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NEXT GENERATION BUSINESS INTELLIGENCE FOR SMALL AND MID-SIZE ENTERPRISES
ADOPTION, PREFERENCES AND OFFERS IN POLAND

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Abstract

Business Intelligence systems can be very useful for all kinds of companies. With the development of new technologies, the so called *Next Generation Business Intelligence* is evolving enabling simpler implementation, faster integration with other systems, as well as improved availability and usability.

Fierce competition is inherent in today's markets. There is a need for improved decision making and faster response to changes. BI systems are an interesting approach to dealing with such problems.

For a long time, this was only a solution for large enterprises, due to the cost of deployment. Recently, simpler and cheaper products are becoming available, as well as new, alternative methods of provision are being considered. Because of that, Business Intelligence begins to be also within the grasp of small and mid-size companies. However, very little research on Polish market has been found.

This thesis, first of all, investigates the reasons for the current level of BI adoption in Poland. Moreover, it analyzes products that BI vendors currently have to offer, with a focus on solutions suitable for SMEs. Lastly, companies' satisfaction from using a BI system, as well as preferences during selection and implementation are being explored. A relation between those various factors related to BI systems, and the company size is studied, based on a research of Laukkannen et al. (2005) done for ERP systems.

Literature review and previous research on IS for SMEs were the basis for designing two one-off surveys conducted among businesses, and phone interviews with BI vendors. Almost 100 companies, from all over Poland were contacted.

The results revealed that not the cost issue is the main reasons for low BI adoption level but low BI awareness and level of informatization of Polish companies. Except for that, there have been some SME targeted offers launched during last three months, showing that BI is not only for big corporations. Finally, a certain relationship between the size of the business, and satisfaction and preferences of companies have been identified.

This thesis shows that there is a need for education within the filed of Business Intelligence, especially among the smallest businesses.

Contents

Glossary

CIO – Chief Information Officer
CSV – Comma Separated Value
KPI – Key Performance Indicator
ROI – Return On Investment
OLAP – On-line Analytical Processing
ETL – Extract, Transform and Load
EAI – Enterprise Application Interfaces
EII – Enterprise Information Interfaces
DBMS – Database Management System
DBA – Database Administrator
RFP – Request For Proposal
KDD – Knowledge Discovery in Databases
BPM – Business Performance Management
AI – Artificial Intelligence
VPN – Virtual Private Network
SLA – Service Level Agreement
EDI – Electronic Data Interchange
ERP – Enterprise Resource Planning
CRM – Customer Relationship Management
SCM – Supply Chain Management
MSSO – Multiple Source Simple Output
MDM – Master Data Management
RDF – Resource Description Framework
TCO – Total Cost of Ownership

Chapter 1

Introduction

1.1 Report Structure

The first chapter of this thesis, consists and introduction to the topic. First there is a problem statement characterized along with the presentation of the hypotheses. After that, there is a short elaboration on the theoretical framework, followed by important concepts used in this thesis.

In the second chapter a general market situation is being described. It is the followed by a characteristic of small and medium-sized enterprises. A division of companies, depending on the size, are present based on the European Union regulations.

The third chapter is devoted to Business Intelligence. After a brief history to BI, a design framework is used for the purpose of thorough characteristic of BI systems. There are both, technical and business aspects used in this part. Later, the main function of such systems is defined - Knowledge Discovery in Databases -, along with the Decision Support System. At the end of this chapter, some advantages and disadvantages are shown.

In the fourth chapter of this thesis, a new concept of Next Generation Business Intelligence systems is introduced. The idea is defined, along with BI 2.0 and BPM concepts. A description of various features of Next Generation BI solutions is given, including: real-time reporting, visualization techniques, web-based interface, SOA and data quality issues. Finally, future trends, taking under consideration the drivers and barriers, are presented.

Various concepts related to BI provision are described in the fifth chapter. At the beginning, a concept of Total Cost of Ownership (from Gartner) is defined, followed by alternative types of using BI. First, the idea of outsourcing is presented, then SaaS business model is briefly described. The chapter is finished with the way Open Source is being used in relation to BI.

The sixth chapter is devoted to the study. A research methodology is first described, including the characteristic of surveys and phone interviews, which were the main method used, for gathering information. Then, the results of the study are presented. After that, the analysis of results is performed along with discussion and conclusions. Finally, the limitations of the study, and recommendations for future research are given.

The last, seventh chapter, present a summary of the entire thesis, and the findings. Main conclusions are again given.

At the end of the thesis, the bibliography is given, followed by a list of figures, tables, as well as appendixes.

1.2 Problem Definition

Current situation on the market is extremely difficult. Competition is very strong. Whenever a new idea arises, copycats show up in an instant, making it even more difficult to survive. Fast changing environment is another cause of problems. Companies need to keep up with new technologies and new ways of doing their work that are being developed and introduced each day. Prices of products and services are constantly decreasing, therefore it is important to find profits in all possible places - e.g. decreasing the cost of production. Except for that, in most industries, all possible customers are already in the game, so the problem is not to find new ones, but to keep the ones that a company already has 0 the importance of Relationship Marketing is being stressed[Rottensteiner(2001c)]. Firms cannot afford losing a customer, so they need to respond to changes in an instant. Moreover, most of the companies, having multiple IT systems supporting their business operations (ERP, CRM, SCM etc.), need to find a way to handle all the information more effectively, draw consolidated conclusions instead of just isolated ones (from a single system, in a single department at a time).

A solution to most of those problems are the next generation Business Intelligence systems. They serve a variety of purposes from simple analysis, through being a performance management indicator to a sophisticated and comprehensive decision support system. It allows for instantaneous reaction to problems within the company as well as changes in the external environment leading to decreased loses (both in profits and in customers).

Such a system, however, is not for free - rather on the contrary. Building the entire infrastructure, buying the necessary hardware, taking care of the system integration, training the users, having IT support - all this requires great investments, which usually are beyond the capabilities of SMEs. Small companies need to be very cautious and careful while selecting a solution, since bad investment of this size, may lead to an end. On the other hand, such companies are probably

the ones that need BI solutions the most, in order to be able to compete with big corporations and mass production.

The price of deployment of such a solutions, is most frequently said to be the main obstacle to increased adoption. *In this thesis, I would like to show, that although the cost may be repelling, the main factors slowing the adoption of BI systems in Poland, is in fact very low informatization, and low awareness of Polish companies about the capabilities of such solutions.*

Cheaper solutions are becoming more and more popular, and BI vendors are also targeting their offers to the group of SMEs. This thesis will also try to show, that *technologies incorporated in next generation Business Intelligence systems, are facilitating their provision in alternative, more attractive offers.*

Lastly, this thesis will try to investigate companies preferences during the selection and implementation of BI systems. Most of the papers treat small and mid-size companies as one homogenous group. A research by Laukkanen et al. (2005) on ERP system adoption, shows that there are differences not only between SMEs and large enterprises, but also within the group - between small and medium size businesses. It is assumed therefore, that in case Business Intelligence systems, there is also such a difference.

No research on the topic of reasons for BI adoption level in Poland could be found. Except for that, various new technologies are being developed, as well as new business models introduced. It is possible to find in various places, recent technological advances related to various aspects of Business Intelligence. There is, however, missing a kind of comprehensive paper, where alternative ways of BI provision were defined and brought together. This thesis aims at providing such a characteristic. Moreover, the relation between company size, and BI drivers and constraints have not yet been investigated.

As a result, this thesis can be used by BI providers, to get information about the state of the Polish market. It could also be useful for companies, especially SMEs as a reference and introduction to general idea of Business Intelligence, more advanced features, being implemented in the Next Generation BI, as well as alternative possibilities of using such a system, which would otherwise be beyond their reach. Because of lack of empirical research related to Business Intelligence that was realized on the Polish market, the author of this thesis expects it will contribute to the knowledge, dealing with this subject. It could also help BI vendors understand the importance of distributing information on BI and reaching the customer, before their competition does.

1.3 Methodology

This thesis, in order to answer the above stated need and investigate the situation on the BI market will conduct a complex research. The BI awareness and informatization level among Polish companies will be determined by means of a one-off study, on a sample taken from all companies, from all sectors.

After that, BI vendors, offering any kind of BI solution on the Polish market will be found, and questioned by means of an interview. The research will try to determine general offer of the providers, as well as identify special offers targeted at small and mid-size companies. Features of such systems, provision model, as well as its pricing, the author will try to analyze and give a general characteristic of.

Lastly, another cross-sectional study will be conducted with companies already using BI systems. This research will try to understand and analyze the preferences during selection and implementation. Moreover, a relationship between the size of the enterprise and various factors will be studied.

In order to do all that, a theoretical research first needs to be done, in order to understand the subject of Business Intelligence systems, next generation BI technologies being developed and features being introduced to the products. Also the alternative approaches to BI systems will have to be determined and understood from the theoretical point of view. Therefore this thesis, will also be suitable for general introduction to BI, for people who are new to solutions of such type. Each of the fields presented in this thesis, can then be further explored, based on particular needs.

1.3.1 Theoretical Framework

This thesis will use a number of concepts and ideas for proper understanding of the subject. These are:

- Small and Midsize Enterprises

- Business Intelligence

- Next Generation BI - BI 2.0 and BPM

- real-time operational BI

- visualization techniques

- web-based technologies

- SOA

- Outsourcing

- Software as a Sevice

- Open Source BI

All mentioned above issues, are strongly interrelated with each other. As a starting point it is important to take the SMEs under consideration. These are a specific kind of businesses, which need to compete with greater ones, but have some advantages and disadvantages in comparison with them. Therefore, this paper will begin with a characteristic of the market situation and general description of SME. It is crucial to remember that the simple approach that considers a small business to be a little big business is strongly mistaken. Previous finding related to this group of companies will be presented here, in order to give a reference to the results of the analyses performed in the practical part.

Other concepts are rather broad terms. A theoretical analysis of each of the concepts will, therefore, follow. Business Intelligence and Next Generation Business Intelligence are IT systems that give the user a a number of functionalities, which ultimate aim is to support the decision making process. A description of Business Intelligence systems will be provided, to give the reader a general idea of what BI solutions are, how they are constructed and what are the different parts. Except for that, it will show how different terms are approached in this thesis.

In the Next Generation BI part, various functionalities and technologies will be characterized. Some of them are already implemented in BI solutions, while other are still under development. The aim of most of these technologies, is to facilitate the integration of BI with other IT systems in the company, as well as support the over-the-web provision of the service.

At this point the paper assumes BI technology can be useful for all companies, including SMEs. Because of that, no matter if all features are needed, or only some of them, there is an issue of how to implement such a solution. Business Intelligence systems are expensive, and SMEs will probably need to find an alternative to just buying the vendor's product and implementing it from scratch. Therefore, business models based on outsourcing, ASP, SaaS, as well as Open Source are most likely to be more suitable for this group of businesses. Each of those terms will be presented in the theoretical part and later on analyzed in the practical part, in order to elaborate on their viability for the *BI for the masses* concept.

1.4 Fundamental Concepts

As a starting point, it is important to define the most fundamental concepts that will be used throughout the entire thesis. It is crucial to be able to distinguish between data, information and knowledge, since very often they are confused[Orf and Mayros(No Date)].

Data is merely a record of the moment. For example, a customer name, phone, age and address are data. This is a cornerstone of all Information Systems, but it is very difficult to analyze and use for humans. In companies, it usually is related to customers, transactions, products. Each piece of data is almost useless, but after processing it evolves into information. Data is on its own disorganized.

Information is evolved from data. When data becomes organized it becomes information. The collection of data begins to offer multiple views that tell a story of markets, customers or industries is information. However, large amounts of information, are still very difficult to analyze quickly by humans.

Knowledge results when information becomes so compelling that the user begins to see current or future trends/projections that correlate to specific profit opportunities at the speed of thought. These are patterns identified in information, that give the ability to understand certain trends and behavior.

In this thesis, some of the concepts are described in detail, but most of them are only briefly characterized. This paper can be used as a general guide to BI related content. However, for more details the reader is encouraged to use the referenced material and other literature.

Chapter 2

Market Situation and SMEs General Characteristic

2.1 General market situation

The basis of business operation, especially in case of SMEs is *differentiation.*

> *"In today's competitive business environment, the ability to identify profitable customers, build their long-term loyalty and steadily expand existing relationships is key competitive factor to a company"*
> [Lee and Park(2005)]

This is a starting point. The best way to attract customers is to offer them something that they need, and that is not available on the market already. Other approach, is to deliver a product or service that already exists, but in a different way. This is the cornerstone, but at the same time, the most difficult thing to realize, and only few are able to come up with a revolutionary idea - like Larry Page and Sergey Brin, the cofounders of Google. The rest is usually copying someone else's idea. And nowadays, in the world of Internet and the World Wide Web, as well as fast communication, ideas are spread all over the world in an instant. Because of that, it is even more difficult, to achieve success.

> *"Most companies operate in increasingly commoditized markets where new products and services can be copied within days. Mergers and acquisitions are no longer sufficient methods of gaining market share or growing revenue. Advances in technology, such as the Web, wireless devices and broadband communications, are rewriting the rules of the same game in increasingly rapid cycles. And with more information, more choices and higher expectations, your customers hold more power than ever."* [Sas(no date)]

Due to the above mentioned reasons, there is a fierce competition in almost every sector of today's economy. Only businesses which require considerable investments or achievements like Google, which almost in an instant, from a garage 2 person project, become a 10,000 employees, worldwide company [Google(2007)] in about 5 years, are difficult to copy. The rest of the enterprises, has to handle more and more competitors coming every day. As a result, *"the focus of most businesses today is simple – increase sales with the least amount of expense"* [Orf and Mayros(No Date)]. However, easier said than done. In order to increase sales - increase the market share and attract new customers - the quality of the product or service needs to be improved in comparison to competition. This, on the other hand, is hard to obtain with decrease of expenses. Nevertheless, a way to increase efficiency needs to be found at some point of value creation. Bigger companies benefit the economy of scale. Smaller ones, need to find a solution in a different place. And because of that, today's entrepreneurs need to face a lot of problems and take under consideration a lot of different issues.

> "As a result firms need appropriate decision support infrastructures in order to face these challenges." [Seufert and Schiefer(2005)]

A very promising solution, in such a situation may be a Business Intelligence system. The decision support side of such solutions, enables managers and company owners to make better informed decisions. They are then able to find the places where the costs can be decreased.

2.2   BI market situation

BI vendors for a long time have been concentrated on larger companies. However, they also started to experience increasing competition. Because of that, Business Intelligence providers are constantly broadening their range of offers. Having spoken to most of the vendors on the Polish market, it turns out that majority is also taking medium size companies under consideration and has customers in this group. Except for that, some providers also begin to target their offer to the smaller companies. Cognos introduced Cognos Now!, a solution targeted especially to the group of SMEs on May 14, 2007, and Oracle launched its Oracle Business Intelligence Standard Edition One on June 25, 2007, which is a complete solution that should suite small and medium-sized companies' needs (for details see Chapter 6).

2.3 Small and Medium-sized Enterprises

This group of companies is a very important one in numerous countries. *"In most industrialized countries, small and medium enterprises are acknowledged as vital contributors to economic growth and job creation"*[HSBC(October 2004)]. What is even more important is the fact that SMEs are playing a very important role in the European Union economy, including Poland. EU is strongly supporting this sector in a variety of ways. This includes equally financial support, as well as regulatory issues and creation of special units and institutions who's role is to advise and help the group of SMEs in their operations[Konarska(2003)].

According to an estimation[HSBC(October 2004)] in 2003 Europe there were 19,25 million SMEs giving 97.4 million jobs. Collectively, this accounted for 70% of employment, 57% of turnover, 51% of value-added and 42 % of exports by all enterprises in Europe. In EU, this group of companies is of about "99% of the all companies and provide around 65 million jobs and contribute to entrepreneurship and innovation" [European Commission(May 2003)].

In Poland, in 2005 there were 3,5 million SMEs registered, which was about 99,5% of all companies. This group provided 67% of jobs and create 48,6% GDP [Polish Ministry of Economy(2005)]. Because of such an influence, the government needs to pay attention to this group. It needs to stimulate the development and improvement of this group's environment.

2.3.1 Adherence Factors

After joining European Union, Poland is using common in EU regulations, regarding the definition of the companies of different size, which are included in the economic activity liberty Act.

Enterprise category	Headcount	Turnover	or	Balance sheet total
medium-sized	< 250	≤ € 50 million		≤ € 43 million
small	< 50	≤ € 10 million		≤ € 10 million
micro	< 10	≤ € 2 million		≤ € 2 million

Figure 2.1: Enterprise adherence criteria[European Commission(May 2003)]

The adherence of the company to a particular group of companies depends on three factors:

- number of employees

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- the size of the turnover

- the size of balance sheet total

Based on these numbers, the company is assigned according to Figure 2.1. There-
fore, the size of the company is determined based on two factors. One is the
number of employees and the second is either the turnover or the balance sheet
total. The practical part of this thesis, uses this criteria of division.

2.3.2 Management

It is a very common mistake to assume that managing a small business is essen-
tially the same as in case of a corporation, but on a smaller scale - lower sales,
smaller assets, and fewer employees[Welsh and White(1981)]. The most important
difference is a sort of condition, called *resource poverty*, which requires a diverse
approach from the one used for larger companies. This condition is related to the
mentioned above lower sales and fewer employees, but above all to the fact that
the company is stuck with one, usually small industry, having a lot of competitors.
Such an environment results in price cuttings as a way for increasing revenues, and
because of the smaller scale issue, the profits suffer considerably in such a case.

Except for that, employees' salaries, as well as the salary of the owner, represent
a more significant part of the revenues, which, on the other hand, are smaller
than in case of big companies. Because of this fact, there is not much more left
for investment, innovation, hiring professionals, who's help the company could
definitely make use of, etc.[Welsh and White(1981)].

Moreover, external factors have a stronger influence on the companies belonging
to the group of SME [Welsh and White(1981)]. All types of regulations related to
general and labour law, taxes, interest rates, economical changes on the market,
all considerably affect more smaller enterprises than their greater counterparts.

Therefore, appropriate measures need to be taken, and proper management is
necessary. In order to be able to make good decisions, one has to be aware of
the differences in the management of companies of various sizes. The only way
to understand the realities of SME group, it is crucial to be aware of the above
mentioned differences.

2.3.3 Development Barriers

According to the Polish Ministry of Economy (2005) SMEs in general encounter
three major development barriers:

- market and environment barriers

- management barriers

- financial barriers

The first barrier is related to the fact of small scale, and in this situation, all variations in the economy have a stronger influence on this group of companies. Another relevant issue in this matter is the competition, which in case of smaller enterprises is easier to copy the product or service.

The second one, as mentioned in the beginning of this section (Section 2.3) is due to insufficient knowledge and skills of managers and entrepreneurs, which are very often a direct result of insufficient funds. This leads to decreased innovation and general development of the company.

Last, and probably the most important development barrier are the financial issues in the enterprise. Very often salaries of the employees and the owner take the larger portion of the business earnings, therefore, there is not much left for investment. Because of that, it is difficult to broaden the range of company's services. It is also very problematic to introduce new equipment, new technology or a new information system, no matter how helpful it might be for the company in the long run.

2.3.4   Information Systems in SMEs

As mentioned previously, SMEs, due to resource poverty, experience greater problems with implementation of new technologies. Nevertheless, the fact of a more problematic situation does not implicate that the latest IT solutions are only for big corporations. As a matter of fact, the group of smaller companies have a lot to gain from recent technological advances in various fields. Of course, *"some of these firms are destined to be the first victims of this new competitive tool, [but] others, by being more innovative, have been able to profit from the mane advantages offered by technological development"*[Blili and Raymond(1993)].

However, greater care has to be taken during selection of new technologies, since SMEs cannot afford any mistakes. Because of the financial issues, described above, they have a limited budget of any kind of innovation. In such a case, if the company chooses a bad option, the loss is more perceptible.

Except for that, previous researches previous researches prove that smaller companies often lack the necessary knowledge during system implementation, as well as have insufficient information during selection[Laukkanen et al.(2005)].

Nevertheless, despite the development barriers, mentioned in the previous section, smaller companies are implementing more and more information systems of various kinds. Some solutions are chosen because of all the benefits that the enterprise will experience, but there are also many related to the external influence

[Laukkanen et al.(2005)]. A very common situation, in case of SMEs, is that a larger business partner, a key client that the smaller company strongly depends on, decides to implement an IS, and at the same time forces it to implement the system as well. This is usually the case with ERP, SCM and EDI systems, which in order to give more benefits, require other companies to have it as well.

Business Intelligence, on the other hand, is an example of a solution, that is not related to the operation of other companies, in this type of way. Therefore, the decision to implement it, is only dependent on the company's individual needs. However, external advice in the form of consultancy companies or friends may also be present.

As far as the benefits are concerned, a kind of decision support system, which BI usually is (see Chapter 3), is probably even more useful in companies from the SME group, than in case of big corporations. Smaller business cannot afford making a mistake, so being able to make better informed decisions is a significant advantage. On the other hand, such a system is related with rather considerable investment and smaller companies may not have the necessary funds. This way SMEs find themselves in a vicious circle. Because of that, and because of the increasingly competitive environment, small and medium businesses are in a difficult situation.

2.3.5   Comments

Despite all the doubts and problems, a promising thing is the fact that there are a lot more SMEs than corporations (99,5% of all companies in Poland in 2005). Therefore, vendors will soon run out of customers if they only target greater enterprises. It can be noted that more and more vendors and service providers are beginning to cooperate with SMEs, trying to get a greater share in this market.

Chapter 3

Business Intelligence

Nowadays, IT departments' tasks in most of the companies are not delimited to simple IT infrastructure management, distribution of equipment to other employees and operating help desk. The situation on the market forces entire companies to achieve operational efficiency. In order to do that, every department, including IT, must collaborate withe eachother. The role of Information Technology in this case is to cooperate with *"internal business customers and proactively manager growth – all the while seeking new savings opportunities."*[IBM(2007)]. Because companies are facing increasingly demanding challenges, IT departments also need to take under consideration:

- Costs control

- Integration of multiple systems

- Simplification of the infrastructure

- Proper allocation of resources for addressing long-term business needs

- *Improved performance with fewer resources*

- Focus on IT governance[1] and strategic planning to manage priorities

Questions arise: *how to achieve all this? how to use assets more effectively? how to improve business operations and decrease costs at the same time?*

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[1]A structure of relationships and processes to direct and control the enterprise in order to achieve the enterprises goals by adding value while balancing risk versus return over IT and its processes - http://www.austin.cc.tx.us/audit/Glossary/LetterI.htm

A possible solution would be Business Intelligence and companies become to realize that. EXP[2] identified *Business Intelligence* systems as the highest priority technology in 2006 survey. According also to that survey *"two-thirds of CIOs believe their competitors make better use of information"*, and recognize strengthening the *'information value chain'* as the highest priority technology planed to increase their BI budget by an average of 4.8 percent in 2006[Sas(no date)].

So is BI really a solution to all those challenges? What is all the hype behind BI for?

3.1   History in Brief

Business Intelligence systems are a rather new solution, however the idea itself dates back to the times before Christ. A famous Chinese author, Sun Tzu, in his military strategy book, *"Art of War"*, was the first to mention this idea. He "believed that in order to win a war, you must have complete knowledge of your own strengths and weaknesses, as well as the strengths and weaknesses of your enemy"[Sun Tzu(No date)], and this is considered to be the cornerstone of today's Business Intelligence systems. In current difficult and competitive environment, enterprises need to be aware of their pros and cons, as well as realize what are the weaknesses of their competitors, and exploit it.

Getting closer to present times, 20 years ago, *"Business Intelligence was known as Decision Support Systems and was limited to large enterprises and used primarily by a select group of elite and highly trained users"*[Dresner(No date)].

In 1989, Howard Dresner, a research scholar at Gartner Group, created the term BI and defined it as a set of methods and concepts to improve business decision making by using data resources.

So the general idea is to make companies realize that understanding their customers is not enough, one has to understand its competitors and itself, in order to achieve success. Business Intelligence tools are developing very fast, and each new solution provides the user with a handful of useful features to make the decision making process easier. BPM by means of KPI helps managers understand the company itself, while BI gives them the ability to understand better their customers and the market, in which they operate.

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[2]"Growing IT's Contribution: The 2006 CIO Agenda", Gartner Executive Programme (EXP), January 2006

3.2 Definition and general characteristic

There is a number of definition of the term, however they are essentially quite similar. According to Webopedia:

> *"The term Business Intelligence (BI) represents the tools and systems that play a key role in the strategic planning process of the corporation. These systems allow a company to gather, store, access and analyze corporate data to aid in decision-making. Generally these systems will illustrate business intelligence in the areas of customer profiling, customer support, market research, market segmentation, product profitability, statistical analysis, and inventory and distribution analysis to name a few."*[3]

In todays business environment, companies are bombarded with enormous amounts of data coming from a myriad of places all the time. Whether these are client data from the CRM system, newspaper articles related to company's operations or e.g. latest news from the Stock Exchange, treating about unsuspected merger or acquisition in the sector, all this is or might be highly relevant for the business and therefore needs to be stored and processed appropriately. The analysis then has to provide essential information to the decision makers.

BI delivers data exploration and analysis capability to the executives to support their decisions and their day-to-day business activities.[Foley and Bates(2004)] It is essential to look at the *whole picture* and, most importantly, at *the result*, so building a Data Warehouse alone is not enough to be talking about a BI system. There is a bit more than just that.

Reasons for using

Such systems are, above all, a source of more informed business decisions. Being able to recognize various opportunities as early as possible, having time to react to them appropriately and making 'the right decisions at the right time' leads to gaining competitive advantage. BI systems gather data from multiple sources and by means of advanced analytics and reporting, if used correctly, support the decision making process in an outstanding manner. Except for that, such systems can monitor the standard operation of the company and can provide the user with information about its performance, usually by means of KPI. Strictly speaking, organizations need BI so that they *"can make more money, save more money and allocate what they have more effectively – by getting better answers faster"*.[Sas(no date)]

Moreover, using BI systems leads to[Wikipedia(1)]:

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[3]source: http://sbc.webopedia.com/TERM/B/Business_Intelligence.html

- enhanced communication among departments

- coordination of activities

- faster response to changes (e.g. in financial conditions, customer preferences, supply chain operations, etc.)

According to Gilad and Gilad (1988) *"with structured Business Intelligence programs corporations are better able to*:

- track current and potential competitors

- analyse markets

- determine likely candidates for acquisition or merger

- monitor technological developments, and keep abreast of a broad range of political, economic, social and legislative trends with significant impact on a company's future"[Davis(No date)]

Therefore, reasons for using BI systems are numerous and can be found on almost every possible level of company's operation. It seems that in today's environment, in order to stay on the market and remain competitive, it is inevitable that businesses start sooner or later making use of advanced IT tools and technologies. BI is one of such technologies, and at the same time, enables superior performance and effective usage of other IT systems within the organization.

3.3 Design Framework

There is a number of ways a BI solutions can be analysed. In the following pages, a general approach will be used, to present most of the aspect of this kind of systems. It was introduced by a BI professional Rick Sherman in a column published at DMReviw.com[Sherman(2003)]. However, more detailed analysis and description of each element of that approach will be presented in this paper.

A concrete framework is essential for proper design and organization of the Business Intelligence system. Without a good approach, a lot of misunderstanding and conflict is most likely to arise. Most of the problems are conceived because of the difference between IT experts and business users of the future system. This is because of various reasons.

First of all, business people very often are not aware of what is technically possible and what is not. Moreover, they are only interested in the solution and

do not pay attention to what is required to achieve a particular result. The reality is quite seldom as simple as it may seem.

IT professionals, on the other hand, sometimes exhibit too strong technical approach and have difficulty understanding business needs. The only way to handle such problem is to use a framework in which all the needs are documented and precisely described, IT staff is targeted on thorough understanding of those needs and finding proper, diversified but at the same time the simplest, most convenient and as cheap as possible solution available.
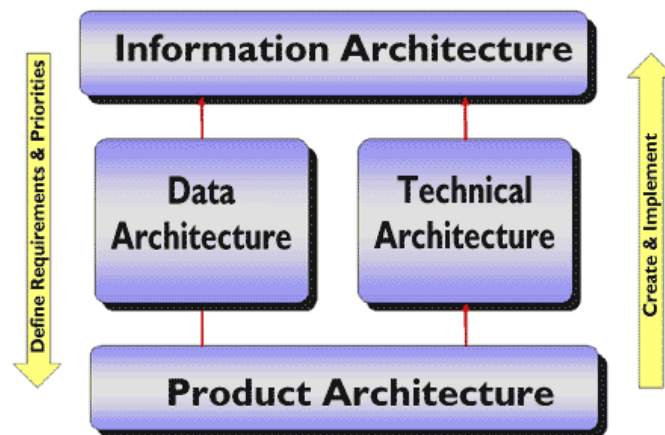
Figure 3.1: Business Intelligence Architecture[Sherman(2003)]

The model of a solid framework is presented on Figure 3.1. According to it, the system consists of a group of interrelated elements, of four architectures:

1. Information architecture

2. Data architecture

3. Technical architecture

4. Product architecture

The following four sections are devoted to presentation and detailed characteristic of each of the elements.

3.4   Information Architecture

This part of the architecture is the closest to the user. It *"defines what business application systems you need to access, report, and analyze information to enable*

business decision making"[Sherman(2003)]. Therefore, within this element all applications and tools of the system, that are visible to the user, are encompassed. At the same time, this part is usually the only one that business users really care about and are interested in. Since the system is supposed to serve their needs, a lot of attention needs to be put in proper definition and understanding of their requirements. It is essential to realize the fact, that those needs not only shape the look of this part of the framework, but also all other three. Depending on what the users want to receive and how they want to receive it, appropriate database systems, as well as other technical solutions will have to be implemented . Therefore, while creating this element of the architecture, it is reasonable to use a methodology from the group of Agile methods or Contextual Design. These methods stress the importance of the user feedback during the planning and development process, as well as divide the system into small parts, iterations and make good use of incremental delivery of consecutive elements of the final application. This is especially significant in case of larger BI solutions with multiple functionalities, however also smaller ones should pay attention to those aspects. It is enormously efficient to avoid constant modifications and changes of the already implemented system and instead develop a successful system from the very beginning[4].

Within this architecture, it is possible to divide the system into layers, depending on the task to be performed.

3.4.1 Functional Layers

In general, there are three layers[Szwoch(2006)]:

- Integration – responsible for data extraction from source systems and, later on, initial cleansing, transformation and feeding of the analytical layer;

- Analysis – most complex and diverse; uses a myriad of tools ranging from simple queries, through multidimensional analytics to decision support systems based on artificial intelligence

- Reporting – the aim of this layer is to present data to users in the most convenient way

Integration

Each layer is highly important for the entire solution. The first one, takes care of finding the necessary data and handling of multiple versions of the same record. Moreover, it performs initial transformations. However, the most important feature is reading the data from any possible source and loading it into the analysis

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[4]based on Requirement Engineering course, the author participated in

layer. There are various kinds of databases and a variety of ways that the data can be stored. Whether it is a SQL server, MS Access database, an Excel sheet or a CSV text file, the integration layer should be able to read it, distinguish the data stored in it and prepare it for further analysis. In case of multiple sources, the data has to be transformed into a single version before loading.

