A collaborative approach of Business Intelligence systems

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Abstract: *To succeed in the context of a global and dynamic economic environment, companies must use all the information they have as efficiently as possible, in order to gain competitive advantages and to consolidate their position on the market. To achieve these goals, the companies must use modern informatics technologies for data acquiring, storing, accessing and analysing. These technologies are to be integrated into innovative solutions, such as Business Intelligence systems, which can help managers to better control the business practices and processes, to improve the company's performance and to conserve it's competitive advantages. This paper presents Business Intelligence systems and emphasizes their collaborative feature.*

Keywords: *Business Intelligence, collaborative systems, competitive advantages, decision making process, portal*

1. Introduction

Information is stored anywhere in modern organizations: in transactional systems, data warehouses, computer networks and personal computers. It is used to assist most of activities, both operative, tactical or strategic. Nowadays, information supports all critical business decisions. Most of organization consider that information is a strategic asset and act for the permanent optimization of its management and usage in order to gain competitive advantages.

It is unanimously stated that all activities in an organization are based on information. That is data acquiring, storing, transporting and processing. Information becomes a new resource, a real asset of the new economy. The impact of information and communication technologies (ITC) on business modifies the perception of information as a factor of production. While in times past a business was defined as people, technologies and assets, in the knowledge-based economy people, technologies, assets and information are taken into consideration. The new economy is characterized by a greater impact of information resources on production chain, the gradual disappearance of borders between products and services, and the appearance of new business opportunities based on ITC (e-business, e-commerce, e-banking etc.).

More and more organizations consider that their knowledge and competence are the most valuable asset they have. In the new economy, ITC usage contributes to gaining important benefits and competitive advantages, and determines organizations to become more flexible and to adapt themselves to the changes in the business environment.

Any company's success depends on how well it understands its business processes, how efficient it manages its operations, and how well it knows its customers. To stay competitive, companies must be able to identify their profitable customers, their business trend, the most sold products, and the most productive distribution chains. Getting high quality data is no longer a profit and loss issue, but a surviving on the market issue, a matter of success or failure. Companies have understood that the future means analyses, reports, forecasts, as well as real-time data management. A judicious data usage is not possible

without a proper, powerful and robust information infrastructure, that allows usage of all company's data for making the best operative, tactical and strategic decisions. In today's context of a competitive economic environment which is permanently changing, the ability to use information in an intelligent way, in order to cope with challenges and to benefit for opportunities, represents an essential condition for any company that wants not only to stay on the market, but also to consolidate its position. As information is the basis of all activities in a company, this one must use information systems that can produce and manage it properly. These systems must ensure the information availability for all users that need it in a timely manner and in a proper format, provide to executive managers the possibility to view, analyse and assess the company's business processes, that is underlie their decision on an information support based on Business Intelligence (BI) technology.

2. Short presentation of Business Intelligence technology

To achieve the above purposes, it is necessary to implement information solutions that are able to offer to managers a complete and consistent view across the present status of the organization, as well as projections on different periods of time, solutions that are able to support the decision making process in order to adopt coherent and well-founded strategies. A BI solution is one of the best solutions that can respond to these goals. A BI system is "*an information system with an open and flexible architecture that integrate innovative technologies that are able to ensure a uniform and consistent storage of all data that are relevant for their organization and the environment it is acting in, turn data into information and knowledge, and use it judiciously use it in the decision making process, so that to conduce to gaining competitive advantages against competition*" [1].

BI systems emphasize data integration, analysis and mining, as BI aims to provide the capability to access and analyse information and benefit on the competitive advantages offered by these analyses.

BI has started up in order to respond managers' demands for an efficient analysis of company's data, to better understand the business status, and to improve the decision making process.

In the early '90 it became an interest field for academia and, in the next ten researching years, several technologies were transformed in well founded approaches concerning data extract and processing.

BI solutions manage data storing in a different way than that used by transactional systems. This way facilitates proactive searches and analyses of data from various and isolated sources. A BI solution helps in generating and disseminating valuable information to people that can use it for analyses needed in the decision making process.

Nowadays, BI got a greater importance for decision makers. Data acquisition – from operations, customers, business partners and employees – was always an important action for business running, but now the proactive usage of information has become essential. BI makes a difference between reacting to problems and anticipating opportunities, and between experience-based presumptions and proactive fact-based decisions [2].

