

# Business Value of Business Intelligence Systems Lies in Improved Business Processes

ALES POPOVIC, TOMAZ TURK, JURIJ JAKLIC  
Department of Information Management  
University of Ljubljana, Faculty of Economics  
Kardeljeva ploscad 17, 1000 Ljubljana  
SLOVENIA  
<http://www.ef.uni-lj.si>

*Abstract:* - In today's competitive marketplace, organizations must focus scarce resources on the strategies most likely to yield success. Business intelligence (BI) helps them achieve this focus giving the complete vision to learn from the past, monitor and communicate the present, and gain insight into the future. In the paper we propose a framework for analyzing benefits of BI systems that is based on three tier analysis of their business value, where we separate the goals of better information quality from business goals (e.g. changes in business processes that contribute to the fulfillment of strategic business goals and more appropriate response to business drivers). We maintain that the business value of BI systems does not arise only from better information processes and information quality but mostly from the consequently improved core and key business processes.

*Key-Words:* - Business Intelligence, Business Intelligence Systems, Information Quality, Business Processes, Business Value

## 1 Introduction

In today's rapidly changing business environment, the need for timely and effective business information is recognized as essential for organizations not only to succeed, but even to survive. In circumstances of increasing uncertainty about future conditions of business operations, demand for faster business decisions and stiff competition forces organizations to reduce the risk of taking wrong business decisions. Since the costs of wrong decision-taking are increasing [15], organizations have to support their decisions with facts and information whereas intuition, once often used, plays only a supplementary role. Business intelligence (BI) presents business information in a timely and easily consumed way and provides the ability to reason and understand the meaning behind business information through, for example, discovery, analysis, and ad hoc querying [1]. The purpose of BI systems is to follow the outcome of business operations, to provide information, and to analyze it when taking business decisions. Architecturally we can divide BI systems into two parts: a) data warehousing and b) access to data, data analysis, reporting and delivery.

Although business decisions are taken at different organizational levels, when it comes to daily operations these decisions are based upon business policy or business rules. BI systems above all support decision processes on analytical level. Consequently, according to Marchand et al. [8], BI systems have one of the greatest potentials for reaching information asymmetry compared

to competitors and thus to attain comparative advantage with information technology.

There are several possible uses of BI systems. Some of the most frequent uses include business performance management, outcome analysis, internal reporting and reporting to external institutions, support for execution of strategic plan, support for critical success factors analysis, support for balanced scorecarding, customer relationship management, supply chain management, risk management, product profitability analysis etc.

When it comes to consideration about introducing BI systems into organization the prevailing factor is often improved information processes, t.i. providing information in a different way. Information goals, such as following the outcome of business operations, independent data access, data integration from different (operational) sources, and interactive and comfortable access to data are important, however, they are only the first step in justifying investments in BI systems.

In the paper we discuss justification of investments in BI systems and propose a framework for analyzing business value of BI systems.

## 2 Cost-benefit Analysis

Analysis of costs and benefits represents a methodological framework for verifying feasibility of investments, t.i. analysis of their economic justification. Although cost-benefit analysis is often understood as a tool, it has a much broader meaning. We could define it

as a way of thinking that in general allows verification of economic justification of any human activity since it derives from the utilitarian view for explaining human decisions ([2]). In this sense it does not only limit to investments (e.g. future purchases of information technology) but also extends to verification of economic justification of the current situation (of realized investments) and other arrangements that are not necessary investments. In essence, cost-benefit analysis is about comparing costs and benefits of a certain arrangement in current situation. When analyzing costs we look at events that reduce utility whereas when analyzing benefits we explore events that contribute to higher utility. Unfortunately, measuring utility in an absolute meaning is not possible. Therefore we always compare the effects of adopting one arrangement over another, or against a situation that would occur if no arrangement was taken. The usual measure of an arrangement outcome in business decisions is money.

