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ANALYSIS OF INFORMATION SYSTEMS IN POLISH COMPANIES AND THE REALIZATION OF THE BUSINESS INTELLIGENCE CONCEPT

Abstract: A management staff's need to gain necessary information in a certain period of time, in order to make the best decisions requires employing analytical applications of data processing based on a data warehouse. The architecture of an information system which contains the above-mentioned software allows the realization of the Business Intelligence (BI) concept. The aim of the following article is to analyze the state of implementation of information technology solutions which enable the multidimensional analysis of data in selected Polish companies in order to identify the possibilities of implementing the BI concept. Firstly, four interpretational approaches of implementing the BI concept are presented in order to guarantee the clarity of the deliberations. Subsequently the information technology solutions essential to the BI concept are discussed. An analysis of the results of the study conducted in Polish companies concludes the article and regards the implementation of transaction processing systems which operate the basic range of activity of the examined companies, data warehouses, analytical tools and corporate portal concerning the realization of the BI concept within them.

1. Introduction

Over the last decades information technology has tried to support every possible range of business activity of a given company¹. They use variety transaction processing systems such as ERP orientated at creating proper data lists and preparing reports correctly. These applications allow to generate many standard reports, however, they do not simplify the search for the answers to various, unusual questions concerning the economic domain for the management staff. Making

¹ It is especially noticeable in the last two decades in which we have a significant increase of capital expenditures on information technology solutions. For example, in American companies in the 60s they only made up 5% and by the end of the 80s already 15%, in the middle of the 90s 30%, reaching 50% by the end of the 90s [Carr 2004]. The worldwide value of the market of the ERP class system in 2006 amounted to 28.3 billion USD [Maciejewska 2007b, p. 10].

the right decision often requires the dynamic monitoring of the company's activity, executing multidimensional data analysis (also coming from many years before) and generating reports on demand. This is why companies which wish to survive on the ever-changing and competitive market, have to obtain necessary information coming from organisation and its environment, to process it and distribute it among the employees. This is often linked to the necessity of implementing information technology solutions, which increase the integration of the transaction-based systems with analytical systems and also cause the increase in support of the decision-makers in the decision-making process. The available modern information technologies meet the challenge of supplying not only data, but information, which has been correctly processed and passed on to the recipient in the clearest possible way.

One of the suggestions, which was developed as an answer to the management staff's needs, is a solution that is based on the BI concept, which is to guarantee that important information is passed on to the right decision-makers in due time in order to make the best possible decisions for the company. In Gartner's EXP 2006 CIO Survey, BI solution was ranked as the highest technology priority among CIOs (see [Ruddy 2006]). According to Forrester Research, business intelligence software is one of the leading technology growth areas in the US, with a projected 2006 increasing rate of seven percent (see [Weitzman and Wu 2007]). An increase in the tendency to implement BI systems has also been noticed among Polish companies. According to PMR Research (and also IDC) the value of the Polish BI market in 2005 amounted to 47 million USD (see [Maciejewski 2007a, p. 11]).

2. Concepts of business intelligence

In both literature and economic practice variety interpretations of the term "business intelligence" can be found. Despite the fact that the term was first used by H. Dresner from the Garter Group in 1989 in reference to the already developing new class of information systems (see [Ufford van 2002]), discussions about the concept and meaning of business intelligence continue. Selected BI definitions have been presented in Table 1.

Whilst analyzing the BI definitions four basic approaches to the concept can be noticed where it is interpreted as:

1) a management concept which goal is to assure that the managers obtain information of appropriate quality and in due time²,

2) an information technology solution which means dedicated applications allowing an advanced analysis of data (queries, reports, analysis),

3) a system architecture comprising, first of all, data warehouses, query and report tools, online analytical processing, statistical analysis and data mining,

² A wide review of the concept is presented in work [Przegląd popularnych koncepcji zarządzania 2001].

