UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER'S THESIS

AN ANALYSIS OF THE IMPLEMENTATION PROCESS OF A BUSINESS INTELLIGENCE SYSTEM IN PIVOVARNA LAŠKO UNION

Ljubljana, February 2019 ANA ANGJELESKA

AUTHORSHIP STATEMENT

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LIST OF ABBREVIATIONS

BI – Business Intelligence
BICC – Business Intelligence Competence Center
BI portal - Business Intelligence portal
CIO – Chief Information Officer
DW – Data warehouse
EDI – Electronic Data Interchange
ETL – Extract, Transform, Load
HGC – Heineken Governance Cycle
IS – Information System
IT – Information Technology
KPI – Key Performance Indicator
MDB - Multidimensional database
OLAP - Online Analytical Processing
PLU – Pivovarna Laško Union d.o.o
ROI – Return on Investment
SCT - Social Cognitive Theory
SQL – Structured Query Language
TAM - Technology Acceptance Model (TAM),
TTF - Task Technology Fit

INTRODUCTION

Business Intelligence (hereinafter: BI) systems have been highlighted as one of the riskiest Information Technology (hereinafter: IT) investments, requiring collaboration among IT and business leadership, accounting and finance personnel, and operational-level managers of firms to generate business value (Wagner & Weitzel 2012). Thus, successful deployment and use of BI systems requires a broad organizational effort blending organizations' resources and a synergistic effort between business and IT people (Anderson-Lehman, Watson, Wixom & Hoffer, 2004).

According to Kimball, Ross, Mundy and Thornthwaite (2015), there are three critical areas that organizations should assess before getting ready to do a BI project:

1. The level of commitment and sponsorship of the project from senior management
2. The level of business need for creating a BI implementation
3. The amount and quality of business data available

As almost every other kind of engineering project, a BI system project goes through six stages between inception and implementation (Moss & Atre, 2003):

1. **Justification:** The first stage assesses the business need for the development of the new Business Intelligence project.
2. **Planning:** In the planning stage strategic and tactical plans are developed which provide the basis for how the BI project will be created and implemented.
3. **Business analysis:** The business requirements for the BI system need to be fully understood, and for that purpose a detailed analysis of the business needs to be performed.
4. **Design:** Design a solution for the business need.
5. **Construction:** Build the product i.e. create the BI system
6. **Deployment:** Implement the BI system and determine whether it meets the customer's needs.

Once deployed, a product is continually improved and enhanced based on the feedback from the business community that uses the product.

The literature on Business Intelligence besides offering a roadmap for implementation (Moss & Atre, 2003; Grossmann & Rinderle-Ma, 2015), also provides us with an understanding of the benefits of BI systems (Hočevar & Jaklič 2010; Popovič & Jaklič, 2010; Chen & Siau, 2012). Consequently, extensive research has been conducted on many case studies which discuss the benefits and applications of BI (Rohloff, 2011; Andronie, 2015). However, the literature does not seem to offer any case examples on the challenges companies run into while undergoing this process and no actual best practices which would help other companies with

their own BI system projects. The case studies do not explain the obstacles the companies run into during this project implementation and how they are overcome.

The motivation for this research is to understand and analyze the process of BI implementation by looking into a specific company in Slovenia, Pivovarna Laško Union d.o.o.

The main purpose of my master thesis is to provide a set of best practices for future use by examining and analyzing the process of implementing a Business Intelligence system and how it unfolds in order to shed some light on the challenges faced during the implementation and the opportunities that arise from using a Business Intelligence system.

I will analyze the company structure, the areas of use for the BI system, the user acceptance, the challenges faced and overcome during the process of implementation as well as the opportunities for improving the workflow efficiency.

My master thesis research questions are:

- What are the challenges run into when implementing a Business Intelligence system?
- What are the best practices?

The most appropriate approach for answering these questions and accomplishing the purpose is a case study. The structure of this thesis is divided in three parts. The first part explores the literature review on Business intelligence discussed through some general concepts of business intelligence terms, technology and implementation steps. The second part is empirical. Here it is explained that the research was conducted using focus interviews, review meetings, observation of the work and official documentation. The third part covers the purpose of my research which is an analysis of the implementation process of a BI system and the results of the research, which are the best practices. The thesis finishes with concluding remarks and recommendations for future research.

1 BUSINESS INTELLIGENCE AND BISUNESS INTELLIGENCE TECHNOLOGIES

1.1 Definition of Business Intelligence

Business Intelligence is a set of methodologies, architectures, technologies, applications and practices that are used to collect, transform, integrate, analyze and present data and information necessary for organizations to improve their decision making (Rud, 2009). The first reference for the term Business Intelligence appears in 1958 in a paper of H.P. Luhn who defined a business intelligence system as "an automatic system that is being developed to disseminate information to the various sections of any industrial, scientific or government organization"

combined from the definitions of "Business" as "a collection of activities carried on for whatever purpose, be it science, technology, commerce, industry, law, government, defense etc." and "Intelligence" – "the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal" (Luhn, 1958).

Business Intelligence as we know it today, has evolved from DSS- Decision Support Systems which appeared in 1960 and were further developed in the mid-1980s, when in 1989 Howard Dresner introduced Business Intelligence as an umbrella term for a set of concepts and methods to improve business decision making, using fact – based support systems. Namely, Business Intelligence systems are data-driven DSS (Dresner, 1989).

According to Moss and Atre (2003), business Intelligence is an architecture and a collection of integrated operational as well as decision-support applications and databases that provide the business community easy access to business data. They suggest that BI decision-support applications facilitate many activities, including:

- Multidimensional analysis - online analytical processing
- Data mining
- Forecasting
- Business analysis
- Balanced scorecard preparation
- Visualization
- Querying, reporting, and charting (including just-in-time and agent-based alerts)
- Digital dashboard access
- Other cross-functional activities

Moss and Atre (2003) give the following examples of BI decision-support databases:

- Enterprise-wide data warehouses
- Data marts (functional and departmental)
- Data mining databases
- Operational data stores
- Operational marts
- Other cross-functional decision-support databases

Over the years there have been different definitions for Business Intelligence by different authors. According to Chaudhuri and Narasayya (2007), business intelligence is "a collection of decision support technologies for the enterprise aimed at enabling knowledge workers such as executives, managers and analysts to make better and faster decisions". Business intelligence is defined as "providing accurate information to the right people at the right time. The term also means the capability to transform existing data into information that everyone in the

organization can trust and which they can use to adopt effective decisions" (Miller, Brautigam & Gerlach 2006). Howson (2013) defines business intelligence is a technology that allows people from all levels of an organization to access, interact and process data for an enterprise's management, to improve its performance, to discover new opportunities and to work more efficiently. According to Andronie (2015), the essential functionalities of *business intelligence* systems are:

- Business processes performance and measurement of the objectives achievements
- Quantitative analysis by predictive analytics, predictive modeling, business process modeling, statistical analysis
- Ease the process of reporting at department or company level
- Ability to use different tools to enable people inside and outside of the company to work through electronic data interchange (hereinafter: EDI) or by data sharing;
- Enable managers to make informed decisions using the available information and identify outliers

BI is both a process and a product (Jourdan, Rainer & Marshall, 2008). From the perspective of a process, BI aims to increase the decision-making quality and to reduce the time it takes (Pirttimaki & Hannula 2003). It encompasses complete data warehousing process, including data extraction, transformation, and loading (hereinafter: ETL). On the other hand, from the perspective of a product, BI is a family of products that support business users' decision-making processes - from quick access to business information to easy creation of reports. It provides powerful tools to perform query, report, and multidimensional analysis. Thus, BI provides friendly interfaces for supporting business users to read information and to create reports (Inmon, 1992).

As stated by Popovič, Coelho and Jaklič (2009), there is a high level of awareness about the potential benefits of business intelligence. Due to its significant impact on a company's performance, it is a top IT priority and many companies have also made it a top strategic priority.

According to Gangadharan and Swami (2004), BI is the use of technology to help companies make better business decisions. They suggest that BI systems provide the information needed for employees to improve their efficiency and more easily analyze the data, and consequently improve the overall company performance. Additionally, BI systems help companies thoroughly investigate their activities in order to find new ways to save money or acquire new streams of revenues (Gangadharan & Swami, 2004).

A lot of BI projects fail because of weak project management, poor planning, low quality data or undelivered business requirements. For a successful implementation of a BI project, managers need to understand the BI processes and activities, and they also need some

guidelines for what to do and what not to do during the phases of implementation. (Moss & Atre, 2003).

1.2 Business Intelligence technologies

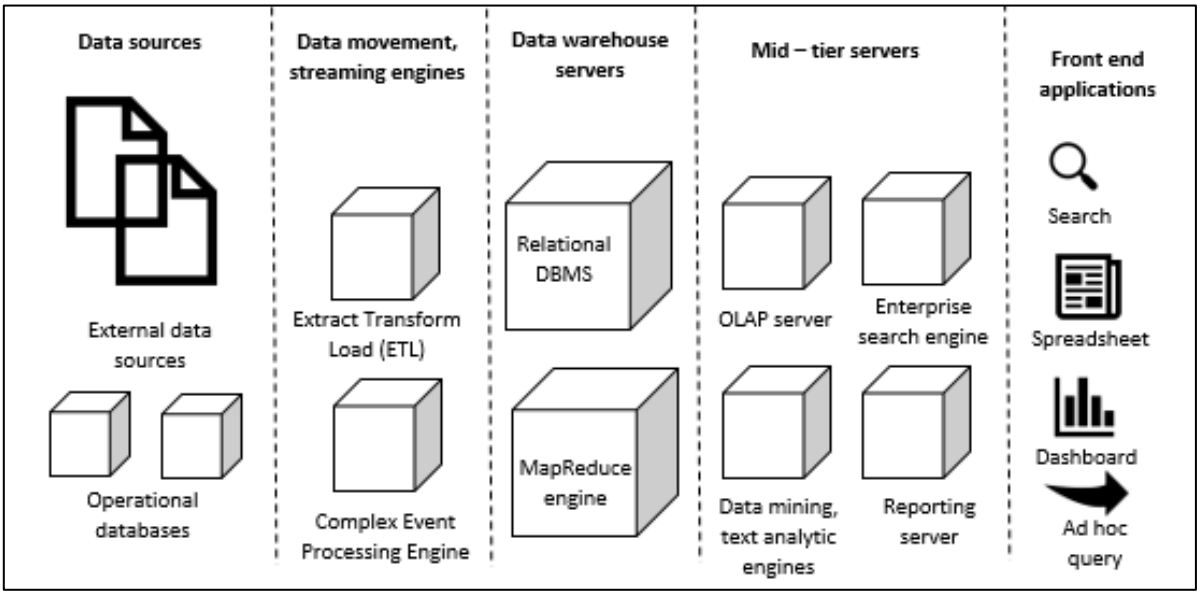
In this section of the thesis the most important business intelligence terms will be explained for a better understanding of the business intelligence technology which follows.

1.2.1 An Overview of Business Intelligence Technology

The data on which BI tasks are performed usually comes from multiple databases from different departments of the company. This various data needs to be reconciled due to differences in data formatting, quality etc. and the process of cleansing, standardizing and integrating of the data can be challenging. The process of preparing the data for the BI is called Extract Transform Load (ETL). The data is extracted from the multiple databases and loaded in a repository called data warehouse which is managed by one or more data warehouse servers. A popular choice for storing and querying warehouse data is a relational database management system. The users search through the data using Structured Query Language (hereinafter: SQL) queries. Data warehouse servers are accompanied by a set of *mid-tier servers* that provide specialized functionality for different BI scenarios. The multidimensional view of data and the options of filtering, pivoting and drill-down are available to the users through the BI applications provided by Online Analytical Processing (hereinafter: OLAP) servers (Chaudhuri, Dayal & Narasayya, 2011).

There are several frontend applications through which users perform BI tasks: spreadsheets, enterprise portals for searching, performance management applications to track key performance indicators of the business using visual dashboards etc. Visualization of data can enable decision makers to interactively track the data and discover patterns and outliers. Another important area in business intelligence is mobile BI, which provides opportunities for users to use the BI on smart devices, anywhere and at any time.