BI systems integrate data from various sources, store it for a long period of time, so they offer facilities of discovering trends and patterns that can be used for business value improvement. This is ensured by improving communication and planning. As they are flexible and scalable, these systems provide fast and efficient responds when the environment is changing. They enable critical information to be duly accessed and eliminate unfounded presumptions, ensuring a strong support for the decision making process.

BI systems concur to efficiency and productivity increase, enabling *collaboration* between all organizational structures and a global view over the entire organization, as well as deploying role-based solutions, according to the requirements and tasks of each user. Users become more efficient in their role, because each user can access the data he needs and the appropriate tools.

3. Business Intelligence systems, as collaborative systems

Taking into consideration those presented above, BI can be defined as "*a combination of data, processes, tools and technologies that provide to managers valuable information that support decisions made in order to increase the organization's efficiency and profitability*" [3]. It allows users on any organizational level to access data, to interact with it and to analyse it in order to run the business, to improve the performance, to discover new opportunities and to operate efficiently. Such a system provides a global view over the entire organization, enables data analyses from multiple points of view, and allow a fast feedback when the business environment is changing.

A company's success is based on information, and BI is a permanent process of data acquiring, analysing and dissemination. Its main purpose is gaining and conserving competitive advantages, preventing failures and exploitation of the opportunities that appear on the market. BI systems create an intelligent business framework that enable delivery of consistent and high quality information to all users, both inside and outside the organization. They offer ways for network communication, enabling a fast dissemination of information, and a better synchronization of all organizations activities. As a matter of fact, BI is a generic term, un "umbrella" for a set of applications and technologies for data accessing and analysing in order to support users to make better decisions.

BI systems help users to identify and solve their problems, to discover business risks and opportunities, to anticipate market's trends and to estimate competitors' operation. They allow a better understanding of business requirements, and a better management of customers and suppliers relationship. Using such systems, managers can react faster to the problems that appear, to estimate correctly the company's position against competitors, so the company is able to gain competitive advantages.

Although BI systems have evolved in order to respond to increasing analysing and reporting requirements. From traditional reporting and analysing applications, now they are powerful, friendly and faster tools designed for strategic decision making and performance management. More stages can be identified in BI evolution, as shown in figure 1. Starting with transactional applications that could deliver static reports regarding the company's activity, *Management Information Systems* (MIS) and *Executive Information Systems* (EIS) were developed in the middle '80. One of the major problems these systems cope with was that they needed a lot of manual work for data conversion and load from data sources into the repositories used by these systems. Starting with the early '90, data warehouses and Extract, Transform and Load (ETL) tools began to be largely used. The developing of new powerful analytical instruments has led to an intensive usage of BI tools. The progress of these systems, their functionality and capability improvement, is attended by a continuous approach to end-users, systems becoming more friendly, reliable and easy to use.

