

USING ADVANCED BUSINESS INTELLIGENCE METHODS IN BUSINESS PROCESS MANAGEMENT

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ABSTRACT

Business intelligence refers to computer-based techniques used in discovering, processing and analyzing business data to present statistics of business process to managers and analytics. Is a set of applications and techniques used for gathering and analyzing data stored in data warehouses and data marts. Integrating advanced business intelligence methods, such as data mining, predictive analytics and complex analysis, into business process management becomes essential for business. In this way analysts and managers of business processes with the successful use of mentioned methods have the opportunity for effective business and this reduces total cost of ownership.

A major challenge is: How to establish business intelligence methods in process management using service oriented architecture? In the article we will discuss the issue of integrating business intelligence with business process management and use of advanced business intelligence methods to create complex reports and analysis.

1 INTRODUCTION

One of the most important steps in the efficient business is understanding business process flow and its proper managing and monitoring. This can be achieved by using business process monitor managements systems (E.g. Business Activity Monitoring) which graphically displays the efficiency of key performance indicators. Thus managers and analysts in a quick and effective way obtain information about critical business process activities – this leads to fast response and problem solution, business can be more efficient by using advanced business intelligence methods. In the article we will discuss the issue of using advanced business intelligence methods for creating complex reports and analysis and fill the gap integration between business intelligence and business process management.

2 BUSINESS INTELLIGENCE

In the business, most of the analysts and managers need access to accurate and timely information which helps them

to reach their business goals. To understand the past behavior of their business, they must have access to preliminary data. But today the focus is on getting access to current transactions and business events in order to react quickly to new demands, market pressures, competitor movements, and other business challenges.

Business intelligence (BI) is the process where users obtain accurate and consistent business data from the enterprise data warehousing environment (e.g. data warehouses, data marts). With obtained data from different business context, users can analyze and identify trends and anomalies, execute simulations and obtain insights about business problems. [3]

2.1. Benefits of business intelligence

Recently the concept of business intelligence has gained huge significance in every organization. But if we want to understand this significance, we need to know and understand the most common benefits of business intelligence. We also need to be aware that benefits of using business intelligence depend on the size and structure of your business and will vary. However, there are a number of benefits that are common to all businesses that deploy BI. [3]

Common benefits of business intelligence are listed below:

- Helps align the organization towards its key objectives.
- Empower analysts and managers with a single version of the truth.
- Enables faster and fact-based decision making.
- Meet or exceed your customer expectations - based on factual information.
- Find latent problems by building a picture of the information we cannot see.
- Get instantaneous answers to next business question. The next business question is the question that you did not know existed until you began looking at data.
- Quickly recognize what are competitive advantages.
- Combines multiple sources of data for decision making
- Efficient collection and distribution of essential data and statistics.

2.2. Life cycle of business intelligence

The successful introduction of business intelligence requires four steps, which are with each other connected cyclically. Figure 1 show the life cycle of business intelligence.

- **Getting accurate data** – Getting large amount of data from data warehouses, data marts, databases and other sources.
- **Analyzing the data obtained through BI operations** – Complex elements are extracted into smaller segments for better understanding and creating new knowledge. Business problems are solved by indentifying business needs. Reporting components (annual reports, analysis, dashboards, charts, etc.) are created.
- **Identifying trends, changes and incorrectness** – Trend forecasting by using predictive analytics. Identify threats and opportunities within the business by using complex mathematical methods and algorithms
- **Simulations and gaining new knowledge** about business problems and opportunities.

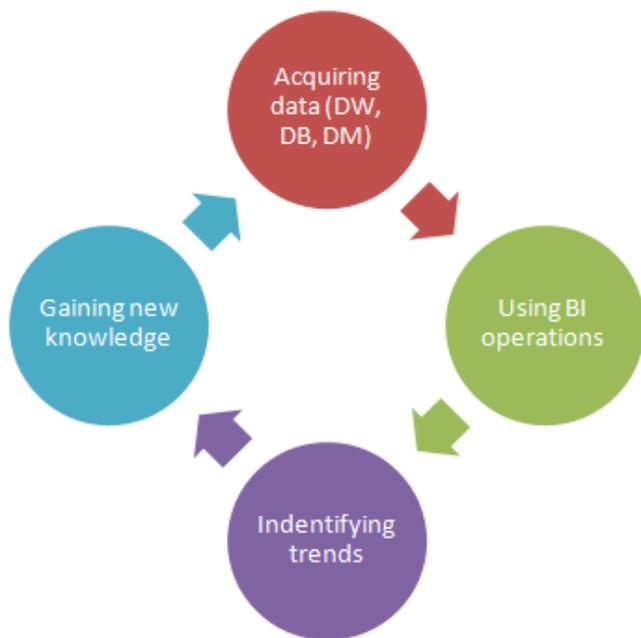


Figure 1: *Life cycle of business intelligence.*

3 ADVANCED BUSINESS INTELIIGENCE METHODS

In the next section we will discuss using advance business intelligence methods in business process management to create complex reports and analysis. [4]