This kind of reasoning caught up in various forms of evaluation of investment decisions. Most often it can be found in financial criteria, such as internal rate of return (IRR), net present value (NPV), return period of an investment etc. If we look at return on investment (ROI), we try to financially estimate costs and benefits on a long-term as a result of investment. We estimate costs and benefits compared to the situation without investing. When we look at return period of an investment we try to come up with a period when the investment pays off either by direct income from selling goods/services or by lower opportunity costs.

Cost-benefit analysis philosophy can also be found in other forms, such as least-cost analysis (also known as total costs of ownership - TCO) or in other templates/methods specially designed for IT investment areas (for example [13]). A special challenge in justifying an investment is finding its costs and benefits in the long run. One way out could be to define the nature of costs and benefits in greater detail and prepare some sort of "taxonomy" of different categories of costs and benefits. Templates/methods for investment evaluation are therefore a combination of such categories, with predefined analysis process and an appropriate criterion (e.g. NPV) for final estimate. Methods usually also include some kind of directions for dealing with intangible costs and benefits leading to multicriteria decisions.

Cost-benefit analysis in connection with IT is often understood as a part of feasibility study. This can include analysis of various issues, such as organizational feasibility, political feasibility etc. Cost-benefit analysis fits into economic feasibility. Frequently, economic feasibility goes along with financial feasibility. The latter tells us whether or not are we able to finance our project. When combining economic and financial

feasibility we have to be careful not to mix up some of the categories (e.g. the question of costs of purchasing assets - do we take into account the amount at invoice reception or depreciation of such asset?)

Based on our experience and literature review we can ascertain that for BI systems it is relatively simple to determine the costs and harder to define benefits. The main focus of the paper are therefore benefits. These usually can't be directly measured on the market. Benefits deriving from BI systems are hard to define in terms of greater productivity, which is general presumption with investments in IT. As we will see later on, BI systems importantly affect information quality and through it business performance.

There are several researches and frameworks in the area of justifying investments in data warehouses. Watson and Haley [17], Watson et al. [16], Sentry Market research and IDC study [12] present possible sources of benefits of such investments. Wu [19] draws our attention to the importance of evaluating both tangible and intangible benefits before DW project execution. Computerworld survey [4] (surveyed 113 IT managers) showed that according to respondents about 90% of benefits from IT projects are intangible. Morris [11] presents a comparative study of building own data warehouse and analytic application vs. buying one. His findings show that building an analytic application may cost more, but there is no indication that the approach itself materially affects potential return. However, the distribution of the costs were significantly different, with build analytics projects showing higher percentages for internal services, reflecting a reliance on in-house IT resources for custom development. On the other hand, buy analytics projects had a higher percentage of costs for external services, reflecting a reliance on consultants to customize a packaged application. Hammond [6] assesses that BI systems can help organizations meet two objectives: the imperative for better information access and analysis to meet increasing competitive pressures, and the opportunity to capitalize on data for competitive advantage over laggard rivals. To further support our findings presented in this paper it is important the research of Taub [14] where the author establishes that sources for return of data warehousing investments do not arise from the data warehouse itself but rather from new or improved business processes that such data warehouse enables.

### **3 Information Goals of Business Intelligence Systems**

In general it is easier to assess the benefits deriving from information goals. These aim at reducing the gap between the amount of data organizations collect and the

amount of quality information available to users on tactical and strategic level of business decisions. Gartner [7] defines discrepancy between fast growing amount of collected data and slower increase of the amount of quality information the information gap. It is important to note that the amount of information increases slower than the number of decisions that (should) have appropriate information support. Intuition in business decisions is still important, however, its role has shifted towards a more supplementary element within structured decision process that is based on information in all phases.