Analysis

The second layer, on the other hand, is designed to perform a variety of, as its name suggests, analysis. These can be as simple as comparison of sets, trivial aggregation functions made on one or two tables. They might as well be extremely complex, joined computations on many tables with a myriad of relations. Therefore, this layer needs to be prepared for any eventuality and, depending on the needs, give the user a wide offer of possibilities.

Reporting

The last layer, reporting, is responsible for making the results of all the calculations available to the end users. The idea is to present the information, or even knowledge, gathered during the analysis in the most clear and concise way. The stress here is on usability and customization aspects. The former one aims at making the application as easy to use as possible, and available and understandable for relevant employees, no matter what their technical background is. The idea of the later is to make the end product suitable for vast groups of people from a myriad of sectors and being professionals in a variety of departments. The importance of this aspect has been especially noticed recently and much focus is given to it in the BI solutions of the next generation. This will be described in detail in the next chapter, mainly in the Dashboards and Scorecards section.

3.5 Data Architecture

This part of the architecture is related to data and all aspects related to it. That includes also various source systems, from which data is gathered, as well as general rules for and characteristic of transformations of data to produce useful information and knowledge. Although *"it begins with the sources (information provider) and ends with the business user (information consumer)"*[Sherman(2003)], which is similar to the range of the previous element of the system architecture, the actual relevance is on a different level. While Information Architecture is more related to real operations and process of information creation, in all layers (from a source, to a report), the Data Architecture, on the other hand, is more on the meta-level. It encompasses the data information requirements, determines and describes the

sources of data, characterizes business rules and transformations and at the same time includes moving, storing, formatting and giving access to the data.

Most common tasks assigned to this part are[Sherman(2003)]:

- creation of dimensions – data model characteristic

- achieving common data types – unification of data formats coming from a variety of systems

- handling data quality issue (for more detail see Section 4.8) in the following chapter)

- preparing data for further processing – analysis and presentation

Experts suggest good understanding of this element of the architecture followed by precise planning of the components needed and activities required for its creation and management. It is considered to be the most difficult part, because of frequent underestimation and poor understanding. Because of that, this *"is where shortcuts are most often taken ...[, which] results in the creation of information silos with different numbers that confuse business decision making"*[Sherman(2003)].

When discussing data, it is inevitable to mention issue related to how it is organized in the system, within the organization. Technical aspects will be analyzed in the section devoted to next architecture, however, first it is important to go into more detail concerning conceptual aspect of data storage. There are two, main approaches:

1. Collective databases

2. Data Warehouse (DW)

A comparison will be presented on the following pages. After that, a description of three main characteristic features of various databases, on the Data Architecture level will follow:

- Data Model

- Query Language

- Computational Model

3.5.1 Collective databases vs. Data Warehouse

First of all, it is important to realize the need for databases and Data Warehouses. Although, it is expensive to implement new technologies (Data Warehouse is of no exception here), the cost savings in this case can be easily notified. The main idea of Business Intelligence systems is to deliver information to the users. Data Warehouses considerably decrease the costs of information provision to every user within the organization[Kolonko(2002)]. On the following figures, the puzzles represent various source systems. Figure 3.2 shows a system with no database.
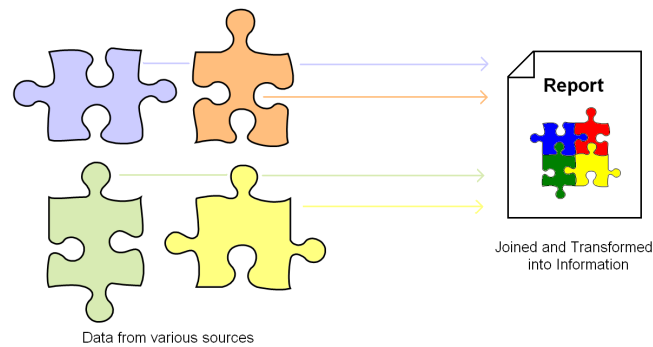
Figure 3.2: Generation of a report, without a database

In this case, the report is generated directly from the data gathered from the systems. It is done simultaneously with the collection, format unification and other transformations.

On the other hand, on Figure 3.3 the same situation takes place but in this system, there is a Data Warehouse included.
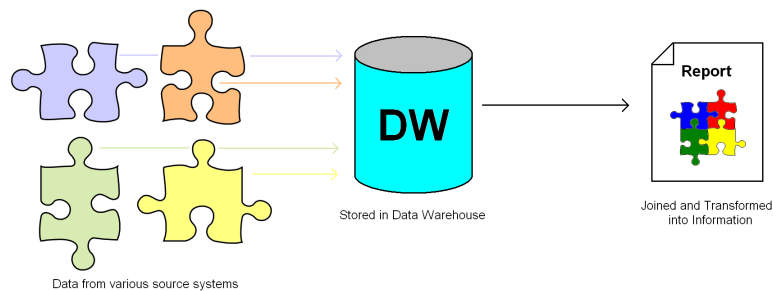
Figure 3.3: Generation of a report with a Data Warehouse

Its aim is to store the data gathered from numerous sources. The data is first modified to a common format, in order to make further transformations easy.

Therefore, in the beginning, all the data that is needed is stored in the DW, and later it is processed and transformed into information, that is put in the report.

Hence, *"the only difference between the two figures is that on the second one, there is an additional element - a Data Warehouse"*[Kolonko(2002)]. Comparing those figures, it seems that this additional element, is just an unjustified additional cost. In order to understand the advantage coming from the system with DW, see Figure 3.4 and Figure 3.5.
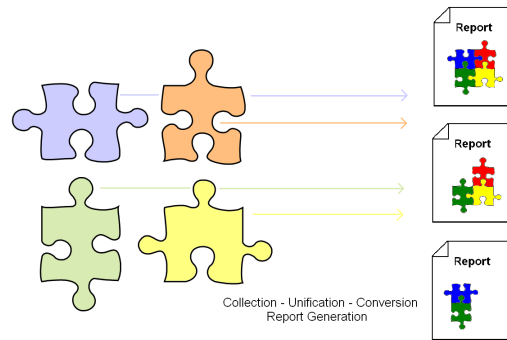
Figure 3.4: Multiple reports without a database

On both figures, a case is presented, where a number of reports is created based on the same sources. On Figure 3.4, each time a report is created the process of data collection, unification and conversion is performed along with the generation of the report. Although different information is produced based on the same group of source systems, the data still needs to be processed as it would be done for the first time.
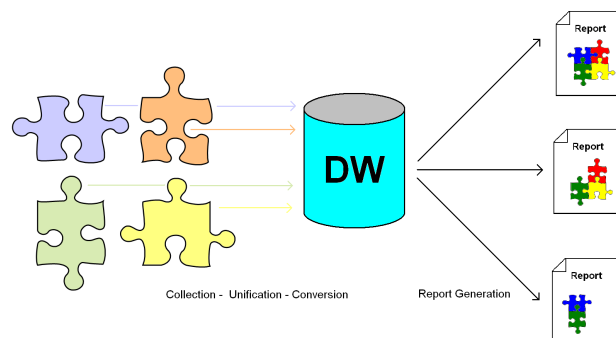
Figure 3.5: Multiple reports, with a Data Warehouse

On the other hand, on Figure 3.5, the entire data needed from the source sys-

tems is initially gathered, unified and conversed to a common format and stored in the DW. After that, the data, in DW, is available for further processing and ready for actual report generation. Therefore, the process of data collection, unification and conversion is performed only once. Because of that, the costs of providing information to users, as well as the time used for preparation of the report is decreased[Kolonko(2002)].

Obviously, the system with a DW is of no use, if only a single report is needed based on particular source systems. Its advantage increases as the number of reports increase. Therefore, this is a solution for organizations that have a high need for information – usually greater enterprises, however recently, with the increase of transactional data in all companies, also SME may make use of it.

Departmental Data Marts
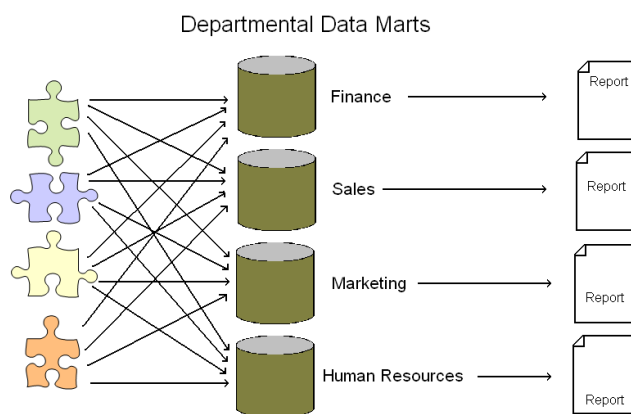
Figure 3.6: Collective database system

If the company is big enough to have separated functions distributed to various departments, then another issue arises. Each department has its specific needs. This includes data, analytical capabilities as well as reporting. A very common solution in such a case, typical for older BI systems, is to use Data Marts for every part of the organizational structure – a so called Collective Database system. As a result, Finance, Sales, Marketing, Human Resources, etc. have their own infrastructures and each one gathers information for their particular needs and prepares reports, specific for their profession (see Figure 3.6)[Kolonko(2002)].

However, with time, the organization gets bigger and both data as well as analytical and reporting needs of different departments begin to overlap[Szwoch(2006)]. In such a case, it is a waste of resources (hardware, software, people, money) to have a separated Business Intelligence system. Therefore, as mentioned before, to

decrease costs it is reasonable to introduce a central Data Warehouse to serve the needs of the entire organization[Kolonko(2002)], as presented on Figure 3.7.
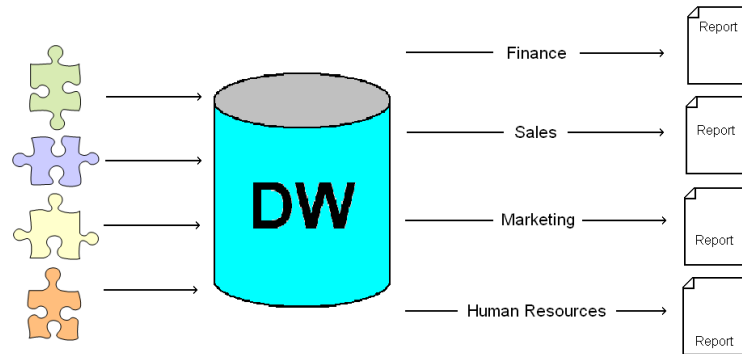
Figure 3.7: Data Warehouse serving various departments

As a result, there is only one copy of each data element and there is only one analysis and reporting solution shared between all departments.

There exists an intermediate solution to those, mentioned above. Some organizations decide to implement central Data Warehouse in the company, but at the same time also include departmental data marts in the system. In such a case, data is gathered from various source systems and stored in DW. After that, in each data mart, necessary and relevant data is put for the needs of the particular branch of the organization. This makes the procedure simplified and cheeper in comparison to the one presented on Figure 3.6 because of the number of interfaces. In the first case, the number of interfaces is equal n x m (where n - number of data sources, m - number of data marts). On the other hand, in the second case, the number of interfaces is equal n + m, since there is only single interface between DW and a single data mart.

The main advantages of data marts are:

- limited hardware resources needed

- inexpensive software is usually enough (e.g. Windows NT)

- rather easy to implement

- reduced source-to-target data-mapping exercise

- rather inexpensive data mart packages available

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- easier to manage

This is usually a good solution for very small companies, or a starting point for bigger ones. However, in case of growing organizations and, equivalently, growing needs, it is essential to not to try to improve everything at the same time.

The main disadvantages of data marts are:

- lack of common understanding of the same notions (i.e. client, product, etc.)

- problem with comparison of results (coming from different systems)

- many disparate sources of the same information and problem with evaluation, which one is correct

- repeated implementation of equivalent transformations of data from the source systems

- not standardized data analysis procedures

- enormous amount of metadata

- general usefulness is limited

- data integrity in case of integration of departmental data marts

On the other hand, *"integrated, corporate Data Warehouse plays, for a Business Intelligence solution, a role similar to the skeleton in life organisms: ensures the shape and form while keeping essential flexibility"*[Szwoch(2006)]. It is a universal source of consistent data, and therefore eliminates misunderstanding and double meanings. Such systems are, in general, considered to provide better operation and performance, however, they have an important disadvantage – they are usually very expensive.

3.5.2 Data Model

The first characteristic feature of all databases is the data model. It is *"an integrated collection of concepts for describing data, relationships between data, and constraints on the data"*[Van Garden(2004)]. Therefore, basically, it characterizes the structure of the database and defines the way it can be used. There exist several models:

- hierarchical

- network

- relational

- object

- object-relational

Hierarchical data model takes a from of a tree-like structure. As the name suggest, the data has some sort of hierarchical relation. The structure starts with a root, which is the highest level. Later on, there are sub-trees, being further levels. In the end there are leaves which contain the actual data. Between elements from one layer to another, consecutive one, there are nodes of a "father-son"-relationship. A characteristic feature of this data model, is the one-to-many relationship. This means that starting from the root, each element can have many child nodes, however, each and every child can have only one parent node. This is a very efficient approach, which makes the access to data rather simple, along the hierarchy. At the same, this advantage is the main disadvantage, since data relations are usually far more complicated. As a result, the approach is limiting or results in data redundancy[Rottensteiner(2001a)].

Network data model is an extension of the hierarchical data model. The greatest difference between those two is that the child records in the network model can have more than one parent node. This results in a, so called, lattice structure. This gives greater flexibility in representation of data structures. Although this model is more advanced it did not become a standard because of the inception of another, more convenient model[Rottensteiner(2001b)].

Relational data model is the most common one. Here, all data is stored in tables. Each row in a table represents a new object, record of the same type. A column, on the other hand, is an attribute, that describes each object in the table. The data types allowed in relational tables can take, depending on the query language, a myriad of forms (e.g. character, text, boolean value and various types of numbers). High normalization of the database structure leads to maximal decrease of redundancy, which in turn allows easier (although usually not shorter) analytics[Rottensteiner(2001c)].

Object data model is generally a new technology. The main goal is *"to offer more complex data types in order to overcome the restrictions of, e.g., the normalized rules of relational databases"*[Rottensteiner(2001d)]. This model is strongly related to object-oriented programming. As a result, each piece of data is an object and at the same time, an instance of an object class, which characterizes all its instances. It also takes general principles from the object-oriented theory:

- encapsulation – communication with objects by means of a defined set of messages

- inheritance – an object class can be derived from another class and in this case, inherits all attributes from the source class, called the *super-class*

- polymorphism – in this case *"derived classes may re-define methods of their super-class(es)"*[Rottensteiner(2001d)]

- aggregation – possibility of creation complex objects composed of a set of elementary objects

These databases are designed in a way to be able to co-operate with object-oriented programming languages (like Java, C++, C#, Visual Basic .NET, etc.), which simplifies creation of applications that perform operations on the data stored in this data model. *"Object databases are generally recommended when there is a business need for high performance processing on complex data"*[Wikipedia(2)].

Object-relational data model was invented in order to *"combine the advantages of the wide acceptance of relational databases and the benefits of the object-oriented paradigm"*[Rottensteiner(2001d)]. The main benefit of object-oriented programming introduced into the relational data model is the ability to create new data types and methods.

The most common and most widely accepted data model for databases is the relational one. Use of this approach results in clear set of data and gives a great range of analytical capabilities to the user. The advantages of this model are so wide, that it will be extremely difficult to find an attractive alternative. The greatest disadvantage of this method is the time, which with the increase of computational capabilities, as well as introduction of indexing and other solutions to such database systems, becomes less and less crucial. However, a lot of attention needs to be put in this aspect, since the need for real-time analytics and reporting are becoming more and more ubiquitous.

Corporate Data Model

In relation to Data Warehouses becoming more and more popular and more widely used, CDM has been developed, taking under consideration the structure of most of the organizations. The main idea of CDM can be, to some extent, seen on Figure 3.7. Its aim is to achieve lack of data redundancy, by having all the necessary data in one, central Data Warehouse, instead of having it in disparate places. Some part of the data in each department may be specific for this and

only this department, however most of it, is shared across the entire organization, and CDM *"is built on a concept that an entity is defined only once in the corporation"*[Kowalski(1999)].

The Corporate Data Model consists of[Szwoch(2006)]:

- data structure along with its metadata

- description of business rules

- terminology – business notions dictionary

- classification and dictionaries related to the operation of the organization

The first step, while developing CDM, is to establish the Corporate Model Environment – a scheme of how the data can be organized[Kowalski(1999)]. Usually it will be build on one of existing examples, which are available, therefore the model needs to be adjusted to the particular organization. After this is done, the data from the legacy system should be mapped, however care must be taken, since same elements (same records in the database), stored in various places, may have different names (although representing the same thing). This is usually a result of using different systems and applications in different departments[Szwoch(2006)].

Moreover, the applications used on the system can be more universal, while operating on a complete, consistent and clean data set (it is possible to avoid having several applications, where each of them gives an additional, necessary functionality, but at the same time, mostly does exactly the same work as the other ones). Only in this way, the information can be delivered faster [Kowalski(1999)]– according to the increasing business needs.

The Corporate Data Model can be extremely useful, with the development of the organization and related increase of data storage and information generation needs. It completely removes data redundancy (decreased hardware needs), puts all data in one system (decreased management needs - less IT staff needed), and by that also makes it possible to use less applications to provide all functionalities needed (decrease software needs). As a result of all this, the costs are, in a long-run decreased. However, it requires careful planning, management and considerable investment, which may discourage the decision makers. The creation of CDM is quite complex and because of that, it takes time to realize such an enterprise.

3.5.3 Database Management Language

There are four groups of languages used in database systems[Sciaga.pl(No date)]:

- DDL – Data Definition Language - responsible for defining the structure

- DML – Data Manipulation Language - used for filling, modifying and removal of data from the system

- DCL – Data Control Language - used for transaction control (access or decline)

- QL – Query Language - that enables getting the data from the system by means of queries and conditions, as well as other functions

Structured Query Language is the most common database language, which, in practice, is the integration of all of the above languages. It is a standard interactive and programming language for getting data from, and updating a database.

3.5.4 Computational Model

This defines how various calculations are performed in the given database type. In case of relational databases, the operations are based on values in specific column of a record. There is no universal identifier of the field, so it has to be addressed by means of indication of a record and an attribute of the table. Moreover, it is impossible to modify record after record, separately. It has to be done globally using a query language[Sciaga.pl(No date)].

On the other hand, in case of object-oriented databases *"objects are created and modified mainly directly by means of object-oriented programming language, appropriate for the database"*[Sciaga.pl(No date)]. In comparison to the previous case, each object is assigned a unique identifier, unchanged over time, which can be used to define a connection between objects.

3.6 Technical Architecture

This part of the architecture is about technologies that are being used in each part of the system. These can be for example[Sherman(2003)]:

- relational databases

- On-line Analytical Processing (OLAP)

- BI

- Extract - Transform - Load (ETL)

- Enterprise Application Interfaces (EAI)

- Enterprise Information Interfaces (EII)

- networks and operating systems

Very often, people tend to associate technology with the actual product. It should be avoided because of two reasons. First of all, products may consist of a myriad of technologies, and associating it with only one, does not express the actual capabilities of the application[Sherman(2003)]. Secondly, one technology is usually introduced in a number of products, which gives the possibility to choose the best product for our needs and investment abilities.

The Technical and Product Architectures are separated for a very good reason. It is crucial to start with a good understanding of business processes and identify the actual data and information needs. After that it is essential to analyze *technologies* based on those needs and try to *"identify the ones that will support them"*. Only after thorough analysis, evaluation of various products can be performed. An approach of buying numerous products and trying to find the "perfect" one, without a good understanding of organization is a very common mistake. It is also important to realize the function of each technology and to be able to realize which solutions are competing, and which are complementary ones.

There are enormous amounts of options while looking for a implementation solution. There are many technologies that can be used. In order to understand the analysis and comparison of possible technologies, an example is shown below.

3.6.1 Local vs. Client-Server

The database systems that store the information for further analysis can be of two types.

Local databases are the most simple systems that are stored entirely on one computer[Sciaga.pl(No date)]. Usually, it has no Database Management System and because of its simplicity, it has small setup and configuration requirements. With the increase of database size or the number of users, the performance drastically decreases. Moreover, it cannot be improved with new hardware[Blue(2001)].

Taking the data integrity under consideration:

- data easily corrupted

- unmanaged indexes

- concurrency issue - during multiple update of the same data at the same time, no errors are generated

- transaction control

Client-Server database is a more advanced and complex solution. All data, as the name suggest, is stored usually on a dedicated server. The access to the database is remote by means of terminals (can be in distant location). It makes use of Database Management System (DBMS) and requires more attention during the setup and configuration process. It is designed to handle enormous amounts of data and exhibits almost constant performance with the increase of data stored and number of users. Except for that, it is highly scalable with hardware[Blue(2001)].

As far as data integrity is concerned, there exists:

- corruption management

- managed indexes

- concurrency control

- transaction control - logs data changes by users, allows for rollback (reaching the state as before the update)

Pros and Cons

In Table 3.1 a comparison of the two approaches is presented.

Local databases	Client/Server databases
Low Cost	Higher Cost
No Licensing Fees	Licensed per user (recently also per server)
Minimal Setup and Configuration	Configuration can be complex
Minimal Maintenance	May require DBA

Table 3.1: Comparison of Local vs. Client/Server databases[Blue(2001)]

As a result, the local databases are a good choice for small databases with minimal traffic and read-only data, while the client/server approach is usually ideal for medium to large ones, with higher traffic, changing data sets and transaction base systems.

3.6.2 Comments

Knowing what the business needs are, and understanding which technology provides what kind of a solution, it is possible to choose the appropriate one. It is essential to determine the technological needs and only then, start with the analysis of offers from various vendors. The last step is to find the best product available.

3.7 Product Architecture

This part of the framework concerns the actual products on the market, that are being used by the customers. As mentioned before, it is advised to go through the entire framework suggested here (or another one similar), in order to understand the exact needs of the organization and find a suitable solution. Failing to do so, will start with issuing RFP at the beginning of the "project", and receiving simply product specification[Sherman(2003)]. This ends up with either organization trying to adjust the needs to the vendors offer, or the vendor himself, trying to convince about his product superiority over competition and its suitability for that particular organization. This, very often, is not the case, since *"vendors very often underestimate your data requirements and issues"*[Sherman(2003)] and later, if problems occur, blame other systems and applications in the company.

To avoid such issues, the company itself needs to be responsible for and perfectly aware of everything it does and that is going on around, from the conception of the idea to the final implementation and evaluation of the chosen solution.

3.7.1 How to select?

While choosing a Business Intelligence system, there are various aspects to be taken under consideration. SAS suggests a evaluation framework, which can be seen on Figure 3.8.
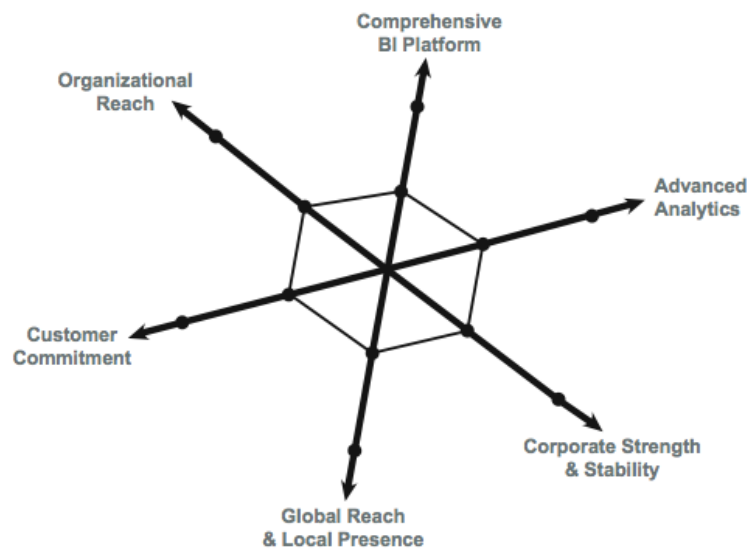

Figure 3.8: 6 key dimensions to consider when selecting a BI vendor[Sas(no date)]

According to it, the criteria are divided into three main groups[Sas(no date)]:

1. Technology

   - comprehensive BI platform vs. point solution
   - true analytics vs. query and reporting capabilities

2. Alignment with customer needs

   - intelligence across all organizational levels and functional areas
   - vendor's commitment to customer support

3. Corporate vision and geographic scope

   - will the vendor grow with the evolution of organization needs
   - global reach and local presence

Another very good and this time definitely independent source of BI systems evaluation is done by Cindi Hawson in a series of seven articles *BI scorecard* on the Intelligent Enterprise Magazine web page.

According to Hawson (2004) products should be analyzed looking at one functional area at a time. With this approach she concentrates on:

1. Query Capabilities

2. Reporting Capabilities

3. Information Delivery

4. Excel Integration

5. OLAP

6. Administration

7. Architecture

In the end it turns out, there is no single vendor that would exhibit superior performance in all the aspects taken under consideration. At the same time, *"there isn't a single best BI tool in the market, but rather, a best fit for your company and particular deployment needs*[Hawson(2004)].

3.8   Implementation Issues

"BI is one of the hardest technologies to deploy because comparatively little of the challenge is about technology.   The process demands a broader skill set and business focus than other aspects of IT"[Hawson(2006)]

As mentioned earlier, a typical BI system consists of parts responsible for *"data integration, intelligent storage query and reporting, and advanced analytics"*[Sas(no date)]. It is important to start with requirement engineering process to determine all the needs before going further. There is no single perfect solution, so if the company's needs are quite numerous, than it probably will end up with *"a mix of different types for a comprehensive, robust, expandable solution"*[Sherman(2003)]. However, the worse thing to do, is to purchase different systems, trying to find the best, without prior understanding of the problem.

First of all, there is a question of how to define success. In general there are three most common approaches to this aspect[Hawson(2006)]:

- ROI

- Cost Savings

- Percentage of users accessing the system (licensed and active)

CEOs usually want results, and for them the result is profit. Therefore the best way to satisfy this group is by means of ROI[Dragoon(2003a)]. However, although it sounds simple, the reality is completely different. It is rather difficult to determine this number, since in case of increased revenue, it is usually impossible to determine, which part is gained because of BI solution, and which because of other activities[Hawson(2006)]. There are far too many components affecting this result within the entire organization.

The second, also financial approach, is to determine what are the cost savings that are directly a result of implementation of the new technology. This number is easier to access.

On the other hand, the third way, that is usually used by technology related people is the percentage of employees using the system to the number of licenses. In this case, the idea is to reach as high number as possible[Hawson(2006)]. According to a survey conducted by Intelligent Enterprise Magazine, companies that consider their BI solution implementation to be successful, indicate this number to be 42%.

All BI experts agree in most of the points related to successful system implementation. The common elements are[Hashmi(2004)],[Dragoon(2003a)],[Hawson(2006)]:

- there has to be a clear and precise business objective to be achieved by its mean

- data quality

- business processes need to be closely related with BI

- a unified platform should be used both for BI and business applications

- employees need to be flexible and highly motivated

- a global approach has to be used and strictly followed

Above all, BI systems from the very beginning need to be a strategic part of every business model. Although BI is becoming a *must have* technology in order to be competitive or even just to be able to remain on the market, the system itself is not a solution. Starting a BI initiative and rolling out the system will not give expected results simply by being introduced. It has to be fully incorporated within the organization. It is essential to align BI strategy with business needs. Therefore, full cooperation of IT and business is a must.

If Business Intelligence is to be successful (even useful a bit), the data, on which all analysis are being performed, has to be clean[Dragoon(2003a)], [Hawson(2006)]. This means, there has to be a common format of storage that enables getting rid of duplicates and making it relevant. As much as 78% of respondents to a survey conducted by Intelligent Enterprise Magazine said that data is the factor for deployment success. A good suggestion is to *"use your BI strategy to create something core to business performance and provide the right data to support the effort"*[Hawson(2006)].

In order to achieve best results and highest cost savings it is wise to standardize on a platform. Vendors usually offer suites, which in most cases can satisfy all organizational needs. In case of very specific needs, related to specific branch of the industry, there might be a need for an additional solution that will provide the exact functionality, not covered by the vendor's suit. In such a case, an extra application will be required. However, a situation, where each department has a separated infrastructure and different applications should be avoided. There should be only "one" solution for the entire company and only "one" for all the needs. Otherwise, functionalities will be overlapping and the company can be paying considerably more than it actually should[Hashmi(2004)], [Dragoon(2003a)].

Of course, it is easy to aim to achieve previously mentioned unification, if the organization is starting from scratch, since it can use all the experience of other

companies. In case, where the solutions are already implemented, it is a good idea to decide on one, and start migration. It can be done slowly (so called *slow death* of systems not being used), but a better solution is to follow the example of Allstate. After deciding on one solution,

> "the company offered incentives to encourage users to migrate to the new environment. As soon as major stakeholders were comfortable with the quality of the information presented in the Business Objects tool suite, Allstate pulled the plug on old reports."[Hawson(2006)]

This way, unnecessary systems and multiplications of data were removed earlier, saving money.

It is also considered highly relevant to choose the appropriate tool to be the universal solution within the organization. *"The number of users is often inversely related to what you're asking of the tool's capabilities"*[Hawson(2006)] (see Figure 3.9). Therefore, it is important to be aware what are the actual organizational needs as far as the complexity of the solution is concerned. Taking the tools and the corresponding success under consideration, it turns out that ad hoc querying and reporting ones delivered the most success[Hawson(2006)].
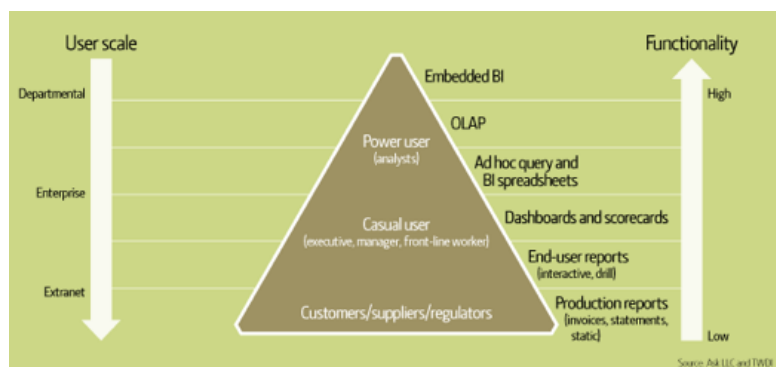
Figure 3.9: Which users need which tools?[Hawson(2006)]

Throughout the entire development and implementation process, all users have to be devoted and highly motivated for the incoming change. Some, should take part in the initial phase, during the specification of the requirements. Some, ones who lack the necessary skills, should be trained, in order to be prepared for the solution, when it is implemented.

Except for that, as in case of any project, good management is of major importance. The implementation stage should not begin until the project is well prepared. Requirements have to be defined, both business and IT, and later on

prioritized. The time frame for realizing the project has to be well calculated as well. When introducing any changes into the plan, the alloted time has to be reconsidered, since not keeping deadlines, especially in case of technology that influences the entire organization, is a great "offense". Priorities are necessary for the introduction of BI system to fit in time and in the financial budget. It is rarely possible to fulfill the needs of all interested parties, therefore the most important issues have to be handled first, and only later, if resources allow, smaller requests can be taken care of[Hawson(2006)].

