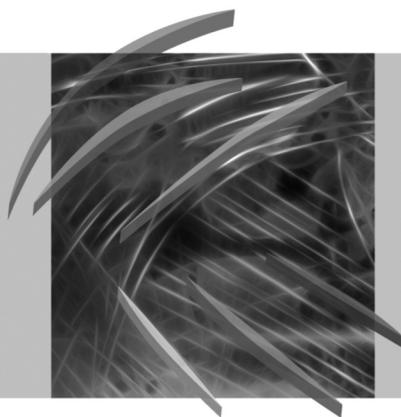


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BUSINESS INTELLIGENCE IN ENTERPRISE 2.0

Summary: The paper is devoted to business intelligence within the new form of a modern enterprise called Enterprise 2.0. It consists of five parts. After brief introduction, information society and knowledge-based economy are presented. Within the next part Enterprise 2.0 is described. Part four presents business intelligence in Enterprise 2.0 and its features. A short summary ends the paper.

Keywords: information society, knowledge-based economy, business intelligence, Enterprise 2.0, cloud computing.

1. Introduction

We are living in very interesting times. New technologies, new information solutions have changed the approach towards organisation management. Nowadays, we observe very fast progress in the development of information and communication technologies affecting all sectors of our life. New economy (called also knowledge-based economy) is becoming more and more important. It is often combined with information and communication technologies, technical progress, and innovations. As its most significant features, we distinguish:

- globalisation,
- information technologies,
- knowledge development.

In information society and in knowledge-based economy, knowledge is treated as one of the most valuable assets. One can observe the tendency to know more and more. New information and communication technologies offer better, faster, and more powerful tools and techniques and, on the other hand, these new possibilities create new needs.

When new information technologies, named generally as Web 2.0, appeared, they started changes and in consequence the enterprise which introduced these technologies transformed into an organisation called Enterprises 2.0. Implementation of new ideas and technologies like the Internet, Business Process Management (BPM), Service Oriented Architecture (SOA), process approach in enterprises, have an effect on such a firm so that it differs from the firm in which these news have not

been introduced. Enterprise 2.0 can be seen as “a set” of some features like strategy, culture, and a way of information technologies management. All these elements are equally important. Among modern information technologies, business intelligence is one of the most important due to the fact that it can deliver different, often very complicated business analysis necessary in the decision-making process.

2. Information society and knowledge based economy

For last \pm 20 years we have observed coming into being new type of society, based on information and knowledge and very innovative. Fast progress in information technologies allows gaining, transmitting, and analyzing knowledge. Casey says that information society can be defined as a society in which information is a key element of the social and economic activities and changes [Casey 2001, p. 34]. That is why the importance of access to information in economy as well as in social life is still growing. There are many names to describe “information society”. Among them “knowledge-based society” is very popular.

One of the most important features of information society is intensive exploitation of knowledge. Knowledge and information should be managed. Their quality as well as how quick they are obtained by interested managers is crucial. These elements are competitive factors in industry, services, and public administration. Managing any enterprise requires efficient knowledge as well as human capital management. As human capital we understand here all the assets that are acquired, maintained, developed, evaluated, and supervised. Any organisation to be fully competitive on global and local markets should fulfill two conditions [Kisielnicki 2004]:

- (1) to possess knowledge,
- (2) to be able to use possessed knowledge.

Information society is strictly connected with fast progress in teleinformation technologies. Mobile telephony or the Internet enable communication and access to information, which is important in distance communication as well as in distance transmitted knowledge. The job environment is getting more and more complex and it influences, among other things, the common organisational changes, taking over and merging, globalisation, and the mobility of employees. Working in such an environment requires appropriate prepared human capital, cooperation in the field of the post specialisation, distribution of competences or projects, etc. Information technology has become the distinguishing feature of the information and knowledge epoch and it affects on the society. Knowledge and information become the basic production factors.

In information society the new type of economy arises that is known as knowledge-based economy. It is a new stage in development of economic entities and whole societies. Knowledge as well as information becomes one of the most important assets, aside from raw materials, capital, and work. Still increasing importance of globalisation, science, and knowledge treated as a basis for today

changes can be seen as important features of knowledge-based economy. The need for knowledge as well as highly educated people is growing. Still increasing competition requires permanent growth of people's competence and permanent learning.

The World Bank states that knowledge-based economy is based on six following pillars: innovativeness, education, institutional and business surroundings, information and communication system, knowledge management in enterprises, and regional conditioning. Modern economy can be characterised by dynamism (changeability of technology and working methods, communication and interdisciplinary) and knowledge (provision of knowledge based services).