Table 1. A review of variety definitions of business intelligence

Author/Source	Description
Biere M. (2003)	Business intelligence is the conscious, methodical transformation of data from any and all data sources into new forms to provide information that is business driven and results oriented.
Gray P. (2003)	Business intelligence systems combine data gathering, data storage, and knowledge management with analytical tools to present complex corporate and competitive information to planners and decision makers. The objective is to improve the timeliness and quality of the input to the decision process.
Haskimi N. (2000)	Business intelligence describe a set of concepts and methodologies designed to improve decision-making in business through the use of facts and facts-based systems.
Jagielska I., Darke P., Zagari G. (2003)	Business intelligence system is a combination of data and information, processes, tools and technologies that provide decision-makers with business insight or intelligence, and which allow them to develop processes and make strategic decisions in an effort to make their organization more effective and/or profitable.
Moss L., Atre S. (2003)	Business intelligence is an architecture and a collection of integrated operational as well as decision-support applications and databases that provide the business community easy access to business data.
Oracle (2007)	Oracle business intelligence is a portfolio of technology and applications that provides the industry's first integrated, end-to-end Enterprise Performance Management System, including category-leading financial performance management applications, operational business intelligence applications, business intelligence foundation and tools, and data warehousing.
Rossetti L. (2006)	Business intelligence 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.
Savioz P.(2004)	Business intelligence consists of activities of collection, analysis, and application of information describing relevant facts and trends (opportunities and threats) from organization's entire environment used to support the business decision-making process.
Triple Tree (2002)	Business intelligence applications are decision support tools that enable real-time, interactive access to and analysis of mission-critical corporate information. Business intelligence: closing the loop between analysis and action.
Turban E., Aronson J. (2001)	Business intelligence is used to describe the new role of the Executive Information System, especially now that data warehouses can provide data in easy-to-use, graphics-intensive query systems capable of slicing and dicing data (Q&R) and providing active multi-dimensional analysis (OLAP).

4) a system solution resulting from the strong co-operation of information technology and business where BI is not only a tool for data analysis, but also the preparation and conduction of this analysis.

In the following article BI is interpreted as a system solution, meaning a set of methods and processes meant to improve business decisions using data coming from outside sources, all of the company's supplies and the employees' knowledge,

when the delivered technological solutions allow to collect, process and manage data and also analyze and distribute the information.

The construction of a business intelligence environment requires data from just about all business applications within an enterprise, processed and stored in many different forms to support individual business intelligence processes.

3. Information technology solutions essential to the realization of the BI concept

The realization of the BI concept is related to the necessity of guaranteeing appropriate information technology solutions, which increase the integration of the transactional systems with analytical ones and cause the increase in support for the decision-makers in the decision-making process. It demands the architecture which allows [Dudycz 2005a, p. 237]):

1) the integration and storage of data originating from various sources maintaining their quality, coherence and correctness,

2) analytical processing, consisting solutions for the multidimensional analysis of actual economic facts, the discovery of the dependence among them and also the prediction of events,

3) the popularization information with the help of tools with a user-friendly interface.

The data integration and storage layer guarantees, first of all, quick access to coherent, integrated data on the level of the whole organisation. The following are information technology solutions:

1) ETL (Extraction, Transformation and Loading) tools – used for the extraction, transformation and loading of data from transactional systems to the data warehouse,

2) the data warehouse – a subject-oriented, integrated, time-variant, and non-volatile collection of data used in support of management decision-making (see [Inmon, Imhoff and Sousa 2001, pp. 93-97]).

The technologies and tools used on the level of analytical processing should meet the needs of different user groups, including people who independently design reports and analysis (eg. analysts), and people who utilize pre-prepared reports (eg. board directors, finance directors). In the range of such a group the following solutions can be: basic analytical tools, advanced analytical tools, analytical applications constituting dedicated solutions.