Lastly, there will be no innovation in any field, without the executive support. By many professionals, *"inadequate funding is a major obstacle for success"*[Hawson(2006)]. Hence, in case CEO is not convinces directly by the vendor's presentation, someone else has to do it. A good way to get that approval, is to start a small and "simple" pilot project, which will prove BI usefulness.

All the above aspects are related to the organization internally - they depend on the situation and decisions made inside the company. However, the success of Business Intelligence implementation is also dependent on the vendor's attitude. *"To ensure success of your BI initiative, you need assurance that your vendor prioritizes customers' needs above their own short-term initiatives and financial targets"*[Sas(no date)]. The provider of the solution needs to be devoted to customer support, and has to think about customers' needs. If this is not the case, the perfect solution at the time of implementation, may become a fiasco after a certain period, when problems occur or more sophisticated needs develop.

3.9   Knowledge Discovery

> *"There is an urgent need for a new generation of computational theories*
> *and tools to assist humans in extracting useful information (knowledge)*
> *from the rapidly growing volumes of digital data"*[Fayyad et al.(1996)]
> (Fayyad et al. 1996)

Organizations are collecting enormous amount of data, regarding large variety of issues. These concern both the internal and external aspects of company's day-to-day operations. Of course, the greatest part is about customers, their preferences, habits and all possible things that might influence their relation with the company. This amount is becoming more and more significant, and *"exceeds our ability to reduce and analyze (data) without the use of automated analysis techniques"*[Wright(1998)]. Therefore, there is a strong need for IT solutions that would enable that analysis. The reason for such big interest in KDD is that it is supposed to serve and *"support the building of Decision Support Systems, and [by*

that] Business Intelligence"[Rennols(2005)]. The DSS will be covered later in this chapter. It is worth starting with a definition of KDD to avoid misunderstandings that sometimes occur:

> *Knowledge Discovery is defined as the non-trivial extraction of implicit, unknown, and potentially useful information from data"* (Frawley et al. 1991 cited Wright 1998)[Frawley et al.(1991)]
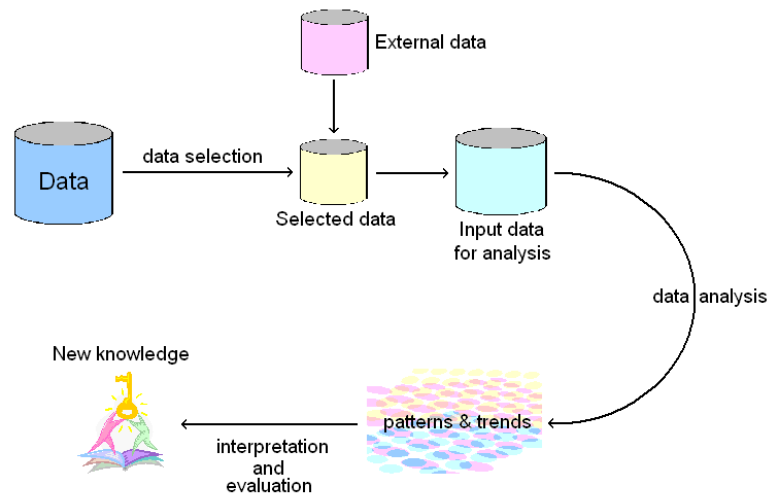
Figure 3.10: Knowledge Discovery in Databases process[Chong(No date)]

The process of knowledge discovery can be quite complex and may requires a variety of components. On Figure 3.10 a simplified scheme is presented.

Not long ago, tools, based on data in the database, were able to tell the organization about its past. The idea of advanced analytics, that are in KDD, is to *"incorporate predictive capabilities, including data mining, text mining, forecasting and optimization"*[Sas(no date)]

Some consider Data Mining another, competitive technology[Wright(1998)]. In this paper, an approach treating Data Mining as an element technology of KDD, is used. Next to DM, there are also other knowledge discovery solutions. Altogether, these are:

1. Data Warehousing

2. Data Mining

3. Text Mining

4. Web Mining

Each solution needs to fulfill some basic requirements that qualify it to perform what is necessary.

First of all, the knowledge discovery process has to be performed on large amount of data. The simple reason for that is that in order to be able to determine a pattern, a considerable sample needs to be taken under consideration. It is not possible to deduct any useful knowledge, operating on a small portion.

Secondly, what is directly related, is the efficiency. High value in this case is necessary, because of these large data volumes, being analyzed. Time is of the essence, therefore the results need to be delivered as quickly as possible.

Another requirement to consider, is the accuracy of the results provided by the system. It is obvious, that in order for the knowledge that was discovered to be useful for further analysis and for the decision making process, it is essential that it is true and based on facts[Wright(1998)].

Concerning the output from the system, it has to be readable and possible to understand by the person that is suppose to use it. It should be in a convenient form. Moreover, it should also be an interesting result, a source of potential value for the user, something new. An important thing to remember, is the fact that knowledge discovery needs human interpretation[Chong(No date)], therefore they need to be able to use the system easily.

Lastly, the solution should incorporate some kind of automated learning. Since it operates on large data sets that exceed the capability of human analysis, the machine should at least a bit of thinking. Therefore, artificial intelligence algorithms, neural networks, etc. should be implemented to be able to increase the performance in discovering interesting patterns[Wright(1998)].

KDD techniques

Learning is a necessary part of KDD. Initially, the machine discovery was the most popular learning technique[Wright(1998)]. However, the best results are obtained in conjunction of machine and human capabilities. As far as the KDD techniques are concerned, there are various approaches to classification. The most common one divides those application among the following groups[Wright(1998)], [Chong(No date)]:

- Probabilistic

- Statistical

- Classification

- Deviation and Trend Analysis

Other approaches include: visualization techniques, Bayesian classification, inductive logic, data cleaning/pattern discovery, decision tree analysis, genetic algorithms, neural networks. Except for that, there are also approaches that combine few techniques.

Probabilistic Approach can be used for predictions of possible trends in the future, planning and control system. The outcome may give a probability that something will happen. This technique is useful in cases, where uncertainty is present.

As a result, this approach can be used in day-to-day analyses, in most of the companies, to be able to react to future trends, and rapidly changing situation on the market.

Statistical Approach on the other hand, gives information about what was and is going on in the company. This approach is based on analysis of data in the database, which gives percentages, charts and uses other visualization tools, for enabling comparison and evaluation of various factors.

This technique can be extremely useful also in most of the organizations, especially the ones that deal with large amounts of data. Such type of analysis can be a good business performance measure or indicator.

Classification , as the name suggests, divides data into groups, based on similarities. There are few techniques that can be used within this approach:

- Bayesian

- Pattern discovery and data cleaning

- Decision Tree

Deviation and Trend Analysis is concentrated on analysis of patterns and detection of irregularities. Usually, a useful source of information and knowledge are the deviations from typical behavior. If everything operates fine, there is nothing to detect. However, if something out of sense occurs, it may be an important thing to take under consideration

A combination of Classification and Deviation & Trend Analysis, can be used for example in fraud detection[5]. This turned out to be very useful during analysis of employee performance for a customer, and allowed to identify deviations from

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[5]based on authors experience in Fraud Investigation and Dispute Services department at Ernst & Young Business Advisory

normal behavior (which was a source of fraud patterns), and by means of classification, it was possible to separate different fraud cases into different groups of unethical behavior.

3.9.1 Data Warehousing

Behind this term, there are hidden at least two meanings. As the name suggest, it starts with a Data Warehouse. According to 1keydata.com (2007),Data Warehousing is *"the process of designing, building, and maintaining a data warehouse system"*[1keydata.com(2007)]. However,

> *"a data warehouse offers no tangible return on investment to an organization. The value lies in the processes that the data warehouse enables."*[Foley and Bates(2004)]

And the process - Data Warehousing - in this case would be defined as *"a technique for properly assembling and managing data, from various sources, for the purpose of answering business questions and making decisions that were not previously possible"*[Intoweb(2006)].

The benefits of the infrastructure with a Data Warehouse were described earlier in this chapter(see Section 3.5). Such a database is designed in a way to eliminate multiple versions of the same data and with a main reason of increasing efficiency of data analysis and reporting.

Data Warehousing[Rennols(2005)] is based on database principles and technology. It is considered to be a "soft data-mining" and it is about finding associations in the database, by means of SQL queries. As a result, the user gets a set of tables with drill-down options. The main idea of development within this field is to simplify the process of query creation in order to enable business users to operate on their own[Greenspun(2004)].

3.9.2 Data Mining

> *"Data Mining is the use of automated data analysis techniques to uncover previously undetected relationships among data items. Three of the major data mining techniques are regression, classification and clustering."*[Chapple(No date)]

Therefore, Data Mining and Data Warehousing are concepts that are very much alike. Some, consider it to be the same thing, others treat it as a slightly different one. In the second case, the difference is that DM uses more sophisticated techniques of Machine Learning and statistical algorithms. These are very often

non-linear and non-scalable, designed for a specific data set, which is usually limited to some extent. Except for that, *"there is usually little direct use of databases or warehouses*[Rennols(2005)]. DM often operates on flat files.

3.9.3 Text Mining

While Data Mining and Warehousing use well-structured, defined and organized databases, Text Mining (TM) uses unstructured text databases - large or multiple documents. The result of the analysis should be more or less the same as in both previous cases, however in TM, another step is introduced at the beginning, namely the Feature Extraction[No author(2003)]. In order to be able to perform all sorts of analysis, some attributes and values need to be determined. TM uses technologies like:

- Computational Linguistics (CL)

- Natural Language Processing (NLP)

- Machine Learning

to produced meaningful structure out of previously unstructured data set and gather the necessary statistics, data or information. Features to be found in a document, are either directly specified by the user, or are taken from existing tables (e.g. table of serial numbers of products that a company delivers).

Except for that, TM is strongly related with a technical discipline of Information Retrieval (IR)[No author(2003)]. This includes:

- document search

- navigation

- categorization

- filtering

- dynamic clustering

- association rules

Taking all this under consideration, Text Mining is the process of generation of information or knowledge from the text, by means of making data structured, and determining patterns and trends within the data[Wikipedia(3)].

The big interest in treating text documents, and therefore, the development of Text Mining is related to the fact that 80-90% of data is stored in unstructured

text formats[No author(2003)], [Witte(2006)]. Being able to analyze such data precisely, and to get meaningful and useful results, can be a very good source of knowledge. This aspect of Business Intelligence, although very often underestimated, should be taken seriously under consideration.

3.9.4   Web Mining

In the era of Internet and the World Wide Web, these notions are understandable for everyone. Most people also realize the amounts of data and information that is being stored on web servers. With the increase of this data, a need for its analysis arises.

> *"Web Mining is the application of Data Mining techniques to discover patterns on the Web*[Wikipedia(4)]

This approach to Knowledge Discovery can be divided into three major fields:

- Web Content mining

- Web Structure mining

- Web Usage mining

Recently, there has been a new field worked upon, namely the Semantic Web mining[Kolari(2004)].

Web Content   mining deals with the content of the web pages. It uses DM techniques and operates mostly on texts, but also images records[Srivastava(No date)], [Liu(2005)]. The data analyzed is either unstructured(plain text), semi-structured (HTML), or structured (XML)[Kolari(2004)]. This is a very useful area of development, however full automation in discovery is impossible nowadays, because of, previously mentioned, lack of standards in the structure of the Internet.

Web Structure   consists, simply speaking, of web pages and hyperlinks. However, the interrelations between them are not as simple as it may seem. An example of a Web Graph Structure is presented on Figure 3.11.
   The Web Structure Mining is the process of determination of the web structure and the analysis that provides information related to PageRank or authoritativeness[6], which than improves the search engines by means of filtering[Kolari(2004)].

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[6]devised by Google, measures not only how many links point to a website, but the "quality" of sites providing the links - available from: www.totheweb.com/learning_center/seo_glossary.html

Web Usage mining performs analysis based on data *generated by client-server transactions on one or more Web localities"*[Srivastava(No date)]. This enables deriving knowledge on user profiles, their habits and preferences. The sources of data in this case are web logs, clickstreams, and database transactions[Kolari(2004)]
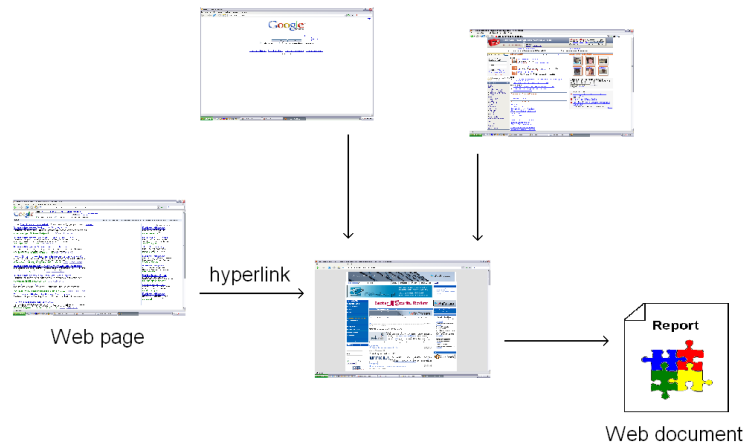

Figure 3.11: Web Graph Structure[Srivastava(No date)]

3.10 Decision Support System

The techniques, mentioned above, should be introduced in a company mainly according to its needs. However, a precise and thorough understanding of all possible aspects can be present, usually, when all of them are used at the same time. In such a case, an organization could analyze information gathered from structured databases, mostly concerning customers and current company operations (data warehousing and data mining), enormous amounts of text files related to a variety of issues (text mining), as well as relevant information on the Internet (web mining – especially concentrated on content). After that, everything that was collected should be combined, patterns and trends identified and appropriate knowledge deducted, to support decision making process. Decisions based on a greater variety of sources, is more objective and probable to be good, resulting in improved performance of the company. All those techniques, combined together, would construct a complex but strongly developed Decision Support System.

Very often, Business Intelligence and DSS are notions used interchangeably, and therefore usually treated as exactly the same thing.

"A now superseded term for a software application that analyzes business data and presents it so that users can make business decisions more easily. (see also Business Intelligence)"[7]

To a great extent it is, however, there is a bit more in BI than just the decision supporting.

First of all, it is also responsible for measuring performance. Significant part of BI development is concentrated on the usage of Key Performance Indicators, to give to the employees, on different levels, information about how good the company is doing on the market.

A good indication of such an approach is the fact that many consider Business Performance Management (BPM) to be the next generation Business Intelligence (see Section 4.2)

Except for that, as mentioned in Section 3.9, in some cases, DM techniques, which are a part of BI solutions, can be used to determine patterns and trends, not for supporting the decision making process, but for using as a service offered to customers (fraud detection example).

Because of that, this paper treats DSS as a part of BI. In this case, the more suitable definition would be:

"a highly flexible and interactive IT system designed to support decision making when the problem is not structured; an information system that utilizes decision models, a database, and a decision maker's own insights in an ad hoc, interactive analytical modeling process to reach a specific decision by a specific decision maker"[8]

With the increase of size of organizations, and with the processes becoming more and more complex and affected by a variety of different aspects, decisions that for a long time were very simple, are beginning to exceed human capabilities. The amount of data stored in databases, numerous interrelations on the market that affect each company, the myriad of factors that influence each and every aspect within the organization, make the decision making process almost impossible without any support. DSSs are able to perform all the necessary collection, analysis and knowledge discovery and to provide appropriate person with a summary of information that is required. Such a person, having a concise report, which can be precisely tailored and customized according to the specific needs, is then able to understand the myriad of issues related with a quick glance, and make a well-informed decision.

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[7]source: www.oranz.co.uk/glossary_text.htm
[8]www.321site.com/greg/courses/mis1/glossary.htm

Instead of simple reporting, more advanced and intelligent DSSs give to the user an insight into the information that is required and aids the process of structuring decisions[Druzdzel and Flynn(2005)]. Even more advanced ones, incorporating Artificial Intelligence (AI), present well-defined alternatives, and the decision makers role can be limited to choosing one of the options. No matter, whether people decide to rely entirely on the machine's thinking, or use reports to analyze different aspect on their own, such systems simplify the process and make it more quick. And since time is of the essence in todays fast changing reality, they are extremely useful, and probably unavoidable to use.

3.11   BI problems and disadvantages

But, not all that glitters is gold. Although it is difficult to find general information on disadvantages that lie behind Business Intelligence solutions, it does not mean that they do not exists. Having analyzed various sources, based on which previous sections were written, it is possible to realize the truth: *A great care has to be taken with BI solutions.* There are pitfalls that need to be taken under consideration:

- cost

- implementation issues

- speed of operation

- vendor's intentions and capabilities

First of all, the price. In most of the cases, BI is an expensive investment. Therefore, the organization, before deciding on such a solution, needs to be certain it needs it, that the system can be well incorporated in the company and aligned with the strategy, that the users will be using it and that the company is capable of funding the entire enterprise, in order to reach the expected results. Without that, the money will be spent for nothing.

The decision makers, responsible for the decision related to a BI solution, need to be aware that ROI does not always come the next day. IT systems require big investments, and they affect the day-to-day efficiency of the company. By increasing it, the company is able to have considerable cost savings, however in certain period of time. BI is of no exception here.

Another thing to consider are the users. The BI solutions are becoming more and more simple, and there is a strong focus on empowering all users in creation of reports. The idea is that each and every one of them is able to get the necessary information on their own. However, no matter how simple the solution will be, it will still require training and preparation. Moreover, various incentives for

using the system have to be introduced. Whether it is a new technology in the organization, or is it a change in a vendor or in the infrastructure, the people do not like to make things in a different way they are used to.

Except for that, another problem that may occur, are the results that the solution provides. Without prior analysis of the offer, it may turn out after implementation that the company got not exactly what it wanted.

Moreover, there is a hype for BI solutions and, because of that, lots of vendors emerge on the market. Some of them pretend to provide solutions which do not really offer a necessary variety of integration tools, advanced analytics and a suitable set of reporting services. Companies need to have a thorough understanding of all related issues - starting from the actual organizational needs, ending at the ability of a particular vendor to fulfill them, in order not to get deceived and carried away by the good looks.

There is also a question of speed of the system. Companies, having great amounts of transactional data, need to be aware, that in most cases it takes hours and even days to process some of the queries.

SME, need to take additional issue under consideration. Finding a well-suited solution is only the beginning, since the vendor may not be interested in making changes in his solution based on the needs of companies other than the big ones. Therefore, there is another criteria for SME, namely to make sure that the provider will evolve with the development of the company and that new needs and requirements will be implemented in the solution.

3.12   Summary

In this chapter, a general characteristic of various issues related to Business Intelligence solutions was presented. There are numerous sources of detailed information about each and every aspect of BI mentioned, however the idea was to show the complexity of such a system and basic insight into its components.

The answer to the question from the beginning of the chapter is not a straightforward one. In general, Business Intelligence, is an IT system, which most of the companies should have in order to stay competitive on the market (by dealing with challenges: cost control, integration of multiple systems, simplification of the infrastructure, proper allocation of resources for addressing long-term business needs, improved performance with fewer resources, as well as focus on IT governance). However, the process of determination of companies needs, finding a proper solution and precise implementation of the system require a broad view on the problem.

The hype for BI tools is in my opinion justified, however, to avoid the repetition of the dotcom boom, care must be taken. This is a very useful technology, however it has to be well incorporated into the company, and not treated as another must-have IT system in the company, that will solve all the problems by itself.

Chapter 4

Next Generation Business Intelligence

> *"Taking BI to the next level means not only transforming data into information, but also getting it into the right hands, at the right time and in the correct format to be used for timely decision-making. BI is not about exclusivity, it's about every player in the corporate network having the information they need and the tools necessary to turn that information into sound decision-making"*[ProClarity(2004)]

In previous chapter, the general idea behind Business Intelligence has been presented. The process of transforming the data into information and further finding patterns in information, to obtain knowledge. This is the *final product* that is supposed to aid the decision making process.

However, there are two major problems related to the initial idea of BI. First of all, the report resulting from complex analysis performed on the data that a company posses, are to be provided only to high-level managers (the last decision-makers in the chain). The idea of next generation BI is to give access to advanced analytical tools also to lower-level managers, or even further. Every employee in the company, no matter how small his/her role is, if is making some sort of decisions related to company's operation, should have the necessary information.

Secondly, in order to increase efficiency and decrease the time required to get the knowledge that is needed, each person should be able to use the BI application on his own, without the need of IT to translate the business needs into the technical language. This additional element in the process has a negative influence on the efficiency in two ways. For one, he needs to be explained, what the business user would like to obtain, a time consuming activity. Moreover, a very common problem is that the IT personnel understands the needs incorrectly and after creating the report, it turns out that it is not what the decision-maker wanted.

Therefore, the aim of next generation Business Intelligence, in comparison to the initial concept, is to[Sas(no date)]:

- give access to more people - so that employees, ideally at all levels, are able to use the BI tools

- improve the usability - so that every user of the system is able to get from it everything he wants, without additional aid

- global access - possibility to use the application anytime and anywhere

- real-time (or near real-time) reporting

- easy integration and development - facilitated implementation and integration with the existing systems within the company, as well as scalability and simplified process of adding new features

  It should be easy to disseminate the results of analysis across all functional areas and organizational levels so that everyone can contribute to the organization's success[Sas(no date)]

Except for that, in order to even start thinking about rolling out a Business Intelligence solution, the company needs to have properly stored and clean data. The data quality issues draw much attention in relation to the future of BI.

4.1 BI 2.0

The BI 2.0 concept, is following the idea of Web 2.0. *"The focus is on people, empowering users to express their creativity, allowing them to freely access information and produce something meaningful from it while focusing on information sharing, communication, and collaboration"*[LogiXML(2006)]. The aim of next generation Business Intelligence is to aid in the decision making process, by giving to the appropriate person exactly the information that is needed. Such information, or even knowledge, should be complete, therefore, the report should include details related to the competitors, to both, the general and particular for the company operations, market situation. Also intelligence regarding things like, customer behavior, stock levels, new technologies - everything that is related to the decision that is supposed to be taken.

A general summary of the difference of between the current state of BI and BI 2.0 can be seen on Table 4.1.

A very strong focus of BI 2.0 is on collaboration [Raden(2007)]. Many decisions, especially the most important ones, regarding the entire company and the

Before, BI was about...	Now, BI 2.0 is about...
Static consumption of reports	Dynamic user communities, active collaboration and immediate information sharing
Pushing and presenting static reports to users	Delivery of dynamic, Interactive information plus users building their own reports or subscribing to the information the want
High-csot, luxury function of the organization	Cost-effective solutions available across the enterprise
BI for a few specialized users	BI for everyone in the organization as needed
Print-oriented reports	Web-based, interactive reporting applications
Charting with static bar and pie charts	Intuitive, dynamic and interactive data visualization
OLAP for analysis	OLAP in addition to other innovative, less complex yet high performing alternatives for data analysis and ad hoc reporting
Complex and time-consuming installation, deployment, upgrade and use	Simple and easy to use installation, deployment, upgrade and use
Desktop-based or static HTML reports	Reports integrated with events and automated processes, reports as Web Services (via XML)
Desktop, Active-X and smart client reporting applications	Pure Web-based applications with rich user environments and highly interactive user interfaces
Pre-defined search parameters	Dynamic or free-style searches and data exploration
Structured data	Broader set of supported data types including unstructured data and XML Web Services as well as mash-ups of this content
After-the0fact analysis due to data latency	Real-time and near real-time reporting and analysis for critical, operational problem-solving
Per user software licensing	Per server licensing for unlimited users or subscription-based licensing
Disparate and separately packaged BI components	Complete BI feature sets and functionality delivered on an open, unified platform

Table 4.1: Comparison between BI and BI 2.0[LogiXML(2006)]

general strategy, are not made in a nick of time by a single person. Such decisions depend on many factors, and different people in the company participate in making it. Therefore, the idea is to improve communication and sharing within the BI applications, so that CEO, CIO, CFO and others, are able to include their knowledge, as well as their concerns. As can be seen in Figure 4.1, there should be an *active collaboration* and *immediate information sharing*.

The BI solutions of the next generation should be *cost-effective and available across the enterprise. "If organizations can transform 100 BI users to 10 000 in a month, the market will not allow the incumbents to reap a 100x windfall in revenue"*[Raden(2007)]. When BI becomes a greater market, and it is growing very fast, there will be new BI vendors and providers evolving, as well as Open Source solutions will be present. Already, there are Open Source systems under development (see Table 4.2)

Product	Internet address
BIRT	http://www.eclipse.org/projects/roadmap/project.php?project=birt
Pentaho	http://www.pentaho.com/

Table 4.2: Open Source Business Intelligence[McAllister(2005)][LaMonica(2006)]

Better availability, related to decreased costs of launching a BI solution in the company, is going to take place with the introduction of different pricing models. Per server for unlimited users, instead of per user pricing, as well as On-Demand services are the ones that will enable it.

Recently, there is a strong debate related to what types of data should be supported and how it should be stored. Most professionals are convinced about the Data Warehouse approach and the one-truth version of data located at one place. However, in BI 2.0 the idea is to use data from multiple sources for analysis, no matter if it is a file located on a internal server, or a post in the internet. The most important thing to change, is the introduction of the unstructured data type, which next generation BI solutions have to support.

Lastly, there is also the case of a bit more abstract concept, being introduced, namely, the semantics. As the Web 2.0 is to be semantic, BI 2.0 should follow. *"Locating the right information to solve problems must be a semantic process, not requiring knowledge of data structures or canonical forms"*[Raden(2007)].

4.2 BPM

A very important idea of next generation Business Intelligence, is that it should not only provide information about external environment and internal factors affecting the decision making process. There should also be a more process oriented

approach introduced and the BI suite, except decision supporting features, should provide performance/process measures[CBR(2006)].

The BPM abbreviation has a double meaning, which unfortunately, is very often confused. For one group of people, it stands for Business Process Management, while for the other - Business Performance Management. Both concepts differ from one another, and have diverse uses. Nevertheless, although different, both concepts are very useful, and should be joined with typical BI system, to provide a complete, and comprehensive solution (see Subsection 4.3).

4.2.1 Business Process Management

A business process is a set of coordinated tasks and activities, conducted by both people and equipment, that will lead to accomplishing a specific organizational goal[SearchCIO.com(2006)], and as the name suggest, a BPM system of this kind is taking care of various business process within the company. This includes methods, techniques and tools to design, enact, control and analyze business processes. The aim of this system is to manage and improve the processes, to make them more efficient, more effective and bring greater benefits in the long run[Becker et al.(2003)]. It is crucial to adjust the processes to the changing internal and external conditions, and Business Process Management is dealing with this aspect as well.

BPM activities can be categorized as follows[Burlton(2001)]:

- process design - designing and modeling of existing business processes, and creation and simulation of new ones

- process execution - supporting and automating the execution of the process

- process monitoring - analyzing the performance of each process

4.2.2 Business Performance Management

> *"BPM is a strategy that combines management methodologies, processes and technologies to help companies ensure thy are meeting their strategic goals"*[Henrie(2007)]

Performance Management is a very hot topic recently, and more and more managers are convinced by its usefulness. A BPM standards group defines BPM *as a set of integrated closed-loop management and analytic processes, supported by technologies that address financial and operational activities"*[Whiting(2004)]. And BPM applications are one of the most crucial technologies that need to be implemented in the company.

The cornerstone of such systems are:

1. Strategize

2. Plan

3. Monitor and analyze

4. Take corrective action

A very common way to present the overall performance of the company to the employees is by means of KPIs. These indicators show how the company operates in various important fields. A person can easily notice changes in the values of such metrics and react accordingly.

One way or another, BPM provides information about the internal situation of the company, which according to Sun Tzu[**?**], are necessary for being successful in the battle - also in the economic one.

4.3   BI + BPM = Next Generation BI

"BPM and BI will become and are becoming increasingly intertwined"
[ASPnews.com(2007)] We are living in the information society - knowledge economy. Being well informed and able to get knowledge out of the things we do is the basis of operation. This is valid in day to day life, but most importantly, in the professional life as well.

In todays highly competitive environment, businesses need to be very creative and innovative to survive. Companies are also forced to handle enormous amounts of information in everyday operations. They need to be aware of everything that is going within the enterprise, but also that have to be up to date with their competitors, trends on the market, situation in the local and global economy. IT systems are a very convenient solution to most of the problems that a business may have with handling information. Business Process Management systems will aid in managing all the processes that are taking place in the company, from the moment of their creation, to completion. Business Performance Management systems, on the other hand, are facilitating general management of the company by indicating how the company is working in various fields. Business Intelligence, in its original form, helps managers to make better informed decisions, taking under consideration different factors affecting a particular situation.

Business Intelligence systems of the next generation should be able to encompass all this in one application. Such application should be able to use all the information possible to make the decisions even more informed.

> *"Analysts believe combining BI with BPM - kept separate and siloed -*
> *will provide a more natural, dynamic computing environment. While*

BI is a more mature, multi-billion-dollar market comprised of Business Objects, Cognos, and others, BPM has taken on greater importance with the move toward service-oriented architecture (SOA) and Web 2.0 computing

4.4 Real-time reporting

"Real-time business intelligence is about keeping pace in the accelerating world of business"[Whiting(2003)]. Companies gather more and more data in everyday operations, and because of fierce competition and fast changing environment, should be able to analyze the data and react accordingly. Typical query realization in few days or weeks after data collection is very often no longer sufficient. This is the reason why real-time BI is getting considerable attention recently.

The real-time analysis process has some latency inherent in it, and the main task is to minimize it as much as possible. According to Hackathorn (2004), there are three types of latency:

- Data latency - time taken to collect and store data

- Analysis latency - time taken to analyze data and turn into actionable information

- Action latency - time taken to react to the received information and take proper action

And the idea of real-time BI systems is to decrease those latencies as much as possible.

"The most visible use of real-time business intelligence is business-activity monitoring.[...] to detect "business events", such as production-line problems, spikes in customer complaints, and diminishing stock on a retailer's shelf. Key performance metrics and alerts are delivered through dashboardlike interfaces on managers' desktop computers or through mobile workers' handheld devices, pagers, and cell phones" [Whiting(2003)]

However, it is important to distinguish between the data that needs to be processed and delivered to the user in *real-time*, from the ones that are not so urgent[Patel(No date)]. Fast data analysis is related with high expenses and, therefore, should not be used without a good reason. *"Drawing a line between each refresh frequency and deciding which information should be real-time and which can wait is a key for a successful real-time data mart solution"*[Patel(No date)].

Except for that, there will be even stronger requirement for improved data quality (for more information see Section 4.8). *"Real-time business intelligence, in fact, will make IT departments more accountable for the quality of the data they provide for analysis. If there are data-integrity issues, they're going to come up much quicker"*[Whiting(2003)].

4.4.1   Real-Time BI Architecture

In the chase of real-time BI there are few approaches available[Wikipedia (5)]:

Event Based Real Time BI -   such systems use Event Stream Processing techniques in order to analyze events without prior storing, which leads to decreased latency. Whenever an event occurs, the system is taking it under consideration and informing appropriate decision makers about it. The person then is able to react accordingly in an instant, instead of realizing the problem at a later stance.

Real Time Data Warehouse -   here, an increased refresh cycle in the Data Warehouse is used. The data, therefore, is updated more frequently. With an on-demand approach to using the Business Intelligence application, the user is able to view real-time information, instead of using days or weeks old queries.