In business praxis, information gap comes in different forms. Among others, the most common are:

- Data required for analysis is located in different sources that are hard to integrate. Data sources are inconsistent.
- Management gets extensive reports that are rarely used or inappropriate.
- There is quite some data within organizations they are unaware of.
- Data within operational databases is not properly arranged to support management's decision.
- For "non-technical" analysts it is a complicated and time consuming activity to prepare reports and execute queries. Traditional tools for querying and reports are despite a graphical user interface hard to use.
- Due to increased need for information in analytical decision processes IS staff plays a role of data steward: integrate data from different sources, prepare reports, aggregate data etc.
- Analysts take too much time to gather the required information instead of its analysis.
- There is lack of external and/or competitive information to support decision making, data owners are too protective of information, and there are limitations of incompatible software/hardware systems [6].

In all of the above cases we can see examples of poor information quality. We understand information quality in a broader sense that also includes the access mode (e.g. speed, comfort, security and interactivity). When analyzing attainability of information goals of BI systems we therefore have to use information quality criteria. One of the broadest and thorough analysis provided Eppler [3] who by reviewing relevant literature about information quality identified 70 criteria for quality with some of these partially or fully overlapping. The outcome of his research is so called Eppler's framework with 16 criteria covering all aspects of information quality.

Phase	Criterion name	Description
IDENTIFICATION	Comprehensiveness	Is the scope of information adequate? (not too much nor too little)
	Conciseness	Is the information to the point, void of unnecessary elements?
	Convenience	Does the information provision correspond to the user's needs and habits?
	Accessibility	Is there a continuous and unobstructed way to get to the information?
EVALUATION	Accuracy	Is the information precise enough and close enough to reality?
	Consistency	Is the information free of contradictions or convention breaks?
	Timeliness	Is the information processed and delivered rapidly without delays?
	Security	Is the information protected against loss or unauthorized access?
ALLOCATION	Clarity	Is the information understandable or comprehensible to the target group?
	Correctness	Is the information free of distortion, bias, or error?
	Traceability	Is the background of the information visible (author, date etc.)?
	Maintainability	Can all of the information be organized and updated on on-going basis?
APPLICATION	Applicability	Can the information be directly applied? Is it useful?
	Currency	Is the information up-to-date and not obsolete?
	Interactivity	Can the information process be adapted by the information consumer?
	Speed	Can the infrastructure match the user's working pace?

Tab. 1. Description of the selected criteria [3].

Eppler's framework consists of 4 elements:

- Vertical structures with four criteria levels: suitability and own characteristics (covering content quality) and optimized information gathering process and infrastructure reliability (covering access quality),
- Horizontal structure divided into four phases of information usage cycle: identification (where is the information we need?), evaluation (can we trust it?), allocation (can we adapt it to our current situation?), and application (how can we best use it?) (see figure 1).
- Sixteen criteria disposed in categories and information process phases (see table 1)
- Principles for improved information quality.

Quality information acts as key element in business process management by enabling results follow-up, on-line process analysis and control, and consecutively dynamic adjustment of organization [8]. Since information quality, as previously defined, can be influenced by appropriate IT we can assume that this can be used to explain the interrelations between IT, business process management and business performance.

With the help of analysis of connections between BI solutions and information quality criteria we can define and later check fulfillment of information goals. Thus, for example, data warehouse can contribute to information versatility (comprehensiveness criterion) since by integrating data sources we can acquire a whole

view of business operations that are subject of interest when solving a specific business problem.

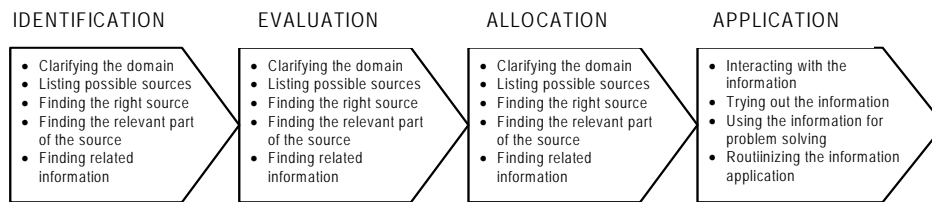


Fig. 1. Information usage cycle [3].