Figure 1: Typical Business Intelligence

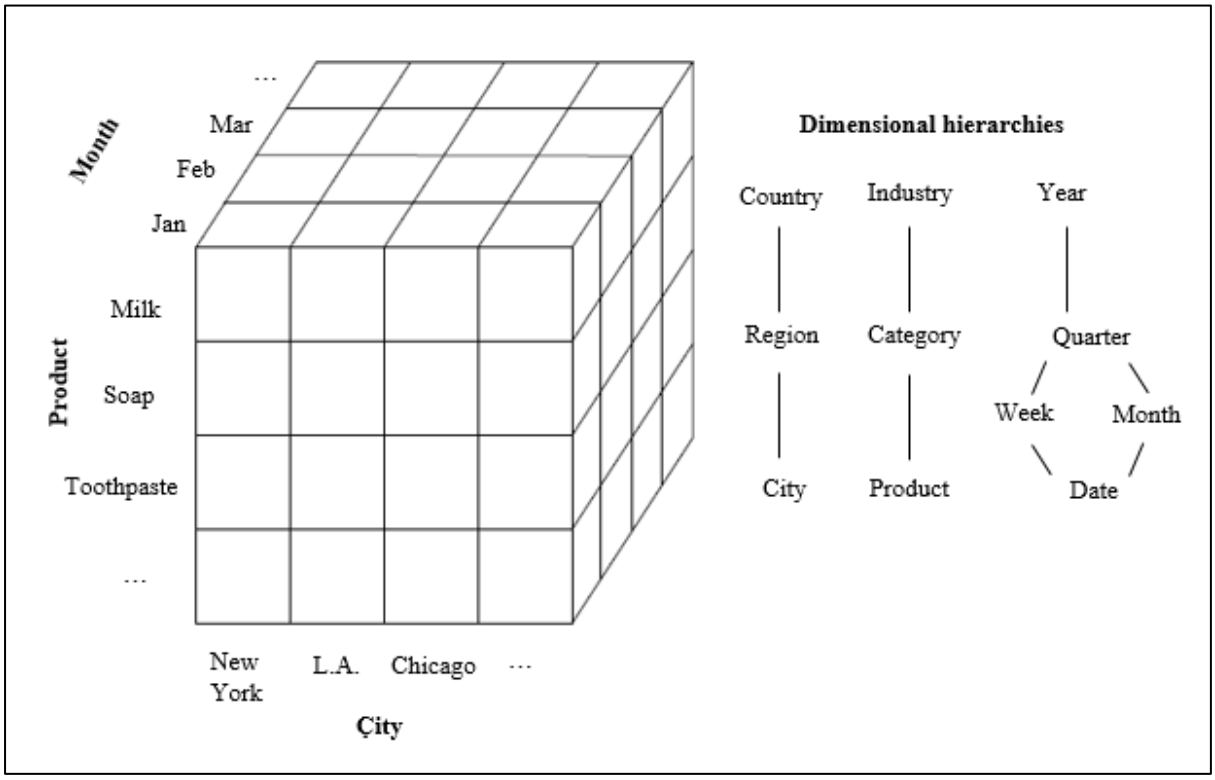


Source: Chaudhuri, Dayal & Narasayya (2011).

1.2.1.1 Query Processing

The multidimensional view of data is a popular model used for BI tasks, as shown in Figure 2. In such data model, there is a set of numeric measures that are the objects of analysis and each of these numeric values is related to a set of dimensions which provide the context for the measure. Examples of such measures are sales, budget or revenue and the dimensions related to a sale can be product, customer or city. Hence, a measure can be understood as a value in the multidimensional space of dimensions. Each dimension is associated with a set of attributes, for example, the city dimension may consist of: the neighborhood, the address or the post code attributes. The attributes of a dimension may be related via a hierarchy of relationships. A distinguishing characteristic of this model is its emphasis on aggregation of measures by one or more dimensions; such as the total sales for a product by country in a given period of time.

Figure 2: Multidimensional data



Source: Chaudhuri, Dayal & Narasayya (2011).

1.2.1.2 Extract-Transform-Load Tools

In order to get accurate reports at the right time, as well as create an informative predictive analysis, high quality data needs to be loaded in the data warehouse from operational databases and external sources. Extract Transform Load (ETL) is a collection of tools that help discover issues with data quality, consequently correct those issues and load data into the data warehouse.

Data load and refresh is a tool which is responsible for moving the data from the operational databases and external sources to the data warehouse quickly and efficiently. There are two major points here. First, the data that needs to be moved needs to be identified and collected at the sources. For this purpose, transaction logs or filters are used. The second challenge is related to techniques for efficiently moving captured data into the warehouse. Partitioning the data helps minimize the disruption of queries at the data warehouse server. Finally, data load and refresh utilities are used as checkpoints for the operation so that in case of a failure the work is saved up until this point (Chaudhuri, Dayal & Narasayya, 2011).

1.2.2 Online Analytical Processing

Online Analytical Processing is a computer processing technology behind many Business Intelligence applications which allows the users to selectively extract and view the desired data.

It is a powerful technology for data mining or discovery of previously unrelated relationships between data items, report viewing, complex analytical calculations, planning, forecasting and building predictive "what if" scenarios. To provide users with this kind of analyses, OLAP data is stored in a multidimensional database. A multidimensional database considers each attribute in the relational database as a separate dimension. OLAP tools provide users the ability to analyze multidimensional data interactively from multiple perspectives. OLAP has three analytical operations: consolidation, drill-down, and slicing and dicing. Consolidation is the aggregation of data that can be accumulated in one or more dimensions. Drill-down is an operation that allows users to navigate through the details. Slicing and dicing is an operation with which users can take out a specific set of data of the OLAP cube and view the slices from different viewpoints. These viewpoints are sometimes called dimensions. Databases configured for OLAP use a multidimensional data model, allowing for complex analytical and ad hoc queries with a rapid execution time. They combine aspects of navigational databases, hierarchical databases and relational databases (O'Brien & Marakas, 2009).

1.2.3 Relational database

Codd defines a relational database as "a collection of data items organized as a set of formally described tables from which data can be assessed, assembled and reassembled without having to change or reorganize the actual database". A relational database is a set of tables containing data fitted into predefined categories and each table contains one or more data categories in columns. Each row in a table contains a unique instance of data for the categories in the columns. A user of the database could get a view of the database that matches the user's needs. While being easy to create and access, a relational database also has the ability of being easy to extend. After the original database is created, a new data category can be added without requiring that all existing applications be modified (Codd, 1970).

1.2.4 Multidimensional database

A multidimensional database (hereinafter: MDB) is a type of database that is optimized for data warehouse and online analytical processing applications. It is a variation of the relational model that uses multidimensional structures to organize data and express the relationships between them. Multidimensional databases are frequently created using input from existing relational databases. Unlike a relational database which is typically accessed using an SQL query, a multidimensional database allows a user to ask questions related to summarizing business operations and trends. An OLAP application that accesses data from a multidimensional database is known as a MOLAP (multidimensional OLAP) application. A multidimensional database provides the ability to quickly process the data in the database so that answers can be generated readily. Basically, a multidimensional database uses the idea of a data cube to represent the dimensions of data available to the user. Additionally, in this kind of database hierarchies and levels can be defined within a dimension (O'Brien & Marakas, 2009).

1.2.5 Data warehouse

The term **data warehouse (hereinafter: DW)** was coined by William H. Inmon, who is known as the Father of Data Warehousing. Inmon described a data warehouse as being "a subject-oriented, integrated, time-variant and nonvolatile collection of data that supports management's decision-making process" (Inmon, 1992). There are two approaches to data warehousing based on the requirements of the project. The first approach is by William Inmon and it is a top down approach. Here the data warehouse is created first and the data marts after (Inmon, 1992). The second approach is created by Ralph Kimball and it is a bottom up approach also known as the Kimball Methodology. In this method the data marts are created first in order to provide the capability for specific business processes and later the data warehouse is created (Kimball & Ross, 2011).

The goals of a data warehouse are to make an organization's information easily accessible and to present them consistently, as well as protect the information assets. It must be adaptive to change and must serve as a foundation for improved decision making (Kimball & Ross, 2011).

1.2.6 Data mart

A data mart is a collection of data that is designed to serve a particular group of users such as a department in a company. Each department's data mart is specific to its needs and its goal is to meet demands of the group. Moody and Kortnik (2000) describe data marts as the "retail" level of the data warehouse. They state that the data is extracted from the central data warehouse into data marts, where is it accessed by end users for certain analyses.

Data marts should not be confused with data warehouses. While a data warehouse is a collection of the entire organization's data, a data mart is a subset of the organization's data warehouse. The design process of data marts starts with an analysis of the user needs and it is important that the data is structured in a way which is easy for the end users to understand. On the other hand, the design process for a data warehouse starts with an analysis of the data that already exists and how it can be transformed to be used by end users (Moody & Kortnik, 2000; Inmon, 1998).

1.2.7 Data discovery

Data discovery is explained as a technique for creating and using interactive reports and exploring data from multiple sources. It is a user-driven approach for finding patterns and outliers in a database. Traditional BI applications use visual tools for data discovery, such as pivot tables, graphs, charts and maps to find the patterns. But with the transformations in BI in recent years, visualization is an important aspect of data discovery, because the BI applications provide the end users with interactive dashboards where they can track Key Performance

Indicators (hereinafter: KPIs), trends, graphical representations, standard reports, patterns and outliers. The goal is to offer end users easier data analysis and better access to larger volumes of data. (Chalotra, Kumar & Kaku Ram, 2018).

1.2.8 Business Intelligence Portals

Business Intelligence portal (hereinafter: BI portal) is one of the front end applications through which users access the BI system and perform BI tasks. It is usually a browser application from which users have access to different reports and services. (Chaudhuri, Dayal & Narasayya, 2011).

The BI portal's main functionality is to provide a navigation system of the DW/BI application. An example of a BI portal is Microsoft's SharePoint portal which can be designed to custom fit the business processes of the company in order to provide the best user experience.

Below are listed the most essential characteristics of BI portals:

- Usable – business users should be able to quickly and easily find what they are looking for on the BI portal
- Content rich and interactive – besides offering the primary functionality of presenting reports, the BI portal should also offer additional functionalities such as support, advice and documentation
- Clean – the user interface of the portal should be easy to use and have a clean look which will not disrupt the user experience
- Current – the data presented on the BI portal should be up to date and regularly maintained
- Value Oriented – the BI portal should provide an added value to the user for it to have motivation to use it as well the BI system in general.

2 DESIGN AND IMPLEMENTATION OF A BUSINESS INTELLIGENCE SYSTEM

In recent years there have been many publications and discussions on Business Intelligence and its benefits, however little attention has been paid to the questions of creating and implementing a BI system in organizations. There is no sufficient number of case studies and real examples informing about the dos and don'ts when creating and implementing such a system which can be used as examples of the synergy between IT and management processes.

2.1 Prerequisites for implementation

According to Kimball, Ross, Mundy and Thornthwaite (2015), there are three critical areas that organizations should assess before getting ready to do a BI project:

1. The level of commitment and sponsorship of the project from senior management.
2. The level of business need for creating a BI implementation.
3. The amount and quality of business data available.

Kimball, Ross, Mundy and Thornthwaite (2015) suggest that there are 10 questions that every user needs to ask themselves before initializing a BI project. These define the classic set of simultaneous constraints faced by every DW/BI effort:

1. *Business requirements* – This is the most important and fundamental question users need to answer before deciding to implement a BI system. Business users need to decide on the KPIs and business requirements they would need in order to make smart strategic and operational decisions. The answer to this question leads to identifying the data and the measures which will be needed for the system.
2. *Strategic data profiling* – In this question the user needs to clean through the business areas which are requested to be included in the BI, based on the availability of the data to provide solutions and answers.
3. *Tactical data profiling* – Data quality is of the outmost importance before starting with the implementation, and that's why it is necessary to start at the source to check how the data is being entered and provide suggestions for improvement. This is a business re-engineering process which needs to create awareness for better data quality at all levels in the company and should have executive level support.
4. *Integration* – For the data integration to be successful, the common measures and dimensions throughout the company must be well defined and understandable and all the business areas must agree on them. Executive support is of great relevance here as well.
5. *Latency* – The delay before the transfer of data is made, should be reasonable and realistic by the business users' requirements.
6. *Compliance* – As the data to be entered in the date warehouse comes from different sources, some of it may have to be adjusted to align with the others. A clear guidance of which data is compliance-sensitive should exist.
7. *Security* – Data security is a top priority issue, and before initiating this project the user must know how to protect confidential data in the system and on all the applications which will be used.
8. *Archiving* – Past data will need to be archived eventually, and the user needs to have a plan for which data will be archived and for how long.
9. *Supporting business users* – The business users need to have a certain skill set and knowledge in order to successfully use the BI system. Before implementation, the user

needs to access their competencies in using spreadsheets, creating and reading reports from the database.