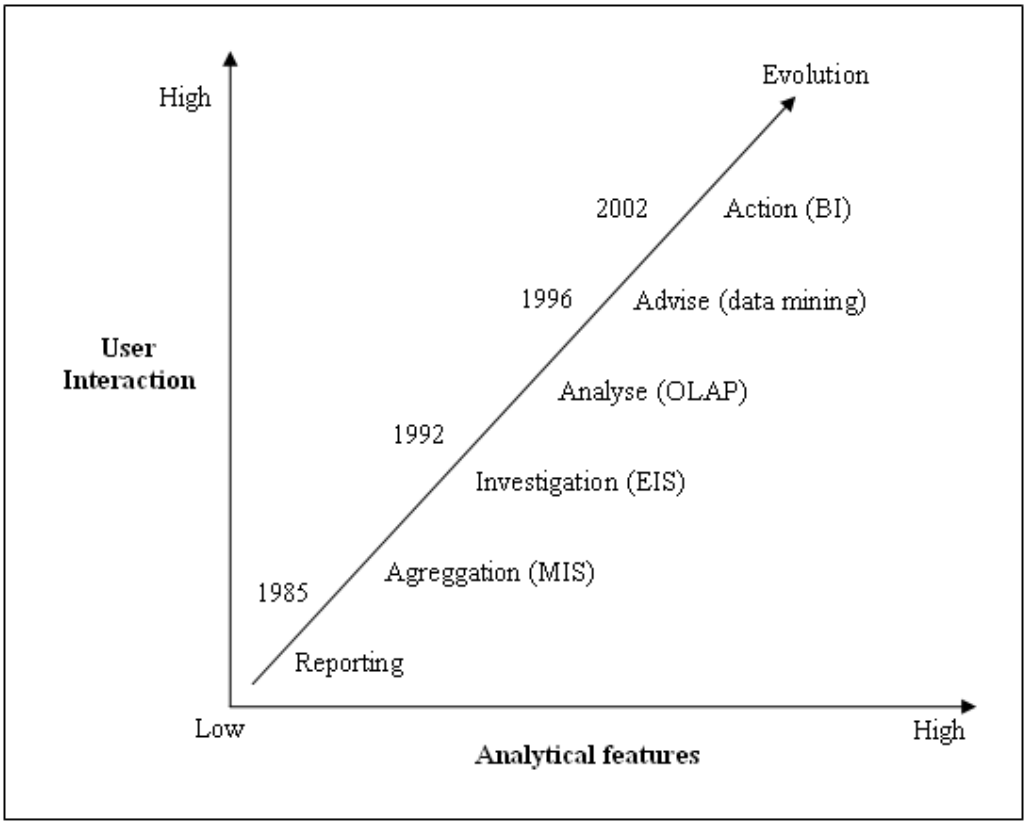

Fig. 1. Evolution of BI systems [4]

In [5] it is stated that three stages can be identified in BI systems' evolution. First, simple SQL-based reports were developed. The first BI systems were generating many reports, and users had to spend a lot of time to analyse them in order to get the needed answers. Applications, developed in a client/server architecture, were offering a fast access to data, but it was rather difficult to use them, so they were used only by analysts and not by managers and executive directors.

When data warehouses began to be used, the second BI systems generation started. These repositories store consistent, present and historical data, both detailed and aggregated, that are organizes simpler than in traditional databases, using a data model that is alike to real life. Thus, the model can be better understood by managers and other non-IT users, and is more adequate to analyses. Data warehouses were followed by data marts – specialized data repositories that accelerated the delivery of information to managers with the aim of making well founded decision. The *On-Line Analytical Processing* (OLAP) technology was developed as an alternative to a dynamic access to complex data, as well as other dimentional analysis tools that allow managers to analyse data from multiple perspectives and explore it in order to discover hidden information.

Later, when it was clear that developing a data warehouse is just the first step in building a BI solution, the third generation of these systems has started. The new systems could offer a consolidated view over the entire organization, dynamic reports from various departments, prediction capabilities, large and fast access at information on different hierarchical levels. Though dimentional cubes and star schemas are still used, more complex analytical solutions are largely used. These solutions use data mining techniques, statistical methods and technologies that provide ad-hoc analysis capabilities. These technologies are more and more used in operational workflows, and not only for strategic decision making.

Nowadays, users have at their disposal a large set of powerful graphical equipments, used for data processing, *communication, collaboration and cooperation*. BI solutions provide a large functionality, from a simple data access to complex interaction and Web report generation.

The synthesis of the stages described above is shown in figure 2, where BI systems' evolution presented based on their complexity and analytical capability.