3.1 Complex analysis

Online Analytical Processing (OLAP) is an important component of business intelligence. Using a data structure (OLAP cube) enables fast data analysis and is defined as the ability to manipulate and analyze data from different perspectives. OLAP is a tool which allows fast creation of

data inquiries and overcomes the limitations of rational databases. Its purpose is to enable fast and user-friendly queries for data. Data warehouses configured for OLAP use a multidimensional data model which allows complex analytical and ad-hoc queries with a rapid execution time. The typical OLAP applications are used in business reporting for marketing, sales, business process management, forecasting, financial reporting and etc. With the support of OLAP the analyst navigate through the database, data warehouse or data mart and search for a particular subset of data, changing the data's orientation and defining analytical calculations. Common operations of OLAP are: [4]

- **Slice and Dice** – Slicing refers to the ability to combine and re-combine the dimensions to see different slices of the information. The dice operation is to slice a data cube on more than two dimensions. Analysis across several dimensions and many categories of data items are used to uncover business behavior and rules. Analysts use this operation to answer your next business question.
- **Drill Down/Up** – Specific technique where analyst navigate among different levels of data.
 - Up mean to move to less detailed information. We see less detailed information or the parent of the child that we are currently viewing.
 - Down mean to move to more detailed information.
- **Pivot** – This technique changes dimensional orientation of report. E.g. changing the dimensions from columns in row and vice versa of the table.
- **Nesting** – Display data dimension one dimension within another.

3.2 Predictive analytics

Nowadays, business is all about placing bets and knowing if the odds are in our favor. Business success depends on being capable to understand and analyze the future and take correct actions as soon as possible. Business analytics and managers must be able to predict the future scenarios well enough to prepare plans to seize opportunities, neutralize threats and mitigate risks. Predictive analytics here plays an essential role and helps to plan day-to-day operations in business. Predictive analytics, using obtained information about data from data warehouses with help of mathematical algorithm, predicts the trend of business processes. The results of predictive analytics are used to identify patterns, trends and forecast business activity flow. The accuracy of forecast depends on the complexity of data interdependence. By increasing the number of variables we get less accuracy forecast. [4]

Methods and algorithms for predictive trends are:

- Regression techniques (Linear regression model).
- Discrete choice models (Logistic regression, Probit regression, Multinomial logistic regression).
- Time series models.

- Survival or duration analysis.
- Classification and regression trees.
- Multivariate adaptive regression splines.
- Machine learning techniques (Neural networks, Radial basis functions, Naïve Bayes, K-nearest neighbors).

Predictive analytics model

Business predictive analytics model analyze historical events and data with goal to find patterns of subtle data in relation to surround which uses data on dependent and independent way. Prediction models often perform real-time transaction and calculations for the purpose of introduction data-driven decisions which lead to efficient and effective business. [6]

3.3 Data mining

Data mining is a process of obtaining and detecting patterns in data. Mainly is used in different practical situations such as marketing, supervision and fraud detecting. Is a process which detects important correlations, patterns and trends with analysis of large amount of data stored in data warehouses. Data mining uses tools and statistical and mathematical techniques to detect patterns in data. Knowledge of these hidden relations provides valuable insight into key business drivers. [3]

We know two basic types of data mining:

- **Hypothesis validation** –Used when we have an idea or a hunch about important relations between data elements.
- **Knowledge discovery** – This type of data mining is used when we may have unknown statistically significant relations between data elements which are difficult to recognized.

The most common tasks which can be done using data mining are:

- **Classification** – Indicates the characteristics of a particular group. A characteristic of each group is used to design a model, which allows the classification of new, unknown samples to one of the groups.
- **Clustering** – Identifies groups of things that have certain common characteristics.
- **Association** – Finds the relations between events which happen at a given time.
- **Sequencing** – Is similar to association. The different is that here we are looking for relations according to the time period.
- **Regression** – Is a form of appraisalment which is used to display information according to predictive value. Linear and nonlinear techniques are used.

- **Forecasting** – Predicting future values based on patterns and large data sets.