10. *IT licenses and skill sets* – For the creation of the system a skillful IT team is needed which will support the technical decisions and help in their execution.

The business users and management need to understand the boundaries and responsibilities of the system. The project manager can still be an enthusiastic advocate, but the boundaries should be clear.

2.1.1 Business sponsorship

The commitment and sponsorship of senior management is according to Kimball, Ross, Mundy and Thornthwaite (2015), the most important criteria for assessment. This is because having strong management backing helps overcome shortcomings elsewhere in the project. However, as they state: "even the most elegantly designed DW/BI system cannot overcome a lack of management sponsorship".

2.1.2 Business needs

Another critical prerequisite for the BI implementation is whether there is a strong business need and whether there is an understandable benefit of the implementation. These needs and benefits can be sometimes driven by the competition in the marketplace in order to gain a competitive advantage.

2.1.3 Amount and quality of available data

Without proper data, or with too little quality data, any BI implementation fails; it does not matter how good the management sponsorship or business-driven motivation is. When identifying and preparing the data for import, it is necessary to determine the data sources which will support the business processes. This specification requires finding the internal (ERP, information technology sources, excel files etc.) and external sources (customers, suppliers etc.) as well as verifying their reliability. For this process, a significant collaboration is needed from decision makers, operational workers and IT department which together need to diagnose all the information systems (hereinafter: IS) and databases used in the company (Olszak & Ziemba, 2007).

For a successful identification of the necessary data, Błotnicki and Wawrzynek (2006) suggest some instructions:

- Find data in the information system which are not important for the analyses which will be done
- Find relations between the data in different IS

- Understand the logical structure of the data in the IS
- Find where possibilities for data errors exist
- Find limits of the IS

These instructions can help identifying the data which is hidden or inaccessible, leading to the necessity of multiple data sources.

When importing data from one or more sources into the data warehouse, there may be errors such as inconsistent representations for the same value, data duplication or missing information in the data. Analyses which help in detecting the data quality issues and improving the data integrity can have a high payoff for BI systems implementation. Before the implementation it is a good idea to do data profiling. This analysis identifies the content, consistency and structure of the data. (Cebotarean, 2011). It enables early identification of issues with data quality by detecting violations of the characteristics that are expected to hold the data. The analysis verifies whether the data combinations are unique or to which degree the uniqueness is violated. Data profiling can also discover new rules that exist in a database. When importing data from an external data source it is important to be aware of which columns are unique or key for the source, so that the incoming data can be matched against existing data in the data warehouse (Chaudhuri, Dayal & Narasayya, 2011). Another analysis is data de-duplication. This is the process of identifying groups of duplicate entities.

This kind of analyses should be done as early as possible in the process of BI implementation and if they show that some data is missing or is inconsistent, the project should be put on hold temporarily while the IT department figures out how to properly collect data.

2.2 Strategy of the BI development

As previously mentioned, BI systems have been highlighted as one of the riskiest IT investments. A successful deployment and use of BI systems requires a broad organizational effort blending organizations' resources and a synergistic effort between business and IT people (Anderson-Lehman, Watson, Wixom & Hoffer, 2004).

Strategy determines the way organizations integrate different activities across different functional areas to achieve objectives. There are different views and definitions on the relationship between information systems and the overall strategy of the company. Several authors (Preston & Karahanna 2009; Reich & Benbasat 1996, 2000) state that in order to achieve competitive advantage from their investments in IT, the IT department's strategy and the company's strategy must be aligned. Reich and Benbasat (1996, 2000) say that information systems strategic alignment is formed using two dimensions: intellectual and social. They define the intellectual dimension as the existence of interrelated IT and business plans of high quality. BI systems implementation can be seen as a representation of the intellectual dimension, because BI systems support business strategies, decision making and activities

(Armstrong & Sambamurthy, 1999). Reich and Benbasat (1996) define the social dimension of IS strategic alignment as the degree to which business and IT users in the company understand each other and collaborate to achieve the IT and company strategy.

According to a number of authors (Kalakota & Robinson, 1999; Rasmussen, Goldy & Solli, 2002) the most important motives for implementation of Business Intelligence Systems are:

- Moving from intuition-based decision making to decision making based on data, analyses and facts
- Predicting the development of the company using predictive and forecasting analyses
- Achieving strategic objectives by matching operational activities such as monitoring the effectiveness of the business processes and aligning budgets with corporate strategies
- Applying standards for repetitive business processes
- Consolidating information transfers to make them clearer for the end users
- Fast detecting of information outliers which suggest possibilities for new threats
- Shortening the time for information analysis and decreasing the number of business users involved in analyzing and processing information
- Automating reporting processes and fast preparing of plans and forecasts.

After deciding on the motives for the BI implementation, it is necessary to decide which business areas will first undergo different analyses. For most companies it is natural to start this process in finance, followed by marketing and logistics. Consequently, it is also important to decide on the complexity of the BI system, whether it will be implemented in only one department covering only a selected scope of functions, or whether it will be more complex, integrating different business areas and activities by the company. In the technological sense, this translates to whether more individual data marts will be created, or whether the company will start building an integrated data warehouse from the beginning. The first approach is a less demanding project scope, meaning the results will be achieved faster. However, it is not uncommon to run into difficulties while integrating the individual data marts into one data warehouse (Olszak & Ziemba, 2007).

The development of the BI starts with decision making on the top management level followed by lower levels of management. The shared knowledge between the managerial levels eases the cross – functional communication and trust between different departments. It also affects the willingness and ability of operational-level managers to use information received from various sources to overcome knowledge barriers and to come up with new ideas how to use this knowledge and the BI solution to achieve the company's strategy. The knowledge shared between the managers can help define the reporting structures to gain added value from the BI system (Cohen & Levinthal, 1989; Attewell 1992).

The Chief Information Officer (hereinafter: CIO) plays an important role in overpassing the departmental boundaries and collaborating with department managers to enable knowledge sharing. They must possess both business and IT knowledge and must be able to implement that knowledge in practical use (Bassellier, Benbasat & Reich, 2003). As Enns, Huff and Higgins (2003) state, one of the biggest reasons for unsuccessful IT project implementations is weak collaboration between the CIO and operational managers, as opposed to successful projects where there is good communication and understanding between all parties.

2.3 The phases of implementation

According to Moss and Atre (2003), as almost every other kind of engineering project, a BI system project goes through six stages between inception and implementation:

1. **Justification:** The first stage assesses the business need for the development of the new Business Intelligence project.
2. **Planning:** In the planning stage strategic and tactical plans are developed which provide the basis for how the BI project will be created and implemented.
3. **Business analysis:** The business requirements for the BI system need to be fully understood, and for that purpose a detailed analysis of the business needs to be performed.
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5. **Construction:** Build the product i.e. create the BI system
6. **Deployment:** Implement the BI system and determine whether it meets the customer's needs.

Once it is implemented, a BI system should be continually improved and upgraded based on the feedback from the business community that uses the system.

The Justification Stage

Step 1: Business Case Assessment

In the first step, the business problem or business opportunity is defined and a BI solution is proposed. The new BI system should bring benefits and value for the company by offering new opportunities or improving existing business processes.

The Planning Stage

Step 2: Enterprise Infrastructure Evaluation

BI system implementation is a cross-functional project and as such it requires an infrastructure establishment. Some parts of the infrastructure may exist before the implementation, while others may have to be created as part of the project. The infrastructure has two parts:

- **Technical infrastructure** – it includes hardware, software, database management systems, operating systems, network components, meta data repositories etc.
- **Nontechnical infrastructure** – it includes meta data standards, data-naming standards, the company data model, methodologies, guidelines, testing procedures, change-control processes, procedures for conflict resolution etc.

Step 3: Project Planning

Detailed planning of a BI project is one of the most important factors which impact the success or failure of a project. The time resource, people resource and technology resource have to be carefully planned as well as the project scope and budget. Consequently, the progress of the project must be monitored and reported.

The Business Analysis Stage

Step 4: Project Requirements Definition

Project requirements should be clearly defined before the beginning of the project. However, since BI systems are dynamic, the project team should expect these requirements to change during the development. Managing the project scope proves as a challenging task because with time, business users realize the opportunities and limitations of the BI system and change the requirements.

Step 5: Data Analysis

One of the biggest challenges of BI project implementation is the quality of the data. The sources may be various and the data needs to be cleaned, consolidated and integrated. This step is severely time consuming, as it should be, because correcting the errors of working with non-quality data can be very expensive.

Step 6: Application Prototyping

The best way to test and analyze the functionalities of the system is by prototyping. Today, the developers have tools and programming languages which allow them to quickly and easily test and prove or disprove certain concepts. Additionally, prototyping allows business users to see the opportunities and limits of the BI technology, which helps them adjust their requirements.

Step 7: Meta Data Repository Analysis

The technical meta data needs to be mapped to the business meta data, and all meta data must be stored in a meta data repository. Meta data repositories can be bought or built and in both

cases, the requirements for what type of meta data to capture and store need to be documented in a logical meta model. The requirements stored there should be compared to data model considered for buying. In addition, the requirements for delivering meta data to the business community have to be analyzed.

The Design Stage

Step 8: Database Design

Depending on the requirements, the data will be stored in detailed or aggregated form in one or more databases. The requirements from the business users must be aligned with the database design schemas.

Step 9: Extract/Transform/Load Design

The ETL process is one of the most important processes of the BI project and it is also the most complicated one. The poor quality of the data is responsible for the long periods it takes to clean and transform the data. Finishing the ETL process in the expected time frame is a challenge for most companies.

Step 10: Meta Data Repository Design

As previously mentioned, the business users' requirements, or more specifically the meta model requirements have to be aligned with the database design. If the meta data repository is bought, it will most probably have to be upgraded with functionalities which are requested by the logical data model and are not provided in the offered product. If the meta data repository is built, the decision has to be whether the database design will be entity-relationship based or object oriented.

The Construction Stage

Step 11: Extract/Transform/Load Development

For the ETL process there are many tools available, some of which are more complicated and others, more simple. Depending on the requirements developed for cleaning and transforming the data in the Data analysis step and in the ETL design step, an ETL may or may not be the best solution. However, it is still often required to preprocess the data.

Step 12: Application Development

Once the functional requirements have been confirmed in the prototyping phase, the development of the access and analysis applications begins. Depending on the level of

development of the prototype, the application can be just an upgrade to the prototype or it can be a more complicated process using different analysis tools. Either way, the application development process is done at the same time as the ETL development and meta data repository development.

Step 13: Data Mining

BI systems in many companies are used only for basic purposes such as prewritten reports, not using their whole potential. The real benefits come from information which are not initially visible, but can be discovered using data mining tools.

Step 14: Meta Data Repository Development

If in the previous steps it is decided to build a meta data repository instead of buying one, a separate team is formed which is responsible for the development process. This development of the meta data repository becomes a big subproject of the BI project.