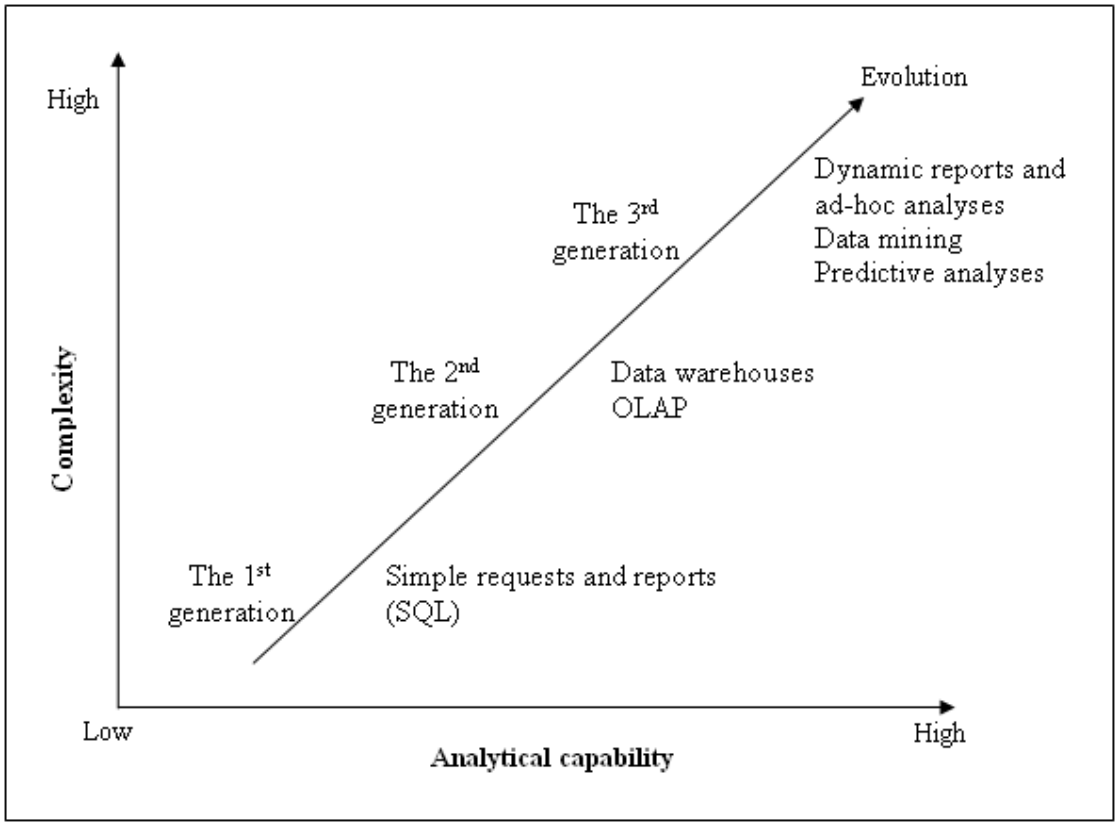

Fig. 2. The generations in BI systems's evolution

The need of intelligent information solutions grows as the company's volume of data becomes larger. As their name shows, BI solution enable an intelligent usage and analysis of company's business data. They help managers to better control the business practices and processes, and duly analyse the company's key performance indicators.

An essential requirement for the business growing and the improvement of company's position on the market is to better understand the business and factors that have both a positive and, especially, a negative influence. Using the new information technologies, companies learn what has happened in their business, why it has happened and what will happen. At the same time, BI solutions contribute to the elimination of communication barriers inside the company and enable decision making process on the basis of consistent information and collaborative support [6].

Thus, BI has an essential role in consolidating company's position on the market, implementing the best practices, and business processes improvement. As a result, the company can operate at a high quality level and become more competitive and efficient.

4. Business Intelligence – an instrument for a collaborative decision making process

BI systems aims to provide to the decision making process accurate, consistent and pertinent information. They make possible developing of evolved decision support systems, capable to assist tactical and strategic decision making, operations and business processes improvement. Thus, these systems contribute to profitability increasing and gaining competitive advantages.

BI systems can provide historical reports, data analyses and alerts that signalize problems and possible threats. Analysing historical information, managers can evaluate the former activity. But it's necessary to estimate the future evolution to, in order to anticipate events and make the most appropriate decisions. BI systems join various activities within the company and emphasize relationships that are difficult to be observed. So, BI overdraws the borders of a stand alone activity and becomes an integral part of the way the business is conducted.

It is necessary that BI solutions be available not only for managers, but also for a great number of employees. At the same time, they must be able to be used by external users, such as customers, business partners, and providers, and to take into consideration the requirements of each user category.

Using all its data, making complex analyses, a company gets new information concerning the business environment and its competitors. This information allows it to better understand its customers' behaviour and anticipate their requirements, to correctly manage threats and risks, to identify opportunities to increase its revenues and reduce costs. Acquiring and storing large volumes of historical data provide the capability to discover patterns and factors that influence the company's activity and to predict the future business evolution. Without BI systems, selection and analysis of relevant information are hardly made, and results are seldom incomplete and provided to late. Only companies that are using BI technologies can cope successfully with the concurrent environment challenges [7].