From information goals' view the most perceivable benefits include increase of information quality through the comfort and speed of information gathering, interactivity etc. As a result, there are shorter times for business decisions taking, especially in the part of information gathering and analysis that are the basis for decision acceptance. The decision times can, however, also extend. It is important to note that the decision process can begin earlier since BI systems contribute to earlier identification of events worth reacting to (figure 2). Thus we can look at BI system as key element for business performance management (BPM) since it reduces the time frame between the occurrence of a business event and the response to it.

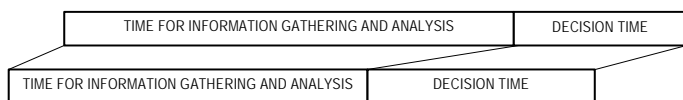


Fig. 2. Decision process before and after introduction of BI system.

#### 4 Business Value of Business Intelligence Systems

Although the perceived benefits from BI systems in terms of better information quality or achievement of information goals are far from being neglected and with their analysis to be reasonable and necessary, we believe that these are only indirect goal to business benefits or business value of such systems. Examples of questions that we can ask ourselves when verifying economic justification of these systems within cost-benefit analysis are:

- Because of integrated data and a whole view of a customer are we going to handle the customer differently? Will we, because of whole information about our supplier, be able to negotiate better deals?
- Will we be able because of faster access to data (without the need to hard-code the reports due to interactive information access) to respond to different

events faster and thus lower the business risk and exploit business opportunities?

- Will a more customized access to information provide a proper format of information to a wider range of users on different levels of decision? Will this have an impact on organizational structure and business process execution?

Thus, business value of BI systems does not hide in better information quality but in improved business processes and thus in improved business performance as a result of improved information quality (figure 2). In the private sector, business performance ultimately means revenue generation and profit delivery. In the public sector, it means accomplishing a mission with an affordable balance between service level and productivity. In either venue, an investment in BI must return profits or cost savings that exceed the amount invested or business value will actually be lost.

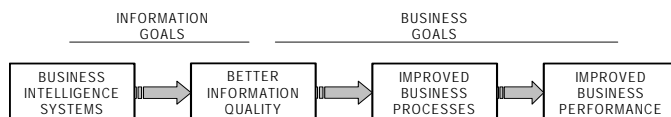


Fig. 3. Information and business goals of BI systems.

When analyzing the business view of justifying investments in BI systems we have to think from opposite direction. We derive from business strategy, vision and goals and ask ourselves how BI systems can contribute to the realization of key business processes by adding value to them [18]. Improvements in information processes in terms of shorter times for information preparation and with these linked savings are as a rule a minor part of benefits BI systems provide.

We understand the business value of BI in its ability to improve the effectiveness of the core business processes that drive business performance (see figure 4). This is in accordance with [18] and it is also comparable with the findings in [5] where authors ascertain a new role for informatics: it has to shift from traditionally support function to a mechanism management uses as a mean for achieving organizational goals. To put it

another way, IS staff has to overcome traditional thinking about providing the best IT support to business users and thus the fulfillment of information goals (the first arrow in figure 3) and move on to embrace the whole chain of analysis of business value creation (see figure 3). This also includes SWOT analysis of BI initiatives and opportunities.

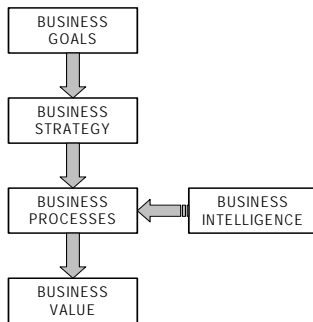


Fig. 4. How BI can be used to create business value.