The basic analytical tools comprise the widest used form of analytical processing, which are:

1) traditional query and report tools – allow to select data which can be formatted, drilled down, drilled across, sliced, diced in order to get reports of telling management and users “what has happened”,

2) OLAP (On-Line Analytical Processing) tools – gain insight into data through fast, consistent, interactive access to a wide variety of possible views of information that has been transformed from raw data to reflect the real dimensionality of the enterprise as understood by the users (see [OLAP Council 1997]),

3) data visualization tools – provide a graphical interpretation of a company's data so that it can be analyzed from different perspectives and allow to create advanced dashboard in which large amounts of information are presented on a single screen,

4) spreadsheets³ – allow to add, subtract, and perform any combination of calculations on range, cells and anything what can be held in the sheet.

Advanced analytical tools make up the second group of analytical processing. Whilst basic analytical tools can be used by the average user on virtually every level of the company's organizational structure, advanced analytical tools require appropriate essential preparation in the range of methods and algorithms that are implemented in them. The following types of software can be considered part of this group of analytical tools:

1) statistical (consist in statistical, perfecting and econometrical methods),

2) data mining – allow to analyze large pools of data to find patterns and rules that can be used to guide decision making and predict future behaviour.

However, the third group of analytical processing contains OLAP technology which can be used in a wide range of business applications. The typical ones are: financial modelling, market share analysis, resource allocation and capacity planning, sales forecasting and balanced scorecard. Analytical applications are tools that provide analysis around a specific business function or a specific vertical industry.

The popularization information makes up the third layer, in which we can find two basic categories of solutions:

1) the *pull* method which consists in accessing the results of analysis in corporate portals (considered in the context of intranet and extranet),

2) the *push* method, where we have an automatic distribution of the results of questions, reports in the form of e.g.: e-mail, text message, fax, automatic prints.

Business intelligence applications should let: mission-critical and integral to enterprise's operations or occasional meet a special requirement, and centrally initiated or driven by user demand.

4. Analysis of research results

The implementation of the BI concept in a company requires first and foremost a detailed analysis of the business procedures of the company and the information

³ A lot of BI analysis on the world is performed on spreadsheets because: (1) spreadsheets allow the total free-form entry of data, (2) the math (formulae, etc.) is relatively easy to understand, (3) the nature of the spreadsheets lends itself to BI due to the free-form nature of how the user can address cells and ranges as opposed to rows and columns (see [Biere 2003]).

needs of the employees taking part in the decision-making process about matters of great significance to the firm. Secondly, it requires the identification of the software already present in order to build a system architecture allowing the long-term data in a data warehouse in such a way which allows analytical processing and receiving reports on demand. In the following point we will concentrate on the analysis of the implemented information technology solutions in selected Polish companies in order to define the possibility of realizing the BI concept within them. The identification requires the analysis of implementing: transaction processing systems covering the basic areas of activity of these companies, a data warehouse, analytical tools and a corporate portal.

Having analyzed the exploitation of software supporting the basic areas of activity of the studied companies⁴ we can affirm that, among small firms the solutions which dominate are those assisting: sales (more than 76% - this can be due to the fact that most small companies work in trade), accounting and finances (almost 65%), however, staff and wages are at a much lower level of interest (only 35% in the studied companies). The situation appears quite different in medium and large companies, where the information technology systems which dominate are those concerning accounting and finances (almost 65%) and staff and wages (this is the case in 83% of medium companies and has become a standard operation in large companies where it can be found in 100% of cases). The remaining applications, which assist supply, production and also sale, can be adopted especially in large companies (this occurs from 80 to 100% of firms, taking into consideration their range of interest). However, an analysis of the providers of such software⁵ verifies the conclusions of the study conducted in 2004 and 2005 that we find an integrated system in large organizations more often than in small ones and that the solution of Polish computer companies dominate more often in the case of small and medium firms⁶. This kind of structure of implementing integrated system results from the fact that small and medium companies use dedicated systems of limited practicality and reasonable tool requirements, which of course is related to a smaller cost of such an investment. The results of this research imply that in large and most medium companies there are integrated systems which collect data from all transaction of business.

⁴ In the research conducted from November 2006 to March 2007 we analyzed companies of a variegated structure in terms of size, activity and territorial range connected with its activity. The studied companies were those which had existed on the market for some time (almost 66% for more than 11 years and 31% for more than 20 years). Only the companies which use an information system for at least one of its areas of operational activity were analyzed. The assumptions of this study are more closely presented in [Dudycz 2007].