Not too long ago, only few departments within a company were using BI applications. Now this situation is changing rapidly, by developing and implementing new systems that covers the entire functionality of the company. It is stated that usage of BI solutions contributes to an open and active information culture [8]. At the same time, through these systems BI advantages are offered to all the people involved in that business: employees, shareholders, customers, providers and other business partners. As information is provided to all interested people, they may state that a democracy of information is instituted at all the levels inside the company and even outside it.

The decentralization of the decision making process has determined an increased need of information into organization, and a portal is one of the ways through which a BI system ensures its dissemination. Because not all users are interested by the same set of indicators, which depends on every one's level and requirements, a portal or another platform having the same functionality has to be used.

A portal allows users to access the company's intranet. It allows employees to access and share the company's data and information. At the same time, it provides capabilities such as: classification of information that is available on intranet, a searching engine, news concerning the organization, access at the email service and other information applications, a document management solution, links to other sites, both inside and outside the company etc.

A portal is the interface between BI applications and users, an information space that is well organized and easy to understand, where users find the tools and information they need. It's a Web-based secured interface that provides a single point for integrating all the company's information and accessing it. It also integrates the applications and services that

are used by employees, business partners, providers and customers. As an example, figure 3 shows the portal of a banking company.

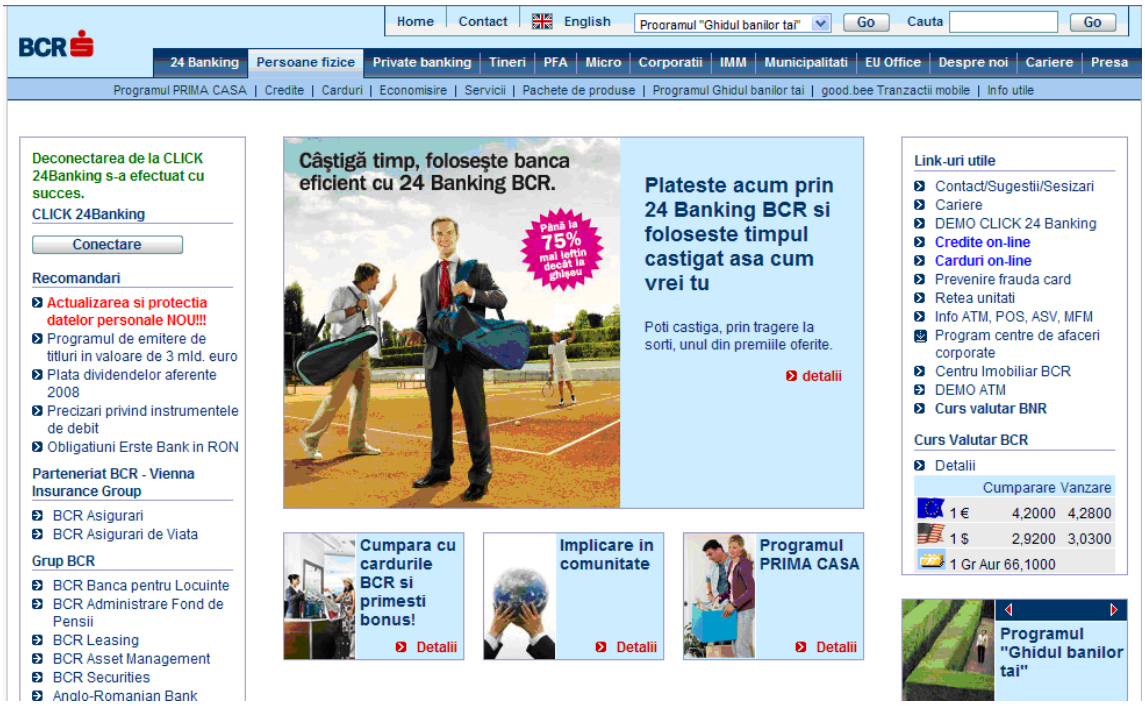

Fig. 3. The portalul of a banking company [9]

The portal in the figure above provides to bank's customers the possibility to make a large set of banking operations, in real time and in a secured environment (users identify themselves through their codes and passwords). It also provide the possibility to access detailed information concerning bank's products and services, branch network, exchange rates, links to the Web pages of bank's subsidiaries, and other useful tools and information.