Real Time Server-less Technology -   this is the latest innovation in the field of real-time BI. As the name suggest the idea is to avoid storing information in the Data Warehouse, and perform all the analysis on the fly. This can be achieved be means of Multiple Source Simple Output (MSSO), which is able to access live data directly from the source (even many, diverse sources). Because of this shortening of the process, the latency can be significantly decreased.

Process-aware Real Time BI -   in such a approach (also known as Operational Intelligence), entire processes are monitored by the system and compared with historic data to identify problems and inconsistencies. Such a system continuously keeps track of the realized processes and notifies the user about alerting situations, indicators attending bad values etc.

Whatever the solution, it is believed that *"the bottleneck in the real-time enterprise is almost always human"*[Whiting(2003)]. Because of that, the more tasks are automated, the quicker the operation. After everything is properly configured and defined, the human intervention should only take place at the end of the chain, directly in the decision making process.

4.4.2 The future of real-time BI

Professionals are rather convinced that the in few years *"every business-intelligence vendor will have converted to a real-time architecture. Or they will be out of business"*[Whiting(2003)]. The predicted time accuracy of data can be seen on Figure 4.1. There is a noticeable increase in the expected need for instantaneous updates, and a significant decrease in case of monthly updates. Managers need current information.
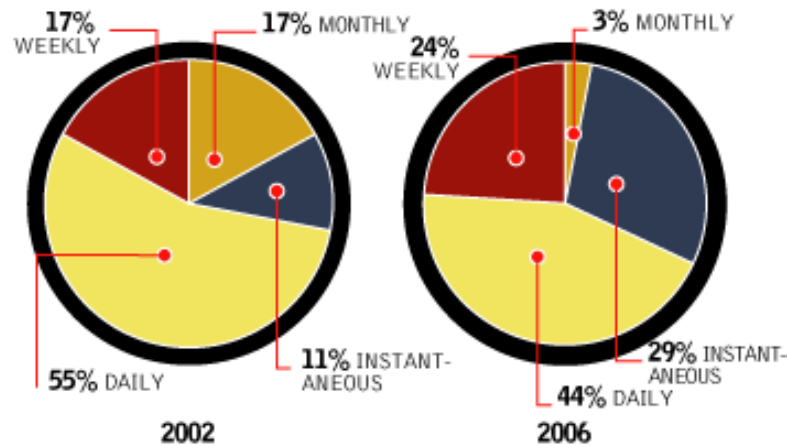

Figure 4.1: How current should the data be for the analysis?[Whiting(2003)]

4.4.3 Real-time or Right-time

A better solution instead of real-time BI is the *right time* BI[White(2004a)] or rather *operational right-time* BI[White(2004b)]. The right-time of action is dependent on the situation, and can range from seconds and minutes, to days or even weeks. This depends on the actual needs of the company. There is no need to analyze data and provide information (knowledge) when it is not required, especially when taking under consideration the fact that faster processing needs greater processing power, better equipment and, therefore, more costly systems. *"Detecting fraud, for example, requires a faster action time than determining that a store has run out of a particular product"*[White(2004b)]. Nevertheless, in few years, real-time Business Intelligence is predicted to be a standard and a necessity to give the competitive edge over other companies.

4.5 Usability and Visualization

"All kinds of studies have shown that we humans respond well to visual data. Graphics catch our eye and, if the picture is familiar and well designed, we can digest information quickly"[MacDonald(2004)]. And this is a general truth, so it is also valid in case of software, including Business Intelligence systems. *"Folks are tired of having to go to IT experts to get their BI reports. They want BI with user-friendly features like search and collaboration"*[All(2007)]. This is the reason why dashboards and scorecards are drawing so much attention recently.

The focus of next generation Business Intelligence systems is on people. The main aim is give access to information and tools no only to the selected group of managers - main decision makers, responsible for general strategy decisions -, but also to regular employees. *"The payoff is that delivering dashboard data to frontline workers puts business intelligence in the hands of people who can exploit it to make money-saving decisions on a daily basis"*[Leon(2003)].

4.5.1 Dashboards

While using dashboards, the result of the analysis is presented to the user in the form of metrics, indicators, graphical trend analysis, capacity gauges, geographical maps, percentage share, spotlights, variance comparisons etc. All sort of graphical presentation that is easy to share, understand, and make use of. All dashboards should be easily configurable, so that the user may adjust it to his personal preferences.

The main idea is to present big amounts of data, with complex relations and dependencies in the easiest form possible. If this is achieved, the efficiency is significantly increased, the decisions made faster and more accurate, bringing to the company expected results.

Dashboards should be designed in such a way, so that they are accessible and easy to work with for all types of users. The design process should not be concentrated on few power users, but on a much larger group of employees of all levels.

Moreover, dashboards give other benefits[Cover(2007)]. For one, instead of providing only a snapshot of information, they are an outstanding tool to give a general information about diverse issues related to a particular aspect or company's entire operation. These solutions enable monitoring the performance of the enterprise in almost any aspect.

Secondly, with the advances in development of mobile devices, dashboards make it possible for the employee to access the necessary information being outside the office. Innovations like SOA, web services, XML, flash etc. enable facilitated information sharing and platform independence.

4.5.2 Scorecards

Another way to present data to the user is by means of scorecards. This is a very useful tool for monitoring the performance of different departments and the entire company.

> *"It displays periodic snapshots of performance associated with an organization's strategic objectives and plans. It measures business activity at a summary level against predefined targets to see if performance is within acceptable ranges. Its selection of key performance indicators helps executives communicate strategy and focuses users on the highest priority tasks required to execute plans"*[Eckerson(2007)]

4.5.3 Comparison

It is impossible to say which approach is better, since they are essentially different things. *"Whereas a dashboard informs users what they are doing, a scorecard tells them how well they are doing"*[Eckerson(2007)]. They present different information and, therefore, each of them enable different activities to be performed or decisions to be made. Table 4.3 presents some most important differences between them.

	Dashboard	Scorecard
Purpose	Display performance	Display progress
Usage	Performance monitoring	Performance management
Updates	Real-time feeds	Monthly snapshots
Data	Events	Summaries
Measures	Metrics	Key performance indicators
Context	Exceptions, alerts	Targets, thresholds
Source	Linked to systems	Linked to plans

Table 4.3: Dashboard and Scorecard differences[Eckerson(2007)]

Therefore, both approaches complement one another and merge elements from one another. Therefore a company can make use of both.

4.5.4 Challenges and Problems

Although these solutions can be very useful, there are a number of issues to take under consideration while thinking about using them. First of all, it is important to realize that *"understanding the goals and processes is far more relevant than the selection of the technology"*[MacDonald(2004)]. As in case of every new system (or part of the system), the key to the success is at the early stage of planning.

There has to be a justified use of new technology, and it has to be aligned with the company's strategy. Many companies are forgetting about this, and expect the new solution to simply pay off for it self just like that.

Except for that, it is also very important to *"incrementally build the application"*[MacDonald(2004)]. Especially while talking about solutions that are going to be used directly by a larger group of employees, it is is absolutely essential to incorporate users in the process of evaluation and selection, and ensure the incremental delivery of the chosen product. Users should participate in definition of the requirements, and the provider of the new technology should introduce the offered solution in parts [MacDonald(2004)]. This way, the end users are able to test it and adjust the application, while using the system with real data and in a existing environment[1].

4.5.5   Comments

When talking about delivering information to people, *"what better way is there than to provide graphical visualization"*[Patel(No date)]. It is a fact that users are able to make better use of what they are getting if it is visualized. Therefore, such an approach to information delivery is a must in Business Intelligence systems.

Dashboard and scorecard solutions are being implemented in the standard BI systems recently (e.g. Cognos, Oracle and others). This is due to understanding of their importance and as a result they are critical in next generation BI - *"Performance dashboards are the new face of BI"*[LogiXML(2006)]. However, the technology still needs to be improved. In comparison to current solutions, the next generation ones need to be even more universal (to fit the needs of increasing numbers of BI system users) and more configurable (to allow for proper personalization and adjustment), in order to provide the exact information in a most convenient form, and at the same time, to fulfill specific requirements of various professions in diverse departments and industries.

However, it has to be realized that although *"data visualization can be a tremendous asset to nearly every organization - however, without clear knowledge of where you're going, the technology won't be able to take you there"*[MacDonald(2004)]

4.6   Web-based interface

"A successful business intelligence product is one that is simple enough for a novice, non-technical user to use without requiring him/her to go to training"
[Influence Software(No date)]

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[1]Very useful approaches in such a situation would be from a group of Agile methods or Contextual Design

Since Business Intelligence solutions are currently becoming available not only to few power users, but to broader group of employees, it is critical that the system is as simple in usage as possible. And *"web-based analytics now deliver standardized analytic capabilities to business users' desktop through familiar Web browsers or similar technologies whatever the may be"*[Imhoff(2003)].

Except for that, the delivered information should be interactive. There should be a possible to modify previously defined requirements for the analysis in order to easily obtain the necessary details.

Moreover, information should be available anytime and anywhere. *"These days, your business users demand more dynamic and interactive reports and expect Web-based availability to access this information wherever and whenever the need it*[LogiXML(2005]. Making the access to the database through ordinary Internet browsers, without the need for specialized applications, makes it possible to access the necessary information without greater problems. Such a solution is, first of all, platform independent - the operation system does not matter. Secondly, with laptops, palmtops and even 3G smart-phones, it gives a great capability of remote access from almost any location.

There are many benefits that web-based analytics (interface) is giving to the company[Influence Software(No date)],[Imhoff(2003)]:

1. because of easy and remote access, the speed of the decision making process is increased - increased efficiency and effectiveness with customers, suppliers and vendors

2. simplified usage - easy training because of well known browsers

3. simplified and economical distribution of information by a company, department or location

4. access to great computational power - all the analysis are performed on a central server with higher processing capabilities than standard PC

5. enable simple sharing of information between various users, and simplify the collaboration process

6. simplified administration of the entire solution - management of the system takes place only on the central server; all updates, scaling, modification etc. are performed in one location (no need to update software on every PC in the company)

7. easier scalability - again, in case of increased needs, the analytics are in one location, no need to improve each machine in the enterprise

8. security - privileges are configured by the administration, once again on the central server, instead of configuration of user's PC (which, for instance, might be located in a different country at that moment)

9. pricing - pay per server license, instead of pay per user; or even pay per use - on-demand model - especially interesting for the SMEs

In the past, there were two attempts to introduce web-based BI solutions into the market[Hummingbird Communications (No date)]. One, was by smaller companies, offering only *web only* products, which did not work out because of the need of large enterprises for full-featured desktop solutions. The second, was provided by some of the greater BI vendors as an additional add-on to the main BI system. These, on the other hand, offered very poor integration with the existing part of the system. Based on those experiences, the Hummingbird Communications Ltd. [Hummingbird Communications (No date)] came to a conclusion that three *iron laws* need to be fulfilled in order to provide a successful web-based BI solution:

- there should be a single solution for the entire enterprise

- desktop clients and web-based solution, should use the same services and provide the same content

- platform and browser specific plug-ins increase the deployment cost and therefore are not a desired approach

However, with the development of new technologies and web services, these laws (although valid) do not present a problem. Service Oriented Architecture (see Subsection 4.7) facilitates the process of integration of different tools and systems within a company, which is related to the first two laws. Moreover, new technologies and protocols make it possible to transmit and present, by means of a web browser, a variety of information making it possible to drop the usage of standalone desktop BI applications - which would make the third law inapplicable.

4.7 Service Oriented Architecture (SOA)

The main idea behind SOA is to enable communication between different systems (services). *"The communication can involve either simple data passing or it could involve two or more services coordinating some activity"*[2]. The designers of SOA want to make each service (whatever it might be) independent from one another.

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[2]source: http://www.service-architecture.com/web-services/articles/service-oriented_architecture_soa_definition.html

In such situation it could be used separately, on its own. Loose coupling[3] is the concept that describes the connection of such services.

According to this idea, experts in a particular field are concentrated on creating a system that provides a certain functionality. Other experts, deal with other solutions, which the specialize in. After that, by means of an open standard technology, each service is able to communicate with others (see Subsection 4.7.1). With this approach, it is easy to integrate different systems, which is very important in case of Business Intelligence solutions, as well as other IT systems supporting operation of enterprises. Moreover, because of the use of standard interfaces, the cost of deployment and integration can be significantly reduced[LogiXML(2006)].

4.7.1 Web services

Web service is a collection of open standards and protocols used for communication between various independent applications and systems. Because of the use of open standards, applications created in different programming languages and working on diverse operation systems, are able to exchange data[Barry(2003)].

> *"Web Services is a method of designing application so that, rather than running as a standalone piece of code on the system, their functions can be made available as "services" for any server or application linked to the network*[LogiXML(2006)]

This gives enormous simplification of integration of various systems within the company. This also would lead to decreased significance of vendor lock-in and network effect.

Most important Web services standards are[4]:

- XML - markup language used for describing data

- HTTP and HTTPS - client/server request/response protocol

- SOAP - protocol for exchanging XML-based messages

- WSDL - XML-based service description that describes the public interface, protocol bindings and message formats required to interact with a web service

- and others, including Web 2.0 standards like Flash, Ajax, Silverlight etc.

SOA can be created using Web services, which are widely accepted and based on open standards.

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[3]minimal dependencies among services, and facilitated connection of various business solutions

[4]source: http://en.wikipedia.org/wiki/Service-oriented_architecture#SOA_and_web_service_protocols

> *"SOA and Web Services can provide new ways of packaging and delivering valuable content and BI capabilities. They make it easy to implement BI services across all functional areas of the business. BI solutions can also take advantage of SOAP and XML features like open standards and platform independence. And, reports can actually be viewed as Web Services using XML rather than HTML, making full interactivity in reports a reality*[LogiXML(2006)]

4.7.2 Managing other IT/IS systems

With the implementation of SOA and, therefore, facilitated communication between applications of various kinds, it is possible to connect other IT systems that a company has with the BI solution. BI should use information gathered from all possible sources, including the systems within the company, in order to give a broad picture of the situation and the best information for the decision maker. Low stock, problems with supplying a relevant product - all information form the SCM system should be take under consideration. Similarly, information regarding customer preferences, habit changes etc. will influence the managers decision. Also all the data from the ERP system, regarding the operation of the company should find its way into the BI solution, as well as other industry-specific systems.

> *"Pressured to show greater quantifiable and strategic value from IT investments, more companies are turning to business intelligence to drive return on investment (ROI) from ERP and operational implementations by unlocking the wealth of information stored in these systems"*[Sas(no date)].

4.8 Data Quality

Some believe that *"the success of any BI implementation depends on having clean data to mine"*[Dragoon(2003b)]. And it's hard not to agree with this statement. All analysis are performed on the data that the company is able to collect from various sources. If this data is inaccurate or there are multiple versions of one data in the system, the analysis cannot provide proper results. For example, *"inaccurate and low-quality data costs U.S. businesses $611 BILLION dollars each year according to the Data Warehousing Institute*[Orf and Mayros(No Date)].

Most of the Business Intelligence solutions available on the market are using Data Warehousing technology as a source. On the other hand, creation of DW in a company is not as simple as copying all relevant data into one place. A lot (if not most) of the DW project fail, because insufficient attention is devoted to the

data quality issues[Sherman(2005)]. This leads, to bad data taken by BI solutions for the analysis, and bad results presented to the decision makers. And, *"the trend of enterprises creating knowledge based solutions where a user seems unwilling, or unable, to utilize existing "bad data" is fundamentally sabotaging the majority of CRM and BI efforts around the world"*[Orf and Mayros(No Date)].

In order to avoid all this, companies need to understand the need of good quality data in their system, and be ready for taking care of this problem from the very beginning of projects that are related to them. Good data quality applications, first of all, take care of bad data, which is absolutely essential, but also take care of good data, by making it more comprehensive, consistent, relevant and timely[Sherman(2005)].

Therefore, it is crucial to deal with data quality issues. In order to achieve expected ROI and ensure people are using the BI system and better decisions are made, companies need to concentrate on data quality issues at the very beginning of BI projects.

4.9 Market development

Since the times of the first Business Intelligence solution, systems of this class have evolved. The next generation BI offers many improvements in comparison to early one. However, there is always a need to do more. Further development in the BI area will concentrate on[Raden(2006)]:

- guided search and navigation - provide a Google-like searching capabilities

- master data management (MDM) - focuses on sharing references (master data) between IT systems or even different companies

- semantics - allow to find, share and combine information more easily; it relies on machine-readable information and metadata represented in RDF (general framework to describe metadata)

- operational BI - increasing the speed of analytics even more, so that the decision is made and put into action in a matter of minutes or seconds[Gile(2004)]

Except for that, there is a tendency to connect the functionalities given by BI and BPM systems, as well as improving the communication between different systems, so that the data from ERP, CRM etc. systems can be fed into the analytical tool.

The technology becomes more and more sophisticated and useful. Because of that, companies are preparing for investments that are required. This, on the other hand, makes this market increasingly interesting for vendors, and therefore

new BI providers launch their products and offers. Except for that, BI vendors, begin to show interest in having customers from the SMEs sector. Because of all that, there are BI solutions being introduced that suit the needs and financial and other resource capabilities of smaller players in the economy.

More and more companies are becoming aware of the existence of such systems and the prices are becoming to be available for more companies. *"Business Intelligence has [...] reached critical mass*[Eckerson(2007)] in the years 2003-2005. The technology *"is recognized by business leaders"* and *"executives are increasing BI budgets"*[Eckerson(2007)]. According to a research from Gartner from 2006[Murray(2006)] *"the global BI market will grow over sever percent a year for the next four years, creating a market worth $3 billion in 2009"*. And some professionals are even more optimistic in this matter.

4.9.1 Drivers and barriers

The drivers of the BI market development are very intensive. All the benefits, promised by BI vendors are useful to all kinds of companies, from a myriad of sectors. These are:

- better, well-informed decisions

- faster response to changes (both internal and external)

- effective use of company's resources

- information about competition

- connection with other IT systems in the company

All those advantages of using such systems are convincing to managers and CEOs.

But not all that shines is golden. There are certain barriers that make them think twice before deciding to implement a system of this class. First of all, it is the price of using such a solution. This accounts for implementation costs, which usually very high, as well as user training, later management of the system, and IT support. Current trends on the market aim at decreasing the Total Cost of Ownership (TCO) of BI by means of new pricing models and alternative ways of provision. Moreover, there is a strong pressure on the vendors and BI developers, to create more friendly user, customizable interfaces, based on Internet browsers, to decrease the necessity for expensive and time consuming training or additional IT support (case when the decision maker is not able to get the report on his own). Except for that, as far as the SMEs are concerned, recent high interest of vendors in this group of businesses, results in significantly cheaper offers and simplified

solutions. This makes it possible for smaller companies to roll out a BI system in a shorter time, with a smaller need for use of company's resources and, most importantly, for a smaller price.

Another important obstacle, to widespread adoption is the fact that many BI implementation projects have failed at some point. Some went into a dead end during the project, while others, although finished, are considered to be a fiasco, because of the ROI not attending the expected value. Most of the failures are related to poor requirement specification by the customer (or even letting the vendor to do it for them), improper selection of the solution, resulting in having a system that does not fulfill companies needs, bad understanding of how such a system can be used and what it cannot achieve, as well as difficult user interface, resulting in low usage in the company (which in the end, does not provide the expected ROI) and not aligning BI with business strategy (implementing it without a good business purpose). However, good understanding of how such systems work, proper definition of the requirements (with end user participation), thorough analysis of each vendor (with an evaluation period on company's real data), easy interface or proper user training and proper project management during planning, implementation and post-implementation phase, as well as assuming realistic ROI, ensure success.

A very common problem, during BI projects, is the data quality issue (see Section 4.8). Many companies, underestimate the significance of this factor, and because of that, end up with a perfect application that operates on bad data, providing useless information to the decision makers. Data cleansing before feeding it into the BI system, is an absolute must for a successful BI operation.

The next generation BI solutions tend to address all the above mentioned issues (except project failures dependent on the customer himself/herself). New technologies incorporated in such systems simplify the integration with the existing infrastructure, and facilitate management and usage. Nevertheless, companies wanting to purchase BI need to present more serious approach and know exactly their needs, because vendors are interested in selling the product and can always find a way to explain further problems.

Chapter 5

BI system provision

The most obvious, typical and probably the most popular (on Polish market) solution is for the company to develop the entire infrastructure and buy the application on their own. In this case, the enterprise needs to buy all the hardware and software, as well as take care of management, support and also training of the users. Moreover, the responsibility for any problems is almost entirely within the company.

Such an approach, although simple and straightforward in understanding, and essentially independent, has a number of disadvantages, with the price being the biggest one. The costs of the above mentioned parts of an IT system, especially of such a big one as Business Intelligence, are enormous. They are exceeding the capabilities of most of the companies from the SME sector, and influence significantly the bigger ones as well. In case of bad implementation, resulting in poor ROI, it may lead to serious problems, including bankruptcy.

In order to decrease the costs of rolling out a BI solution, and at the same time mitigating risks, improving quality and flexibility etc. companies can use alternative approaches. This may be entirely different ways of obtaining a BI functionality, but also, contracting only part of the necessary element of IT system integration (e.g. training, management).

5.1 Total Cost of Ownership

Total Cost of Ownership (TCO) is a kind of financial evaluation and estimation of all costs of having a certain IT solution[1]. This estimation takes into account costs related to purchasing hardware, software, also further management, required training, real estate aspects (devoting a room for servers), additional equipment, personnel etc. It also includes indirect costs which are very hard to measure.

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[1]source: http://searchdatacenter.techtarget.com/sDefinition/0,,sid80_gci342316,00.html

Moreover, TCO is also affected by intangible costs (which are very difficult to measure), like[SaaS Executive Council(2006)]:

- reliability and availability - problems with accessing the application

- interoperability - integration with other systems issues

- extensibility - customizability to companies needs

- security

- scalability - in case of company's growth

- capacity - depending on the adoption and usage in the company

- opportunity costs - in case another project suffers from lower insufficient staff and budget, because of the expenditure related to the project being evaluated

After the analysis is done, this can be compared with the expected benefits in order to determine whether implementation of a certain system is justifiable.

Therefore, the idea is to decrease the TCO of a particular solution. Below, alternative solutions to owning the entire infrastructure and doing everything on your own, are presented.

5.2 Outsourcing

Outsourcing can be defined as "shifting company's essential operations to a third party vendor in order to gain various benefits including better services, low cost and speedy work"[Tutorial-Reports.com(2006)]. Shreeveport defines it as "shifting constant management responsibility, to a third party, for performing a particular service, defined in the contract"[Gay and Essinger(2000)]. At the same time, "it is different from subcontracting , because the function is provided on the ongoing basis, rather than for a specific projects. It can be provided on the same or another location, in the same or separate country" [12Manage(No date)].

On the other hand,

> from the strategic point of view, outsourcing is considered to be one of the most important and giving the greatest benefits business methodologies, enabling various organizations to fully make use of their capabilities and achieving optimal effectiveness and elasticity in responding to their customer needs [Gay and Essinger(2000)].

Therefore, if used properly, this can be a very powerful tool to gain competitive advantage over other players. However, care must be taken when undertaking outsourcing projects. Knowledge Management experts from the Oxford University in cooperation with Missouri University found out, in their world wide survey, that 35 % of 29 greatest outsourcing contracts in 1995-2002 failed to provide expected results [Gay and Essinger(2000)]. Although this solution becomes more and more popular in recent years, the percentage of the failed projects is still around 40 % [No author(2005)]. This proves how difficult it may be. It is a very complicated process and there are many factors to be taken under consideration.

No matter the definition, outsourcing is generally a form of reorganization of company's operation. Because of that, it should only be taken under consideration, when its use can be considered relevant to economical aspects [Kanikula(2006)].

5.2.1 History in Brief

Although outsourcing is a rather new term, the process itself, actually exists for a very long time. For years, companies were using external firms for taking care of the maintenance of the building, its security, cleaning and catering services. At the beginning, all that was performed on a small scale, but since more advanced activities started to be contracted and performed by external provider, the process became an important part of companies strategies and finally gained its name.

Outsourcing dates back to the 1940's and 50's. It was than only related to the manufacturing industry, and mostly had to do with the use of Japanese and other Asian countries cheap workforce for making the necessary parts for cars, electric and later electronic devices [DeMassi(2004)]. After that, most of the industries started to shift part of their activities to other countries, mostly Asia. Except for that, new business models started to be used. On-site companies started to specialize in some services and started to provide them to other companies, like, for example, the earlier mentioned catering and security services. For some time now, even more sophisticated services are being provided ranging from IT, through Call Centers, to Human Resources. This occurred in 1990's, "with the advent of Internet and advancement in the Information and Communication Technology"[Tutorial-Reports.com(2006)].

5.2.2 Basic idea

A variety of different activities can be outsourced, and there is a myriad of ways companies can related to each other in the outsourcing contract (see Section 5.2.4). "In outsourcing, the vendor has complete control over the process being outsourced as compared to contracting in which the customer has more control over the process being contracted" [Tutorial-Reports.com(2006)]. Because of that, it is to make

certain that the outsourcing is indeed required in the particular situation, and if it is, then it is crucial to define the requirements precisely. Only then, according to those requirements, it is possible to find a proper supplier of the service, and verify that his later activities are in fact related to what is written in the contract.

It is important to realize, that in order to use the opportunity, when it shows up, it is reasonable to constantly evaluate the costs and benefits of outsourcing in various fields.

> *"That is not to say that costs alone or ease of management should influence your decision to outsource. However, outsourcing should form one of your options as you evaluate the alternatives for accomplishing the corporation's business and IT goals"* [DeMassi(2004)]

Therefore, any time is good to start to outsource, and it is best to make use of it, as soon as the need arises. Hence, the best option is to monitor the performance of processes in the company, and instantly identify the opportunities.

5.2.3 Reasons for using

There are numerous reasons for outsourcing. Generally, the most important drivers are[12Manage(No date)]:

- to make an organization more competitive, by staying focused on *Core Competences*

- to achieve cost reduction and efficiency

- to give access to special resources and capabilities

- to stimulate entrepreneurship in small organizational entities
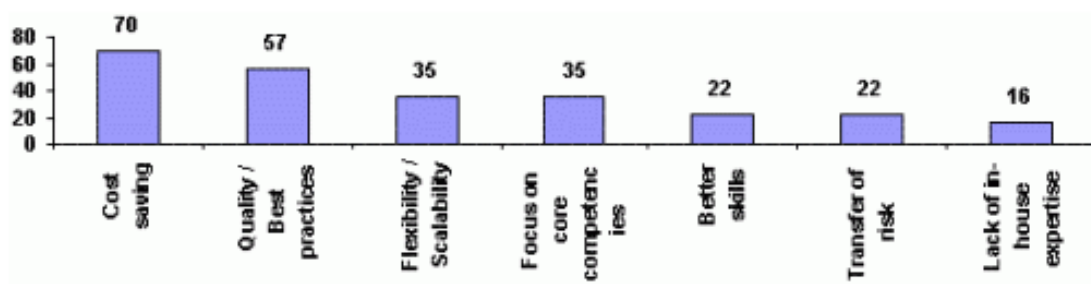
Figure 5.1: Reasons for Outsourcing[Tutorial-Reports.com(2006)]

The first point is very often considered to be the most important one. As long as the process outsourcing process is economically justified and planned thoroughly,

it usually is used to make an external supplier deal with a particular, usually problematic, service in order for the company to be able to fully concentrate on the most important activities performed within the organization - Core Competences.

But from another point of view, "according to Deloitte Consulting Outsourcing Study, October-December 2004, lower cost was the most vital reason given by the respondents" [Tutorial-Reports.com(2006)] (see Figure 5.1)

Going more into details, reasons for using outsourcing, according to Outsourcing Institute, are[Gay and Essinger(2000)]:

1. reduction and control of operational costs

2. gaining access to production of the best quality

3. making own resources free for other purposes

4. gaining additional resources, which an organization does not have

5. speeding up of having benefits resulting from restructuring

6. handling a function hard to perform or impossible to control

7. gaining capital

8. risk sharing

9. cash inflow

One way or another, such a solution is a way of becoming more competitive. Companies deciding to make use of outsourcing save time, resources and money, which in the long run results in increased customer satisfaction.

Nevertheless, it is important to remember that,

> *"The strength of outsourcing is not its capability to immediately solve problems, but the ability to aid in the complex analysis of the way the business is being done, starting from the reason of company's existence. Outsourcing is not a typical business tool - it is a new way of thinking about business"* [Gay and Essinger(2000)]

5.2.4   Types of outsourcing

There are few ways outsourcing can be performed. First, there are at least three business models related to it[12Manage(No date)]:

- Shared Service

- Spin-off

- Outsourcing to an external organization

The first approach, is about outsourcing a business function within a particular organization. In such a case, part of work might be shifted to a specialized department or unit. As a result, all activities of the same kind are performed in one place and by professionals, dedicated to it. It "enables corporations to achieve economies of scale by creating a separate internal entity within the company to perform specific services, such as payroll, accounts payable, travel and expense processing"[2]. This is a very common solution in greater companies to improve performance and decrease costs.

The second business model is a separation of a part of a company, to make an independent, specialized entity. The new spin-off company performs particular activities as a service for the parent company. Apart from that, it can provide those services to other companies.

The last solution, is outsourcing to an external organization. This is the most commonly known way of outsourcing.

It is possible to identify three levels of outsourcing depending on how much the company wants to shift to the vendor[Tutorial-Reports.com(2006)]:

Project Level - in such a case, one project is under consideration, and only some aspects are outsourced to the supplier. This usually takes place, when the project is highly relevant to what the company is actually doing, and when it wants to control, coordinate and take credit for the final result.

Program Level - here, a greater part of the company's work is taken under consideration. On this level, some entire projects are outsourced to the vendor, but the main part is still under control of the company.

Division Level - on this level, the entire activity is outsourced to the supplier. This usually happens, in case of work, that is distant from the core competencies of the company.

The decision on what level to outsource depends on a number of factors, which are related to how important the job actually is and how relevant it is to the main activities of the company. In case, where it is strongly related to the core business

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[2]source: http://www.ebstrategy.com/bpo/basics/terminology.htm

of the company, the company is usually rather reluctant to outsource a lot, and instead shifts only minor parts.

Another important factor, is how the vendor is recognized in the market. If the supplier has a good reputation, and references indicate superior performance, than the client company would be more willing to outsource greater parts.

A crucial aspect is the cost of outsourcing. If making use of such a model seems to provide high cost savings, than the company will tend to give as much as possible. The ultimate reason is to decrease the operational costs and become or remain competitive.

It is possible to distinguish a number of types of outsourcing, depending on the work that is under consideration, how the company and the vendor are related in the contract, etc. These are[Gay and Essinger(2000)]:

1. Function Commission

2. Service Outsourcing

3. Insourcing

4. Co-sourcing

5. Profit-share

The above will be characterized in the following subsections.

Function Commission

This type of outsourcing usually deals with the parts of the company's demand chain that are of smaller importance [Gay and Essinger(2000)]. The functions usually commissioned are things like cleaning and keeping the hi-gene in the toilets, catering for occasional party, organization of company's trip etc. but recently it also has to do in general with activities termed as real estate management. Very often this is a short term contract, which is not a strategic decision, but just a solution for particular, current needs of the company. The term function commission is related to an activity that is shifted to an external supplier, and until that time was performed by a department of the company.