4 INTEGRATING BI WITH BPM

Organizations which want to understand and optimize their core processes and operations need to establish integration between business intelligence and business process management (BPM). With this integration users can directly invoke additional business processes as a result of business insight. Majority of medium and large organizations use the special software for managing and tracking critical business functions. Generally, the integration of complexity and heterogeneity of IT infrastructure and applications represents a major challenge. [5][7]

4.1 Integration problems

Most organizations have failed in process of establishing a successful integration between business intelligence and business process management. One of the major reasons is that the solutions and tools for business process management are offered by different vendors as tools which can be established BI, thus, the lower the change of integration significantly. Even more difficult is integrating that data management entirely on a different area organization such as the development of business processes. Solution that can solve these problems is use of service oriented architecture. SOA enables easy use of business processes with business intelligence services through enterprise service bus. [5] Problems often occur with less-structured and more far-flung data environments where we have frequently changing system source. One of the problems is that most enterprise integration and BI is centralized, while the data is distributed. The solution is to move to a more distributed integration model, where data is ready and available as a service to the individual. The individual is already performing much of the innovation, exploration and integration, and this distributed model facilitates the process.

4.2 Data level integration

Recent approaches to integration between business intelligence and business process management have been very limited and simply reduced to the problem of technical integration between BPM in BI systems. Without doubt the technical integration between those systems is very complex. But when we solve this problem, efficiencies and opportunities in solving real-time problems in organization, increase. [1]

In this section we will discuss integrating BI and BPM. There are several levels (e.g. data level integration, user view integration, etc.) of integration of those two areas. Bellow we will take a look to the data level of BI and BPM integration.

As shown in Figure 2 first step represents the execution of processes in which new events are generated. Processes run

on process server. Through Enterprise Service Bus (ESB) different web services communicate and one of them collects new generated information about events. ESB provides fundamental services for complex architectures via an event-driven and standards-based messaging-engine. The main purpose of the ESB is to interrupt links between services and their users. Later all collected events are filtered, merged and transformed. Structural data is then stored in specific data warehousing environment where they are collected and wait to be used when it is necessary. Collected data is now prepared to be use in BI and Business Activity Monitoring (BAM) systems. On these manner users have possibilities to generate complex reports, analysis and dashboards about business processes. [1] [2]

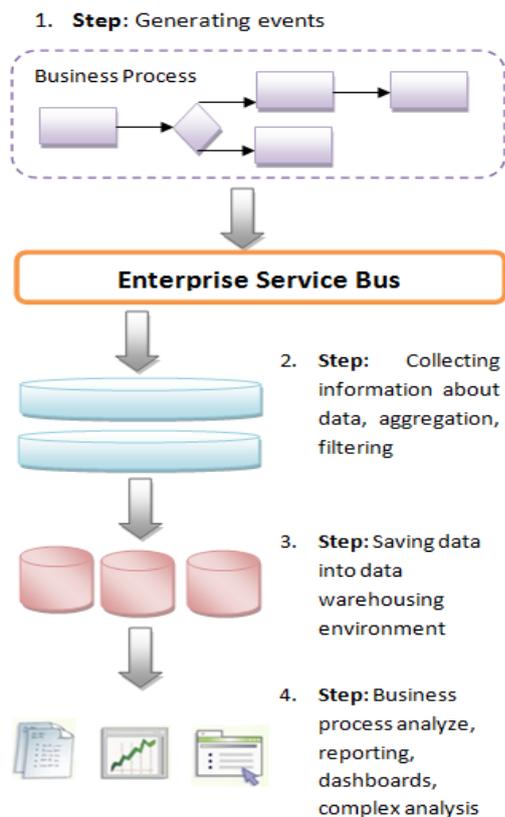


Figure 2: Data level of BI and BPM integration.

4 CONCLUSION

In this paper we discussed integration between business intelligence and service oriented architecture and meaning of using advanced business intelligence functions in the workflow management. Experience from past indicated that successful business requires business process monitoring using different systems and tools (E.g. BAM). This way

business analysts and managers gain important information about activity of organization and with the help of reports, analysis, and dashboards they get insight into what happened in their own organization. But business results are more efficient if they are able to answer following question: *Why at some point the effectiveness of key performance indicators is under the critical level?* Answer to this question is using business intelligence in correlation with business process management and service oriented architecture. We described advanced business intelligence methods which help to create complex analysis in reports. If we want to use those methods with business processes successfully we need to establish integration between BI and BPM which is not always an easy task.

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Operation part financed by the European Union, European Social Fund. Operation implemented in the framework of the Operational Program for Human Resources Development for the Period 2007-2013, Priority axis 1: Promoting entrepreneurship and adaptability, Main type of activity 1.1.: Experts and researchers for competitive enterprises.