The Deployment Stage

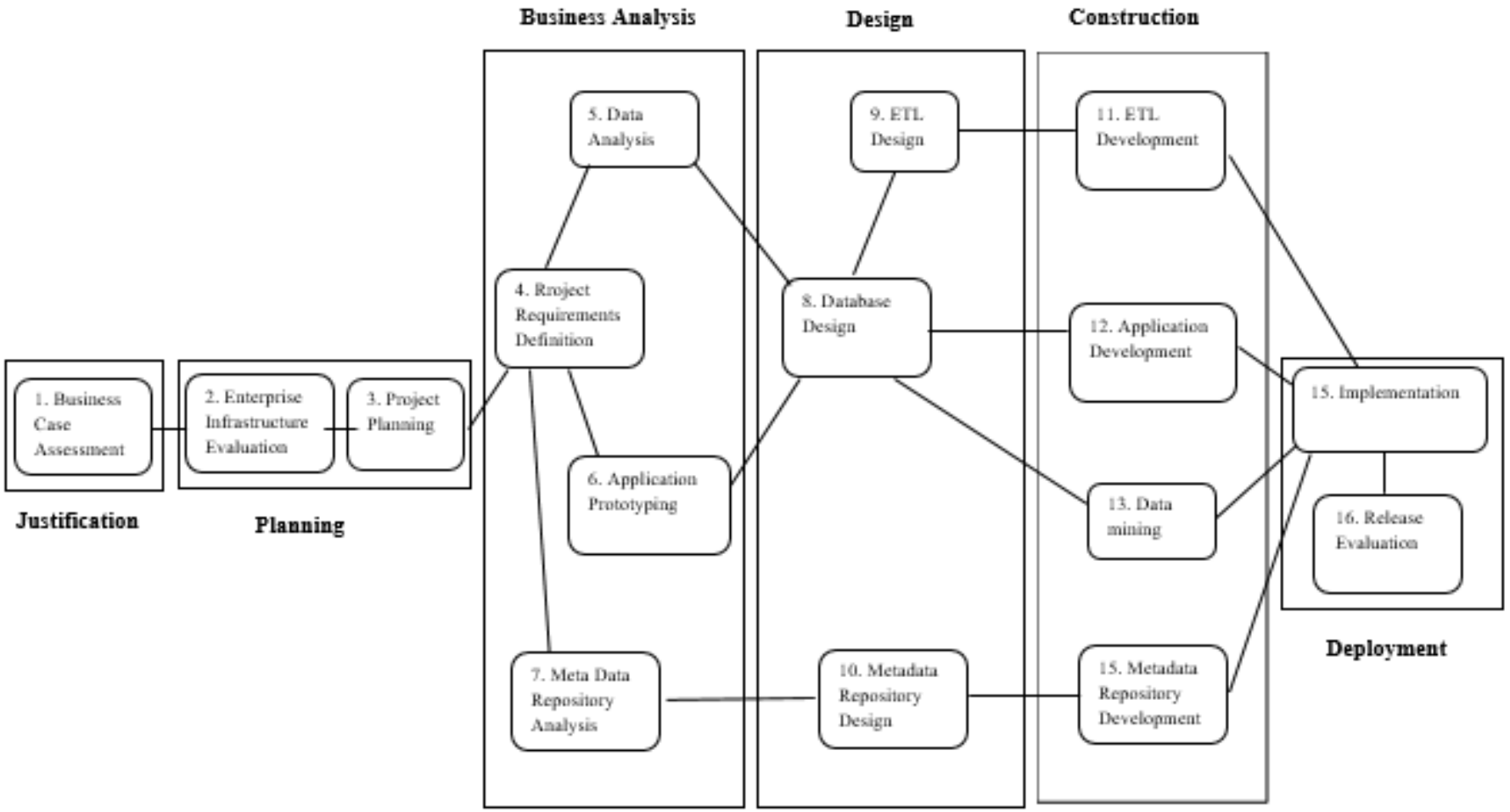
Step 15: Implementation

The implementation step begins when all the functionalities of the BI system have been tested and the databases and the application have been put into use. In this step, business users are being trained to use the system, while support functions such as maintaining the databases, scheduling and running the ETL process and help desk, begin.

Step 16: Release Evaluation

In BI system project implementations, it is crucial to apply the lessons learned from similar previous projects. All challenges related to technology resources, people resources, timelines and deadlines, budget restrictions and overruns as well as conflicts and conflict resolutions, should be carefully examined and project adjustments should be made before the project begins. Any methods, techniques and processes which were not helpful should be reevaluated and if needed, omitted in the new project. The development steps presented in Figure 3 do not have to be performed in sequence, in reality they are usually performed in parallel. However, due to the natural order of the stages, some dependencies exist between some of the development steps. Steps which are presented on top of each other can be performed in parallel, while steps which are presented to the right or left of other steps are performed linearly.

Figure 3: Development Step Dependencies



Source: Moss & Atre (2003)

Some of the development steps are specific for each project, while the majority of them have a cross-organizational feature. These development steps, which have a cross-functional focus, need to include business users from different departments. The business users need to review and agree on the rules, principles, strategies and business requirements for the development of the BI system. Project specific steps are:

- Project planning
- Project requirements definition
- Application prototyping
- Application development
- Implementation

All other steps are cross-organizational.

2.4 BI Project team structure

Moss and Atre (2003) suggest that every BI project team must have a certain skill set to perform the necessary activities. From the overall BI project management perspective, the BI project team structure contains two types of teams:

1. The core team
2. The extended team

2.4.1 The Core Team

According to Moss and Atre (2003), the core team is a self-organizing team—the members divide the work between themselves, they review their results, bring decisions and brainstorm together and co-lead the project. The core team has permanent *project* core team members and permanent *step* core team members.

Permanent project core team members must dedicate 100 percent of their time to the BI project, from the mere beginning to the very end. Besides co-leading the project, they must also perform the activities applied to their roles. This team should not have too many members, usually the optimal number is 4-5 people. The members of the team should include:

- A project manager
- A representative from the business side
- A business analyst from the IT department
- A technical person from the IT department

A key person in the team is the representative from the business side, as his full-time dedication can be considered as a critical success factor for the BI project.

Permanent step core team members must dedicate 100 percent of their time to the developments steps in which they are included.

The core team members work together, they split the work between themselves, review it, resolve problems that may arise, brainstorm and bring decisions together. The members of both, the permanent project core team and the permanent step core team, are usually assigned several roles. The representative from the business side is usually the primary business person who represents the business users for whom the BI application is being developed and they are a full-time member of the core team.

2.4.2 The Extended Team

Unlike the core project team members, the members of the extended team are not required to be fully available for the BI project. They of course, have responsibilities but because the BI project is not their priority, they have to schedule time to work with the core team members. They are usually called when their expertise is required to resolve an issue or when their help is needed in making a decision. Each team member is usually assigned multiple roles and is responsible for the activities of that role (Moss & Atre, 2003).

2.4.3 The BI Steering Committee

Besides the core and the extended teams, in BI projects implementation a BI Steering Committee should also exist. Because a BI project is cross-organizational, it is inevitable that during the implementation some issues will arise, be it on the technical or on the business side. Some of these issues will not be able to be resolved neither by the core nor by the extended team. In these cases, if a resolution cannot be achieved by other means, the decision must be made by an authoritative body of executives known as the BI steering committee or BI arbitration board.

The BI Steering Committee is usually composed of the project sponsor, the Chief Information Officer (CIO) or Chief Technical Officer (CTO), the Chief Financial Officer (CFO), IT managers, business managers, and sometimes even the Chief Executive Officer (CEO) might even be a member of the committee (Moss & Atre, 2003).

2.5 User Aspect

The success of the BI implementation project is measured through the value it adds to the company and the users' acceptance. Business users need to use the system for it to provide some added value. Following this, the BI system needs to be easy to use and accepted by the

users. If the system is not user-friendly, the users will spend more time figuring out how to use it which will reduce their efficiency and trust in it. It is not uncommon for them to become irritated by it and simply not use it, as it does not make their job easier.

Because the BI system is to be used by business users, in order to increase its acceptance, it is advisable to consult them in the early stages of development. They can state what they need from the BI system and help define the business requirements. To get this information, surveys, interviews or focus groups can be used. During these sessions for business requirements gathering, it is advisable to include also the IT department of the company because they can say what is possible and what is not, based on the available data. Including business users in the phases of design and development, can increase the chances of user acceptance of the BI system.

Another way to motivate users to use the BI system, besides their user experience, can be by using the element of competition. Kimball, Ross, Mundy and Thornthwaite (2015) suggest implementing a function on the Business Intelligence portal website where reports on system usage can be found. Implementing this function can provide managers with an insight on how much their departments are using the system and compare them to other departments. This comparison can motivate them to encourage their staff to use the BI system even more.

Watson and Wixom (2007) give an example of how the competitive element can act as an incentive. In their study, they describe how a large call center implemented performance dashboards for all call agents, with monthly incentive bonuses based on their performance. Call agents could compare their performance results to other team members and were motivated to improve their own. The implementation of this type of performance measurement and competition significantly improved agent performance.

In addition to improving the user experience and developing a small amount of competition between departments, the BI project chances of success can be improved by directly involving senior management to help make the BI a part of the organizational culture. They need to provide the users with necessary tools, training, and support. Training encourages more people to use the BI system and helps them get started, and providing user support is necessary to maintain the BI system and resolve user problems. Additionally, a Business Intelligence Competency Center can be established in the company, which will be responsible for user support, help, trainings and maintenance of the BI system.

2.6 User acceptance and satisfaction

Several authors (DeLone & McLean, 1992, 2003; Hayen, Rutashobya & Vetter, 2007) have found that system quality affects the use of BI system and user satisfaction. On the other hand, user satisfaction affects the organizational impact. All this together combines to a firm's 'net benefits'.

User satisfaction has been identified as one of the biggest measures of BI success. (DeLone & McLean, 1992). The user's satisfaction is identified by the level to which the BI application meets the user's expectations. (Chiu, Hsu, Sun, Lin & Sun, 2005). Wixom and Watson (2001) define user satisfaction as the net feeling of pleasure and displeasure which results from summing all the benefits that a person hopes to receive from the information system. The net benefits are used to measure the success of the BI.

In a study conducted by Serumaga-Zake (2017) the role of user satisfaction in implementing a BI system was researched. He based the study on 3 theoretical models, the Technology Acceptance Model (hereinafter: TAM), the Task Technology Fit (hereinafter: TTF) and the Social Cognitive Theory (hereinafter: SCT). TAM suggests that the perceived usefulness of a BI system is proportional to the perceived ease of use of the system. Both, the usefulness and the ease of use affect the user's intention to use the system. The author hypothesized that in the BI system, user satisfaction decreases the effects of system, information and service quality on the perceived net benefits. System quality, information quality and service quality are some of the key success factors of information systems. The study concludes that there is no relationship between information quality and perceived net benefits and user satisfaction in a BI system. On the other hand, system quality and service quality are negatively related to user satisfaction but positively related with the perceived net benefits in a BI system.

It is important for organizations to understand how to increase the users' intention to use the BI system, to read and create reports. Following the suggestion by TAM, that the intention to use the system is determined by the perceived usefulness and ease of use of the system, if a user believes that using a BI system will improve their performance, they will have a high intention to use the system. Hence, we can split the intention to use the BI into intention to read information and intention to create reports. Furthermore, the perceived ease of use of the BI can be split into perceived ease of use to read and perceived ease of use to create reports. Both, perceived ease of use to read and perceived ease of use to create significantly affect the intention to read information and the intention to create reports. Thus, increasing a user's perception of ease of use would increase their intention to use the BI system (Serumaga-Zake, 2017).

2.7 BI success factors

Although BI systems are developed and implemented with the purpose to improve the performance of organizations, there is still a significant number of organizations which fail to reap the benefits of their BI system. Moss and Atre (2003) indicated that 60% of BI projects fail due to inadequate planning, poor project management, undelivered business requirements or those that were implemented were of low quality. Many researchers have attempted to identify the factors which contribute to the success of a BI system development and implementation or simply, the critical success factors.

The definition of Critical Success Factors was first introduced by Ronald Daniel in 1961. He suggested that at an industry level there were 3 to 6 factors which were indicators of success, and the activities related to these factors had to be done exceptionally well for an organization to be successful (Daniel, 1961). This definition was further developed by Rockart (1979) who argued that critical success factors are key areas where the results must be satisfactory for the business to grow. These satisfactory results will provide a high competitive advantage for the company, meaning that the key areas should be given constant attention from management (Rockart, 1979).

The approaches and measures associated with the identification of critical success factors differ widely. Some studies measured implementation factors while others measured BI success. Hawking and Sellitto (2010) made a summary of the critical success factors by different authors over the years which can be found in Table 1.