The greatest problem with this type of a solution is that is typically was about contracts that specified the activities to be done, and not the final result. Because of that, the requirements were very often poorly defined, and therefore the outcome was insufficient.

Service Outsourcing

This is a more complex and advanced type [Gay and Essinger(2000)]. This is not just a one time contract, but a well thought-over decision. The company has a economically justified needs and based on them performs a thorough analysis and evaluation of all possible suppliers. The vendor is possible to provide a highly specialized service and superior performance over the company itself.

The services can be varying, from human resources and accounting, through advanced IT/IS provision, ending on even more advanced Business Process Outsourcing related. Depending on the complexity of the service, specific requirements from the client, as well as the vendor's capabilities, it can be extremely difficult to achieve success (it is important, to first clearly define success, as it is very specific for each and every case). Various aspects need to be taken under consideration, e.g. risks involved in starting such a cooperation, and possible outcomes of poor performance of the provider. At the same time there are numerous benefits, most importantly cost reduction and possibility for the company to concentrate on it's main business activities (for more details see Section 5.2.6).

It is crucial to define the requirements accurately, since if the company does not do it, the vendor will most happily do it himself. As a result, the company may end up in two difficult situations. In the first case, the supplier will realize the outsourcing contract in the most convenient way for him, which not necessarily will be the best result for the company. In the second case, the work might be done according to the vendors understanding of the problem. This again, may not be exactly what the company was looking for. Therefore, to be able to talk about a success, all the requirements, as well as the expected results, need to be precisely stated, in order to avoid any assumptions [Gay and Essinger(2000)]. There also needs to be a way to measure if the results are appropriate, so that the company is later able to rather easily evaluate what was done by the vendor.

These requirements should, most often, be defined by the personnel that is responsible for the work to be outsourced at the current moment. They are the ones who deal with it every day, and are aware what are the expected results. This may be troublesome at the same time, since these people might be loosing their job, so care must be taken during this process.

It is however important, to leave the choice of the method to the vendor. Usually, because the company decides to outsource, it is related to the fact that it is not capable of doing the work itself. As a result, it may not be actually aware of the best method available. The supplier, on the other hand, should specialized in that particular field, and therefore should be able to decide, what is the best way to realize the tasks and achieve the results, defined by the client.

Insourcing

This is another approach to reach higher efficiency [Gay and Essinger(2000)]. The idea is to improve the realization of a certain activity within the company. This usually happens, when the function is too important and too relevant to company's core business operations or too difficult to commission it to an external contractor. The members of the unit responsible for the activity need to increase their skills and improve performance. In some cases, it is possible to create a separate business unit, that is supposed to take care of that certain function alone. Such a unit is the, first of all, responsible for realization of the tasks coming from the parent company, but at the same time, in order to increase the efficiency, and decrease costs it should create economies of scale. This can be achieved by providing service to other, external clients.

Another meaning of the term suggests "transferring jobs to within the country where the term is used, either by hiring local subcontractor or building a facility" [Wikipedia(6)].

Co-sourcing

In this case, both the company and the supplier are responsible for providing resources for completing the task and take credit for the work done. There is a rather tight cooperation between the two firms. Usually, the company delegates some of its people for the realization of the project. However, the importance of the personnel for the company, does not allow for their transfer to the vendor [Gay and Essinger(2000)]. The main problem of such a relationship, is because of the shared responsibility, there is no possibility for amends.

In every team project, communication is the key to success. This becomes even more important in case of cooperation of people from different companies and different backgrounds. It is crucial that people, who's work depend on one another's performance, contact each other regularly. The requirements have to be understood by both parties, as well as there has to be a common understanding of the problem, each side's capabilities, needs, aims and expectations.

Because of shared responsibility, the requirements for each side should be clearly specified, as well as methods for measuring the results of the work. Only then, it will be possible to manage such a project in a correct manner.

Share in profits

This type is a long term relation of companies, which requires investments from all sides, and at the same time, each has a share in the profits [Gay and Essinger(2000)]. This is a more complicated approach and at the same time, more risky. However, because of the nature of the problem, it is not possible to do it any other way.

Here, all companies are fully devoted to proper realization of the terms mentioned in the contract and have their interests in it. The most important drawback in such a case, is the fact that all interested parties are taking a risk.

In order to avoid problems with dividing the profits, clear rules of who gets what and when should be stated in the planning phase. Usually, the host company gets more at the beginning of the cooperation, and, on the other hand, the supplier, gets more, if considerable improvement is exhibited in the operation of the host company [Gay and Essinger(2000)].

Comments

The above mentioned types of outsourcing have different features and, therefore, a different purpose and effect.

The simplest one, the Function Commission, is used mostly in cases of simple activities, and when the company wants to keep the control over the process, but just lacks the necessary resources.

In case of outsourcing, the company defines all the requirements and final effects of the work of the supplier, but is not actually interested in the way it will be provided.

Insourcing is used when the process considered is to related to the Core Competencies of the company, and, therefore, the company is not willing to outsource it to external contractors.

The last two approaches, co-sourcing and share in profits are more complex relations. They require greater experience, greater trust and good cooperation between the host and the vendor in order to achieve expected results. Increased risk is incorporated in those approaches, since both companies need to invest in the projects in some way, but the cooperation may bring additional benefits.

As a result, it is important to thoroughly analyze each particular case and determine, which of the approaches mentioned above is the best. There is no single, best way to do it.

5.2.5 Modes of outsourcing depending on the destination

There is a myriad of reasons for outsourcing, and depending on the actual function to be shifted and the expected benefits, there are various destinations. Characteristic of each of the approaches is presented below[Tutorial-Reports.com(2006)].

On-shoring

This mode is in case of outsourcing to a local supplier. This means that the work is actually done in the destination close to the host company. This is a typical

approach with functions dealing with the work in the company's building. It is also an useful approach, if the outsourcing activities require constant supervision of the company, or close cooperation with the vendor.

Offshoring

This term is related to shifting activities to another country, which is locate far away from the company. This is most often used approach in manufacturing and other alike services. This was also the initial approach to outsourcing, since back in past, most of the work was outsourced to Asian countries, which were a good source of cheap workforce. Recently, except for that, it is also very common to offshore call center services and IT systems to companies in India and Eastern Europe.

The main idea and benefit of such an approach is the cost reduction.

Near-shoring

Similarly to the previous case, this approach is about outsourcing to a different country, however this time, it is a one that is closely located. The reason for that may be because of a variety of reasons. It may be related to cheaper workforce, but also because of lack of an appropriate supplier in the country, or superior performance of competition in the nearby country. It can also be related to the fact, that the company is located in a number of countries, and decides to perform a project for the entire organization in one single location because of cost, regulatory aspects etc.

Home-sourcing

This is a very interesting solution, which became available with the recent technological advances in the mobile networks. Because of the ubiquity of the Internet and mobile phones, as well as VPN, some tasks can be realized outside company's building. This is a good solution, if the type of the work allows it, to decrease costs related to the real estate.

5.2.6   Advantages and Disadvantages

While thinking about outsourcing of any kind, a company needs to take under consideration all possible benefits that such a solution can bring, but at the same time, be aware of problems that may occur. The advantages are quite numerous, and since such an approach becomes more and more popular, there are a number of vendors to choose from. On the other hand, there are pitfalls that need to be considered, since many projects end up being far from company's expectations.

Pros

The most important and appealing benefits of using outsourcing approach are presented below.

Focus on Core Competencies staff and resources benefit This is one of the most crucial advantages of outsourcing [Gay and Essinger(2000)]. A company, when outsourcing a certain service or function (usually a supplementary one), is able to concentrate on the actual core business activities. People, who used to or would be responsible for the particular service, can be diverted to other tasks, more related with company's operations. In such a case, there is no need for additional recruitment, training and managing of people responsible for additional tasks. Therefore, there is no need for additional qualifications and, at the same time, various aspects are simplified.

When activities like customer care, documentation, IT, administrative tasks (payroll, internal audit) are given to external providers, "the company management can focus on company's core competency and bring better services and products into the market" [Tutorial-Reports.com(2006)].

Cost Savings Another, probably equally important benefit are the cost savings. In today's highly competitive situation on the market, the only way to remain is to improve the quality and customer service (by that increasing customer satisfaction), and, at the same time, decrease prices. To be able to do that, companies need to drop production or provision costs. Outsourcing is a good way to realize this. Not only, the actual service, under consideration, is provided cheaper, but additional costs like "resource management, labor, space etc." [Tutorial-Reports.com(2006)] are decreased. "According to Accenture, outsourcing leads to cost saving of 25 to 30 percent. Outsource Partners International estimates the cost savings to reach up to 50 percent when the outsourced work is offshored.

Quality A particular function may be a supplementary for a company, but is a field of expertise for the vendor [Tutorial-Reports.com(2006)]. The supplier, has access to state of the art technologies within his field, professional employees who participate in conferences and training, as well as information about best process and, therefore, offer the best performance in the field.

The company, on the other hand, is not willing to spend too much money on investments related to supplementary functions. Because of that, to achieve the highest possible quality, the best solution is, very often, to use the outsourcing approach.

It is important, however, to thoroughly analyze all vendors and perform careful selection. In order to find a suitable supplier, the company needs to define all requirements and accepted quality of service, to avoid future misunderstanding.

Flexibility   When a company is dissatisfied with the way a particular activity is done, outsourcing is a more flexible approach. This is due to the fact that "changing a vendor in case of poor delivery is much easier than changing a full-time employee" [Tutorial-Reports.com(2006)].

Requirements and other details should be precisely specified in the Service Level Agreement (SLA). "SLA is a contract between the vendor and the user that specifies the level of service that is expected during its term" [Cellglide(No date)]. If the requirements are not fulfilled, then "many outsourcing deals incorporate conditions for change in requirement or termination of contract ensuring flexibility" [Tutorial-Reports.com(2006)].

Time-to-market

First of all, because of the expertise of the provider, some activities can be performed faster if the work is outsourced than done in-house [DeMassi(2004)]. Moreover, in case of offshore outsourcing, there is a benefit of additional shift - a team works on a project in the country of interest, and after they finish, the results and relevant documentation can be sent to a remote location, where a second shift continues [Tutorial-Reports.com(2006)]. This increases the development process, reducing the time-to-market. Except for that, "outsourcing also enables faster start-up, development and scalability for new operations" [Tutorial-Reports.com(2006)].

Access to Diverse, State of The Art Technologies   Outsourcing gives the possibility for the company to gain access to state of the art technologies, that would otherwise be unavailable because of the costs and complexity aspects. This can be seen in two ways. In one case (as mentioned earlier), the vendor has an access to superior technology, and therefore, realizes the tasks in a more efficient way. In the second case, the supplier may be a provider of features of a particular e.g. IT system. In both cases, the company is able to afford a solution, which could not be done on their own.

Risk mitigation   This is a rather obvious benefits. In case of outsourcing contracts, which do not include share of profits (and at the same time, share of risks), the vendor usually takes responsibility for the realization of a certain activity. In such a case, the risks related to that particular function, are placed on the supplier.

Improved Customer Satisfaction If the contract is realized in a good way, and there are no problems, than some of the above benefits occur. In such a case, the customers can experience improved service, and therefore, their satisfaction increases.

Decreased needs for capital investments Since a certain function is outsourced, the company does not need to worry about investments, related to additional equipment, recruitment of appropriate staff, preparation of training for the relevant employees etc.

Additional Benefits Except for that, there are other benefits, which were not expected, but were accompanying the use of outsourcing - the so called *leverage effect* [Gay and Essinger(2000)]. These are:

- identification of needs for additional changes, which were previously not seen

- encouragement and aid for other initiatives (IT system integration, business process modeling and reengineering)

- initiation and stimulation of culture change

- in case of success, a source of favorable point for outsourcing of other activities

Cons

The pitfalls and problems related to outsourcing are as follows:

Vendor Selection "The Vendor Selection process is at the heart of successful outsource partnership" [DeMassi(2004)]. Although changing a vendor, in case of problems, should be flexible (see Subsection 5.2.6), the transfer is still a costly, timely and annoying situation. At the same time, during the change of supplier, the company's service provision/product manufacturing may be delayed.

In order to cope with it, the best solution is to perform a perfect pick at the firs time. Therefore, initially, good requirements need to be specified and a proper RFP should be prepared. Later, it is crucial to elaborate a thorough evaluation process, to be able "to compare different vendors and to compare vendor capabilities against your needs" [DeMassi(2004)]

Decreased "Quality of Service"   The vendor, either could be chosen badly, or the way he completes a certain task, is distant from what the company was expecting (good way for most of companies, but not for a particular one). As a result, the overall QoS, which was performed in-house until that moment, could be decreases [Gay and Essinger(2000)]. Because of that, delays in the value creation process might occur or customers might be dissatisfied etc. Outsourcing a Call Center function to an offshore location, e.g. India, could cause a number of problems. The call center agents might not speak nicely to the customers, they might have problems with solving various issues or have little knowledge about the host company and its products and services [Lam(2001)].

Service Provider Issues   Another drawback of outsourcing is related to various situation related to the service provider. First of all, there might be a bad communication and poor cooperation between the vendor and the host company [Gay and Essinger(2000)]. Bad relations are, usually, not a source of good results and high satisfaction. Especially, that such situation may lead to misunderstandings in a myriad of fields. If this is not solved instantaneously, the number of problems will increase, and each time, it becomes more and more difficult to find a good solution.

Secondly, if the requirements and SLA were badly defined (the vendor needs to figure out some parts), than it most probable that it will be done in the most convenient way for him. The most important part of requirement specification is related to QoS and the related payment for the work being done. If something is unclear, than it will most probably become a source of problems in the near future [Gay and Essinger(2000)].

Lastly, it has to be considered that the company may have a problem, when "the service provider refuses to provide business due to bankruptcy, lack of funds, labor etc." [Cyber Futurics(No date)]

Negative response in the company   This is a rather problematic case, since outsourcing affect many employees of the host company. They might feel that their job and other related opportunities are at risk [DeMassi(2004)]. A a result, employees may refuse to transfer knowledge to the vendor, or make a public issue from such a situation and they might as well cause general bad atmosphere within the company (suggesting that work of others is also in jeopardy).

Intellectual Property Control   There are numerous laws related to Intellectual Property and, therefore, this is issue is rather strongly regulated in the US, as well as by the European Union. Because of that, outsourcing to companies within US and European countries is, in general, simple and there is small risk of theft of

trade secrets, abuse of patents and copyright, and other assaults on intellectual property. However, in case of offshore destination, the situation is more difficult. Therefore, the company needs to be aware of possible issues that might later arise.

Other Drawbacks   Many of the drawbacks of outsourcing are rather related to the improper realization of the contract, than from the outsourcing itself. Therefore, the main reasons for dissatisfaction are the ones that decide whether such a project is a success or not. As mentioned earlier, it is crucial to define requirements in a perfect manner and produce a good SLA, in order to avoid later misunderstandings.

> *"Many organizations wrongly view outsourcing as essentially a cost-reduction strategy and neglect the significant business risks associated with it"* [Lam(2001)]

5.2.7   Type of work

As far as the type of work to be outsourced is considered, there are numerous possibilities [Gay and Essinger(2000)]:

- IT - hardware maintenance, training, software engineering, consulting

- supplementary functions - printing, mail handling, IS administration, archive management

- customer service - off-site customer handling, call center

- finance - payroll processing, purchase, transaction control, accounting

- HR - employees transfer, recruitment and training, human resources IS

- real estate and equipment - building maintenance, security, catering and canteen service

- sales and marketing - advertisements, telemarketing, off-site sales

- logistic - distribution (shipping control, leasing, supply chain management) and transport (vehicle base management, vehicle conservation)

Therefore, there are many functions that can be shifted to external suppliers. The greatest development is experienced in HR, IT, customer service, marketing and media.

5.2.8   IT outsourcing

Although most of the rules and features of ordinary outsourcing apply here as well, there are some aspects specific for IT.

First of all, as the name suggests, this is outsourcing of information technology to an external company - technology solution provider[Tutorial-Reports.com(2006)]. There are two main benefits of such a solution:

- financial savings - when a company already has a technology that is necessary for part of its activities, but wants to drop costs by outsourcing it to an external supplier

- technology access - if a particular technology is too expensive for the company to implement, and the service/functionality provided by it is considered to bring significant benefits,

but reasons like focusing on core competencies or quality are also driving forces.

Nevertheless, whatever the reason, and whatever the benefits, that the company is going to experience,

> *"outsourcing of IT, as well as other functions, should be considered as a part of general business strategy, a not as a response to cope with a tactical problem"* [Gay and Essinger(2000)]

Therefore, such a solution is only good when it is suitably justified. It needs to be aligned with the business strategy, and there need to be some organizational, economical and market premises.

Various functions can be outsourced within IT [Tutorial-Reports.com(2006)]:

- application service provisioning - outsourcing of business application hosting from a third party vendor instead of doing it in-house

- application management

- consulting and reengineering - identifying problems, modeling processes and recommending optimization solutions for better performance, lower costs etc.

- client/server - server is offered by the vendor

- data entry and conversion

- distributed systems - hosting client/server technologies, providing a system, network monitoring and administration services

- system integration - software, hardware, network, enterprise application and legacy, as well as web migration

- testing

and many others.

5.2.9 How to choose a vendor?

When a company decides to outsource a certain function, it wants to reach some of the benefits that were named earlier. In order to be able to achieve it, the company needs to select a good vendor, so that in the end, the service is not delivered poorly [Tutorial-Reports.com(2006)]. There are few criteria that the buyer needs to take under consideration, while evaluating the supplier:

- there should be a strong and proved focus on the quality of service

- the cost of providing the function needs to be reasonable enough, so that the company is able to experience cost savings

- the provider should have access to state of the art technology, enough resources and provide superior performance exceeding the abilities of the buyer

- references and certificates are needed to proof vendors experience

- the contract should be flexible enough to allow for changes and termination

- the supplier should prove the importance of confidentiality

Proper evaluation of the vendor is even more important in case of offshore projects, and at the same time even more difficult.

5.2.10 Application of Outsourcing to BI provision

In case of Business Intelligence systems, there is a number of approaches that can be used. First of all, the entire system can be outsourced and the company would be getting only the functionality. This solution is especially good in a situation when the IT infrastructure already is contracted to external company.

Except for that, it is also possible to outsource only part of the job related to the system. For instance, hardware components (servers etc.), the process of system development, system integration, data entry, conversion and cleansing, as well as training of the users, IT support. Each of these approaches can bring above mentioned benefits (see Subsection 5.2.6), and lead to a decreased TCO. After all, according to a survey conducted by Shreeveport agency, the main benefit of outsourcing was the decrease of the cost of having a particular service [Gay and Essinger(2000)], in this case, Business Intelligence system.

5.3 ASP - On-Demand - SaaS

"A more recent type of outsourcing is the ASP (application service provider) model, where organisations purchase software use on an "as and when' basis"
[Urquhart(No date)] ASP is an external company that provides and end product of the form of software-based service or solution to customers over the Internet[3]. With the development of web-based interface, this business model become a very useful tool to provide an IT-related service, at a much lower cost.

In this approach, the entire infrastructure is located in a central location, and it is managed by a provider company. The vendor is responsible for proper management of the server, and ensuring that the bandwidth is sufficient to serve its customers[Kern and Kreijger(2001)]. Similarly to typical outsourcing contracts, the product service is defined in the SLA.

The pricing model offered by ASPs pay per user basis, or a monthly flat fee[Brain(No date)]. Such a solution is especially aimed at SMEs but is also used by larger companies, since the main benefit is that it *"will reduce the total cost of (IT) ownership"*[Seltsikas and Currie(2002)].

The main advantages of using this type of outsourcing are[Brain(No date)]:

- low cost of entry

- short setup time (usually only an Internet browser is needed on the user's PC)

- no need for specialized IT infrastructure

- decreased employee number

as well as other benefits, common in all types of outsourcing.

However, there also drawbacks to such a solution[Seltsikas and Currie(2002)]. First of all, since the system is managed externally, it is more difficult for the customer to control it. Therefore, the SLA has to be specified very precisely and the provider has to be reliable.

Another thing, is that the problems with Internet connection in the company, result in the inability to use the application.

Moreover, there are issues related to security of the connection, backup features of the provider, and others.

5.3.1 On-Demand

Software On-Demand in essentially the same type of service as ASP. Some consider it to be exactly the same thing. Others consider it to differ in the kind of pricing

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[3]source: http://www.webopedia.com/TERM/A/Application_Service_Provider.html

model. In this case, on-demand is another level of ASP. The pricing here evolved from the pay per user or flat fee approach, to pay per use.

This type of licensing is even more attractive for the customer because of two reasons. First of all, the customer pays only for the real time he used the application, which decreases the cost further in comparison to pay per user model (e.g. a user has an account even while he goes on holidays).

The second reason is, that such an approach *creates a powerful incentive for vendors to make sure users go live as quickly as possible and then continue to actively use the account*[Weinewright(2006)]. In order to ensure that, the vendor is forced to provide an application of the highest quality. This is also indirectly related to the user interface. *On-demand vendors go out of their way to make the user interface as intuitive and self-evident as they can*[Weinewright(2006)], because this increases the adoption of their system and increases their benefits.

5.3.2   SaaS

Software as a Service is another name for the on-demand software delivery, and recently, the one being used the most. It is especially mentioned in relation to SOA[Knorr(2006)]. *"Fueling the momentum toward software as a service (SaaS), Sharp Analytics and similar companies are providing expert-level domain knowledge bundled with software and services for a flat fee"*[Raden(2006)].

5.3.3   Application of SaaS to BI provision

> *"As one of the fastest-growing technologies in enterprise computing, business intelligence (BI) is under ever-increasing pressure to deploy its solutions over the World Wide Web. Though still in its adolescence as an enterprise platform, the Web holds the promise of lowest cost of ownership (LCO) for applications that require wide deployment"*[Hummingbird Communications (No date)]

Such a solution of BI provision is gaining greater acceptance recently. Because of high complexity of BI solutions (in terms of different aspects that need to be considered during implementation), *"the cost of BI systems can escalate very quickly"*[Nesamoney(2007)]. The investments related to a business intelligence system can range from several hundred to several million dollars a year, in case of bigger companies. And SaaS is the model that leads to a considerable decrease of TCO. It is possible to *"start using SaaS BI with a very small investment. Typical SaaS BI offerings are priced in the $50 to $100 per user per month range"*[Nesamoney(2007)]. Companies not being able to afford having the entire infrastructure required for IT systems, including Business Intelligence, turn to

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this model. Development of technologies like SOA, Web services and improvement of the web-based interface, as well as decreasing costs of Internet access (and greater bandwidths), make it possible for such an approach to not only thrive, but replace typical software products. Big enterprises like Microsoft and Symantec, already start to notice the trends on the market and begin their moves in this direction[Pawlowicz(2007)]. It won't be much time, when major players in BI market will take this under consideration and start offering BI using SaaS business model.

However, there are important challenges that BI is facing to be SaaS capable. First of all, there is a need for fully Web-based architecture. Secondly, the user interface need to be easy to use and customizable. Moreover, *"SaaS software is expected to be always on*[Pawlowicz(2007)], therefore, the regular administration and upgrades have to be performed seamlessly, and in case of sudden events - recovered as soon as possible. Except for that, since the entire analysis are to be performed in a remote location, the provider is required to ensure proper security, so that the transmitted data is not compromised. Lastly, because of introduction of additional latency into the process, the best way to achieve improved efficiency, is to use a kind of serve-less technology, to avoid time consuming loading of data into the DW[Nesamoney(2007)].

Whatever the benefits of the solution, as with any type of purchase, the vendor/provider quality needs to be verified and the product evaluated. Except for that, it is absolutely crucial to define the requirements properly and ensure the there is an actual need in the company for the application at stake. Nevertheless, *"according to Gartner Inc., while SaaS is just five percent of all enterprise software today, it is expected to comprise 25 percent of enterprise software by 2011"*[Nesamoney(2007)].

5.4   Open Source

Open source, is a currently well known concept related to software. An application, which is available under open source license, make the source code available (open) and allows its users to use it, modify it and redistributed (in a modified or unmodified form)[4]. The main idea is to use many professionals in order to create a system that should be better than the one delivered under the proprietary license. This is because in the open source approach, since the source code is available to everybody, there are many more people looking for flaws, and many more people working on improvements.

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[4]source: http://www.webopedia.com/TERM/O/open_source.html

The most important rules, that an open source application should follow are[5]:

- users are co-developers

- early releases - earlier release first version is increasing the possibility of finding co-developers

- frequent integration - as an opposite to long intervals, resulting in possible greater number of bugs

- several versions available - at least to: a stable and developer ones (the second having more features, but with possible bugs)

Except for that, a company may decide to participate in the development process, or simply develop certain functionality that is needed and is missing in the original version.

However, it has to be remembered that open source doesn't have to be completely free of cost[Vaughan(No date)]. Many companies, after modifying, sell the product, with the code being available, but for a certain fee.

Moreover, if the project is in an early stage, it may take considerable time until a decent version is available. Except for that, if the solution is free, the provider will probably won't take responsibility for any problems a customer may have.

On the other hand, according to Open Source Community *"the promise of open source is better quality, higher reliability, more flexibility, lower cost, and an end to predatory vendor lock-in"*[esr(2007)]. As a result, the open source solution presents another interesting approach to using a BI system. Lower cost leads to decrease TCO, however, here, there is still the need for other investments related to purchasing an IT solution (hardware, training, IT support.

5.4.1 Application of Open Source to BI provision

Because of high prices for having and using a BI solution, companies started to be interested in finding an alternative. The open source community decided to take care of this matter[McAllister(2005)]. The most interesting projects under development are BIRT (Business Intelligence and Reporting Tools) from Eclipse, and Pentaho Open Source Business Intelligence. The first one is a reporting system for Java-based Web applications.

Pentaho BI, on the other hand, which is *"developing a complete open source BI platform, including reporting, analysis, dashboards, data mining and workflow*

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[5]source: http://en.wikipedia.org/wiki/Open-source_software

tools"[McAllister(2005)]. Some of the members of the development team are suppose to have experience from the greatest companies of the BI market (Cognos, Oracle and SAS). It is possible to download the software for evaluation from the developer's web site[6].

Last option is to use JasperSoft's product, which is an open source code that can be integrated into an application developed in the company[LaMonica(2006)].

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[6]http://www.pentaho.org/download/

Chapter 6

Study of BI market in Poland

According to Lukkanen et. al (2005), although the group of SMEs is usually treated as a homogenous one, their preferences and adoption of ERP differ. He suggested that this group should be further divided. Following this idea, the initial aim of this thesis, was to investigate the difference between small and medium-sized companies in case of Business Intelligence solutions. However, after contacting with few, randomly chosen Polish companies, it turned out, that not only the BI system was nowhere implemented, but also the awareness of Polish enterprises of the existence of such solutions was very low. On the other hand, managers or owners that knew about BI systems, were all complaining about the cost of having BI, and therefore were either not interested in having it, or were waiting for the prices to decrease.

As a result, the aim of this thesis evolved. Because of the development of Business Intelligence, new options arise, and new features are being offered and implemented by BI vendors. Except for that, new ways of using a software are being developed, with a strong focus on decreasing the Total Cost of Ownership. Following this, this thesis aims at:

- investigating the awareness of companies in relation to BI solutions, as well as their interests in this field

- identifying the reasons for not having BI

- investigating the offers of BI providers on the Polish market

- determining company's preferences during selection and implementation of such systems (and try to investigate, whether these factors depend on the size of the company)

- suggesting solutions for the SMEs to be able to afford BI

6.1 Research Methodology

The research was conducted by means of two surveys and phone interviews. First survey was prepared for companies that didn't have a Business Intelligence solution implemented. It consisted of three questions regarding the company (size, number of employees and sector that the company is operating in), and three questions related to their reasons for not having BI, future plans and preferences with regard to this Information System. The aim of this survey was to investigate the BI awareness and interest in this technology.

The second survey, was designed for companies that had a BI system. It consisted of the same three starting questions as the first survey, and nine other questions regarding the system the companies have chosen - reasons and selection preferences, interest in particular features, and importance of certain implementation aspects.

Both surveys were used in a cross-sectioal study. This study was of an exploratory character, and the aim was to investigate current preferences. Therefore in this case, this type of one-off study was preferred over longitudinal one (the result, in case of longitudinal is influenced additionally by various changes related to the time between the consecutive measurements)[Oppenheim(1992)].

Because the second survey is concentrated on analyzing relations, the sample did not have to be representative. It had to be, however, large enough to perform particular comparisons[Oppenheim(1992)].

The first part of the investigation, was a survey conducted in June 2007. The sample consisted of 51 randomly selected companies from all the companies in Poland which are present in Polish, company yellow pages - Panoram Firm[1], which had the largest number of firms listed. For selection purpose, a Microsoft Excel RANDBETWEEN function was used. First, one of the 18 sectors were selected, after that one of the subsectors was selected (in the previously chosen sector), and finally, in that group, a company was selected - each time the RANDBETWEEN function was used. The companies were contacted by phone. Most of the respondents answered the questions over the phone, while the rest provided an e-mail address, and the survey was sent to them in an electronic form. Most of the companies were small, and in this case, the respondent was the owner of the business. In larger companies, the person who answered the survey, was either the managing director or the head of IT department. The companies were from various industries with accounting, manufacturing, IT & high tech, chemical and wholesale being the most popular.

Some companies had their IT functions, outsourced. In most of the cases, the

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[1]source: http://www.pf.pl/serwis/index.html

provider of the service, was a one-person company, which performed installation of the system and regular updates. In one case, the external firm was a larger (but still a small one), IT infrastructure and system integration company. The owner of the company was contacted on the phone and asked questions related to the company's experience with small and medium size enterprises, as well as the owner's subjective opinion on the situation on the Polish IT market, including BI, future plans, and general IT trends.

After the data for the first part was collected, a research was done, with the aim to identify Business Intelligence systems available on the Polish market. For this purpose, Internet resources were extensively used, including a website devoted to various issues and events related to BI in Poland[2]. As far as international resources are concerned, a DM Review Magazine Internet page was used[3]. Except for that, a very interesting source of BI information that can also be used by companies to compare and evaluate various BI products is the website of Technology Evaluation Center[4]. The representatives of the identified BI vendors and providers were interviewed over the phone, and asked questions about their BI offer, experience on the Polish market and their customers' preferences.

The last part of the research was a survey, which was conducted in June and July 2007. The sample consisted of 17 companies. The companies were found on the websites of BI providers, listed in their references. All companies in this sample were contacted by phone. Most of the respondents provided an e-mail address and the electronic version of the survey was sent to them. Very few wanted to answer the questions over the phone. The respondents of the survey, were mainly representative of financial or IT departments, since they were using the system, or actively participating in the selection process. Except for that, in two cases, it was a member of the Board of Directors, and in two, a regular employee. The surveyed companies were from a myriad of sectors.

Phone interviews and electronic form of the survey was used because of the convenience factors. The surveyed and interviewed companies were located all around Poland, therefore the cost and time were very important aspects[Oppenheim(1992)]. This method was used to avoid the time consuming travels (which in general take around one third of the time devoted for investigation), as well as situation where the person to be contacted is on a meeting, on holidays, or any other way unavailable. Also because of the IT nature of the topic, and frequent contacts with IT related personnel, an electronic version of the survey was preferred over answering

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[2]http://www.erp-view.pl/

[3]http://www.dmreview.com/

[4]for BI: http://www.technologyevaluation.com/request/sre_bie_1.asp?se=google_bi&gclid= CN7a3L2Q4Y0CFSSDZwod-T6Zpg

the questions over the phone.