Knowledge is the most valuable asset in knowledge-based economy. This asset can decide about its further development. Products, in which knowledge is the main component, are very competitive on international markets. Natural resources as well as unskilled working force are slowly becoming less important in contrast to human capital, whose importance is still growing. Well-educated and innovative people are needed in modern economy and usually they are well paid. Significance of the knowledge-based economy relies on quick generating of innovative ideas, connected with new products and services. Knowledge and innovativeness have been always important in economic progress. Managers are required new knowledge and new skills. Knowledge can be the source of competitive advantage in knowledge-based economy. But it is not enough to have knowledge; it is necessary to be able to manage it in effective way. The added value of knowledge can be reflected in undertaken activities and decisions.

Knowledge-based economy is connected with information society. We can treat information society as a synonym of modernity, creativity, freedom, and prosperity of people. Its essence is information and knowledge as well as necessary tools (e.g., the Internet) that enable access to them. Information society is a part of information economy (or new economy), which is the developed form of market economy. It can be characterised by a dominant position of employment in the information sector and intensive exploitation of information technology [Hejduk 2004].

Knowledge in an enterprise has been located in various places. Among them databases are one of the most important ones. In databases we can discover useful knowledge in the shape of patterns or relations; knowledge that was neither recognised and known nor conscious. Knowledge can be found in different databases that have been collected in enterprises for years, in documents, decrees, certificates; it can come from the surroundings of an enterprise, e.g., from the Internet, etc. Intellectual capital, understood as employees' knowledge, their experiences, and their good intentions to share their knowledge and the necessity of permanent learning, is one of the features of knowledge-based economy. Knowledge can be seen either in larger or narrower perspective. According to the encyclopedia [*Encyklopedia Powszechna* 2002], knowledge – in a narrower understanding – means the whole of reliable information about the reality and the ability to use it. In a larger sense, it means a set

of information, believes, etc. that is treated as having any practical or experienced value.

Grudzewski, Hejduk [2002] say that knowledge is practical application of information in practice. The same information and knowledge can have different economic value depending on time and circumstances.

3. Enterprise 2.0 – a new form of modern organisation

The term “Enterprise 2.0” was used for the first time by McAfee from Harvard Business School in 2006 in contrast to traditional firms called Enterprise 1.0. He defines Enterprise 2.0 as a firm that uses a social software created within an enterprise as well as between firms, their partners, and clients. The social platforms have to enable easier contacts among people, communication, and collaboration. These aspects are to be realised by using computers and creation of Internet communities [McAfee 2006].

The functionality of this kind of platform can be characterised – according to McAfee and Hinchcliffe – by the following features [McAfee 2006; AMII 2009]:

- search: all assets have to be easy to find and reuse in other processes;
- links: links should be build among contents and a user can create links between contents;
- authorship: users can take part in active content creation;
- tags: for a particular use the platforms should make it possible to tag for easier finding contents interested for him or her;
- extensions: platforms ought to make possible to realise personalisation, detection of particular user patterns and to recommend appropriate actions that should be done by a user;
- signals: changes in the contents that are interested to a user, should be announced by, e.g., RSS channels;
- freeform: the lack of barriers in creation and accessing the contents;
- network oriented: making accessible all assets within the net;
- social – taking into consideration the cultural aspects in creating contents and making them accessible;
- emerge: technology application enabling detection and usage of society common work.

Enterprise 2.0 has been influenced by three main factors, which are:

- the technology Web 2.0;
- the needs for better socialisation of firm applications;
- the business culture enabling fully usage of modern technologies [Whitney 2009].

As the basic competences of Enterprise 2.0 we can point out the following:

- cost effective services;

- managing hard in recovery data sources;
- approach towards a user as a designer of new solutions;
- exploration of niches and particular accent put on a client;
- software not connected with any particular hardware;
- easy in manipulation user's interfaces, not complicated developing models as well as business models [Kania (ed.) 2010].

Emergence of the Web 2.0 resulted in the implementation of new technologies like the Internet, Business Process Management (BPM), Service Oriented Architecture (SOA), and the process approach in an enterprise.

4. Business Intelligence as essential assets within Enterprise 2.0

The main goal of any business intelligence system is to deliver useful managerial knowledge for decision-makers of all management levels [Nycz 2007]. Knowledge can be obtained from different, heterogeneous data sources through their searching and processing.