Table 1: BI Critical Success Factors

Author	Factors
Farley (1998)	Fast implementation, Ability to adjust to business requirements, Useful information, Ease of navigation
Watson and Haley (1997)	Management support, Adequate resources, Change management, Metadata management
Chen et al (2000)	User satisfaction
Sammon and Finnegan (2000)	Business driven approach, Management support, Adequate resources including budgetary and skills, Data quality, Flexible enterprise model, Data stewardship, Strategy for automated data extraction methods/tools, Integration of data warehouse with existing systems, Hardware/software proof of concept
Little and Gibson (2003)	Management support, Enterprise approach, Prototyping data warehouse use, Metadata, Sound implementation technology, External support (consultants)
Mukherjee and D'Souza (2003)	Data quality, Technology fit, Management support, Defined business objectives, User involvement, Change management
Rudra and Yeo (2000)	Technical factors (data quality and data consistency)
Joshi and Curtis (1999)	Project-related factors (project plan must match with business demands and the scope of project management), Technical factors
Wixom and Watson (2001)	Data quality, System quality, Management support, Adequate resources, User participation, Skilled project team
Chenweth et al (2006)	Management support, Champion, Architecture (data marts), Organizational Fit/User acceptance
Yeoh and Koronios (2010)	Management support, Clear vision and business case, Business champion, Balanced team, Iterative development approach, Change management, Suitable technical framework, Data quality

Source: Hawking & Sellitto (2010)

Many critical success factors listed above are not particular only to BI systems, but they can also be applied to other Information System projects. However, one factor which is unique to BI systems implementation is suggested by Sammon and Finnegan in 2000 and it is the need to integrate data from various existing systems. This successful integration of data depends on the number and type of the existing source systems, their quality and the accuracy of their data as well as the ability of the BI to interface to these systems. The greater number of data sources and their diversity have a negatively proportional effect on the BI implementation success (Sammon & Finnegan, 2000).

The key question is thus whether after the implementation of BI systems users actually accept, use, and take full advantage of their capabilities. The business value of BI systems should therefore be shown in an improved business process and hence an improved business performance (Popovič, Turk & Jaklič, 2010). Generally, BI systems have the potential to increase the competitive advantage of organizations (Jourdan, Rainer & Marshall, 2008; Wixom, Watson, Reynolds & Hoffer, 2008).

The 3Ps of Business Intelligence

According to Panian (2007) there are 3 Ps crucial for BI success which need to be examined and aligned. The more effectively they are managed, the better the opportunities for maximizing the Return On Investment (hereinafter: ROI) on the BI.

- People: In BI implementation there are end users and power users. The end users provide the business issues and the type of solution they expect. The power users understand the system and know how to manipulate it to provide the data to whoever needs it when they need it. Additional people may be present such as technical consultants who will help automate pieces of the system. When managing people in this BI success triangle the saying "Too many cooks spoils the soup" applies. A small team of 4-5 people is sufficient to meet the project objectives and it should preferably consist of:
    - Business user representative – the main visionaries for the BI solution
    - Power user – the primary developer of the solution
    - Technical architect – in charge of deploying technical solutions
    - Expert consultant – someone familiar with the BI technology selected who will help overcome the initial learning curve and provide best practice ideas.
- Product: The ETL functions, the database platform and the front-end user applications which support the initiative construct of the BI product
- Process: When implementing a BI system, the organization will identify the processes used before the BI and how they will change/improve after the BI is in place. Most commonly reviewed processes are Business oriented and Data oriented processes.

The company's ability to successfully implement a BI system depends on its so called BI maturity. In cases where business and IT users have previously participated in rewarding BI implementations, and where both groups believe in the added value of the BI, that company may be ready for BI standardization. However, if there is a passive approach from either of these groups, cultural changes have to be enforced on the managerial level. Panian (2007) states that to ensure that the full benefits of BI are going to be received, it's essential to implement a long-term strategy with the following steps:

- Build trust between IT and business users - BI is at the crossroad between business and IT users. It is common in organizations for a lack of trust to exist between these two parties, which may lead to a failure in the implementation of the BI system.
- Implement a BI Center of Excellence - In order to develop and share BI best practices in an organization, a BI center of excellence should be established. It is recommended that a business user should lead the center while closely collaborating with the IT department.
- Align BI initiatives around a framework - Align BI functionality with the technical, functional, organizational, and business needs of the organization.
- Implement a BI methodology - The roles of different user groups should be explained by implementing a formal BI methodology.
- Create a deployment process - The financial results should promote the business use of the BI center of excellence.

2.8 Benefits of BI

For any potential investment in information technology, the perceived benefits and value for money are carefully investigated. The companies need to decide whether the investment will bring growth and improvement in efficiency. There are several methods which can help them in making this decision such as the net present value, rate of return, cost-benefit analysis and others. However, when it comes to information technology, these classical financial methods are not entirely suitable. Additional measures must be taken into account, such as a user satisfaction, the use of IT in decision support etc. (Turk, 2005; Gibson, Arnott, Jagielska & Melbourne, 2004).

The main benefits of BI for a company are increased efficiency and effectiveness by bringing better business decisions. BI systems allow an easier access to information and can provide insights which lead to new business opportunities or redefining existing business processes.

However, in the case of BI as well as information systems, different types of benefits exist. According to Carver and Ritacco (2006), there are four categories of benefits:

- *Measurable (quantifiable) benefits* - they can be clearly measured such as increases in sales and profit, cost savings etc.

- *Indirectly quantifiable benefits* – they are usually related to customer satisfaction, customer loyalty, obtaining new customers all of which have a positive effect on sales and profit.
- *Non-measurable benefits* – they relate to higher motivation of the employees, higher quality of work, better communication and knowledge sharing in the company etc.
- *Unpredictable benefits* – they include new ideas or new solutions for improving the business processes.

Some benefits are more or less directly visible such as the greater flexibility of users by creating reports, faster access to and a better overview of data etc. Other benefits are less obvious and it is hard to determine whether they are actually a result of the use of business intelligence or something else.

There are many different definitions of BI benefits. According to Thompson (2006) the BI benefits are:

- Faster and more accurate reporting
- Improved decision making process
- Improved customer satisfaction
- Increased revenues
- Savings in IT
- Savings in other business areas

Similarly, Atre and Moss (2003) categorize the benefits of business intelligence as:

- Increase in revenues
- Increase in profit
- Improved customer satisfaction
- Reduction of costs
- Increase in market share

Watson and Wixon (2007) place the BI benefits on a spectrum of two measures: of measurement and impact. According to them as business users mature in performing analysis, the benefits become more global in scope and more difficult to measure. Consequently, easy to measure benefits with a local impact are: cost savings, time savings and more and better information. Difficult to measure benefits which have a global impact are: making better decisions, improvement of business processes and support for the accomplishment of strategic business objectives.

Hočevar and Jaklič (2010) summarize their research of BI benefits for the users of a BI system in the following categorization:

- Increased autonomy and flexibility of the users
- Quick and simple analyses
- Improved decision support and operational efficiency
- Opportunities for new analytical functions

3 CASE ANALYSIS

3.1 General information about the company

Pivovarna Laško Union d.o.o. (hereinafter: PLU) is one of the largest joint stock enterprises in Slovenia. It became a joint stock enterprise in 2016 after it officially became a member of the biggest beer brewer in Europe, the HEINEKEN company, in 2015. The company's main business focus is production of beer, cider and non-alcohol beverages such as soft drinks and water. Its main brands are Union, Laško and Heineken, and other brands include MultiSola, Sola Ice tea, Zala, Jabolčni Tat etc. The plan for the future is to fully meet the market trends and requirements by further improving the existing products as well as developing new ones.

Pivovarna Laško Union d.o.o. is the beer & cider market leader in Slovenia. The Headquarters are in Ljubljana, but it operates on two locations, Ljubljana and Laško where it has production facilities and offices as well as 4 distribution centers. The number of employees at the moment is approximately 600 on both locations which work in top management, finance, sales, marketing, supply chain, human resources and production. The company operates on the domestic market on two channels: on trade (hotels, restaurant, bars etc.) where is has both direct and indirect distribution, and off trade (sales to retailers). It also exports to other neighboring countries to 3rd party customers or to other HEINEKEN companies (Intercompany sales). Therefore, the complexity of the business is quite high: multiple product categories, multiple markets and channels, different distribution channels, two production locations etc. (Pivovarna Laško Union d.o.o., 2018).

3.2. Research design and approach

In the empirical part of this study a case study was chosen as a research approach in order to answer the main research questions. The top management of the company reviewed and approved the execution of the case study and the research took place at the company's location. The case study was conducted by the steps listed below.

First, an introductory workshop was conducted with the financial director, commercial control manager, supply chain control manager, members of the controlling teams, the business solutions manager, the project manager and the lead developer from the outsourced company which created the BI system, to present them the general idea of the research and the goal of this thesis. The controlling departments along with the business solutions manager were the

team that was involved in the testing and implementation of the BI system. During the workshop we discussed the idea behind the research, the requirements from their side in terms of documentation, time and people for the interviews, and the expectations from this research. At the end of the workshop, a plan for the research was created and a time schedule for focus interviews was made.

Information was collected between January and July 2018 using multiple inquiries:

- Focus interviews
- Review meetings
- Work observation
- Official documentation

Focus interviews: Two focus interviews were organized with each referring to a different part of the implementation process. The interviews were conducted in person and in English. A guideline with questions and topics for discussion was prepared and was sent out to the attendees beforehand to prepare. The duration of the interviews was different, but each lasted approximately 1-2 hours and they were voice recorded for easier documentation. They helped to understand the beginnings of the implementation process, the planning process as well as the obstacles found. On the first focus group meeting the attendees were the project leader, the manager who was behind the idea for implementing this system, and employees who were directly included in the implementation process. We discussed the idea and the need for this kind of system and seeing that not many companies in Slovenia are digitally mature, this was a big step forward for Pivovarna Laško Union d.o.o. They explained the planning and preparation process for the BI system. Here we also discussed about the obstacles they ran into in the beginning, the biggest being the skepticism and distrust in the BI from the employees of the company. On the second focus interview, which included the head developer of the BI system and the Business Solutions Manager of the IT department of Pivovarna Laško Union d.o.o., we discussed the more technical part of the system implementation. Questions such as which tools they used and what technical obstacles they ran into were asked, as well as how they deal with maintenance of the system.

The focus interviews allowed for the participants to discuss the above mentioned key points and to challenge each other's points of view. The employees shared their opinions openly. The results from these meetings will be discussed more thoroughly in the next section.

Review meetings: In the period between March and June 2018 the company undertook a big subproject of the BI, for which we had a review meeting every two weeks. As I was a part of the team for this project, I attended each of these review meetings and used them as part of my research to keep updates on the current progress of the BI.

Work observation: To get better understating of the process of implementation and to support the relevance of this research, beside the focus interviews, observation of the work was conducted. I attended the meetings for the next steps in the project and observed as well as personally participated in the work of testing the new areas to be implemented, activities and information exchange between departments. Top management enabled broad access to confidential material and documentations. In addition, I also tracked the BI usage in users during the past months to get a clearer picture of the BI usage in the company.

Official documentation: For the purpose of this research, official documentation was provided by the company and the outsourced developer company. The documentation consisted of documents on the architecture of the BI system, planning and development of the BI, technical documentation and documents with naming rules for the measures and dimensions. Due to confidentiality, the official documents will not be provided in addition to this research but will be used as a source for explaining the development cycle.

3.3 Information analysis

As previously mentioned, for this research the case study method was chosen. In this section the information received from the interviews and review meetings will be more thoroughly discussed.

On the initial workshop the goal of this research and the expected outcome was shared with the attendees. The idea was positively accepted because the BI is now a hot topic in the company- it is being used on a daily level primarily by top and middle management, as well as by employees from controlling, sales, marketing and supply chain departments. After a brief discussion on the plan for the research and the support I would need from their side, we agreed on a schedule for the focus interviews and review meetings.