The phone interviews were of an exploratory type. A set of questions was earlier prepared, but was used as a guideline, and not followed directly. The aim of the conversations with the IT integration company, as well as BI providers, was to investigate their experience with SMEs and their opinion on future trends.

6.1.1 Survey design

The versions of the survey that were originally used during the study, can be found in Appendix A and C. Appendix B and D, contain the version of the surveys translated to English. Each survey was targeted to a different group of companies (having and not having BI). Another option was to make a single survey, with a question at the beginning, determining if the company has a BI solution implemented or not. After that, the respondent would be lead to the first part, if his/her company didn't have BI and to the second part, otherwise. This, however, would make the survey look longer, than it actually was, and some people could not want to fill it in, when they found out about it. To avoid that, two separate surveys were designed (first having one page, and second having two pages), and the person was asked on the phone about the BI system in their company. This type of filtering question[Oppenheim(1992)] was used to decide which survey should be sent to a certain respondent. Because of that, a higher response rate is expected to have been achieved.

Survey 1 - Not having BI

The first survey, consists of six questions. The first three questions are general ones, regarding the company:

- size of the company

- number of employees

- sector it operates in

These questions were asked in order to try to determine, if there is a relation between the type of the company and its BI awareness and preferences.

The rest of the questions were related to Business Intelligence. The fourth question was about the reasons for not having a BI system in the company. It consisted of 8 factors and the responses were made by means of a 1 to 6 Likert-type scale, with (1) being *Not important* or *Not applicable* and (6) being *Crucial.* The reasons used were taken from a similar research made for ERP system

adoption[Buonanno et. al(2005)] and based on a review of available literature devoted to BI systems implementation.

The fifth question was to determine if the company was planning on implementing a BI solution in the future. If yes, there was a place to put the date of the expected implementation.

The last question was about how 7 different factors (and a place for additional, eighth one) could influence company's decision to implement a BI solution, or implement the system earlier. Similarly, as in case of forth questions, the factors were based on the review of BI related literature. The responses were again on a 6 level Likert-type scale, where (1) - *No influence* and (6) - *Decisive influence.*

At the end of the survey, there was a place left for additional comments that a respondent might have had.

Survey 2 - Having BI

The first three questions of this survey are exactly the same as in case of the previous one. The remaining 9 is related to BI:

- the way the solution is implemented in the company (outsourcing, SaaS etc.)

- general satisfaction with the product

- year of BI implementation

- participation of end-users in the definition of the requirements

- importance of certain factors during the decision to implement a BI system

- internal analysis and external influence on the decision

- importance of different factors as to which product to choose

- relevance of various constraints during the implementation project

- use and interest in next generation BI features

In the fourth question, the respondent was asked to mark the one (out of 4) that applied. The satisfaction in the fifth question, was measured using 1-5 Likert-type scale, with (1) - *Completely dissatisfied* and (5) - *Completely satisfied.*

Questions from 8 to 11 had responses with 1-6 Likert-type scale, where (1) was *Not important* or *Not applicable* and (6) being *Crucial.*

In the last question, regarding the BI system features, the respondent had four possible options: *Yes*; *No, but interested in*; *No, and not interested in* and *Never heard of it.*

Similarly to the first survey, there was a place for comments provided.

Most of the questions in the survey, were closed ones. A set of most important answers was identified based on the literature and used in the surveys. However, in order to allow for spontaneous answers, that a respondent might want to give, each question, where Likert-type scale was used, had an additional place for *Other* reason, factor etc. that the respondent would like to include. As far as the question about the size is concerned, it was used instead of asking about financial information (size of turnover or balanced sheet total). Companies are very reluctant about giving out this sort of details. Because most of the respondents were owners or high management positions, this information is valid. In few cases, where regular employees where the respondents, they suggested they would find the information, and after that they would fill the survey.

6.1.2 Phone Interview

During the study, a number of phone interviews were conducted. One, was with an owner of IT systems integration company, that implemented and provided IT services to one of the companies from the first sample. He was asked about the general interest of Polish companies (especially SMEs) in IS's that support the operation of enterprises. He was also asked about his experience with Business Intelligence solutions and whether such systems were implemented by his company.

The rest of the phone interviews were conducted with the representatives of companies providing BI solutions on the Polish market. They were asked about their offer, and whether it was also aimed at small and medium-sized companies. There were also questions related to the customers, and whether they were interested in BI systems themselves, or they had to be convinced about its usefulness. A total number of 6 interviews with BI providers was conducted.

6.2 Results of the study

The response rate in case of the first part of the study was around 90%. Companies were, usually, very willing to answer the questions.

In case of the second part, where the survey was longer, required more time for filling, and included more information (that some respondents needed to verify if they could give it out), the response rate was initially around 20%, and after second, third and rarely fourth reminder, it attained a level of 50%.

All in all, a group of almost 100 companies was contacted during the entire research.

6.2.1   IS penetration and BI awareness study

The characteristic of the research sample of the first study can be seen in Table 6.1.

Size	n	Mean no of employees
Small	38	10,2
Medium	12	44,2
Large	1	700

Table 6.1: Characteristic of the research sample.

The companies were selected entirely randomly, therefore, from the group of companies being present in the phone book of companies, there was an equal probability for each company to be chosen. This sample, since very small (because of the time and cost constraints), is not statistically representative[Oppenheim(1992)], however, it is used here as an indicator of the general situation on the Polish market.
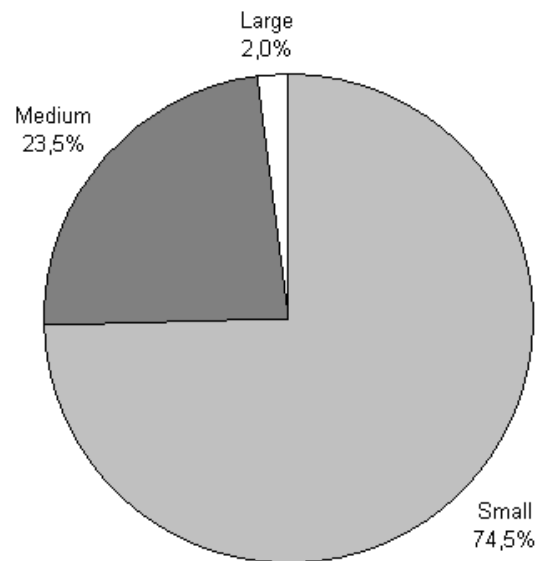
Figure 6.1: The proportion of small, medium and large companies in the first study

On Figure 6.1 a proportion of companies of different size, from the analyzed sample, can be seen. As mentioned earlier, SMEs are a majority in every country, including Poland (see Section 2.3). What is interesting, is that there is a farily large group of companies consisting of only one person. The owner of the business,

in this case, is performing the entire work, and is registered as a company, in order to take advantage of the regulations related to, for example, taxes. In the sample there were 10 such companies, and another 14 had less than 10 hired employees. Such enterprises, usually do not need sophisticated IT systems, but in most cases, they think they don't need it.

According to the owner of an IT system integration company, providing services for SME group, there are mainly two types of situations among enterprises in Poland. One, is when foreign investors or businesses acquire Polish ones, The second group consists of enterprises that were found in the end of 1989 and in early 90's (after the change in the Polish government, and the end to socialism). In the first case, foreign managers are brought to Poland (or Polish, with an international education and experience), with a broad theoretical knowledge, as well as practical experience, which know exactly what they want, and need to achieve success. Such companies are aware of IT/ICT systems supporting enterprises, and are willing to invest in this type of solutions.

In case of the latter group, the owners are very often with different educational background, not related with their company's operation. Moreover, they finished their education at various levels. Some have, higher education completed, while many are straight after secondary, or even primary school. *"In the 90's, sophisticated IT systems were not required and not present, and they got used to doing their business in another way"* - the IT system integration company owner says - *"Now, because they were doing it successfully for many years, they are not interested in any other way, and are rejecting the possibilities that new systems are offering"*.

There are also other, smaller groups of companies that are present on the Polish market. For instance, ones that are constantly developing and their size increases. In such a case, they need assistance in managing increasing numbers of employees, as well as customers, suppliers etc. There are also new companies, founded by young entrepreneurs, who cannot imagine their life without computers and IT systems.

In this study, 27.5% respondents admitted to have been using some kind of Information System that supported their daily operations (see Figure 6.2). That suggests, that there is a low penetration of IT systems on the Polish market. According to IT systems integration company, Polish small and medium sized enterprises are, in general, not yet ready for IS's. *"Few years are still needed, for this situation to change"*.

Among the companies that have already implemented some kind of information system, there are three different class of systems:

- EDI - Electronic Data Interchange systems, which are used for exchange of
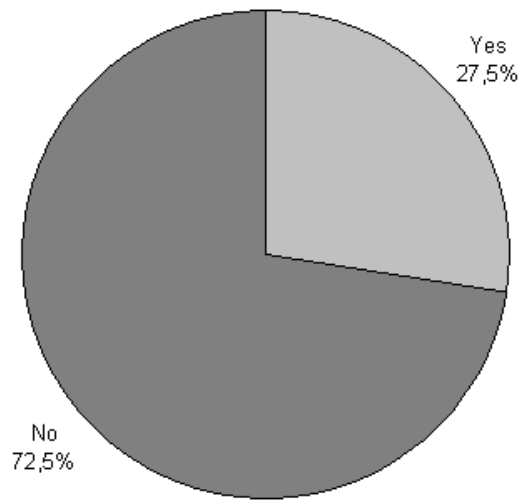
Figure 6.2: Is your company using and IT systems supporting operation of the enterprise?
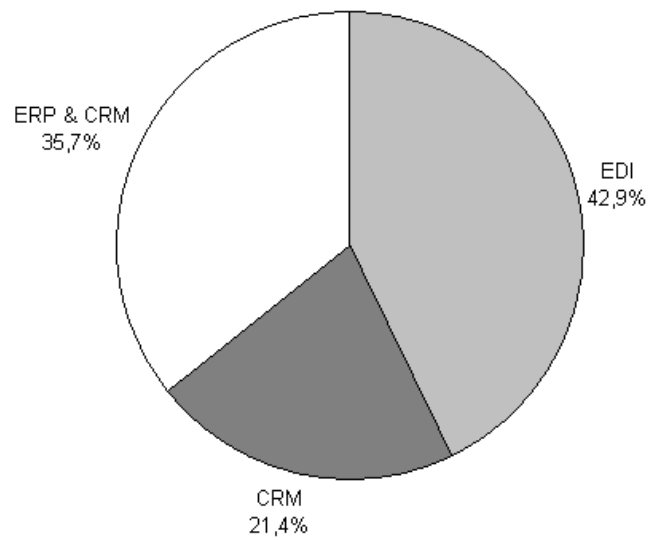
Figure 6.3: What types of Information Systems is your company using?

transaction-related documents (e.g. invoices, bills, purchase orders etc.)[5]

- ERP - Enterprise Resource Planning systems

- CRM - Customer Relationship Management systems

In the sample, the companies had either EDI, CRM, or ERP & CRM systems implemented (see Figure 6.3). The EDI software used by the companies, in most cases, was also used for accounting purposes, and this is the most common type of software being used by SMEs, according to the owner of the IT integration company.

According to Laukkanen et al. (2005), many smaller businesses are forced to implement information systems, like EDI or ERP, because one of their customers or suppliers, a bigger company, is already using it. Such systems, in order to give their full potential, should be implemented in the entire value chain, and exchange information between each other. Because ERP systems are recently becoming more and more popular, and computers are a preferred way for invoicing and accounting. As a result, number of IS's should constantly increase.
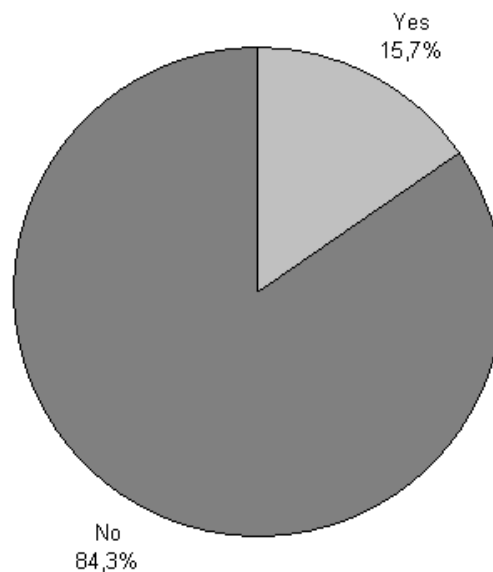
Figure 6.4: Are you having your IT systems managed by an external company/person?

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[5]source:http://www.theaccountspayablenetwork.com/html/modules.php?name=Articles&file=article&sid=7

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In the survey, 15.7% of companies were using some kind of IT outsourcing (see Figure 6.4). In most of the cases (smaller enterprises) the external support was in a form of an external, one-person company. The professional was initially responsible for installation and proper configuration of the operating system on all PCs, as well as other necessary software. After that, this person was supposed to be coming every now and then, in order to monitor the computers, and perform necessary cleaning, reformatting and installation of additional packages. He was also treated as an IT support, and was called for in case of emergencies.

An interesting situation was observed in case of one of the companies from the chemical industry. The selected company, admitted to outsourcing of all their IT-related functions. The provider of the service, turned out to be working for a group of other companies, also from the chemical sector. These companies were said to be closely cooperating, and managing directors from each of the companies, as well as representatives from the company responsible for IS, were said to have occasional meetings, during which a common decision was made as to what new systems to implement. According to the information gathered during an interview with the representative of the IT provider, this company was created during an Insourcing process (see Subsection 5.2.4). Some of the companies, from this group, including the IT provider one, were a single company in the past. At some point a decision was made to create specialized units, including and company providing IT services to the rest, as well as to other, not related enterprises from the chemical industry, which might be interested.

Last thing that was investigated in the entire sample, was the companies' awareness of the existence of BI technology. As can be seen on Figure 6.5, 13.7% of companies, from the examined sample, have heard something about BI systems before. Out of 7 companies, 4 said that they didn't have enough information about the system, to make a decision whether to use it or not. The rest of the reasons were:

- the company is not complex enough to need BI

- BI solutions are too expensive

- is not interested in such systems

From the experience of the IT integration company, SMEs are not yet ready for BI. The owner mentioned he presented a solution with BI capabilities to a company with over 1 million euro turnover - *"After a comprehensive presentation of the features that such system could provide, the owner of the company was only interested about receiving a set of his customers and suppliers, which were inactive for the past 10 days"* - he says. Such a task can be easily realized in MS Excel or Access, which are common tools in most of the companies, including the one at stake.

The integration company admitted to having completed some projects with data analysis, however nothing too complex like advanced analytics, pattern detection and conclusion. *"This is still yet to come, but in few years time"* - the owner said.
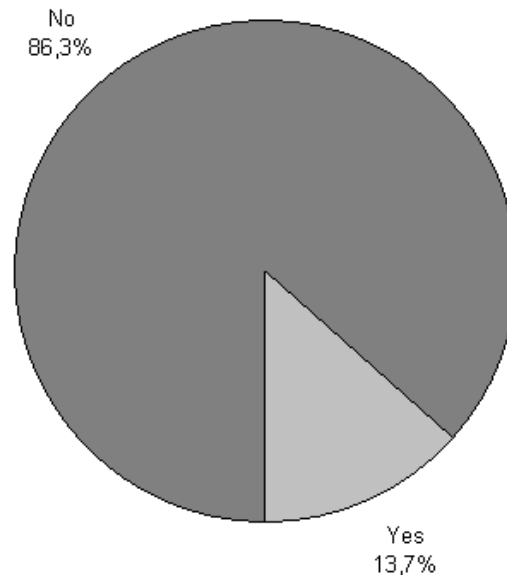
Figure 6.5: Have you heard about Business Intelligence systems?

As far as the factors that could influence the decision to implement BI, are concerned, which were identified during the study, the most prevalent ones were (in order of importance):

1. the company will become more complex

2. the company will become prepared for organizational change

3. a solutions suitable for company's needs will be available

4. quality appropriate to the price

As it was said earlier in this section, in some cases, smaller companies are experiencing pressure from their greater customers or suppliers, to implement a certain type of IT system. However, this is not likely to take place, as far as BI is concerned. Solutions of this class are solely used within a particular organization and its implementation depends only on the internal factors and ability to get the information from various systems and sources. It does not, however, require other companies to use it.

6.2.2   BI providers

In order to investigate the BI offer on the Polish market, the following companies were contacted during the study:

- Solemis

- Controlling Systems

- InForum

- Oracle Polska

- SAP Polska

- Intense Group

- Business Objects Polska

- and 2 sales representatives of Cognos

Most of them admitted to their offer being addressed to medium-sized companies, while some also indicated their interest in smaller ones as well (Oracle, SAP, Cognos). Smaller companies, are generally considered to have not enough resources for new technologies. Except for that, they do not need solutions like BI or at least they don't think they could use them. However, it happens more and more often, that a company is interested in Business Intelligence, and contacts one of the providers to get some additional information. Nevertheless, in general, the vendors still need to approach companies, present the capabilities of BI solutions and introduce them to such systems.

The main reasons for the interest in BI are:

- problems with drawing conclusions from big amounts of data

- they expect to have cost savings related to improved efficiency

- bigger companies have many systems which are working independently, but managers want to be able to have a consolidated view on the company

A very often present statement, in agreement with what was mentioned before, indicate that foreign managers or ones with international education and experience, are coming to the company themselves, and want to know the details of the offer. On the other hand, owners of smaller companies, in a vast majority, have to be introduced to the technology from the very beginning.

Next Generation BI for SME

On June 25, 2007, **Oracle** has launched new suite - *Oracle Business Intelligence Standard Edition One*[6]. This is a complete solution with a Data Warehouse and BI advanced analytics integrated, and it is said to be configured in such a way to suite the needs of small and medium-sized enterprises. This system is available for from 5 to up to 50 users, with a cost of $1000 per user, therefore, smaller companies can have most important BI features for the cost of $5000 for 5 users. This is significantly less, than most of other offers, available until then. Moreover, an important advantage of this solution, is its scalability. The company, can easily increase the number of users, and if the need exceeds the upper limit of SE One (50 users), it is also easy to migrate to Enterprise Edition.

The cost of having Oracle BI SE One, is much more attractive, however $5000 is still something that the smallest ones cannot afford. On the other hand, In such case, it is very probable, that the company is not complex enough to need such a system.

SAP Polska, claims to have customers from all sizes of companies. A representative from this BI vendor, explained that the system and the license they provide, is a complete solution with ERP, CRM and BI. What the customer decides to integrate and use, is their own matter. SAP partners are assisting during integration of solutions, and in most cases, SAP Polska, is not aware which customer decided to implement which systems (except for the largest and most interesting cases)

Congnos has launched a new product on May 14, 2007 - *Cognos Now!*. This solution is *"offered exclusively as hardware appliances and through Software-as-a-Service (SaaS) model"*[7]. This is said to be the only offering of this type, available on the market. Incorporated features, include operational dashboards and real-time information monitoring.

This suite, because of its simplicity in deployment, configuration and management, as well as attractive price, is especially targeted at small and medium-sized enterprises. Except for that, the *resource poverty* aspect is not an issues, since apart from low cost, additional hardware, IT staff and other resources are said to not be an obstacle. Moreover, because of the latest developments in the visualization techniques, the interface is user friendly, and the need for additional training is to diminished. There are two ways Cognos Now! can be used:

- hardware appliance - deployed at customers location and integrated with the existing infrastructure (three editions available: SMB, Standard and Enterprise - suitable for various needs)

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[6]source: http://www.oracle.com/global/pl/corporate/pressroom/2007/250607.html
[7]http://www.cognos.com/news/releases/2007/0514.html

- hosted service - offered in a SaaS model

The product is currently available only on request, since this is a very new solution, and many of Cognos Sales representatives still need training related to this application. Therefore, Cognos Now!, although available, will lack the local support for some time.

As far as the cost of such a solution is concerned, the local representatives did not have the information. The head office in Canada, on the other hand, said there is a non-disclosure policy, and they are not giving pricing information. If a company is interested in having such a system, it needs to have an appointment with Cognos professionals. They will prepare a presentation of the product, in the certain environment, as well as present an offer. The company, however, will have to sign the non-disclosure documents, before seeing the actual price.

6.2.3   BI preferences

Sample characteristic and preferences

The characteristic of the research sample of the second study can be seen in Table 6.2. All companies were taken from the references, listed on websites of a number of BI providers.

Size	n	Mean no of employees
Small	5	29,2
Medium	6	320,8
Large	6	933,3

Table 6.2: Characteristic of the research sample.

The size of each group was important, during the analysis of the relation between the size of the company and various factors. Two tests were used in that analysis. The first one was the Kruskal-Wallis test, in which a particular group is considered to be too small, when there are less than 5 members[McDonald(2006)]. In the investigated sample, the smallest group is the one with small businesses, however, it has exactly 5 members. The second test, was the ANOVA regression analysis. The analysis will be described in detail later in this section.

Companies of three different sizes were distributed rather equally in the investigated sample (see Figure 6.6).

All respondents of the survey, claimed to have the BI solution directly implemented at their location. Each has a completely developed infrastructure, and bought the product from the BI vendor. Outsourcing and SaaS approaches seem to be still in their infancy, as far as BI is concerned, since none of the companies

were using this model. This is most likely due to two reasons. On one hand, the vendors are not yet ready for such provision of BI, and there are no external companies, available in Poland, which would offer BI functionality remotely from their location. On the other hand, the customers are still reluctant about sending their corporate data over the Internet, therefore, the security aspects of BI provided in SaaS model need to be concentrated on.
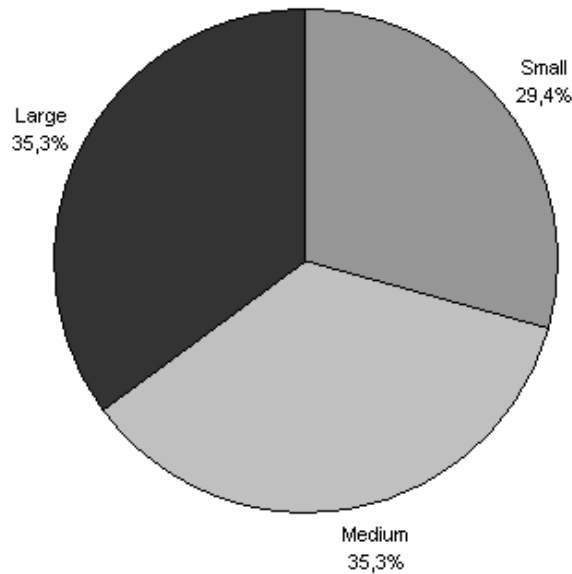
Figure 6.6: The proportion of small, medium and large companies in the second study.

Satisfaction

A very important thing, giving some sort of information about the usefulness of BI systems, is the company's satisfaction. As can be seen on Figure 6.7, over 75% of the respondents are satisfied with the implemented solution, and less than 6% were dissatisfied. The success of a BI implementation is usually measured in three different ways, depending on the person evaluating it (see Section 3.8). It is either a finance-related (by means of ROI or cost savings) or adoption-related (depending on the relation of active to licensed users of the system). Whatever the criteria used by the respondents, the most important thing is that they are making a proper use of their BI solution. The results suggest that within the analyzed group of enterprises, the expected benefits were mostly achieved.
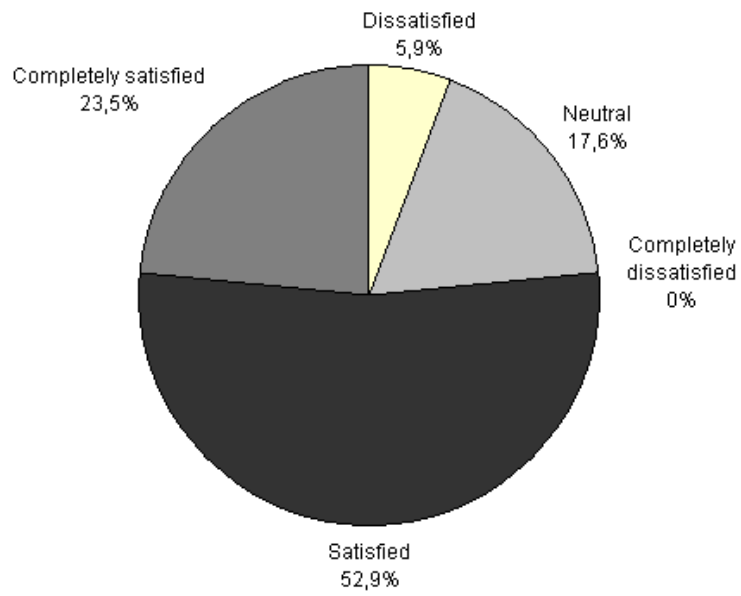
Figure 6.7: Satisfaction from the BI solution
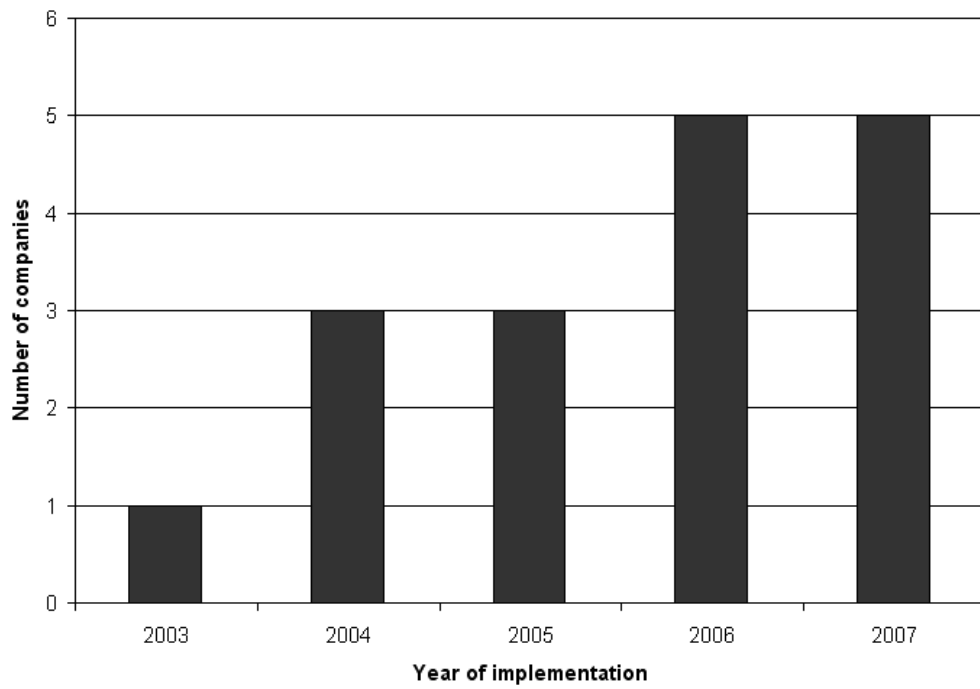
Figure 6.8: Number of BI systems implemented in years 2003-2007

Year of implementation

The number of BI implementation is constantly increasing. As shown on Figure 6.8, within the investigated group, there are more systems deployed almost every year. As for August 2007, there are were as many solutions implemented, as in 2006. This trend is expected to continue. According to Gartner, *"BI market will grow over seven percent a year"* until 2009[Murray(2006)].

End-user participance

IS implementation professionals, stress the importance of end-user participance during the requirement specification, product selection and testing. In the investigated sample, a great majority admitted to users taking part in the above mentioned processes. In only 1 company, the actual users of the system had no influence during the selection. That is a very promising situation, since many IT systems implementations fail, because of vendor's/provider's poor understanding of the companies needs, which are directly related to lack of user participance[8].
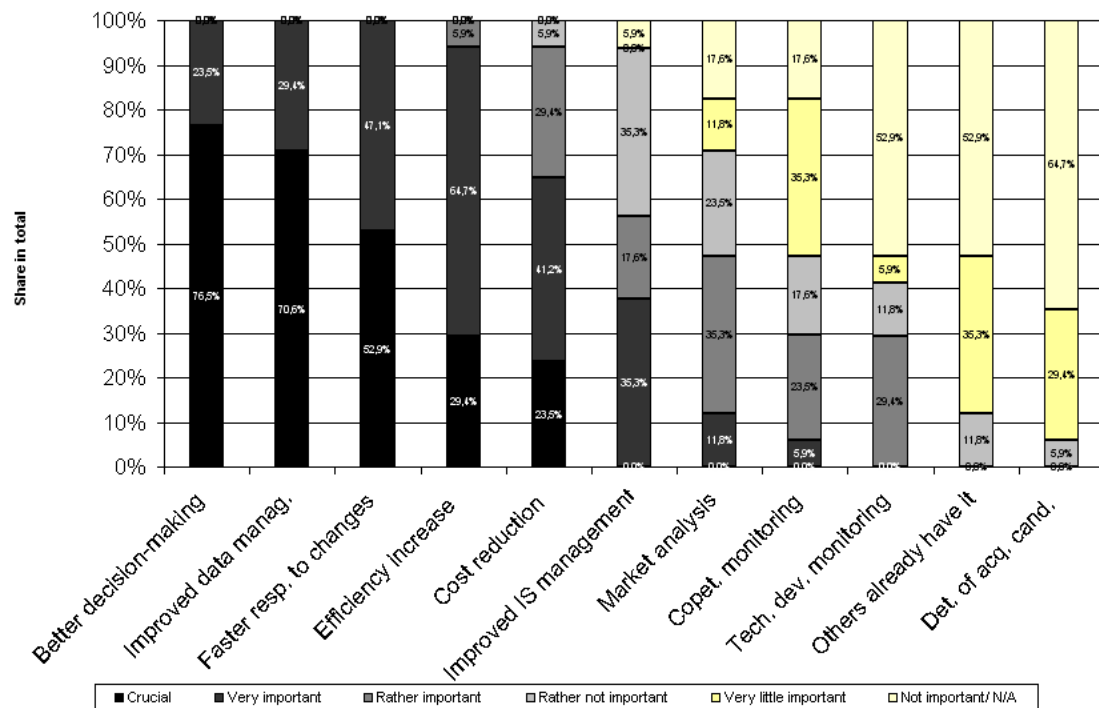
Figure 6.9: Reasons for BI implementation, ordered by average importance.

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[8]based on Requirement Engineering and ICT Systems Development courses, attended by the author

Reasons for BI implementation

The reasons for BI system implementation are shown on Figure 6.9. They are ordered by the average importance, from the most, to the least important.