As a collaborative platform, a portal enables people, usually from remote locations, to meet each other and to share information, to interact together and use specific tools in order to achieve common goals. A portal is a component of organization's information strategy and it integrates several applications developed to solve business problems. These applications ensure information consolidation, management and distribution both inside and outside the company. Through Web services, not only applications are integrated into a portal, but also data, business processes and people, ensuring in this way the *communication and collaboration* between users, as well as the delivery of integrated business solutions. Portals facilitate knowledge delivery, improvement of planning and product development processes, and creation of more efficient functional relationship between groups of people [10]. They offer a better view over the entire organization and help making more efficient decisions. All these contribute to a better understanding of business processes and productivity increasing.

All portals are using the Web technology. It's unanimously stated that the Internet has influenced the way that organizations operate, as well as information applications nature. It enables resources sharing and a rapid change of information with customers and business partners. Schematically, these relations are shown in figure 4, that presents the connection between a BI system and external users, through Internet.

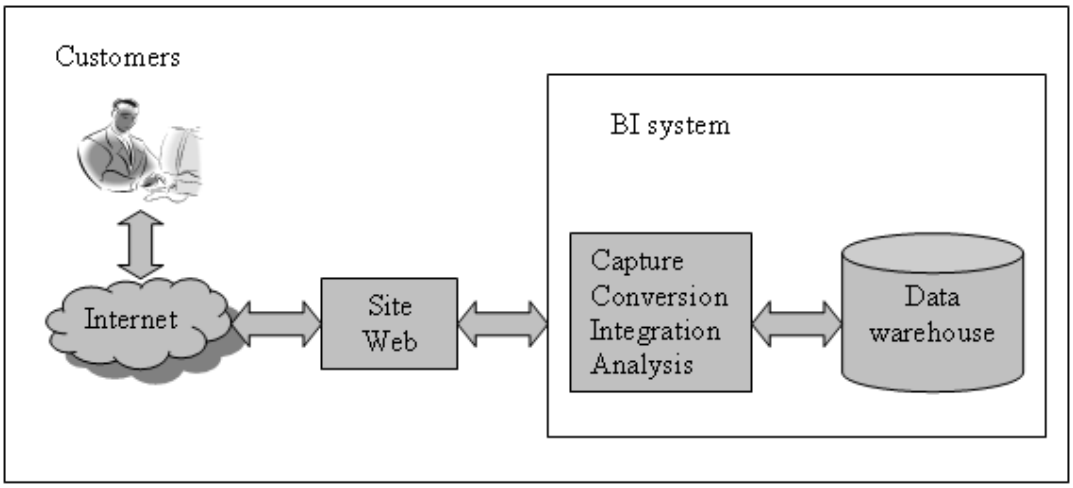

Fig. 4. Business Intelligence and Internet

As a conclusion, a portal is a platform through which various specialized tools are made available to all users within the company. Together with ad-hoc query and analyse tools, with dashboards and scorecards, they provide an easy, fast and flexible access to information stored in various data repositories of the organization.

5. Business Intelligence system development

Nowadays, a company is appreciated not only in terms of its products and services, but also of the information provided to its customers, employees and business partners. The more information is offered, the more valuable the company is. The problem is that information is not stored into a single place. Most of organizations have more information systems, everyone having its own data sources and data presentation tools. Therefore, information is managed by more departments or business units and is difficult to ensure an efficient coordination of this activity. BI systems solve this problem and ensure that users get the information they need, so they can make the best decisions.

A BI system consists of more information applications and technologies that allow data extract, integration and consolidation from various systems within the company and storing it into a single repository that enable information accessing and analysing and knowledge dissemination to internal users, customers, providers, shareholders and other interested people. The usage of such instruments allows users to focus on actions that have a big impact and to duly identify the opportunities that can occur. As they provide on time accurate, up to date and relevant information, BI solutions facilitate the business performance management and help in making better decisions.