⁵ In the case of small and medium companies the solutions of Polish computer companies make up 60% of the implemented integrated systems.

⁶ A wide review of research is presented in work [Dudycz 2005b].

After having identified the information technology solutions responsible for recording various transactions which take place in the activity of the studied companies, we will analyze the tools and software supporting the analytical processing of data. The condition of usefulness of these types of information technology solutions is the aggregation of data which only then can be successfully analyzed. It is guaranteed by the data warehouse⁷. Having analyzed the studied companies we can determine that it already works as a data base in many large firms, which is confirmed by the result – 69%⁸. Although there is a rising tendency among small and medium companies in this area, it does not exceed 50% of examined firms and it is usually a limited analytical data base. We should also pay attention to the fact that the vast majority of firms which have not implemented a data warehouse are not planning such an investment (Table 2). This means that what we have before us is bias towards:

- companies which are aware of the need to possess a data warehouse and the necessity of analytical processing of long-term data,
- companies for which the reports received from transaction processing systems guarantee sufficient information needed in the decision-making process or they do not have problems with dedicated analytical applications overloading their systems.

Table 2. Planned term of data warehouse's implementation in research firms

Planned term of implementation	Small firms [%]	Medium firms [%]	Large firms [%]
In 1-3 years	10,00	27,27	25,00
Not sooner than 3 years	0,00	18,18	0,00
No plans	90,00	54,55	75,00

Source: own presentation based on results of the survey.

This structure of implementation of data warehouses in the studied companies influences the type of analytical tools and applications used. In 46% of large companies specialized reporting systems are used, whilst in small and medium firms it is a question of 24%. Similar differences appear when considering other analytical tools. The same results were received in large companies in the case of implementation of specialized statistical tools and decision support systems⁹ (in

⁷ In the survey of large and midsized companies it was received that one of the most important prerequisite for BI success is the adoption of five best practices for BI implementation: business information governance programmes, enterprise information strategy, information quality programmes, BI competency centres, and enterprise data warehousing (66% adoption by companies which have achieved BI success versus 59% overall) (see [The Business Intelligence Payoff is Here, Reveals Business Week/Knightsbridge Survey 2007]).

⁸ It may be well to add that KPMG gets 68% in their research in 2004 year. Large, over 250 workers, enterprises were studied. [Strojny 2005].

⁹ In research of KPMG it was received 51% [Strojny 2005].

each case 35%) and also in the case of data mining and data visualization tools (both reaching 20%). When it comes to medium companies, data mining was not observed and the remaining tools did not exceed 16%. However, in small companies the implementation and exploitation of the considered analytical solutions were not noted. The basic analytical tool in small and medium companies is the spreadsheet 68% (59% and 75% respectively in small and medium companies) which is more often exploited than in large companies (almost 62%). Independently of the size of the studied organizations a large correlation between the implementation of a data warehouse and the use of an integrated analytical system was observed (we can note an accordance in almost 100% of cases). In the context of introducing the BI concept in companies we must pay special attention to the implementation of a corporate portal. This information technology solution was noted in 42% of the studied large firms¹⁰ and 24% of small and medium firms.

5. Conclusion

Summing up, we can first of all point out a great dependence between the size of a company and its chosen technological infrastructure. Secondly, there is a bias among companies concerning the implementation of a data warehouse. Thirdly, in the case of implementing a data warehouse we can note a positive tendency towards creating an integrated analytical system and striving towards the integration of all the analytical processes within the whole company. This means that in many Polish companies, especially large companies, it is possible to implement the business intelligence concept.

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¹⁰ This result is much lower than in the studies conducted by KPMG where the result for large companies was 75%. This may be due to the fact that in the study conducted by KPMG the companies analyzed were those in which the income exceeds 40 million Euro annually and in which the implementation of a knowledge management system is considered, where a corporate portal is an essential tool [Strojny 2005].

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