3.3.1 The need and idea behind the Business Intelligence system

As previously mentioned, on the first focus interview we discussed the idea and the need for a BI system, the beginnings, the nontechnical pre-requisites, the obstacles and the current status. Business reporting is the basis for decision making and an integral part of the everyday work in this company. Besides the complexity of the business as such, since PLU became a member of the HEINEKEN company the business reporting became more demanding. Business reporting within HEINEKEN is defined by the Heineken Governance Cycle (hereinafter: HGC) which consists of monthly reports on sales volumes, revenues, drivers of revenue, high level profitability, income statement, balance sheet etc. These are all uploaded to a Global platform, which represents the global Heineken BI system. All the reports are with strictly defined deadlines which must be respected. The internal, PLU Managerial reporting has reports on: volume and value sales by market, channel, customer, brand, pack type, SKU and combinations of these dimensions.; cost control by cost center, account, budget accountable, projects,

partners etc.; profitability by market, channel, customer, brand, pack type, SKU etc.; business statements; supply chain reports for production and logistics, each with their own KPIs: KPI scorecard which consists of the most important KPIs for the company, such as volume sales, net revenue from sales, costs, operating profit and more. This increased complexity, the strict reporting timelines (HGC) and requirements created the need for a BI because without an appropriate BI this would be inconsistent and impossible. Additionally, the tough market conditions required more data driven decisions based on value, profitability and more complex analyses. There was also a need for a common information and reporting platform with better availability, anywhere and at any time. Business users needed a one source of truth in their day to day activities, so that they could each work with the same data, and consequently bring a consensus on their business decisions.

Here, a discussion arose evaluating and selecting the processes which have the greatest impact on the company's strategies and goals. At the moment of the interview, sales, supply chain and business statements areas were included, all of which were tested and stabilized. As I previously mentioned, the company recently undertook a big subproject in the BI which is profitability. This is a segment which calculates the dimensional profitability for cca. 200 products and more than 50 customers and customer groups. For the purpose of this subproject, there were bi-weekly meetings of the controlling teams and the developers of the BI system. On these meetings, the current status of the BI was discussed in addition to the tasks for the profitability subproject. The tasks priority was decided upon and the activities of everyone involved were decided. Commercial and supply chain control teams were involved in this subproject, and each member had a specific area to implement and test together with the developers. Several activities were done in parallel because the areas were independent of each other, and the key factor here was the availability of the developer. The profitability report is part of the HGC and its calculation is complex as fixed costs have to be allocated to a single product using allocation pools and allocation keys. Until now this was all calculated manually using Excel tables which took a lot of man power and a significant amount of time - each member had to calculate their own area of profitability. After three months of development and testing, this segment of the BI was also successfully stabilized and by the end of June for the first time it was reported from the BI. This time it took significantly less time and people resources - all the dimensions and attributes were fixed and accurate from the BI, and the quantitative data was now calculated in the BI. The data was already the same as all the other reports previously reported, because the BI was the only source of data. What was needed from the controlling side were top line controls and a sanity check on the data, and some formatting to prepare the file for upload in the Heineken Global BI. The dimensional profitability which was calculated every half year because of its complexity, will now be available in the BI on a monthly level. This provides business users with much more information for decision making, and now, as this kind of data is available in the system, using data visualization tools, analyses and decision making can be done quickly and easily.

Five years ago, the company had a BI system which covered just the top line volumes and revenues, but not other business pillars. Due to the previously mentioned changed requirements, fluctuation of people and lack of maintenance, it was not always considered the only source of truth. It was inconsistent vs the ERP system, it was not quick enough, it was not visual and it was not available on smart devices, only on computers. As a consequence of these factors, users lacked trust in the system. They used multiple sources of data for decision making such as the BI system, the ERP system, local Excel tables etc.

The non-technical pre-requisites included people, time and their organization. At the beginning of the implementation five years ago, mostly employees from the sales department were included because sales and marketing department were the initial target group for the BI. However, with the large fluctuation of people in the company, no one from the business side in the initial team is involved in the BI implementation today. In the past two years after joining HEINEKEN, the controlling team took over the project, they are the user testing group, who are involved in all the phases of the development. A significant amount of their time was devoted to the BI system testing and stabilization in addition to their regular daily activities.

In addition to the distrust in the BI system, the biggest obstacle in the beginning was the skepticism that existed between the members of the user testing group regarding the correctness of the data. The BI implementation required a big initial effort in defining the exact needs, documenting them and testing the results that come out of the BI against the solutions that were previously used for the same processes. The definitions had to be clearly understood by all business users and that is why this was a vital and time consuming task. This obstacle was passed using quick wins, which were several milestones in the project timeline which proved the usability of the system and increased the users trust in it. As the literature tells us, without proper data quality even with the best management team, a BI project is set to failure. In PLU there is a big amount of data on a daily level, part of which is the master data from the ERP system and the other part is the calculation of the measures, some of which are quite complicated. Both types of data need to be checked on a regular basis because the BI is a "live matter" where calculation rules can change.

3.3.2 The development cycle

On the second focus interview, the head developer of the BI system from an outsourced company and the Business Solutions Manager of PLU were present. Here we discussed more about the technical side of the BI system. In addition to the interview, for this part of the research, official documentation for the architecture of the BI system, the planning and development of the BI and technical documentation was provided. All other employees who participated at the beginning of the BI project were no longer working at the company. The questions for the interview were sent beforehand so the participants came prepared. The interview lasted 1,5 hours and was voice recorded. We started with questions about the planning of the development cycle and protocols. As the documents stated, and the

interviewees confirmed, the development cycle of the BI system was constructed of the following phases:

1. Planning
2. Establishment of the infrastructure – test/production environment
3. Development/implementation
    a. ETL
    b. OLAP model
    c. Support applications
    d. User interface
4. User training
5. Testing and stabilization
6. Deployment to production
7. Advising for usage

Throughout all the phases of the process an agile approach towards the development of the BI was used in a combination with classical methods. Agile means there was collaboration between cross-functional teams to define the requirements and develop possible solutions. The purpose of the approach was to execute the planning as accurately as possible so that in the development phase there will be no need to return to the planning phase. The agile approach is reflected in the so-called prototype procedures where the results are quickly coordinated in the test environment and ultimately a final solution is provided in the production environment.

The entire development process was supported by the management of PLU. For a better overview of the process, a ticketing system was developed by the development company, where all project tasks were opened and their progress was tracked. Each of the key business users of the BI system had their own profile with a username and password in the ticketing system, where they entered requests for new functionalities to be developed or for existing functionalities to be upgraded or checked if they were not performing correctly. The system works in a way that when a new ticket is opened, the developers give an estimation of how long it would take for the request to be developed and if the time estimation is in line with the PLU expectations, the request is approved for development by the project leader. Once the task is completed, the business users confirm its functionality and the developers close the ticket. This ticketing system proved itself as a good tool for the project leader to track the new developments to the system and accordingly align the costs and budget for the BI system. It also helped the team to set task priorities, as they could see what other business users requested.

Each of the phases will be discussed below, as they are described in the documentation.

***Planning of the BI solution**:* Before the actual development of the BI solution a plan for the project was developed which included:

- Functional specifications
    - As-is system
    - To-be system
        - Definition of the business questions
        - Definition and alignment of the concepts
    - Definition of the usage – standard reports, analyses etc.
- Technical specifications
    - Architecture of the solution
    - Logical model of the solution (definition of the analysis model)
    - Technical definitions (mapping of the data sources)
    - Infrastructure (test/development, production, rules of transfer)
- Implementation plan
    - Definition of the project group
    - Definition of the way of work
    - Schedule
    - Definition of risks

The planning was done through several workshops with the business users, while in the background, checks were done with the IT department to adjust the business requests with the technical capabilities of the company. As shown above, in this stage the definition of the to-be system was specified, or more specifically the definitions of the measures and dimensions to be used in the new system. As mentioned in the previous sections, it was vital that these definitions were understood in the same way by all business users so as there are no additional corrections further in the development phases. Here also the types of reports and analyses which would be used were defined and a sketch for the templates was designed.

For the technical specifications, in the planning phase, the architecture and the logical model of the solution were defined. The technical infrastructure of how the data will be mapped from the data source was also planned and the plan for the 2 system environments (test and production) was established.

In this phase, the project group was determined, including members of the PLU IT department, business users and developers from the external company. A project timeline with clearly defined milestones was established and users' tasks and activities were generally delegated.

***Establishment of the infrastructure**:* The suggestion for the infrastructure establishment was provided upfront to the company and it was revised afterwards in line with the company's business needs. During this phase there were separate tasks for the developers and the users:

- The developers developed the solution on their servers and monitored the operative tasks, definitions, any errors that may appear during the execution as well as their solving and performed internal tests. They also prepared the solution to be transferred to the production environment.
- The users tested the solution on the test environment and aligned the errors with the developers.

After confirmation that the solution is correct and is functioning properly, the data was transferred to the production side, which is the business users side of the BI system.

***Development/Implementation**:* These two phases ran in parallel. The development of the support applications was done on the developers site, and each new version was sent to the business users for testing and confirmation until the system was stabilized. In the implementation phase, as explained further in the text, procedures for deploying to production were established with rules and incentives. Rules for the ETL procedure and naming of dimensions and measures were also created.

***User training**:* Before the testing and stabilization phase, training of the user test group was performed. For this project it was requested that the users are capable to work with technology. Also, it was assumed that they would be educated and trained throughout the whole phase of testing and stabilization, and thus eventually become active advanced users of the system, its promoters and transfer knowledge to end-users.

***Testing and stabilization**:* In this phase the OLAP model, data transfer from the sources as well as the support applications were being tested. For testing, a user test group was formed where each user was responsible for testing a specific part of the project, for which a testing scenario was prepared in a discussion between the company and the developers. The testing scenarios for each part of the project lay out the steps which the test user must take and the method of reporting the end result compared to the expected result. If the result was different from the expect result, the error was reported and after it was corrected by the developers the test was redone by the user. This procedure continued until the expected result was achieved.

The testing scenarios were prepared during the implementation phase. For certain tests during the preparation of the testing scenarios, business users were included with whom the points of testing were identified.

In the ETL sub-phase automatic control points were implemented where for example the total sum at the source and in the data warehouse were tested to see if they match, to assure completeness of the data. Defining the testing points is a component of the planning of the BI solution.

In PLU the developer was once a week present at the company where the development, but mostly the testing was performed. On occasions, when needed, the developer was present more than once. During this time, he was also available for questions by the users.

***Deployment to production**:* During this phase the procedures stated in the contract between the company and the developers were adopted resulting in a document with rules. User and technical documentation were prepared. A list of all the definitions in the OLAP cube, the dimensions, attributes, basic and calculated measures and hierarchies was prepared.

Before deployment of the solution to production, training of the users was conducted. Additionally, the user test group who were also promotors of the BI system, helped the other users in getting to know and use the system. That's why choosing the individuals in this group is one of the success factors of the project even after the deployment to production.

***Advisement for usage**:* After the production of the system, for a specified period of time advisement for usage was performed by the developers for a better use of the system by the users. The measure for this goal is user acceptance and satisfaction as well as a wide user group. A technical and business administrator of the BI system from the company side was advised.

After discussing the planning of the development, the discussion continued with the architecture of the BI system. The architecture takes into account the need to capture data from heterogeneous sources and combine them in a common denominator. In this context, in addition to the classic ETL process, use of Master Data Management (MDM) procedures is enabled for merging and consolidation of key dimension data. The ETL process is done overnight every night, but manual refreshing is also possible preferably on a limited data series.

The first phase of the ETL – Extract, as previously discussed, is the process of extracting data from various data sources. In this particular case, the main data source is the company's ERP system – SAP as well as flat files. The Transformation phase refers to the sequence of commands or functions in the obtained data to ensure that the data is properly aligned and loaded. In the Load phase we load the data in the data warehouse.

The OLAP technology used in the PLU BI was Microsoft SQL Server Analysis Services, which was named by Gartner as a leading technology in its field. In addition, as a solution for the BI functionalities in this BI system, the complete Microsoft BI platform was used, which includes Microsoft Office, Microsoft SharePoint and Microsoft SQLServer. For visualization of the data, Pyramid Analytics BI Office tool was used. The BI system also has several perspectives which provide customized views of the data for different user groups (sales, procurement, supply chain etc.).