The term business intelligence (BI) has many descriptions. According to one of them, BI can be treated as a set of concepts and methods that help improve the decision process and it is done by using the fact based support systems. We can say that BI systems are a way of obtaining the business information and its verification. From the perspective of information systems, BI is seen as a system which – using the OLAP (On Line Analytical Processing) technology and data analyses – delivers, to managers, answers on important business queries and identification of important trends and patterns. Within business intelligence we can exploit the data collected in various information systems regardless of the fact that they were in use in past or they are in use today.

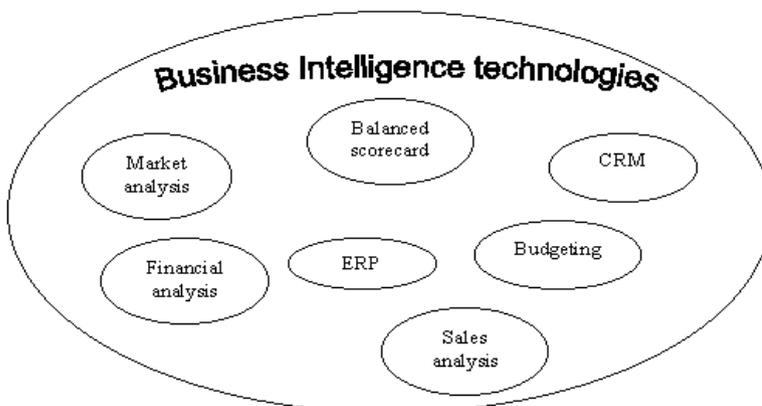


Figure 1. The place of business intelligence within the information systems within the enterprise

Source: based on [www.solemis.com/Downloads/PROPHIX.ppt].

As we see, BI is the center of attention within all the information solutions in an organisation and can be treated as a “binder” as well as a possibility of enterprise improvement. There are some requirements put towards BI:

- integration of data coming from heterogeneous sources into one, consistent data store;
- delivery of interactive possibilities for data manipulation;
- offering different ways of data presentation (graphics, tables, standard, and *ad hoc* reports, etc.);
- simplicity when using;
- BI should guarantee appropriate level of security and limit access to data.

Model of business intelligence can be shown as in Figure 2, where under the terms “system modules” we understand such modules as financial and accountings ones, CRM, ERP, human resources, etc.

The star structure is a basic model of data in data warehouse. It consists of a fact table (including measures and keys to dimensions) and some dimension tables (including their keys and data). They are connected by keys. The structure of snowflake is improved star. The most complex data structure is called the hybrid one.

The OLAP technology allows for a quick and intuitive analysis of a large amount of data adapted to user’s needs in various sections, at various levels of details. OLAP can be implemented in relational technology (ROLAP – relational OLAP), multidimensional technology (MOLAP – multidimensional OLAP), or in HOLAP (hybrid OLAP). Among many techniques of multidimensional data analysis, we can distinguish: drill-down, drill-up, slice-and-dice, drill-through, pivoting, rotating, ranking, aggregation.

When we have a business intelligence system based on data warehouse, we can use it to many realisations as for example for reporting of routine activities or monitoring the state and realisation of projects. In practice, the application of business

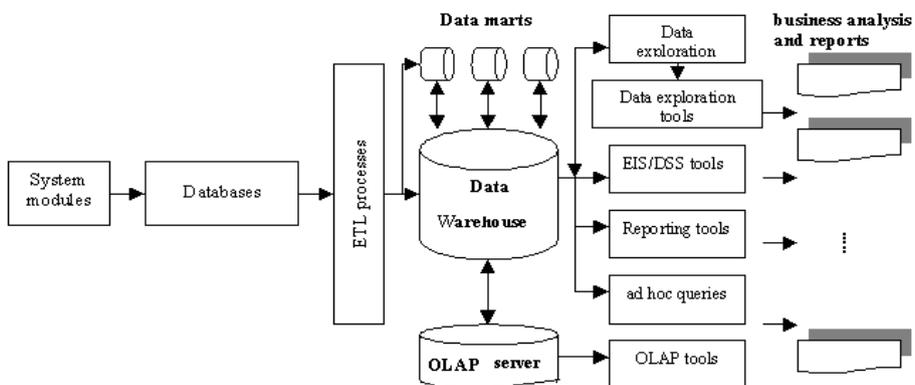


Figure 2. The BI model

Source: based on BI System... [2003].

intelligence requires the usage of modern IT solution. The tools of BI, e.g., Oracle Discoverer or BI Beans, allow presenting in a graphical way the analysed features from various points of view.