A BI system has to allow the integration with other collaborative systems and services, such as email, Web etc. Such services increase the system's value and certify that users will use it. The system has to ensure *data distribution and information sharing* in the entire organization, that is ensuring all users' access to the information they need.

Building a BI system is based on a methodology that is different from that used at transactional systems' development. A prototype has to be built quickly, even if it doesn't respond to all the end-users' requirements. The system will be developed by building successive iterations, more and more complex and closer to the final version – the so called "spiral" approach. Trying to build the system into a single iteration has a little chance to succeed, because of very large financial and time resources that are needed.

A BI system is an enterprise one that evolves together with the organization and is permanently enhanced according to business users' feedback. Because of its complexity and differences to transactional systems, a BI system cannot be developed into a single iteration; it is built in an iterative approach. In every iteration the stages presented in figure 5 are scanned; a new version is built, as the system becomes more evolved and mature.

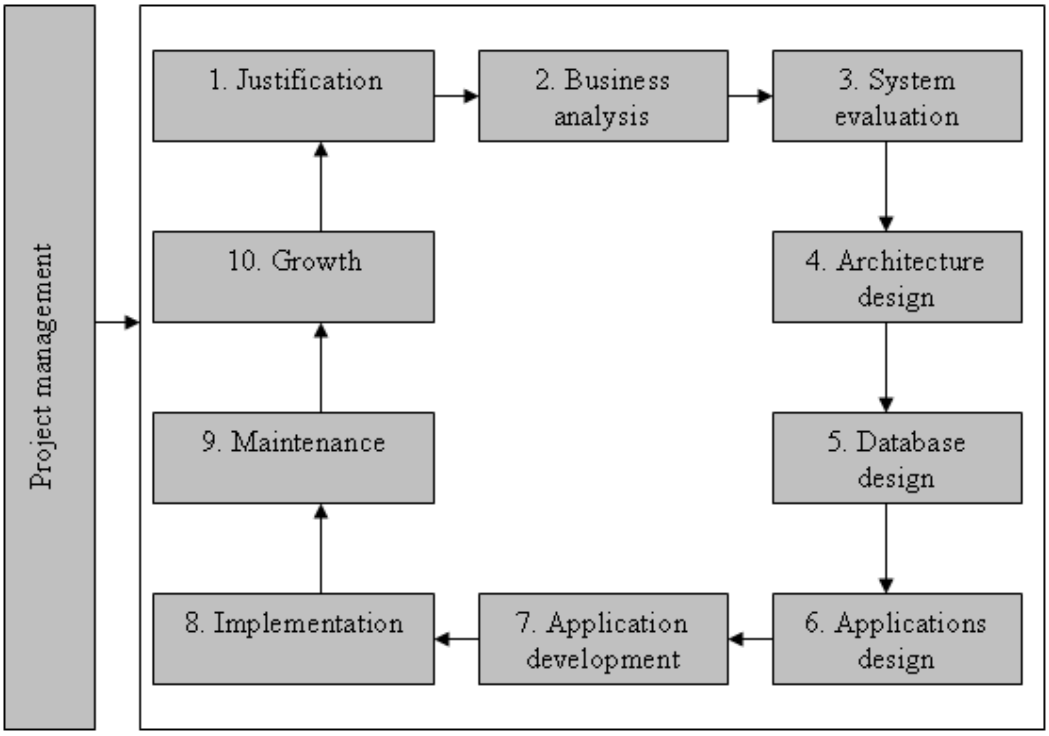

Fig. 5. A BI system developing cycle [1]

During the justification stage, the necessity for a new system is presented and contended, the project scope is defined and the needed costs and expected benefits are estimated.

During the business analysis stage, the problems are analysed in depth, a global solution for solving them is established and a plan for the next activities is made.

During the system evaluation stage, the organization's infrastructure, data that is available, and hardware and software components are assessed.

During the architecture design stage, the new system's technical structure is established, so that it can respond to the aimed business requirements.

During the database design stage, the new system's logical and physical data structures are developed.

During the application design stage, instruments needed for extracting data from source systems, its transformation and load into the data warehouse, interfaces for accessing data and tools for its analysis are built.

During the application development stage, the instruments that were designed are built, tested and validated.

During the implementation stage, the integration and testing of all the system's components are made, as well as the users' training and the deployment of the new system.

