems and BI in-memory (QlikView)**

Traditional BI	QlikView
Lots of tools: data warehouse and data marts; OLAP; query and reporting tools; data mining	Simple architectural premise – all data should be held in memory
Presentation techniques (dashboard; scorecards; reports)	Presentation technique (charts)
Multiple vendors	One vendor
IT driver	End user driver
Longer time of implementation (about 18 months)	Short time of implementation (few weeks)
High costs of implementation	Low costs of implementation
Slow payoff	Quick payoff
Less convenient and flexible for users	Easy to use, flexible
Time-consuming calculations	Fast query and on demand calculation engine (unlimited number of dimensions ad measures possible to be changed in a few minutes)

Source: Authors' research.

Figure 3. **The main page of Kick IT & Qlik IT**
Source: Authors' research

Other applications of this type are QlikView App an GlobalWaterViews. The first one gives information for cycling fans about Tour the France races for analyzing the data by many dimensions such as year, country, rider, team, yerseys etc. The second one provides the analysis concerning the world's clean water crisis.

Conclusion. The most important aspects for business analytics in the nearest future will be simplicity, coherence, social attitude and effective strategic accomplishment. The traditional BI systems have integrated analytical backgrounds which contain advanced tools used for visualization and graphic presentation of data. They provide the users' independence by the use of reports defined previously and the possibility of making analyses on demand.

The newest analytical tools have lower requirements to equipment, they do not need OLAP cubes, they integrate directly with external systems (ERP, CRM etc.) and that is why the time of implementation is expressed in weeks and not in months. The

data after being loaded and compressed are analysed in operational memory. Even the most complicated calculations are made quickly and the time of waiting for an answer is all-time-low (expressed even in seconds) even in case of the data including billion records. It is a breakthrough as far as analytical tools and BI are concerned. Soon it will dominate the market.

They provide access to the information required in overviews, whereas the advantages of BI in-memory are as following:
- accessibility of data, analyses;
- easy to use;
- powerful;
- flexible;
- scalable.

In BI in-memory systems the process of business decisions-making is based on current and reliable information. Access to stored information is immediate and it is presented in a clear form for analyses and reports. As a result, data organization at an enterprise is improved. What is more, protection and control of access to strategic resources of an enterprise is provided. It contributes to identification of lacks in data and lack of managerial information. The new technology makes it possible to react quickly to various analytical needs of consumers.

The last year crisis had a positive result on the technology of business analytics among companies as a tool increasing company's efficiency and reducing expenses. As a result, rapid development of this area of IT business is expected. Using dashboards enables presenting the results of analysis in a graphic form. That is why, BI technologies become more and more convenient for an ordinary user in a company and accessible for higher number of departments in a company in the nearest future.

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