The BI technology can be treated as a technology of information collecting and delivering. Data warehouse is the basic element of any BI system. Data warehouse integrates the data coming from various source systems. It allows gathering of data as well as their processing within the process of required multidimensional analyses or data mining. Then the results are visualised.

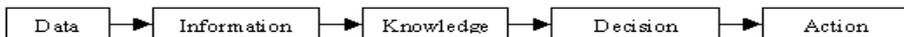


Figure 3. Realisation of the BI process

Source: author's own study.

The analysis of data allows for better understanding of the phenomena that are in the focus of interest in an enterprise. It also allows searching out and assessing the relations among investigated phenomena, identifying critical factors affecting these phenomena, and assessing particular effects of the undertaken activity as well as assessing the diversity of obtained effects for an individual group of consumers and searching the reasons of these diversity.

The in-depth analysis results can increase the effectiveness of undertaken activities, improve effects of the projects in progress and allow planning these activities and projects in a more effective way. The analysis of historical data collected for reporting purposes can be the basis for better prediction for future.

The main goal of BI systems is to obtain useful knowledge from data collected in many different sources through searching out and processing. The managers can quickly observe important advantages coming from the BI implementation and large potential that can be in use when investing in BI technologies. Dynamic progress in technologies supporting effective management is closely connected with business priorities of the managerial staff. On the other hand, process management can be seen as a new paradigm of management. Taking it into account, new requirements are addressed towards BI: such systems should support anticipation of future and should contain appropriate tools enabling construction of prediction models. Those way new tasks are put towards BI systems. The managers expect from new BI (called BI 2.0) that they should be able to realise or rather support business priorities such as [Kania (ed.) 2010]:

- rationalisation of business processes;
- reduction of costs in an enterprise;
- better efficiency of work forces;
- maintenance and finding new customers;
- better relations with clients;
- better usage of information and analysis;

- creation of new products and services;
- more effective targeting clients and markets;
- expansion into new markets and countries.

As said previously, within Enterprise 2.0 the main focus is placed on better efficiency of management and decision processes. If so, we can expect that systems responsible for supporting this process should be qualitatively different from the previous systems. This requirement depicts to almost all the features of systems. The needs created by managers reflect the changes in architecture and construction of the system. These changes and directions of progress in BI 2.0 can be dispatched within four following areas: organisation, data, analysis, and user. When thinking about an organisation, we have to realise that destination, goals, directions as well as decisional levels have to be seen in a broader perspective than in traditional BI. When we look at data, we should see data sources and data management in larger context, e.g., as data sources we have to use not only structuralised but also weak structuralised ones as well as multimedia or streams of data coming from realised processes. Analyses are the third area of necessary changes (enlargement) in BI2.0. They are connected with the range of data mining (performed not only on numeric data, but also on symbolic ones and analysis of the text). A very interesting change is within the subject of analysis: not only facts, but also processes. Also the type of analysis is to be seen broader: not only forward but also backward. The last “area” of changes is connected with a user, and a users group is larger in comparison with traditional BI and covers except specialists also mass participation [Kania (ed.) 2010; Tapscott 2006].

To obtain such goals, many changes are required in architecture as well as functionality of BI and they include [Kania (ed.) 2010]:

- changes in data management;
- creation of support for process management;
- data coming from social applications should be included within the data analysis.

Taking into account what has been already said, we can draw such a conclusion that all the systems responsible for improvement of management processes should be qualitatively better in comparison with traditional BI systems [Kania (ed.) 2010]. Table 1 presents a brief comparison between traditional BI systems and BI in Enterprise 2.0.

Examining Table 1, we can see that there are new challenges in front of BI systems in Enterprise 2.0. They depict such activities as widening data sources, broader automation of data achieving tasks, processing weak structured data, incorporating into data warehouses not only data about processes results, but also about their run. BI in Enterprise 2.0 must allow processing symbolic data. The need to analyse symbolic data, multimedia, and moving the analytical process at the semantic level seems to be obvious because it is closer to an end user. He or she will expect better cooperation with the BI systems through active help when realizing his or her (user’s) tasks.

Table 1. Business Intelligence for Enterprise 2.0

BI domain	Traditional BI	BI for the Enterprise 2.0
1. Purpose	Management need for information Tactical decision making	+ Corporate need for transparency + Trust + Engagement + Relationships
2. Objectives	Cost-cutting	+ Growth
3. Interface	Passive intelligence	+ Active, visual intelligence
4. Nature of work	Routine Manual	+ Interactive + Cognitive
5. Decision level / involvement	High level decisions Specialized user	Decisions at point of impact High participation (the masses)
6. Metrics	Bottom-up, existing data	+ Top down, using data to support strategy

Source: Tapscott [2006].