3.3.3 Defining the areas of scope

The creation of the data warehouse required a planned approach from the company. Its content must not come from the available data, but instead from the business user's needs. During a series of workshops, the developers and the company agreed on the needs for information, whose purpose is to support the decision-making process (management, middle management, analysts). The areas of analysis which were needed for this support were determined to the level of measures and dimensions. The business users with support from management created a list of business requests. Based on these requests, a functional specification of the BI solution was created, which determined the content and the way of use of the BI system. These requests were the entry point in preparing the logical model of the data warehouse, where the mapping between the measures and dimensions was done. Here it should be noted that special attention was given to the measures and dimensions which were used in more business areas, so that each user understands them in the same manner. Additionally, in the process of naming the measures and dimensions, a document with all the measures naming and rules for calculation was created. There are two types of measures in the PLU BI system: basic and calculated. The basic measures are taken from the fact tables in the data warehouse and on them we can perform mathematical operations. The calculated measures are derived from the basic measures and additional business rules. In the creation of the dimensions a star scheme was used because of the large number of data.

As previously mentioned, a document with the naming rules of measures, dimensions and attributes was created. When this BI project started they were in Slovenian, however after the acquisition by HEINEKEN they were translated to English. This was a sub project on its own, because when a measure is renamed in the OLAP cube it "falls out" of all the reports and dashboard where it was previously used and has to be added again. This basically means that all the reports that were prepared for the SharePoint portal or for specific users, had to be redone. However, this change provided information on how much users use the BI system when they noticed it was not working and it allowed them to send out requests for new reports to be created.

Currently in the PLU BI system four areas of scope are present: sales, supply chain, business statements and profitability. The creation of the BI system started with sales, initially volumes and revenues by customers and brands which were tracked daily by the sales director, managers and sales reps. Later this measure group was upgraded with additional measures and dimensions leading to daily tracking of detailed sales. After this area was stabilized, at approximately the same period business statements and supply chain areas were added. Supply chain data required an additional data source to be integrated in the data warehouse. This added to the complexity of the BI system, but significantly reduced the time required to report supply chain data and freed more time for analyzing the data and business partnering. In the past period the total profitability of the company, to the lowest level of product, was added in the BI. This was a large subproject which required a lot of dedicated time on both the developer and

business user side. These areas represent four different measure groups in the BI where each has its own measures and dimensions, some of which are more complex, and others are simpler. Additionally, users can combine the measures and dimension of different measure groups for advanced analysis – however, this is possible only for some, not all. The data in the measure groups described above relates only to actual data and each has many different KPIs and time measures: In the Month (ITM), Year to Date (YTD), Last Year (LY), Year to Date Last Year (YTD LY) etc. For each of them, a plan and last estimate of the plan measure groups were added, to enable analysis and comparison. The plan and last estimates are added as Excel flat files in the BI because they are not in SAP. For each of them a folder location shortcut is created where the users simply paste the files and they are integrated in the OLAP cube.

For the work observation part of the research I was present at all Steering committee meetings and the internal PLU meetings we had on a regular basis. I had an opportunity to be daily exposed to the BI and participate greatly in the testing and stabilization phases. In addition, in the past months I tracked the BI usage in the company. In only a month and a half there was an increase of 96% on company level, with more than 150% usage growth in some users. This was contributed by the BI usage trainings which were organized and the internal "BI promotional campaign" which was started using a bi-monthly newsletter, informing users of the latest updates in the BI system and tips and tricks for more insightful use and better user experience. Additionally, the company has an internal social network where a PLU BI Community group was created and it is used as an additional tool for promoting the system.

3.4 Challenges during the implementation

All major projects run into obstacles and challenges during their implementation. This BI project in PLU was no exception. However, from all challenges some lessons can be learned for further use. The biggest challenges faced in PLU during the BI system implementation were:

- Time resource: The project took longer than expected. Depending on the project complexity and all the factor that affect its implementation, the project duration can vary. In this particular case the biggest reason for the overtime was the need to align the definitions, to be understood in the same way by all business users. Consequently, it is always a good practice to plan for more time than initially estimated.
- People resource: Due to the integration in HEINEKEN, other IT and business projects were going in parallel and team members were busy on other projects. Additionally, there was a fluctuation of employees and changes in the BI team members. The new members first had to be introduced to the project and educated how to work with it before they could start working on it.
- Lack of information sources: The data for the data warehouse was stored in different sources, some was in the ERP other was in Excel tables, which complicated the process of

data integration into the data warehouse. Furthermore, as new areas of scope were added in the BI system, additional data sources had to be integrated in the data warehouse.

3.5 Benefits of the BI in Pivovarna Laško Union d.o.o.

However, despite these challenges the project was graded as extremely successful by the employees and management team and all the goals were achieved. Additionally, a lot of new business needs for the BI were identified and some existing processes were simplified. The BI project in PLU provided multiple benefits for the company on different levels:

- *More time for business partnering:* Before the BI significantly more time was used for calculating and analyzing the data which now we get directly from the BI in a matter of seconds. This leaves more time for business partnering, for sharing knowledge and expertise with other employees to bring value to the company.
- *More informed and quicker business decisions:* The BI became critical for the business and it is being used on a daily level by Management team members and other employees. After providing appropriate education and training, business users no longer wait for the data but instead are actively using the system and deep diving themselves (self-service approach). This provides them with an opportunity to bring quicker and information-based business decisions for their daily activities.
- *Quicker business modelling and creation of annual/strategic plans and last estimates:* In PLU each year an annual plan for the next year is created and three last estimates of the plan during the year. These processes require a lot of data, man power and time but since the BI, they have been significantly improved in terms of data quality and time duration. Now these plans and last estimates are in the BI, and they allow for quick and more complicated analyses.
- *Formal storage of data:* With the BI, historical data is stored in the system as a snapshot of what was reported not changing over time. In this way the right version is always available, and the users do not need to search through different versions to find it.
- *The BI system is the only source of truth in the company:* The goal of the BI project was accomplished; the BI is now used by business users for their day-to-day activities and decision making on a daily level. Users trust the system and the quality of the data they receive.

3.6 Best practices for implementing BI

As stated in the literature review, for a Business Intelligence project frameworks and factors exist which contribute to its success. Some of them are general and apply for all BI implementations and others are specific to a certain project. However, what the literature didn't state were some best practices, methods or techniques for BI implementation which were superior to others. As a result of this research, after discussing with the interviewees, I made a

list of the best practices used by PLU which would be a guideline for other companies when implementing their BI systems.

The best practices for implementing a Business Intelligence system in Pivovarna Laško Union d.o.o are split in three groups:

- Organization
- Process
- Technology

They are followed by an "after implementation process" which further contributes to the success of the BI. Their goal is to provide a trustful and reliable source of truth.
Each of them will be discussed in more detail.

3.6.1 Organizational best practices

A major project such as implementing a BI system, means a major change for the company. Managing any change requires that the stakeholders are aware of the need for the change and how it will benefit them, as well as support by the project sponsor which will lead to acceptance by the users. Consequently, the best practices which PLU applied are:

- ***Have a clear business vision and business case****:* The question here is "Why do we need to implement a BI?". The BI implementation should be business driven and the need should come from the business. In the case of PLU, the implementation had two driving streams:
  - *Compulsory reporting to Global functions* – the goal was to reduce time for reporting and free time for Business Partnering
  - *Business needs* – Creating one source of truth and one source of data on which to conduct the day-to-day business decision making. Data needed to be faster, more visualized and more user friendly.

  These reasons led PLU to the decision to implement a BI system.

- ***Appoint the right and powerful sponsor****:* The sponsor should be a member of the management team who will set a high tone and need to implement and finalize the project. They should make the implementation a company priority. In this case, the sponsor was the financial director of the company who, as previously said, has an authority to prioritize the project. What they did, and which can be used a good practice, is they organized a kick off meeting with all team members and functions involved where the sponsor had a powerful motivational speech. They gave appropriate responsibility and authority to the project leader, the partners and the team members.

3.6.2 Process best practices

For a BI project implementation to be successful, effective process management is required. It needs to be clearly defined what is the expected outcome of the project and what is everyone's role in achieving it. PLU applied effective process management through the following best practices:

- ***Business centric champion**:* Having an interested business user or a business centric champion is crucial since they drive the need to have the BI in place and motivate others to use the system as the only source of truth. In the case of PLU these were the Sales and Marketing directors. They motivated their teams to use the system on a daily basis which led to more demands (different reports and view of the sales data) from business users once they understood the added value. An important thing to understand here is that a BI implementation is a "use and improve" process, meaning that when business users use the system they find inconsistencies, suggest corrections and improvements. It is also important that this is communicated to all the final users, otherwise it can create distrust.

- ***Defined process, scope and milestones**:* For a successful BI implementation, the timeline, milestones and roles of the team members must be clearly defined. In PLU a steering committee was organized and appointed as the responsible body for the implementation of the project and regular Steering Committee meetings were held. On these meetings the progress of the project, the obstacles, the milestones and future plans were discussed. The roles of team members were redefined, and their availability was agreed upon with their superiors.

  From a BI implementation, a change in processes and other BI projects will arise. Companies should always plan more resources than needed to respect the time and budget frame.

- ***Involve users in the development of the BI system**:* A good practice is to try to plan and get an initial quick win to boost the motivation of the team and users. In PLU a step by step approach was taken to implement the BI in stages so that users see the benefits early in the process. Another good practice here is to selectively invite team members to the Steering Committee meetings to increase their visibility in the eyes of the management team and give them recognition.

- ***Delegate a BI team and create a BI governance process**:* A BI system is a "living process" that changes and needs constant maintenance. In PLU during the implementation there was no formal BI team, this role was done by IT and controlling departments, but the roles of the people involved were clearly known. A BI team should be created consisting of an IT specialist, a business specialist and a BI specialist. They should take care of the maintenance of definitions, updating reports, education of end users and after

implementation upgrades. There should also be an established governance process in order to incorporate new requirements and follow their development.

3.6.3 Technology best practices

In order to create trust in the BI system, the data must be correct and understandable to all users, and it needs to be easily available. Technology plays a big part in achieving this. PLU applied the following practices in making users accept the BI system and helping them make better business decisions:

- ***Align the correct definitions with users (data quality and integrity)****:* This is an extremely time-consuming task which took a significant amount of time in PLU, but a vital element of BI implementation. It is also important when doing a BI upgrade since it is quite expensive changing the definitions later in the process. This practice provides that all the users speak the same language and understand the concepts in the same way. In PLU there was a case when the definition for one measure had to be changed after implementation, due to a new accounting standard. This change brought along changes in all the calculated measures which were derivatives of this one, it required new measures to be created and additional testing. As expected, it also brought additional expenses to the project.

- ***Visualization****:* It is important to create a visual representation of data for high level management. The BI PLU can be used to create reports in Microsoft Excel, which are only numerical representation of data and no graphical representation is seen. For visualization, PLU uses Pyramid Analytics BI Office, a data visualization tool used to create interactive dashboards, which help to understand the business trends and performance. The tool takes data from the OLAP cube and provides more accessible and understandable view of the data. The added benefit of using visualization is the increased user acceptance and satisfaction. The business users were properly trained in using the tool with individual or group trainings. The application's ease of use and availability increased their intention to use the BI system. They were offered support whenever needed and were always engaged in the new developments.

- ***Availability and speed****:* Make the BI more available by implementing the solution on smart devices so they can use it anywhere and at any time. In PLU the BI visualization tool was installed on the users' tablets and smart phones, which proved highly effective. It increased the BI usage by 96% in only a month and a half (internal company research). An important thing to remember here is that the speed of the tool should be high because business users lose interest if it takes too long.

After implementation process

After the implementation of the BI was completed, PLU continued the process with another best practice which strengthened the users' trust in the BI system:

- ***Keep business users involved, market your product and inform users:*** After the implementation it is important to regularly review the business needs and keep the users involved in the process. This can be done by setting up monthly meetings with the users to see what they use, what they need etc. It is also important to constantly inform users about updates, which PLU did using a newsletter and sharing updates on the company's internal social network. It is a good practice to create a brand for the product (ex. PLU BI) which will increase visibility and trust, and use the brand for marketing the product to increase the interest in the BI on the user side. Users can be engaged by providing education and trainings for them on a regular basis.