During the maintenance stage, the system's management and monitoring are made, in order to ensure its running as the parameters were set on.

Based on system's monitoring observations, technological progress, users' new requirements, evolution of the economic, social and legislative environment, requirements for future development are established.

The complexity of a BI system makes impossible its development into a single iteration. The stages presented above are resumed into a new iteration, that will produce a system's new version, having enhanced capabilities. During this iterative process, a special activity – the project management – is run on. During this permanent stage, an efficient communication has to be established between functional departments and IT department.

6. Conclusions

Nowadays, organizations cope with much more challenges than ever before: fast changes in a global, complex and competitive business environment, the change and diversification of users' requirements, the growing complexity of systems and technologies, extended regulation and compliance requirements. Permanently, organizations generate, use, store and share information with their customers, business partners and providers, At the same time, they have to report periodically certain information to their shareholders and to various regulation and control institutes.

To cope with these challenges and to stay on the market, organizations have to implement new information systems, that can transform them into dynamic organizations, capable to react quickly and efficiently to all changes in the business environment. As information has become a strategic asset, capable to provide competitive advantages, the new systems have to ensure the integration of all data the organization has and store it into repositories that allow complex analyses, pertinent forecasts and decisions made to ensure a permanent development of the business. Such systems stopped to be just an option, they have become a necessity, am imperative of our times. Among them, a special class is constituted by Business Intelligence systems, that are complex systems allowing the efficient integration of information technologies, both the current and the future ones.

Business Intelligence (BI) is a generic concept that groups under the same umbrella more instruments from business and information fields, instruments that are used in order to transform data into information, information into decisions, and decisions into successful actions.

At the beginning, BI systems were destined only to strategic level of organization's management. Nowadays, they are to be used by a lot of users, from all the hierarchical levels of the organization. At the same time, they are open to external users to, such as shareholders, customers, business partners and providers. Now, a company is judged not only depending of the quality of its products and services, but also depending on the way it provides information to users, both internal and external.

A BI system allows users on all the organization's levels to access the data, to interact with it and to analyse it in order to run the business, improve its performance, discover new opportunities and act efficiently. Such a system offers a global view over the entire organization, ensures the possibility to analyse the activity from multiple perspectives and allows rapid reactions to the business environment changes. All these purposes are treated in a collaborative manner, ensuring a single version of the truth for the entire organization.

References

[1] M. Velicanu and Gh. Matei, *Tehnologia Inteligenta Afacerii*, Editura ASE, Bucuresti, 2010.

[2] M. Velicanu and Gh. Matei, "Utilizarea soluțiilor de Inteligența Afacerii în sistemul bancar," *Revista Contabilitate şi Informatică de gestiune*, No. 26, 2008.

[3] Gh. Matei and M. Velicanu, "Business Intelligence – philosophy of successful companies," *Proceedings of the Fourth International Conference on Economic Cybernetic Analysis "Global Crisis Effects on Developing Economies", special session "Decision Making Modeling and Risk Assessment"*, ASE, Bucharest, May 22-23, 2009.

[4] N. Rasmussen, P. S. Goldy and P. O. Solli, *Financial Business Intelligence: Trends, Technology, Software Selection and Implementation*, John Wiley and Sons, Inc., New York, 2002.

[5] M. Muntean, *Inițiere în tehnologia OLAP. Teorie şi practică*, Editura ASE, Bucureşti, 2004.

[6] M. Velicanu and Gh. Matei, "Databases versus Data Warehouses," *Proceedings of the Eight International Conference on Informatics in Economy, Informatics in Knowledge Society*, ASE Publishing House, 2007.

[7] M. Velicanu and Gh. Matei, "Soluții informatice suport pentru afaceri inteligente," *Revista Studii şi cercetări de calcul economic şi cibernetică economică*, No. 1, 2008.

[8] J. Salmeron, „EIS data: findings from an evolutionary study," *Journal of Systems and Software*, Vol. 64, No. 2, 2002, Elsevier B.V., pp. 111-114.

[9] www.bcr.ro/bcrro

[10] M. Muntean, „Business Intelligence Solutions for Gaining Competitive Advantage," *Revista Informatică Economică*, No. 3 (43), 2007.

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