The three most important reasons for BI adoption are:

1. Making better informed decisions

2. Improving data management within the company

3. Increasing the response to changes

Those factors were considered either *Crucial* or *Very important* by all respondents. After that, there was increasing the efficiency, reducing the costs and improving IS management, mentioned. The least important reasons were: monitoring technological development in the sector, fact of other companies having such a solution and determining a likely candidate for acquisition. Over 50% of respondents considered each of these as *Not important* at all, or *Not applicable* to the company.
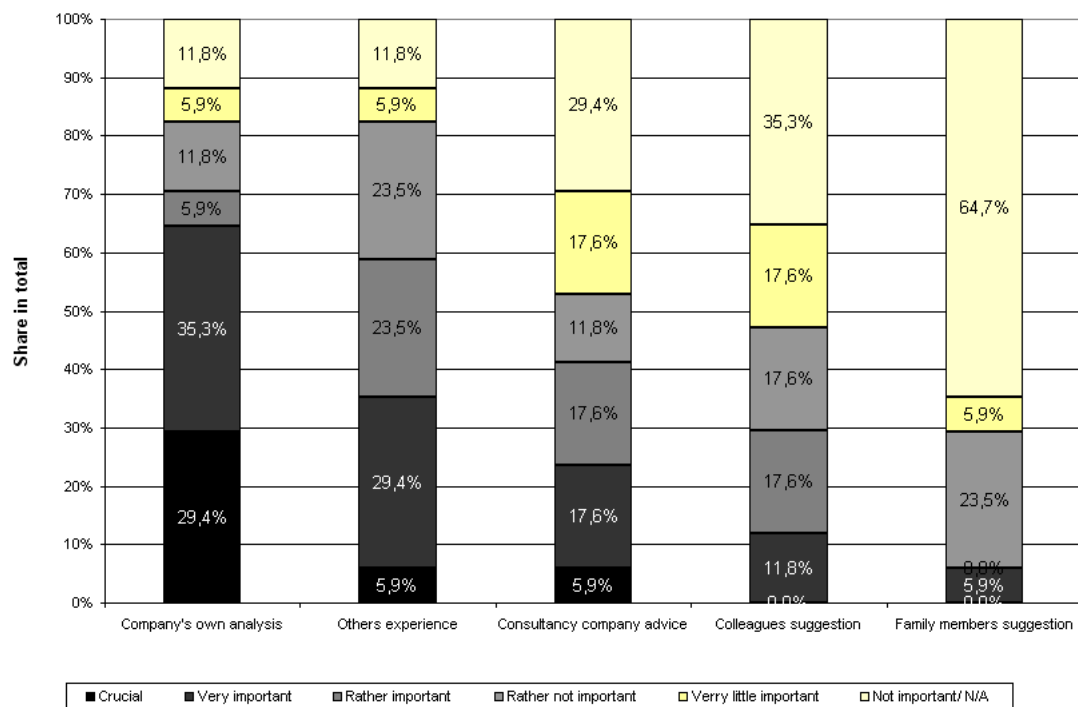
Figure 6.10: External influence during BI system selection, ordered by average importance.

Role of external influence

Figure 6.10 shows the role of external influence, during vendor/provider selection. Over 65% of respondent, considered company's own analysis as *Crucial* or *Very important* and used it as a main selection criteria. Some (about 35%) admitted to taking under consideration the experience of other companies, already using the product of a particular BI vendor. Almost 25% used a consultancy company advice. The results indicate that the role of external influence is rather not very strong, during selection of a BI system. The most important point of reference is an internal analysis of the offers, performed by the company itself.

Selection preferences

On Figure 6.11, various factors related to the BI system, important during selection process, are presented.
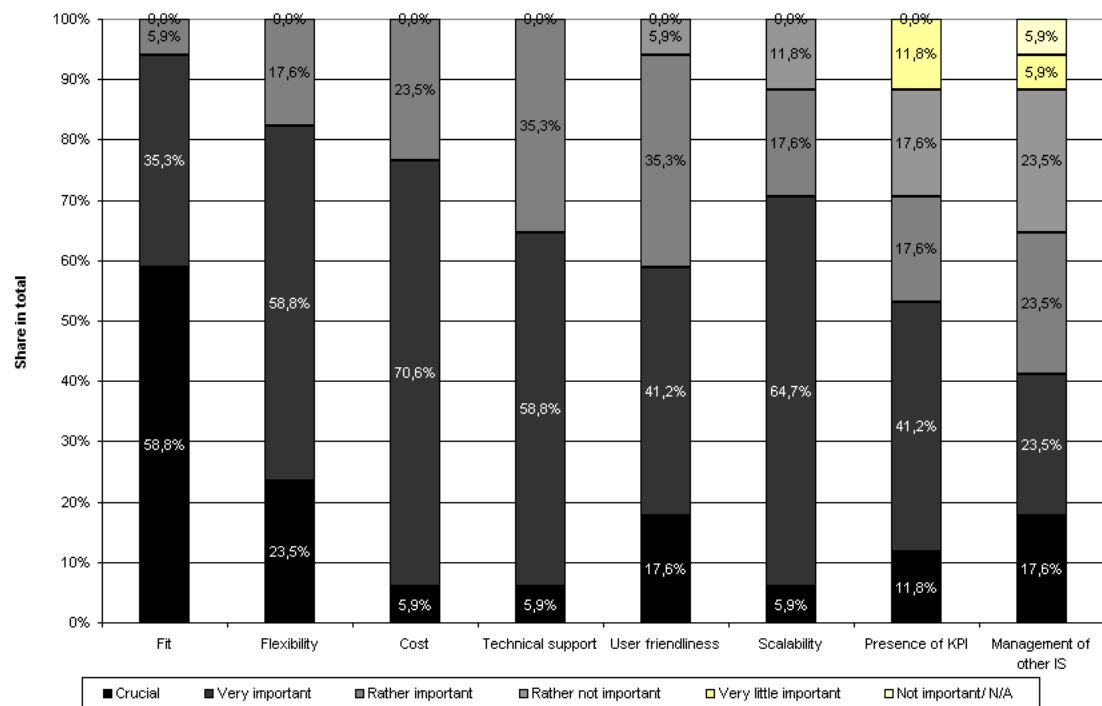
Figure 6.11: Influence of different factors during BI system selection, ordered by average importance.

The three most popular reasons were:

1. Fit to company's needs

2. Flexibility of the system

3. Cost of the solution

The most important factor of BI selection, was the fit to company's needs. 58,8% of respondents considered it to be *Crucial*, and another 35,3% thought it was *Very important* (all together almost 95%). This suggest that the investigated companies understand that no technology is a direct source of success, and that the most important thing is that is properly aligned with the company's strategy and suitable for particular internal and external environment of the company.

The least important factors were management of other IS in the company, and capability to monitor the performance of the company (e.g. by means of KPI).

Implementation constraints

The necessity of alignment of BI with the general strategy of the company, is also indicated, while taking under consideration the factors important during system implementation. All adoption constraints are shown on Figure 6.12.
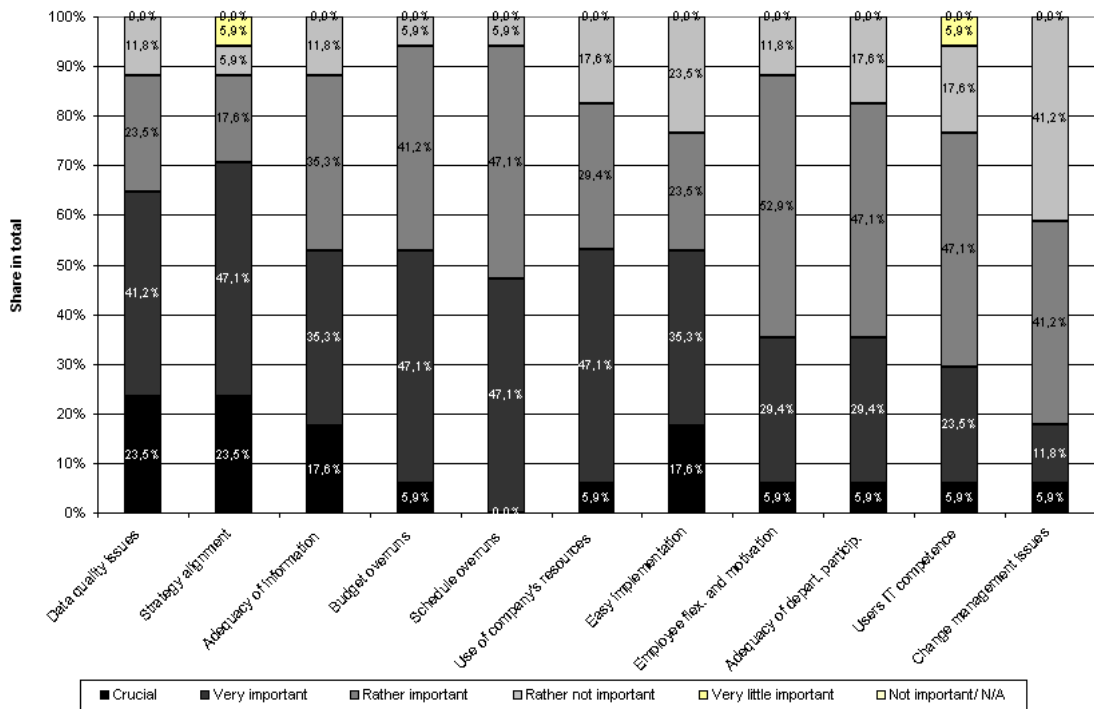
Figure 6.12: Relevance of constraints during system implementation, ordered by average importance

The strategy alignment factor is the second most important one indicated by the respondents (over 70% considered it to be *Crucial* or *very important*). The most important one, is the data quality issue. As it was earlier mentioned (see Section 4.8), good data is absolutely essential for proper BI system performance, and there are specialized companies, that deal with this issue[9].

After that, there are factors like (answering *Crucial*, *Very important* and *Rather important*): adequacy of information during BI system selection (87,8%), budget (94,1%) and schedule (94,1%) overruns, as well as too extensive use of company's resources (82,6%). The least important ones are users' IT competence (76,5%) and problems related to changes imposed by BI on the company (58,9%).

Popularity of features/technology

There are certain features and technologies, which are inherent in next generation Business Intelligence systems. Some of them are already being implemented in the solutions being currently available. Figure 6.13, shows how many respondents are already using them.
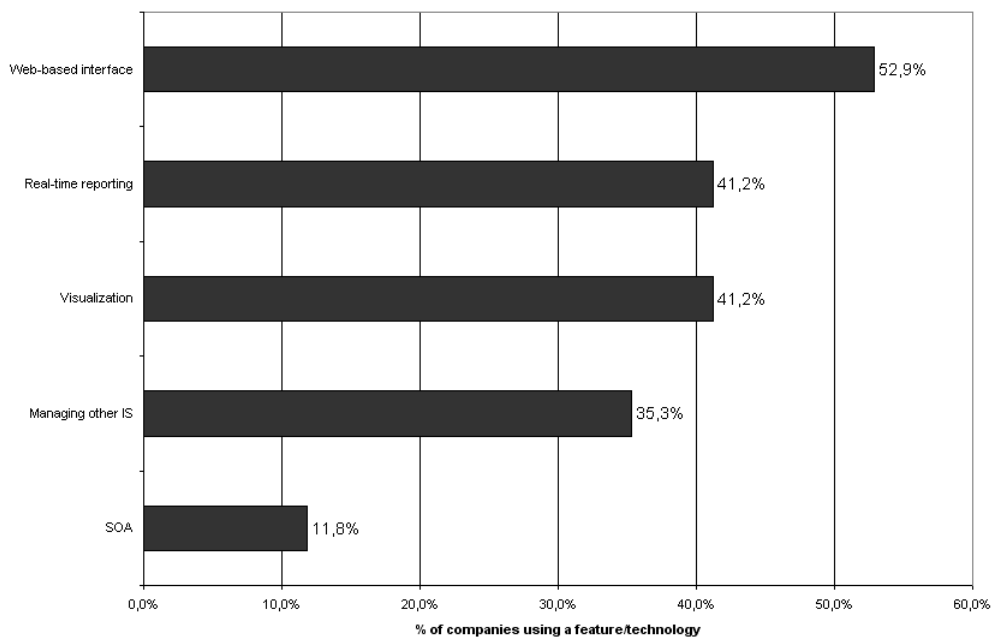
Figure 6.13: Usage of next generation BI feature/technology.

The most popular is Web-based interface (52,9%), real-time reporting (41,2%) and visualization (41,2%). These features facilitate the access to the application,

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[9]see http://www.dmreview.com/portals/portal.cfm?topicId=230005

present the information in the most convenient way, and ensure it is all the time up to date. The Service Oriented Architecture, which is a very important part of the next generation BI, is the least popular (11,8%). It is also the one, that the companies are least interested in (see Figure 6.14). This is however related to the fact, that *most of the respondents have not heard about SOA before* (64,7%).
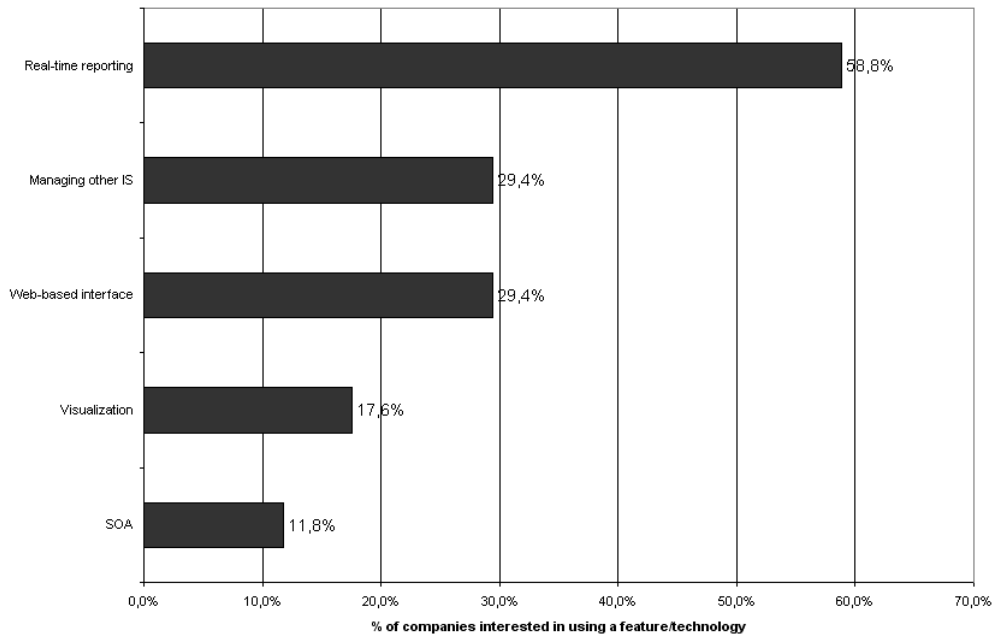
Figure 6.14: Interest in using next generation BI feature/technology

Figure 6.14 presents the interest of companies in the above mentioned features/technologies. From the group of companies that are not using it before, the most popular is the real-time reporting (58,8%). Managing other IS in the company (29,4%) and Web-based interface (29,4%) are the next. Interestingly, 41,2% of respondents know what visualization is, and are not interested in having it. This may be related to fairly simple data and information structure, which are rather simple to comprehend, and do not require advance presentation capabilities to be used.

6.2.4   Relation analysis

The gathered data, for the questions with Likert type scale, was analyzed using two test. Since it was not possible to assume a normal distribution of the answers in the survey, the analysis was performed by means of non-parametric statistical tests. First, a regression analysis was performed. This analysis tool is part of

Microsoft Excel Analysis ToolPak and performs linear regression analysis using the *least squares* method. It determines if there is a relation between a single dependent variable, and one or more independent variable. In case of this study, the dependent variable was each of the factors, used in the survey, while the independent variable was the size of the company. The outcome of the analysis is a set of regression statistics and ANOVA parameters. The one of major importance, is the value of *significance F*. In order to consider a test statistically significant, the significance should be less than 0,05.

The second one was the Kruskal-Wallis test. Initially, there is a *null hypothesis* assumed that there is no relation between the two variables and that the companies should be treated as one, homogenous group. A spreadsheet giving the possibility to perform a Kruskal-Wallis test was found[10]. It calculates the significance P, and the value of the test H. If P is less the 0,05, than the *null hypothesis* is rejected.

The Kruskal-Wallis test can be used when the samples are small. The samples are considered to be too small, when the number of entities in a group is less then 5. Therefore, the test was suitable for the set of data gathered in this study.

The aim of the analysis was to investigate the relation between factors and the size of the company, to try to determine, if small and mid-size companies should be treated separately. The tables, presented in this section, are designed as follows:

- Factor - name of the factor, used in the survey

- Sig.1a - Kruskal-Wallis test for relation, comparing three groups: small, medium and large enterprises

- Sig.1b - Kruskal-Wallis test for relation, comparing only small and mid-size companies

- Sig.2 - Regression analysis result

- Small - average importance of the factor in the group of small businesses

- Med. - average importance of the factor in the group of medium-sized businesses

- Large - average importance of the factor in the group of large businesses

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[10]source: http://udel.edu/ mcdonald/statkruskalwallis.html

Satisfaction

As shown in the Table 6.3, only the Kruskal-Wallis test for small and medium-sized companies was statistically significant. Looking at the average values of importance, it can be easily noticed that there is a meaningful difference between those two sizes. On the other hand, the values for medium and large companies are the same. This suggests that smaller companies are far more satisfied with the BI solution then their bigger counterparts.

Factor	Sig.1a	Sig.1b	Sig.2	Small	Med.	Large
Satisfaction	0,076	**0,026**	0,068	4,6	3,7	3,7

Table 6.3: Satisfaction significance test, along with mean values for each group of companies.

Reasons for BI implementation

In this part of the analysis, only the regression test was significant, and only in case of one factor - other companies already have BI (see Table 6.4). This reason, although indicated as not so important by all company sizes, in comparison to other reasons, was the most important for medium size companies (3,0). Smaller businesses (2,0) and larger enterprises (1,6) assigned significantly less importance to this factor.

Factor	Sig.1a	Sig.1b	Sig.2	Small	Med.	Large
Cost reduction	0,48	0,245	0,954	4,6	5,2	4,7
Efficiency increase	0,891	0,637	0,904	5,2	5,3	5,2
Improved IS management	0,907	0,848	0,494	4,2	4,0	3,7
Other companies have it	0,068	0,139	**0,012**	2,2	3,0	1,6
Competition monitoring	0,487	0,92	0,263	3,0	2,8	2,2
Det. acquisition cand.	0,881	0,668	0,507	1,6	1,3	1,3
Market analysis	0,484	0,300	0,390	2,6	3,3	3,3
Tech. dev. monitoring	0,652	0,684	0,377	2,6	2,2	1,8
Better decision making	0,064	0,409	0,410	5,6	5,8	5,8
Impr. data management	0,206	0,173	0,080	6,0	5,7	5,5
Faster response to changes	0,498	0,827	0,385	5,6	5,7	5,3

Table 6.4: Reasons for BI implementation significance tests, along with mean values for each group of companies.

Looking at the average values of importance of some factors, like cost reduction and market analysis, a significant difference can be observed. Cost reduction

seems to be less relevant for smaller companies than to medium ones, while market analysis is more important for both, medium and larger enterprises. Here however, now statistical significance was found. The rest of the reasons, seem to be of similar importance for businesses of all sizes.

External influence

As far as the role of external influence is concerned, a relation to the size of the company was identified in case of importance of company's own analysis (see Table 6.5). Both Kruskal-Wallis test were statistically significant, indicating a difference between all three groups of companies. Although, in general, it was the most important way, the companies were making a decision, which BI vendor/provider to select, a significant difference was found. It was considered absolutely *Crucial* by mid-size businesses (5,7) and *Very important* by larger ones, while smaller companies on average said it was *Rather not important* (3,2). This group paid more attention to experience of other companies using a particular BI product (3,8) and consultancy company advice (3,4). Although some difference can be observed in these types of external influence, this was not statistically significant.

Factor	Sig.1a	Sig.1b	Sig.2	Small	Med.	Large
Company's own analysis	**0,043**	**0,034**	0,101	3,2	5,7	4,8
Family memb. advice	0,405	0,203	0,590	1,2	2,3	1,7
Others experience	0,797	0,642	0,796	3,8	3,3	4,0
Colleagues advice	0,495	0,456	0,113	3,2	2,5	1,8
Consultancy advice	0,774	0,577	0,504	3,4	2,8	2,7

Table 6.5: External influence significance tests, along with mean values for each group of companies.

Selection factors

In the group of factors influencing the selection of a particular BI product, there was a significant relation found between the size of the company and BI capability enabling management of other IS (see Table 6.6. All the tests were statistically significant, and meaningful difference was identified. The importance of this factor is the greatest for smaller companies (5,4), while mid-size ones (4,0) and large ones (3,0) place considerably less attention to it.

Looking at the mean values, one can notice that, there is a noticeable difference in case of scalability. Smaller companies consider it to be less important (4,2), than bigger companies (medium-sized (5,0) and large (4,7)). The greatest interest of medium companies may suggest that they are developing very fast and the number

of users, as well as the amount of data to be analyzed, may quickly increase. This test however was not found significant.

Factor	Sig.1a	Sig.1b	Sig.2	Small	Med.	Large
Technical support	0,180	0,608	0,090	4,4	4,7	5,0
Scalability	0,209	0,107	0,382	4,2	5,0	4,7
User friendliness	0,701	0,445	0,560	5,0	4,5	4,7
Cost	0,932	0,726	0,923	4,8	4,8	4,8
Flexibility	0,900	0,762	0,979	5,0	5,1	5,0
Fit	0,520	0,767	0,806	5,6	5,5	5,5
Management of other IS	**0,020**	**0,038**	**0,002**	5,4	4,0	3,0
Presence of KPI	0,887	0,698	0,775	4,2	4,5	4,0

Table 6.6: Selection factors significance tests, along with mean values for each group of companies.

What is interesting, however, is the fact that in case of three most important selection factors: fit (5,5), flexibility (5,0) and cost (4,8), the average importance is almost exactly the same. This suggests that the most important factors are exactly the same in each group.

Implementation constraints

As can be seen in Table 6.7, there are two factors which one test was significant.

Factor	Sig.1a	Sig.1b	Sig.2	Small	Med.	Large
Schedule overruns	0,348	0,14	0,095	4,8	4,3	4,2
Budget overruns	0,958	0,751	0,831	4,6	4,5	4,5
Use of company's resources	0,293	0,434	0,385	4,4	4,0	4,8
Users IT competence	0,076	0,244	0,228	4,0	3,5	4,7
Change manag. issues	0,617	0,375	0,954	4,0	3,5	4,0
Easy implementation	**0,010**	**0,004**	0,129	5,4	3,5	4,3
Adequacy of information	0,483	0,688	0,625	4,6	4,8	4,3
Adeq. of depart. particip.	0,097	0,117	**0,030**	3,6	4,3	4,7
Data quality issues	0,598	0,332	0,503	4,4	5,0	4,8
Strategy alignement	0,960	0,763	0,840	4,8	4,8	4,7
Empl. flex. and motiv.	0,912	0,608	0,792	4,2	4,3	4,3

Table 6.7: Adoption constraints significance tests, along with mean values for each group of companies.

Both Kruskal-Wallis tests were significant in case of easy implementation. Looking at the mean values it is obvious that this factor is considerably more important for smaller businesses (5,4) than for large (4,3) and for mid-size (3,5). This most likely due to the fact, that difficult and time consuming implementations, impede the performance, and smaller companies are more affected by such changes.

On the other hand, the regression test was significant in case of adequate participation of various departments in the selection process. The average importance values provide rather obvious results. For smaller companies this is of minor importance (3,6), and it is increasing with the size of the company (and indirectly with more departmental structure). Medium-sizec businesses, having a more complicated organizational structure, consider it to be significantly more important (4,3), while the largest enterprises even more (4,7). In case of smaller ones, the BI system is mostly selected for a considerably smaller group of people (sometimes even one person), so the departmental participance is usually not an issue. In bigger companies, the system is either implemented for a single department, and then, except for IT professionals, there is a need for representatives from the interested party, or it is to be used across more units, or even entire organization. In such a situation, in order for each group to be satisfied with the functionality, the need for their participation becomes crucial.

Factors like: alignment with the general strategy of the company, budget overruns and employee flexibility seem to be equally important to all groups.

On the other hand, schedule overrun is more important for smaller companies (4,8) than for medium (4,3) and large (4,2), while data quality is less important for small ones (4,4), which usually have less data, than for medium (5,0) and large enterprises (4,8). For these factors, however, the tests were found to be insignificant, therefore no statistically justified conclusions can be drawn.

Feature/technology usage and interest

In Table 6.8, the analysis results for next generation features/technologies are shown. The regression test for Web-based interface resulted to be significant. The average value for large enterprises (1,2), shows that, in general, the majority of companies are using this feature, and many other are interested in using it. In case of mid-size companies (1,7), some companies, on average, are using it and most of the rest is interested. On the other hand, in case of smaller businesses (2,2) some respondents indicated that they are not interested in this technology. There are most likely two main reasons for that:

- less work-related travels, therefore the user of the BI system has a constant access to the infrastructure via installed application

- less people accessing the system, therefore, the licensing issues are of minor importance

This would, however, most likely change dramatically, while alternative method of BI provision was used.

Feature/technology	Sig.1a	Sig.1b	Sig.2	Small	Med.	Large
Web-based interface	0,093	0,287	**0,024**	2,2	1,7	1,2
Visualization	0,222	0,183	0,107	2,6	1,8	1,7
Real-time reporting	0,321	0,156	0,815	1,4	1,8	1,5
SOA	0,668	0,816	0,547	3,4	3,5	3,0
Managing other IS	0,502	0,845	0,310	1,8	1,8	2,3

Table 6.8: Feature/technology usage and interest significance tests, along with mean values for each group of companies.

Small companies, also seem to be less interested in visualization (2,6) than medium-sized (1,8) and large enterprises (1,7). On the other hand, operational BI with real-time reporting is comparably interesting for all companies (small (1,4), medium (1,8), large (1,7)). These, however, were not statistically significant.

6.3 Analysis and Conclusions

The objectives of the study were the following:

1. investigate the reasons for low BI adoption in Poland

2. investigate alternative ways of using BI, focusing especially on the needs and capabilities of small and mid-size companies

3. investigate the relationship between the size of the enterprise, and various preferences related to BI system selection and implementation

Two surveys were designed, for companies having and not having BI solution. Except for that, a number of phone interviews was conducted with BI vendors. In case of the relationship analysis, companies were divided into three separate groups (small, medium and large), and special focus was placed on determining the differences within the group of SMEs.

Micro companies

There is a considerable group of companies, in Poland, that include only one-person. There are also many businesses having less than 10 employees. Theory

and previous researches indicate that most of such enterprises do not actually need sophisticated IT systems. Their dat-to-day operations are simple enough, to be handled without a support. The research supports this claim, since, in the first study sample, 72,5% of companies admits to not using any kind of IS supporting the operation of the enterprise.

Many of these companies, being managed by less technologically aware people, most probably won't ever become interested in such solutions. Therefore, providers of IS need to be aware that a rather large group of businesses, will not be penetrated for years to come. This situation is most likely to change from year to year, however it will take some time to get to this group of customers.

Taking this under consideration, as well as the fact that some businesses that heard about the BI system before being surveyed, indicated that a reason of not having such a solution is that the company is not complex enough, suggests that vendors need to be aware that the interest in BI will not considerably increase on its own. The solutions need to provide features that would aid SMEs, and convince them, that this BI is not only for complex organizations, but also simpler ones can appreciate better informed decision making.

Although many companies are too simple to need sophisticated Information Systems, vendors should convince them that BI solutions can be extremely useful also for less complex businesses. There is a need for making companies more informed about such systems.

Informatization

In most of the investigated SMEs, a single computer (or a few) was present, and only standard applications like MS Word and Excel were used. As mentioned earlier, only 27,5% of Polish companies are using some kind of IS. This low level of informatization, impedes the introduction of new technologies into the market.

Low informatization in Poland results in companies not being interested in new solutions, which are being developed

BI awareness

As much as 13,7% of respondents in the first study, admitted they have heard about Business Intelligence systems before and out of 7 such companies, 4 convinced they did not have enough information about BI. This indicates that there is a very low awareness of Polish companies of the existence of such solutions. Moreover, there is an even lower percentage of businesses being informed enough, to know what BI systems are about. When being presented to BI features, an owner of a

medium company was interested did not understand the benefits that he might get. Instead he was interested in simple calculations, which could easily be done in Excel spreadsheet.

Because of all that, although the BI market is supposed to develop in the incoming years, providers cannot only count on customer coming to them. They definitely need to make a move themselves.

Very low BI awareness and high percentage of companies having not sufficient information is most likely to be the most important reasons for low BI adoption, on the Polish market. Because of that, BI providers cannot yet count on the word-of-mouth spreading of this technology. There is a great need for a good campaign introducing managers and company owners to the solution and informing them about the pros and cons.

IT outsourcing

15,7% of all companies investigated during the first study (however, it has to taken under consideration that most of the companies are not using computers as a support for their business operations), and almost 50% of companies using some type of IS, are having their IT function outsourced. Businesses are aware of the benefits of using outsourcing and are not reluctant about contracting IT to an external company/person. Because of that, the alternative approach to BI provision is likely to be accepted by smaller companies.

All respondents of the second study, admitted to be having entire infrastructure developed at their location, and having bought the BI system. No information was found on the interest of companies in alternative ways of solution provision, as well as related problems and concerns.

Outsourcing and Software as a Service provision models, should not be rejected by the companies, since they are aware of the benefits and are making use such approach. Nevertheless, a study should be conducted to investigate company's interest in other approaches to BI provision, with a strong focus on the problems that might arise, and concerns that businesses might have. However, for sure, the security of data transmitted over the Internet needs to be assured.

Cost of BI

Previous researches indicate, that cost is an especially important factor, while making a decision about a new IS. The second study, partially support this statement, since, on average, it was place on the third place after fit to needs and flexibility. Furthermore, small businesses, because of limited financial capabilities

and resource poverty, were previously said to be especially interested in cheaper solutions. They were said to have not much funds left for investments and innovation, after salaries of the owner and the employees were given. However, according to the study, cost of BI solution is the 5th most important factor (based on average importance) for small enterprises, which does not entirely support the statments.

It is still however a very important factor, and according to the study, it is equally relevant for all types of sizes. Therefore, BI solutions need to be provided with more attractive pricing models.

Bi vendors need to offer solutions which clearly show that the price is strictly related to the quality of the service. Smaller companies value different factors more than cost, however they still have limited finances, therefore cost-effective models are a must.

Importance of SMEs in the economy

Because of high proportion of SMEs to large companies, as well as big share in number of employees and GDP creation, they are very important to the national economies. They also present a potential big market of new products. Previous market analysis studies indicate that IS vendors, including BI are becoming more and more interested in this group. The market research, conducted in this paper supports this fact. All interviewed BI vendors admitted to their offer being also targeted to medium-sized companies, while few also indicated their rising interest in smaller businesses. Two products, particularly interesting for SMEs have been introduced into the market in the last 3 months (Oracle and Cognos), while another one, is said to be integrated with EPR and CRM systems and offered as a complete suite already for some time (SAP).

BI providers are starting to realize the importance of SME sector, and begin to offer more attractive solutions that are available to this group. Other vendors should develop similar products for smaller business, in order to be able to get their share in this big market

Alternative provision methods

In order to decrease the cost of using BI, alternative way of providing it need to be offered. Current technological developments in the field of BI, make the alternative provision methods possible. SOA, Web services, web-based interface and visualization are next generation BI technologies being implemented in currently launched solutions. The research supports this fact, since e.g. SOA simplifies in-

tegration with other products and web-based interface enables easy usage of the SaaS model (Cognos Now! and Oracle BI SE One).