For more or less last ten years the new idea of computing called cloud computing has been developed. According to the National Institute of Standards and Technology, “cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” [NIST 2010]. The following basic types of cloud computing can be distinguished:

- Infrastructure as a Service (IaaS): where a user obtains access to infrastructure (software, hardware) and services via the Internet;
- Platform as a Service (PaaS): a user has access also to operational environment;
- Software as a Service (SaaS): except the possibility of accessing infrastructure as well as operational environment, a user can have access to applications (software as a service accessible for a client when needed).

Many other resources can be seen as a service in cloud, e.g., communication as a service, storage as a service, database as a service, etc. (see Figure 4).

The following sorts of clouds can be distinguished:

- public cloud, where a client fully uses the external IT resources;
- private cloud, which is located on the user’s territory and only he or she has access to the cloud’s resources;
- hybrid cloud, when a client locates part of the resources (e.g., important data) in a private cloud and other parts (e.g., applications) in the public one;
- dedicated cloud, where some parts of the cloud are selected (e.g., servers) and a client is the only one person who has a right to access it.

The idea of cloud computing towards business intelligence can be successfully applied to Enterprise 2.0. Especially when we remember that moving computing

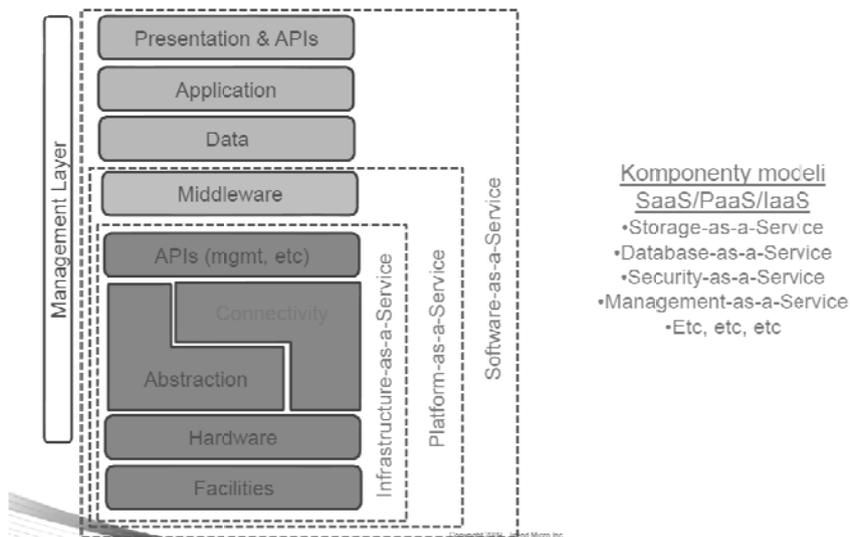


Figure 4. Services architecture in cloud computing

Source: Raszewski [2011].

partly or totally to a cloud can give many advantages such as saving costs connected with the necessity of buying hardware as well as software. A client obtains immediate access to those services for which he or she pays.

5. Final conclusions

Information and knowledge are one of the most important assets and their value is still increasing. Business intelligence is a technology integrating a huge amount of various data collected in heterogeneous data sources that are in use today as well as the archival ones. It provides managers with useful information and knowledge supporting them in the process of decision-making. Enterprises are changing towards process-oriented firms and, in consequence, they need more adequate BI systems. New tendencies in the form of cloud computing also will have important impact on BI within Enterprise 2.0. We can expect that progress in BI will go in these directions.

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BUSINESS INTELLIGENCE W KONCEPCJI ENTERPRISE 2.0

Streszczenie: Artykuł poświęcony jest *business intelligence* w nowej formie skierowanej do nowoczesnych przedsiębiorstw zwanych *Enterprise 2.0*. Składa się z pięciu części. Po krótkim wstępie, zaprezentowane jest społeczeństwo informacyjne i gospodarka oparta na wiedzy. W następnej części opisana jest koncepcja *Enterprise 2.0*. Część czwarta przedstawia *business intelligence* w *Enterprise 2.0* i jego funkcje. Artykuł zakończony jest krótkim podsumowaniem.

Słowa kluczowe: społeczeństwo informacyjne, ekonomia oparta na wiedzy, *business intelligence*, *Enterprise 2.0*, *cloud computing*.