To ensure a return on an investment in BI, we have to identify and manage those factors that make a difference in whether the investment pays off. From a technical perspective, there is an established body of knowledge around data warehousing that we can deploy to ensure that fundamentals of acquiring, staging, and delivering information and BI systems are done correctly. From a business perspective, we are primarily concerned that BI initiatives are focused on business processes that make a difference. We cannot expect much of an ROI on BI initiatives aimed at tangential parts of the business. To have a profit impact, BI investments must be directed at management processes and/or business processes that have the greatest impact on profits (private sector) or productivity and service (public sector).

Figure 5 illustrates an example of analysis of BI system impact on improved business processes. Thus, an improved consistency of information can lead to better budgeting planning and better cost analysis which are important grounds in corporate financial planning. In negotiations with our business partners (e.g. suppliers, logistics partners) improved timeliness and information currency can help us gain better deals. Another example of positive impact of BI system through improved information usefulness (applicability) is on marketing campaign management process: up-to-date and useful information can help promote goods and services to right target audience with desired impact. Among revenue generating processes another example would be better understanding of customer needs for goods and services that can be achieved through precise and right amount of information about our customers. Nevertheless, BI systems can also help to improve order management processes (through information to the point) and supply

chain management process (through improved applicability and timeliness).

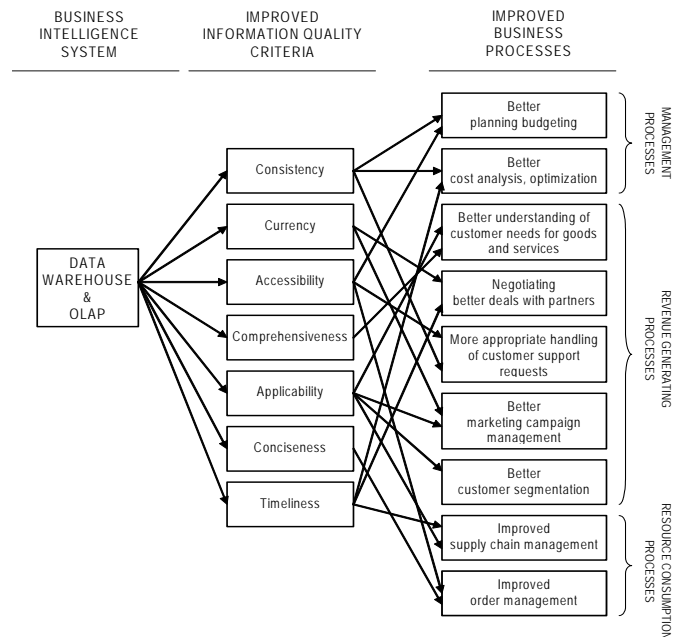


Fig. 5. An example of analysis of BI system impact on improved business processes.

#### 4 Conclusion

BI systems should meet the business requirements, facilitate the use of BI, support the accomplishment of strategic business objectives, enable improvements in business processes, and improve communication and cooperation across organizational units. Measuring the benefits of BI is not simple. Many of the effects that BI is assumed to create consist primarily of nonfinancial, and even intangible, benefits such as improved quality and timeliness of information ([9]). Although the nonfinancial effects should lead to financial outcomes (e.g. cost savings), there may be a time lag between the production of the intelligence and the financial gain. Therefore, measurement in practice is quite difficult.

For analyzing benefits of BI systems we propose a framework that is based on three tier analysis of their business value, where we separate the goals of better information quality from business goals (e.g. changes in business processes that contribute to the fulfillment of strategic business goals and more appropriate response to business drivers). This is also the main difference between traditional decision support systems (covering the needs of narrow problem areas) and BI systems (based on integrating decision support on the organizational level and strategic orientation). Justification of BI systems has therefore to be business (not technology) oriented and act as an enabler for

reaching business goals of an organization. When deciding upon the introduction of BI system we have to estimate the risks of introducing as well as not introducing such system.