From the methods mentioned in the theoretical part of this thesis, outsourcing is being used, and Open Source CRM was used by one of the companies, from the first sample. outsourcing and SaaS offer significant decrease of cost of using BI. In case of Open Source BI, the company still needs to have the entire infrastructure, therefore this is a good solution for companies that already have the infrastructure, and are considering a purchase of a BI system. Instead of buying a typical product from a vendor, they can use an Open Source system, which is usually offered at a lower price.

Companies have to make a proper use of the next generation features and technologies related to BI. Such solutions will enable them having a better and cheaper offer. Customers, on the other hand, need to search for all available offers. They might use outsourcing. Also a SaaS approach can be attractive, if they do not have the infrastructure already. They can use an Open Source system, in case they have all the necessary hardware installations. They can also use a traditional approach.

Satisfaction

The results of the study indicate that there is a significant difference between satisfaction level of small and both, mid-size and large companies.

As previous researches indicate, small businesses very often suffer from insufficient information and knowledge during product selection and implementation projects. On the other hand, SMEs cannot afford mistakes, especially when investments, as high as BI related, are concerned. Because of that, they need to follow all, broadly available guidelines, in order for the solution to be successfully implemented. As a result, the high level of satisfaction of smaller enterprises can be related to good implementation project realization.

Another explanation, is that in case of smaller companies, the solutions is usually to be used by one person or a small group, while in bigger companies, it is implemented for a greater number of users (and possibly various departments). As a result, it is considerably easier to fulfill the requirements of smaller group of people than that of the larger one.

Vendors should understand and use the reasons for bigger satisfaction of smaller companies. Focusing on smaller companies, and having good opinion spread to potential customers may positively influence the share in the market. On the other hand, being able to determine the reasons for better satisfaction of small business, can give the vendor and advantage over the competition. However, most likely way to improve the satisfaction of larger customers is to focus on customization and

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personalization features, which in case of solutions for larger groups are especially important.

User participance

A rather high satisfaction of the respondents in the entire sample, may be related to user participance, which was not present in only one surveyed company. It is a very promising fact that Polish companies are aware of the importance of end-user active presence in the process of requirement definition, as well as product selection, implementation and evaluation.

Companies need to understand the need for user participance, in order to achieve success. This could be directly related to the satisfaction from the product. However, small representation of companies, in which users did not take part in BI selection and implementation, does not give significant results. This issues should be further investigated

Cost reduction

According to previous research, because of resource poverty, SMEs are especially interested in cost cutting. The second study conducted in this thesis only partially supports this claim. Comparing the average values of importance between different groups of companies, it turns out that small businesses are the ones paying the least attention to this factor. The mid-size enterprises are the ones who value the cost-reduction the most out different groups, but still this factor is the fifth most important in this group. On the other hand, the real *resource poverty* issue is not applicable to the companies analyzed here (average number of employees in this group was 320, and the respondents were initially not certain as to which group the company should be assigned - medium or large ones-, which would indicate that the turnovers were close to the border).

Previous research finding, stating that SMEs are especially interested in cost cuttings because of resource poverty were proved, in this study, not to be true in case of Polish companies.

Reasons for having BI

Previous findings, indicate that the reasons for BI implementation include more informed business decisions and making the right decision at the right time. The findings of this study, seem to support that. The main reasons identified are:

- making better informed decisions

- improve data management

- increase the response to changes

Increased response to changes is simply put being able to make the right decision at the right time - instantaneously after an event takes place. Except for that, and additional important reasons is the improved management of data, of which companies, currently, have enormous amounts.

The relationship test in this group didn't produce any important results. The only relation of a factor depending on the size of the company, was in case of other companies already having it. However, the importance of this factor, was in general very low, and does not give any valuable information

The most important reasons for BI adoption are similar to previous studies and equally relevant for companies of all sizes. The vendors should then focus on the features and technologies which are related to those factors and the marketing and information campaign can, in this aspect, be targeted to all groups. An obvious feature to be taken under consideration, is real-time reporting, which leads to faster response to changes. Also data quality issues need to be handled appropriately.

Role of external influence

Researches on IT/IS investments indicated that external influence pays a particularly important role especially in small enterprises. In a research by Laukkanen et al. (2005) for ERP systems, on the other hand, no support was found to that statement. In case of the second study, conducted within this thesis, in relation to BI systems, this was only partially supported. Small businesses assigned less importance to own analysis, than their larger counterparts. The only external factor that was fairly more important for small enterprises, was the experience of other companies, however, its role was not found to be a general basis of the decisions.

The relationship between the size of the company and the factors from this group gave a statistically significant result, indicating that the company's own analysis importance is dependent on the group. It was absolutely crucial for midsize companies (5,7) and very important for large ones (4,8), while only rather important for the smallest (3,2). However, low importance of this factor in their case, is very likely to be related to the fact that they suffer from insufficient information and knowledge to perform this type of analysis.

No significant influence of external factors have been found, in case of companies of any size. The importance of own analysis is noticeable in the investigated group (65% consider it to be crucial or very important), however, as mentioned earlier,

smaller companies are often not aware of BI systems or do not have the necessary information. It is absolutely essential that providers start educating smaller companies about the idea of BI solutions.

Selection preferences

The most important factors that influence the selection of a particular product, identified in the research, are:

- fit to company's needs

- flexibility of the system

- cost of the solution

All of these, are equally relevant for all groups of companies, therefore, if vendors concentrate on them, all customer should be more likely to choose their product.

A lower cost of the solution, can be achieved by means of next generation BI features and technologies. Moreover, vendors can provide access to the BI application by means of alternative provision models, mentioned before, and described in the theoretical part of this thesis.

Previous analysis show, that customers want more user friendly BI. The thesis partially supports this statement. Although user friendliness was found to be, on average, the fifth most important selection criteria, the average values show that it is taken under consideration during choosing the solution (small (5,0), medium (4,5) and large (4,7))

Except for that, a relation was identified between the size and the need to manage other IT systems using BI. Surprisingly, smaller companies are more interested in this feature, although bigger companies are the ones that usually have multiple IT systems.

Providers need to focus on making their products universal and customizable (so it would fit to various needs), and is capable of high personalization (flexible). They also have to offer a user friendly interface in their application. Moreover, being able to integrate the BI solutions with other IS's in the company, is important for smaller businesses, therefore, the vendors should incorporate this option, especially in the solutions aimed to this group of customers.

Implementation constraints

The most typical implementation constraints, mentioned by the respondents are:

- data quality issues

- strategy alignment

- adequacy of information in system selection

Previous studies indicate that vendors very often underestimate customer's data requirements, while 78% of customers considered it to be the condition of successful BI system deployment.

As far as other factors of successful implementation, found by previous researches, are concerned, BI having a justified business objective was also found to be important in the second study. However, flexibility and motivation of employees was not supported by this research

Customers need to pay attention and control how the data requirement aspects are treated by the provider, since "success of any BI implementation depends on having a clean data to mine"[Dragoon(2003b)].

Easy implementation

Theory says, the infrastructure of BI should be simplified and integration of multiple systems should be facilitated. During the study, a significant difference was identified in case of the easy implementation factor. Small companies consider it to be the most important factor (5,4), while medium ones (3,5) and large enterprises (4,3) assign considerable less. Extensive use of company's resources during implementation was also found to be rather important.Except for that, availability should be improved, according to the theory.

Taking this under consideration, the BI solution models launched recently by Cognos, seem to be most appropriate for small businesses. The deployment is extremely simple, since either a single hardware appliance is introduced at customers location, or the BI functionality is offered using SaaS model. In both case, the implementation is significantly simplified. Although the price of such a solution (the one from Cognos) remains a question, according to theory, SaaS BI should be available at a very low investment with a price ranging from \$50 to \$100 per user. Such price is very cheap, and even if the cost of Cognos Now! would be a bit higher, it would still be a very cost-effective solution. Whatever the model used, the availability of the system would be very high, because of the use of Web-based interface.

Vendors wanting to offer BI systems to small companies, need to focus on easiness of installation. Except for that, SOA seems to be a promising technology, since by it means, the integration of the new solutions would be considerable simplified, which is also crucial.

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Departmental participation

Department participation was found to be considerably more important for large companies. This is most likely due to the fact that smaller businesses very often do not have a departmental structure, or on a considerable smaller scale.

Departmental participation is important in case of larger companies, so vendor should in this group of companies, help their customer understand that need.

SaaS and Web-based interface

Study of the trends (theory), and companies' preferences (practical part), show that simplified implementation, easy scalability and attractive pricing are the driving factors of BI development. SaaS over the Web-based interface, with ensured security and privacy issues, seems to be the best model for providing BI systems.

The best solution for small companies, that would take their preferences and needs under consideration is the SaaS BI model, offered via Web-based interface. Vendors should follow this idea.

Visualization

Visualization techniques, are becoming more and more popular as researchers indicate. However, this study did not find significant interest of companies in this matter.

Vendors either should advertise visualization more, or should offer it for a specific group of companies, that would actually appreciate it

However, it has to be remembered that *"understanding the goals and processes is far more relevant than the selection of the technology"*[MacDonald(2004)]

6.4   Limitations

The greatest limitation of the studies was the size of the sample. Because of the time and cost factors, the first sample, although randomly selected, was not very big, which may result in not very precise indication of the general situation. In the second research, some dependencies were identified, with significant statistical tests. Looking however at the mean values of importance for other factors, one could expect that there might be a greater difference between small and mid-size

companies. Nevertheless, for future research, greater samples should be investigated.

In both studies companies were to mark the size of the enterprise. Following studies could ask for turnover and total balanced sheet to ensure proper assignment to particular group.

An analysis of similar type, for a greater sample, could also investigate the relation between the sector that the company operates, and the listed factors. Because of small number of BI users in Poland, such a research is difficult for the moment, but should be considered in the future.

A low awareness was found to be present on Polish market and because of that, some recommendations for information campaigns and education of entrepreneurs is advised. When this is realized a longitudinal study could be realized, to investigate the change of various aspects with the companies being better informed.

Similarly, the second study, because of lack of previous researches on the BI market (especially in Poland), was more of an exploratory character. The results should be taken under consideration and analyzed more thoroughly. For example, a longitudinal survey of the satisfaction could be performed.

The satisfaction could also be investigated in more detail. There are three main ways the satisfaction is measured by managers - ROI, cost savings, and user adoption. These could be used in the further research instead of general question about satisfaction.

Furthermore, the reasons for greater satisfaction of smaller companies should be focused on in further research.

The interviews indicate that companies with foreign influence (foreign managers, acquiring companies, etc.) are above all interested in BI. Further research could verify this statement, and determine if it indeed influence the level of awareness and interest in capabilities of various IS, especially Business Intelligence.

User participance in the requirement definition, as well as selection, implementation and evaluation of the product was found to take place in Poland on rather large scale. This should be more deeply analyzed, with more detailed questions, as well as relationship between the user participance and other issues, like for example satisfaction, should be investigated.

The research found that one of the best solutions for SMEs, to have a BI solutions is to use some sort of outsourcing (e.g. SaaS). An analysis focused on how likely, the customers are to use outsourcing for BI, as well as on what are their concerns, could be performed. An investigation of the satisfaction and relevance of various factors, used in this study, should be done for companies using alternative BI provision methods, for instance on another market.

The role of external influence during selection of the product, was partially supported in case of small companies, in the study. This area should be further

investigated.

Another field that needs broader exploration is the integration of BI with other IS. Smaller companies were found to be interested in using BI for using data from other systems, like ERP and CRM, therefore this should be the focus in following studies.

Chapter 7

Summary and final conclusions

This thesis was focused on investigating the reasons for low BI adoption, analyzing available BI offers on the market, as well as customer's preferences during selection and implementation of BI solutions and their dependence on the size of the company. BI systems may give great possibilities to businesses and, if used appropriately, increase the competitive advantage.

Two one-off studies and a set of phone interviews were conducted during this research. Almost 100 companies were contacted. 51 respondents revealed interesting information about the BI awareness. 9 BI vendors/providers explained details of their available offers, and 17 businesses, using a BI solution, enabled investigation of the preferences during selection.

The first hypothesis was supported by the empirical data gathered during the study, since in case of Poland, it is not the cost, that impedes the BI adoption, but very low informatization of companies and almost zero awareness about the existence and capabilities of BI systems. Therefore, few years are generally needed for companies to realize the importance of IS and for the informatization to increase. Meanwhile, vendors should start educating the companies about BI solutions. There are still many companies that are using different information systems, and are most likely to be interested in BI, but have not heard about it before.

Companies providing BI solutions, are aware of importance of SMEs, and are starting to target this sector as well. A number of interesting offers, suitable for smaller businesses because of the size, cost and easiness of implementation have been launched during last three months (May - August 2007). There are two main options, either a single hardware appliance, easily integrable with the existing infrastructure, or BI functionality offered over the Software-as-a-Service model.

The recent development of various technologies like web-based interface, SOA, Web Services, visualization etc. enable providing BI in such simple manners. At the same time, companies seem to be using IT outsourcing, therefore this is not something completely new. Of course, SaaS requires corporate data to be send

over the Internet, but with endured security company's should be interested in using this approach.

The research found that companies understand the importance of end-user participance in the process of selecting, implementing and evaluating BI products. This results in rather high satisfaction with the solution, and actual benefits being brought by the system. Especially the smaller companies are satisfied with BI systems, which is an interesting information for both, customers and vendors. Small businesses need to understand that such solutions can be very useful, and vendors should be the ones to help them in this matter.

A very important reason for BI system implementation, except for making better informed decisions is the increase of reaction to changes. Real-time reporting was found to be the third most important reason, and was equally important for all companies. Moreover, 41,2% of respondents were already using it, while the remaining 58,8% was interested in using it in the near future. Vendors, therefore, should focus on providing operational BI solutions, which would enable making the right decision at the right time.

Company's own analysis was identified as the most important way of determining a good provider. This factor was a bit less important in the group of small enterprises, however this is most likely to be related to lack of complete and relevant information. "It is necessary to ensure that people know exactly what needs to be done and how to go about it" [Davis(No date)]. Because of all that, it has to be stressed again, that vendors should ensure that businesses are well informed on BI capabilities and exact offers.

Factors that were indicated to be crucial to companies of all sizes were fit to the needs and flexibility of the solution. Vendors, therefore, should assign extra importance to customization and personalization of the product.

Moreover, data quality issues, are still the most important constraint during implementation, for all enterprises. On the other hand, easiness of implementation, is especially important for smaller companies. Because of that, the solutions specifically aimed to this group should be simple in deployment.

Some relationship between the size of the company and preferences during selection and implementation of BI was identified, however, this field should be further explored.

The benefits of the next generation Business Intelligence solutions are numerous and high satisfaction among customers is a very encouraging factor. Nevertheless, as with any new system, it has to be remembered that "without clear knowledge of where you are going, the technology won't be able to take you there" [Visual Mining(2004)]. Therefore, companies have to ensure that all decisions they make, including the one about implementing a BI solution, need to be aligned with the business strategy, and have a reasonable business objective.

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Ankieta do pracy magisterskiej. Mateusz Hajnysz (1 strona)

Celem tej ankiety jest analiza rynku Business Intelligence (BI) w Polsce i zbadanie preferencji i planów firm związanych z BI oraz powodów nieposiadania tego systemu. Ankieta jest **ANONIMOWA**.

1. Jak duża jest firma? **Mała** ☐ **Średnia** ☐ **Duża** ☐

2. Ilu pracowników jest zatrudnionych w firmie? ☐

3. W jakim sektorze (sektorach) działa firma?

4. Jak istotne są następujące powody nieposiadania Business Intelligence (BI) przez Pana/Pani firmę?	Nie istotne/ N/A	Mało istotne	Raczej nieistotne	Raczej istotne	Bardzo istotne	Decydujące
Nigdy wcześniej nie słyszałem o BI	☐	☐	☐	☐	☐	☐
Nie posiadam wystarczająco informacji na temat BI	☐	☐	☐	☐	☐	☐
Nie widzę dobrych powodów aby używać BI	☐	☐	☐	☐	☐	☐
Firma nie jest wystarczająco złożona	☐	☐	☐	☐	☐	☐
Firma nie jest przygotowana na zmiany organizacyjne	☐	☐	☐	☐	☐	☐
Rozwiązania BI są zbyt drogie	☐	☐	☐	☐	☐	☐
Nie jest dostępne rozwiązanie, spełniające wymagania firmy	☐	☐	☐	☐	☐	☐
Złe doświadczenia *znajomych/innych firm* z rozwiązaniami BI	☐	☐	☐	☐	☐	☐
Inne (jakie?):	☐	☐	☐	☐	☐	☐

5. Czy jest Pan/Pani zainteresowany(a) implementacją BI w przyszłości? **Tak** ☐ kiedy?(rok) ☐ **Nie** ☐

6. Jak bardzo, następujące czynniki, mogłyby wpłynąć na *rozpoczęcie szukania rozwiązania BI/wcześniejszą decyzję o implementacji rozwiązania BI*?	W ogóle	Bardzo słabo	Słabo	Średnio	Bardzo	Decydująco
Firma stanie się bardziej skomplikowana organizacyjnie	☐	☐	☐	☐	☐	☐
Firma stanie się przygotowana na zmiany organizacyjne	☐	☐	☐	☐	☐	☐
Koszt posiadania BI zostanie obniżony	☐	☐	☐	☐	☐	☐
Rozwiązanie odpowiednie dla potrzeb firmy stanie się dostępne	☐	☐	☐	☐	☐	☐
Firma zdobędzie więcej informacji na temat możliwości BI	☐	☐	☐	☐	☐	☐
Większa ilość reklam *sprzedawców/dostawców* rozwiązań BI	☐	☐	☐	☐	☐	☐
Lepsze doświadczenia *znajomych/innych firm* już posiadających BI	☐	☐	☐	☐	☐	☐
Inne (jakie?):	☐	☐	☐	☐	☐	☐

Uwagi:

Dziękuję bardzo za poświęcony czas. Proszę uprzejmie o odesłanie ankiety na adres
mateusz.hajnysz@gmail.com.

Survey for M.Sc. thesis of Mateusz Hajnysz (1 page)

The aim of the survey is to analyze the Business Intelligence (BI) market in Poland and investigate preferences and plans related to BI and reasons for not having it yet. The survey is **ANONYMOUS**.

1. What is the size of the company?   Small ☐   Medium ☐   Large ☐

2. How many employees does the company have? ☐

3. In what sector(s) does the company operate? ☐

4. What is the importance of the following reasons, for not having a Business Intelligence (BI) solution in your company?

	Not important/ N/A	Very little important	Rather not important	Rather important	Very important	Crucial
I haven't heard about BI before	☐	☐	☐	☐	☐	☐
I don't have sufficient information about BI capabilities	☐	☐	☐	☐	☐	☐
I do not see any good reason for having BI	☐	☐	☐	☐	☐	☐
The company is not sufficiently complex to need a BI system	☐	☐	☐	☐	☐	☐
The company is not ready for organizational change	☐	☐	☐	☐	☐	☐
The BI solutions are too expensive	☐	☐	☐	☐	☐	☐
There is no suitable solution to meet the company's needs	☐	☐	☐	☐	☐	☐
Colleagues/other companies had bad experience with BI	☐	☐	☐	☐	☐	☐
Other (specify):	☐	☐	☐	☐	☐	☐

5. Do you want to implement a BI system in the future?   Yes ☐   when? (year) ☐   No ☐

6. How strong, the following factors, could influence you *to start looking for a BI solution/to implement a BI solution earlier*?

	No influence	Very little influence	Little influence	Influence	Strongly influence	Decisive influence
The company becomes more complex	☐	☐	☐	☐	☐	☐
The company is prepared for organizational change	☐	☐	☐	☐	☐	☐
The cost of having a BI solution is decreased	☐	☐	☐	☐	☐	☐
A more suitable BI solution, for company's needs, is available	☐	☐	☐	☐	☐	☐
I have more information on BI system capabilities	☐	☐	☐	☐	☐	☐
More *vendor/provider* advertisements	☐	☐	☐	☐	☐	☐
Better experience of *colleagues/other companies* who already have it	☐	☐	☐	☐	☐	☐
Other (specify):	☐	☐	☐	☐	☐	☐

Comments:

Thank you very much for your time. Please send back the survey to mateusz.hajnysz@gmail.com.

Ankieta do pracy magisterskiej. Mateusz Hajnysz (2 strony)

Celem tej ankiety jest analiza rynku Business Intelligence (BI) w Polsce i zbadanie preferencji firm przy wyborze, implementacji oraz użytkowaniu systemów BI. Ankieta jest **ANONIMOWA**.

1. Jak duża jest firma?   **Mała** ☐   **Średnia** ☐   **Duża** ☐

2. Ilu pracowników jest zatrudnionych w firmie? ☐

3. W jakim sektorze (sektorach) działa firma? ☐

4. W jaki sposób _Pana/Pani_ firma korzysta z BI? (proszę wybrać jedną opcję, która najlepiej pasuje)

Posiada całą infrastrukturę i zakupiła rozwiązanie BI ☐

Outsourcing rozwiązania BI (hardware, software, administracja systemu, itd.) ☐

Off-shoring rozwiązania BI (hardware, software, administracja systemu, itd.) ☐

Software as a Service (outsourcing tylko aplikacji BI) ☐

Inne (jakie?): ☐

5. Jaki jest Pana/Pani ogólny poziom satysfakcji z posiadanego rozwiązania BI?

Bardzo niezadowolony(a) ☐ ☐ ☐ ☐ ☐ Bardzo zadowolony(a)

6. Kiedy miała miejsce implementacja systemu BI? (rok) ☐

7. Czy końcowi użytkownicy systemu brali udział w definiowaniu wymagań systemowych i wyborze rozwiązania?   **Tak** ☐   **Nie** ☐

8. Jak istotne były następujące czynniki podczas podejmowania decyzji o implementacji rozwiązania BI?

	Nie istotne/ N/A	Mało istotne	Raczej nieistotne	Raczej istotne	Bardzo istotne	Decydujące
Redukcja kosztów	☐	☐	☐	☐	☐	☐
Zwiększenie efektywności	☐	☐	☐	☐	☐	☐
Efektywne i skonsolidowane zarządzanie innymi systemami IT	☐	☐	☐	☐	☐	☐
Inne firmy już posiadały system BI	☐	☐	☐	☐	☐	☐
Monitorowanie konkurencji, zwiększenie przewagi konkurencyjnej	☐	☐	☐	☐	☐	☐
Ustalenie ewentualnego kandydata do przejęcia	☐	☐	☐	☐	☐	☐
Analiza rynku	☐	☐	☐	☐	☐	☐
Monitorowanie rozwoju technologicznego w sektorze	☐	☐	☐	☐	☐	☐
Wyciąganie lepszych wniosków i podejmowanie lepszych decyzji	☐	☐	☐	☐	☐	☐
Lepsze operowanie danymi	☐	☐	☐	☐	☐	☐
Szybsza reakcja na zmiany	☐	☐	☐	☐	☐	☐

9. Jak istotne, podczas wyboru _producenta/dostarczającego usługę_, były …

	Nie istotne/ N/A	Mało istotne	Raczej nieistotne	Raczej istotne	Bardzo istotne	Decydujące
Własna analiza wewnątrz firmy	☐	☐	☐	☐	☐	☐
Sugestie spółek powiązanych (np. spółka matka)	☐	☐	☐	☐	☐	☐
Doświadczenie innych firm korzystających z _produktu/producenta/dostawcy_	☐	☐	☐	☐	☐	☐
Sugestie znajomych	☐	☐	☐	☐	☐	☐
Sugestie firm doradczych	☐	☐	☐	☐	☐	☐
Inne (jakie?):	☐	☐	☐	☐	☐	☐

10. Jak istotne były następujące czynniki podczas wyboru producenta/dostawcy?

	Nie istotne/ N/A	Mało istotne	Raczej nieistotne	Raczej istotne	Bardzo istotne	Decydujące
Pomoc techniczna	☐	☐	☐	☐	☐	☐
Możliwość dostosowania rozmiaru systemu do zmiany wielkości firmy	☐	☐	☐	☐	☐	☐
Przyjazność użytkownikowi	☐	☐	☐	☐	☐	☐
Koszt	☐	☐	☐	☐	☐	☐
Elastyczność systemu	☐	☐	☐	☐	☐	☐
Dopasowanie do potrzeb firmy	☐	☐	☐	☐	☐	☐
Zarządzanie innymi systemami w firmie (np. ERP, CRM, SCM)	☐	☐	☐	☐	☐	☐
Możliwość monitorowania działalności firmy poprzez wskaźniki (np. KPI)	☐	☐	☐	☐	☐	☐
Inne (jakie?)	☐	☐	☐	☐	☐	☐

11. Jak istotne były/są następujące czynniki podczas implementacji systemu BI?

	Nie istotne/ N/A	Mało istotne	Raczej nieistotne	Raczej istotne	Bardzo istotne	Decydujące
Nieprzekroczenie ustalonych terminów	☐	☐	☐	☐	☐	☐
Nieprzekroczenie ustalonego budżetu	☐	☐	☐	☐	☐	☐
Wykorzystanie zasobów firmy niekolidujące z realizacją codziennych obowiązków	☐	☐	☐	☐	☐	☐
Problem kompetencji użytkowników w korzystaniu z IT	☐	☐	☐	☐	☐	☐
Problemy związane ze zmianami spowodowanymi wprowadzeniem BI	☐	☐	☐	☐	☐	☐
Łatwość implementacji	☐	☐	☐	☐	☐	☐
Dostateczna ilość informacji o systemie BI podczas jego wyboru	☐	☐	☐	☐	☐	☐
Odpowiedni udział różnych działów (funkcji) podczas wyboru BI	☐	☐	☐	☐	☐	☐
Jakość danych w bazach posiadanych przez firmę	☐	☐	☐	☐	☐	☐
Uzgodnienie wprowadzenia BI ze strategią i dokładne cele biznesowe	☐	☐	☐	☐	☐	☐
Elastyczność i motywacja pracowników	☐	☐	☐	☐	☐	☐

12. Czy firma korzysta z następujących możliwości i funkcjonalności BI?

	Tak	Nie, ale jestem tym zainteresowany(a)	Nie, i nie jestem tym zainteresowany(a)	Nigdy o tym nie słyszałem(am)
Dostęp do BI przez przeglądarkę internetową	☐	☐	☐	☐
Techniki wizualizacji informacji (np. dashboards, scorecards)	☐	☐	☐	☐
Raportowanie w czasie rzeczywistym (np. powiadomienia, aktualizacje)	☐	☐	☐	☐
Service Oriented Architecture (SOA)	☐	☐	☐	☐
Administracja innych systemów IT w firmie	☐	☐	☐	☐

Uwagi:

Dziękuję bardzo za poświęcony czas. Proszę uprzejmie o odesłanie ankiety na adres mateusz.hajnysz@gmail.com.

The aim of the survey is to analyze the Business Intelligence (BI) market in Poland and investigate companies' preferences in selection, implementation and usage of BI systems. The survey is **ANONYMOUS**.

1. What is the size of the company?   **Small** ☐   **Medium** ☐   **Large** ☐

2. How many employees does the company have?   ☐

3. In what sector(s) does the company operate?   ☐

4. In what way are you having the BI solution? (choose the one that applies best)

Have the entire infrastructure and bought the BI product   ☐

The BI solution is outsourced (hardware, software, management, etc.)   ☐

The BI solution is off-shored (hardware, software, management, etc.)   ☐

Software as a Service (only the BI application is outsourced)   ☐

Other –   ☐

5. What is your general level of satisfaction with the BI solution you have?

Completely dissatisfied ☐ ☐ ☐ ☐ ☐ Completely satisfied

6. When did you implement the BI solution? (year)   ☐

7. Did users participate in the Requirement Engineering process and the selection of the solution?   **Yes** ☐   **No** ☐

8. How the following factors were important for your company when making the decision to implement a BI solution?

	Not important/ N/A	Very little important	Rather not important	Rather important	Very important	Crucial
Cost reduction	☐	☐	☐	☐	☐	☐
Improvement of efficiency	☐	☐	☐	☐	☐	☐
Need for effective and consolidated management of other IT systems	☐	☐	☐	☐	☐	☐
Other companies had it	☐	☐	☐	☐	☐	☐
Track competitors, increase competitive advantage	☐	☐	☐	☐	☐	☐
Determine likely candidate for acquisition	☐	☐	☐	☐	☐	☐
Analyze markets	☐	☐	☐	☐	☐	☐
Monitor technological development	☐	☐	☐	☐	☐	☐
Draw consolidated conclusions and make better informed decisions	☐	☐	☐	☐	☐	☐
Batter handle the information	☐	☐	☐	☐	☐	☐
Faster response to changes	☐	☐	☐	☐	☐	☐

9. How important during *vendor/provider* selection were the following?

	Not important/ N/A	Very little important	Rather not important	Rather important	Very important	Crucial
Company's own analysis	☐	☐	☐	☐	☐	☐
Company's family members suggestion	☐	☐	☐	☐	☐	☐
Experience other companies using the *product/vendor/provider*	☐	☐	☐	☐	☐	☐
Colleagues suggestion	☐	☐	☐	☐	☐	☐
Consultancy company suggestion	☐	☐	☐	☐	☐	☐
Other –	☐	☐	☐	☐	☐	☐

10. What is the importance of each factor in the decision which *product/approach* to choose?

	Not important/ N/A	Very little important	Rather not important	Rather important	Very important	Crucial
Technical support	☐	☐	☐	☐	☐	☐
Scalability of the system	☐	☐	☐	☐	☐	☐
User friendliness	☐	☐	☐	☐	☐	☐
Cost	☐	☐	☐	☐	☐	☐
Flexibility	☐	☐	☐	☐	☐	☐
Fit	☐	☐	☐	☐	☐	☐
Management of other IT systems	☐	☐	☐	☐	☐	☐
Presence of Performance Management Indicators	☐	☐	☐	☐	☐	☐

11. What is the importance of the following constraints during BI system implementation project?

	Not important/ N/A	Very little important	Rather not important	Rather important	Very important	Crucial
Schedule overruns	☐	☐	☐	☐	☐	☐
Budget overruns	☐	☐	☐	☐	☐	☐
Use of company's resources	☐	☐	☐	☐	☐	☐
Problems related to the competence of users in the use of IT	☐	☐	☐	☐	☐	☐
Problems related to the changes imposed by BI on the company	☐	☐	☐	☐	☐	☐
Easy implementation	☐	☐	☐	☐	☐	☐
Adequacy of information in BI system selection	☐	☐	☐	☐	☐	☐
Adequacy of participation of various departments in BI sys. selection	☐	☐	☐	☐	☐	☐
Quality of data already stored by the company	☐	☐	☐	☐	☐	☐
Alignment with overall strategy and precise business objectives	☐	☐	☐	☐	☐	☐
Employee flexibility and motivation	☐	☐	☐	☐	☐	☐

12. Is your company using the following features?

	Yes	No, but Interested in using	No, and not interested in using	Never heard of it
Web-based interface for a BI application	☐	☐	☐	☐
Visualization techniques (dashboards and scorecards)	☐	☐	☐	☐
Real-time reporting	☐	☐	☐	☐
Service Oriented Architecture	☐	☐	☐	☐
BI for managing other IT systems	☐	☐	☐	☐

Comments:

Thank you very much for your time. Please send back the survey to mateusz.hajnysz@gmail.com.