Figure 4: Example of the PLU BI newsletter

Source: Adopted from Pivovarna Laško Union d.o.o. (2018)

These best practices were applied by PLU in the implementation of a BI system and can be used as a guideline for other companies during their BI implementation projects.

3.7 Business Intelligence Competency Center as an opportunity for PLU

Seeing that now the Sales, Supply chain, Business Statements and Profitability data is in the system, and other spheres are to be added in the upcoming period, the system is becoming a

one source of truth for the company. The company will no longer struggle with data sourcing and manual correcting of the data quality, but instead can focus more on analyzing the data. But, until this final stage is reached, there is still a need for an enterprise-wide data collection and analysis approach. Considering this need, my suggestion is to establish a Business Intelligence Competency Center (hereinafter: BICC). The literature supports this by defining BICC is a cross-disciplinary team assigned within a company who is charged with championing "BI technologies and standards, as well as the business alignment, project prioritization, management and skills associated with significant BI projects." (Strange & Hostmann, 2003). The BICC in PLU would consist of IT and Business users and a BI specialist. Up until now, PLU used the developers from the outsourced company which managed all matters considering the development of the system and support, as well as management of technology issues. However, with the growth of the project, the workload on the developers increased, followed by an increase in costs for PLU. Another issue is the communication gap that exists between the business users and the IT programmers who created the system.

Planning to avoid these costs as well as the dependency on the vendor, the BICC should be created with the intention to bridge the gap between business users and the outsourced company, while at the same time improving the analytical capabilities of the company. This would lead to employees relying on skillful experts from the BICC, within the organization, to provide them with the reports they need in a timely manner. The creation of the BICC should be supported by the management team as a cross-departmental unit combining technical and functional resources to manage information delivery.

The first role of the center will be to maintain the technical side of the system as well as take care of the data and its accuracy by performing regular tests and controls. It will serve as an internal consulting, analysis and support organization, which leads to its second role - to improve and optimize the ongoing financial processes in the company, providing the users with the latest data and making it available for them to use the data in a smart and efficient way. The team will consist of members who understand the needs and wants of the business users, in terms of content and time, and who are also technically competent to provide them with these results. Its role as a liaison between the business and the IT company means that it will have to take on some of the responsibilities from the IT company. The IT company will remain in charge of developing the system, writing the code and the MDXs while the BICC will be in charge of maintaining it and creating the reports and dashboards. This separation of responsibilities will be good because it will provide each group with its mission and vision, as well as a responsibility when conflicts arise. With the creation of the BICC the users will reduce their dependency on the IT company and focus their attention towards the BICC for their reporting needs.

The next step for the BICC will be to establish a companywide governance policy. Until now the business analysts were dealing with not totally satisfactory results when analyzing data due to the inconsistency and quality of the data. As an added value in this process, my

recommendation would be to position a Data Governance Manager as part of the BICC team. As explained by Foster, Smith, Ariyachandra and Frolick (2015) in their research of a BICC implementation in an insurance company, a Data Governance Manager is responsible for:

- Defining data across the enterprise;
- Improving data quality;
- Resolving data integration issues;
- Providing data usage policy and quality standards;
- Determining data security;
- Maintaining business rules applied to data and data retention criteria

The BICC should also have proactive as well as reactive data quality processes. The first would help prevent data quality issues from occurring with early involvement in new information systems initiatives. The reactive processes including resolving of data quality issues give feedback to the proactive processes by means of lessons learned.

The success or failure of such a center is primarily dependent upon the composition and skills of the team. The accomplishments of this investment, the BI project as well as the BICC, up to date and in the future, will save the company a significant amount of time and money.

BICC Best practices

Implementing a BICC would be a sub-project of the BI development. According to a study on BICC best practices (Foster, Smith, Ariyachandra & Frolick, 2015) there are several best practices for implementing a BICC, which are the result of addressing the data and process issues in data governance and practices.

The first best practice is the same as in the BI project implementation, securing an executive sponsor who will support the sub-project and will be directly involved in its implementation. Without an executive sponsor, the chances of failure are much greater. The sponsor has authority and responsibility, will support the project when difficulties arise and will keep the project implementation in place and on time.

The second is splitting the tasks and responsibilities between the BICC and the IT company. This is essential in order to avoid duplication of tasks and reduce time and money by giving more responsibilities to the BICC team, which now will act as a liaison between the business users and the IT support. However, taking away some responsibility from the IT company, does not mean a loss of trust in it, it is merely a way to let them focus more on their core competencies, such as development and upgrade of the system, rather than maintenance and building reports for business users. As mentioned in the previous section, this will be one of the roles of the BICC in PLU.

Third key practice is quick wins. The most important part of any project are the people. By providing quick wins, the ones involved in the implementation of this kind of project, especially due to its magnitude, will gain confidence in the system. This is especially crucial for the members of the BICC team. In the case of PLU, in the beginning of the BI system implementation, a distrust existed. This skepticism repeated each time there was an issue with the system functionality. The practice of quick wins, such as automating the monthly reports, helped increase the trust and assurance in the system and motivate the users to use it more and to upgrade it. Another example is the preparation of the half year profitability reports, for which before the BI cca. 1 week and 2 teams were needed to prepare it. Now, with the BI, the reporting was done in 3 days and with only a few people involved. This quick win increased the users' satisfaction in the system.

Fourth, it is important for the company and its employees to learn how to operate the system themselves, independently from the IT support. Self-service applications and training are needed to teach the users how to complete their own tasks and work more efficiently, while at the same time lifting the load from the IT, which can focus on other aspects of the project. By doing this, the employees gain an efficient skill set and the company saves money. In PLU the BICC would be responsible for training the business users and would only act as support when needed.

Fifth, it is important to measure and communicate the success of the BI in its ongoing processes and to show the part that the BICC takes in helping the company reach its BI goals. This is best done through visualization of the success in a scorecard showing its current state and upcoming goals.

And lastly, the BICC team needs to have both technical and business skills in order to better understand the needs and requirements of the users and be able to provide them with a technical solution. In this case, the soft skills might even be more important than the technical ones.

CONCLUSION

The main objectives of this thesis are to provide a set of best practices for BI system implementation while investigating the challenges during the implementation and the opportunities that arise from it. Case study was used as a research method and it was done in the period between January and July 2018. The information obtained from the interviews, meetings and official documentation combined with the literature review, contributed in providing the set of best practices and researching the opportunities.

In the theoretical part of the thesis the business intelligence terms are defined and explained as well as a general overview of the business intelligence technology and how it works. The design and implementation of a business intelligence project with the phases are explained for a better understanding of the research part.

In the empirical part of the study we see a real case of implementation of a BI system in Pivovarna Laško Union d.o.o. By analyzing the information gained from the interviews and documentations, the process of implementation is explained going through all the phases of planning, establishing the infrastructure, development, testing, training and acceptance. This process is preceded by defining the need for the BI system. This part also provided for an insight in the challenges faced during the implementation of this BI system and the opportunities that it provides for the company. As main challenges, the lack of time and people resources were identified together with the lack of information sources integrity. These challenges serve as additional advice for other companies which plan on implementing a BI system, to plan more time, to manage their employees' time accordingly and to provide a better basis for the data integration.

Based on these information and after discussing with the stakeholders of this project, I was able to put together the set of best practices for implementing a BI system based on this particular case. The best practices are divided in 3 groups: organizational, process and technology. The organizational ones are about specifying the business need and appointing a powerful sponsor. The process practices focus on having a business centric champion; defining the process, scope and milestones; involving users in the development of the BI and delegating a BI team. The technological best practices which were defined are data quality and integrity; availability and speed; and visualization. Additionally, another best practice was defined as an after-implementation practice. It suggests keeping the users involved, marketing the product and informing users on developments.

As an opportunity or recommendation I saw from this research, is the establishment of a Business Intelligence Competence Center in Pivovarna Laško Union d.o.o.. The BICC will maintain the BI system by taking care of the data quality and accuracy and will serve as an internal consulting, analysis and support organization. Researching the literature on this topic, I also found best practices for implementing a BICC in companies which are: securing a powerful sponsor, dividing the tasks, celebrating quick wins, teaching users how to operate the system independently, communicate the success of the BI and create a team which will have both business and technical skills.

Overall, this study answered its research questions and fulfilled its purpose. The research was demanding and required a lot of time and effort on both sides. There was significant support from the company side regarding manpower and documentation. The benefits from this research are twofold. For the company this research raised awareness of the challenges during the implementation, it improved the internal communication and opened space for future improvements and upgrades. The recommended opportunities might be implemented, and the findings of this study can be useful for training new employees. Additionally, other companies looking to implement a BI system may use the findings of this research as a guideline, which is the purpose of this study. Finally, this study, the case of PLU can serve as a hands-on example

for other companies looking to implement a BI system and can provide ideas for other researchers.

The limitations of this study are that this is a context specific BI implementation, which was done under the given circumstances. The circumstances may differ for other companies.

Finally, the main recommendation for future research is to expand the case study and focus on self-service BI and how data governance and management can enable successful self-service BI. Another direction can be data visualization and the user experience. As we learned from the study, the employees are not too keen on change and new technology solutions, more over they have a certain amount of skepticism towards the BI system. Therefore, by researching the link between data visualization and the user experience maybe we can find some ways to increase the trust in the system and the effect on aesthetics on the usability of the system.

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APPENDIX 1: Analiza procesa uvajanja sistema poslovne inteligence: Primer Pivovarne Laško Union

Sistemi poslovne inteligence so med najbolj tveganimi investicijami na področju informacijskih tehnologij. Zahtevajo sodelovanje med strokovnjaki s področij informatike, managementa, financ in računovodstva, da prispevajo dodano vrednost podjetju. Implementacija sistema poslovne inteligence zahteva široko organizacijsko sodelovanje in sinergijo med poslovnim in IT-svetom (Wagner & Weitzel 2012).

V literaturi o poslovni inteligenci lahko najdemo smernice za implementacijo (Moss, L. T., & Atre, S. 2003; Grossmann, W., & Rinderle-Ma, S. 2015), in tudi razumevanje prednosti sistemov poslovne inteligence (Hočevar, B., & Jaklič, J. 2010; Popovič, A., & Jaklič, J. 2010; Chen, X., & Siau, K. 2012; Rahman, S. 2011). Vendar, nam literatura ne ponuja veliko študijskih primerov o izzivih podjetij, ki nastopijo med implementacijo. V literaturi tudi najdemo le malo primerov dobrih praks ki bi pomagali drugim podjetjem pri implementaciji njihovih sistemov poslovne inteligence. Študije ne opišejo ovir, s katerimi se podjetja srečujejo in kako jih premagajo.

Motivacija za to raziskovalno delo izhaja iz potrebe po razumevanju in analizi procesa uvajanja sistema poslovne inteligence z vpogledom v slovensko podjetje Pivovarna Laško Union z namenom večje uspešnosti prihodnjih tovrstnih projektov. . Želeni rezultat raziskave je zagotoviti niz najboljših praks za prihodnjo uporabo z raziskovanjem izzivov in priložnosti, ki izhajajo iz razvoja, uvajanja in uporabe sistema poslovne inteligence. Poleg tega bo v tej magistrski nalogi analizirana struktura podjetja, področja uporabe sistema poslovne inteligence, uporabniško sprejemanje sistema, izzivi in priložnosti za izboljšavo učinkovitosti procesa.

Raziskovalna vprašanja magistrskega dela so zato:

- Kateri so ključni izzivi uvajanja sistema poslovne inteligence?
- Kakšne so dobre prakse pri uvajanju sistema poslovne inteligence?

Najprimernejši pristop za odgovarjanje na tovrstna raziskovalna vprašanja, kjer področja še niso dobro raziskana, je analiza primerov. Začetne informacije za analizo procesa so bile pridobljene preko delavnic in skupinskih intervjujev z vsemi ključnimi deležniki v procesu uvajanja, vključno z zaposlenimi v podjetju in tudi zunanjimi strankami, ki razvijajo sisteme. Poleg tega je bilo izvedeno tudi opazovanje dela, ki je pripomoglo k boljšem razumevanju procesa uvajanja.

Magistrsko delo je odgovorilo na zastavljena vprašanja in izpolnilo svoj cilj. Ključen predlog, ki je rezultat tega dela, je uvedba kompetenčnega centra poslovne inteligence.