Based on our findings we would like to emphasize the following critical factors for successful introduction of BI systems:

- There is a great necessity for partnership between management and informatics within an organization.
- BI system introduction and development has to be based on decision support strategy of the organization as a whole.
- Since business value of BI systems derives from improved business processes based on better information quality it is mandatory for its achievement a proper culture for business process improvement (perhaps even renovation).
- There is a need for iterative and fast introduction of such systems.

When deciding upon BI systems projects management has to take a broader view of expected results. However, it is very important to keep in mind that BI systems as a rule do not directly generate business value but this arises as a result of improved core and key business processes.

#### References:

- [1] M. Azoff and I. Charlesworth, *The New Business Intelligence. A European Perspective*, Butler Group, White Paper.
- [2] A. K. Dasgupta and D. W. Pearce, *Cost-Benefit Analysis: Theory And Practice*, Macmillan Education, 1992.
- [3] M. J. Eppler, *Managing Information Quality*, Springer-Verlag, 2003.
- [4] V. Farrell, *Realizing Data Warehouse Return on Investment (ROI)*, <http://www.terradata.com>, 2003.
- [5] A. Groznik, M. Indihar Štemberger and A. Kovačič, Vloga menedžmenta pri zagotavljanju poslovne vrednosti informatike, *Uporabna informatika*, No. 4, 2005, pp. 213-222. (in Slovene)
- [6] M. Hammond, The Fact Gap: The Disconnect Between Data and Decisions – A Study of Executives in the United States and Europe, *Business Objects*, 2003.
- [7] IT strategies, *Fact Gap Fuels ERP Investments and Invites Printer Vendors to Ride the Wave*, <http://www.techexchange.com/>, 2006.
- [8] A. Kovačič and V. Bosilj-Vukšić, *Business process management* (in Slovene), GV-Založba, 2005.
- [9] A. Lonnqvist and V. Pirrtimaki, The Measurement of Business Intelligence, *Information Systems Management*, No. 23, Vol. 1, Winter 2006, pp. 32-40.
- [10] D. A. Marchand, W. J. Kettinger and J. D. Rollins, *Information Orientation: The Link to Business Performance*, Oxford University Press, 2001.
- [11] H. Morris, The Financial Impact of Business Analytics: Build vs. Buy, *DM Review*, January 2003, [[http://www.dmreview.com/article\\_sub.cfm?articleId=6189](http://www.dmreview.com/article_sub.cfm?articleId=6189)]
- [12] J. D. Power, Justifying a Data Warehouse Project, [<http://www.hpcwire.com/dsstar/98/0203/100092.html>], 1997.
- [13] A. Rejc Buhovac, Methodology for evaluating performance in information technology (in Slovene), *Uporabna informatika*, No. 4, 2005, pp. 223-229. (in Slovene).
- [14] B. Taub, Data Warehouse Return on Investment: Myths and Mistakes, *DM Direct*, December 1999.
- [15] E. Turban and J. E. Aronson, *Decision support systems and intelligent systems*, Prentice-Hall, London, 2001.
- [16] H. J. Watson, D. L. Goodhue and B. H. Wixom, The Benefits of Data Warehousing: Why Some Organizations Realize Exceptional Payoffs, *Information & Management*, No. 39, 2002, pp. 491 - 502.
- [17] H. J. Watson and B. J. Haley, Managerial Considerations, *Communications of the ACM*, Vol. 9, No. 41, 1998, pp. 32 - 37.
- [18] S. Williams, Assessing BI Readiness: A Key to BI ROI, *Business Intelligence Journal*, Vol. 3, No. 9, Summer 2004, pp.15-23.
- [19] J. Wu, Business Intelligence: Calculating the ROI for Business Intelligence, *DM Review*, July 2000, [[http://www.dmreview.com/article\\_sub.cfm?articleId=2487](http://www.dmreview.com/article_sub.cfm?articleId=2487)]