UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER'S THESIS

# THE ROLE OF CORPORATE PERFORMANCE MANAGEMENT AND BUSINESS INTELLIGENCE ALIGNMENT

Ljubljana, November 2017 TIBOR DERGANC

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# LIST OF ABBREVIATIONS

BI - Business Intelligence

biMM - Business Intelligence Maturity Model

BPM – Business Process Management

BSC - Balanced scorecards

CMM - Capability Maturity Model

CPM - Corporate Performance Management

IT - Information technology

KPI - Key performance indicator

MM - Maturity Model

PMI - Performance Management Index model

# INTRODUCTION

Companies have to measure, monitor and analyze their performance in order to be more successful in today's competitive business environment than other companies (Bosilj Vukšić, Pejić Bach, & Popovič, 2013, p. 613). Nowadays companies are using Corporate Performance Systems to measure their performance (Richards, Yeoh, Chong, & Popovič, 2014, p. 1). Corporate Performance Management (hereinafter: CPM) is a management process which systematically helps at planning and budgeting performance of a company. Based on operational and financial targets companies can measure performance and make appropriate corrective actions based on this (Williams & Williams, 2010, p. 5). CPM as a concept is very important from the perspective of business and many times it is considered as next generation of Business Intelligence (hereinafter: BI) (Aho, 2010, p. 1-2). As a term BI was first introduced in 1990's by the Gartner Research Group and one way to perceive it from the perspective of business environment is as a method that can be used to analyze the business environment. Williams and Williams (2010, p. 5-6) define BI as follows: "Business Intelligence (BI) is a systematic approach to delivering and leveraging business information and analytical applications to improve business performance." According to M. Anandarajan, A. Anandarajan & Srinivasan (2012), at first BI was used as a term for data analysis tools. Later, BI was understood more broadly as a circle of all the parts that an integrated decision support infrastructure includes (Baars & Kemper, 2008). Clearly, CPM and BI can be found in the literature as a separate concepts or initiatives but throughout the years they were quite often considered and mentioned together since they can effectively complement each other. In terms of BI and CPM implementation, BI and CPM initiatives are differently implemented in companies since some companies are more mature in this sense and others are less and are therefore not exploiting all the possibilities and benefits that these initiatives are offering. Furthermore, some companies use these initiatives separately while others do not just use them but rather coordinate and align them properly in order to gain greater benefits for the company. There are clearly some authors who argue that BI and CPM should be commonly considered and they try to find their similarities. Some authors, as we discuss in first three chapters, made a distinction between the concepts of BI and CPM and how do they complement each other. On the other hand some authors point out the level of importance that alignment between BI and CPM initiatives can have for the companies in order to provide benefits for them (Williams & Williams, 2010, p. 4). However, what is interesting to us is if companies are actually aware of this and more importantly if they take appropriate actions that would reflect this awareness. The main issue here as in many other cases is that in practice this clearly isn't always the case. As we discus in the third chapter of the master thesis Williams and Williams (2010, p. 4) claim that based on the results of their survey BI and CPM initiatives are used individually in companies and still contribute to better performance of companies. Nevertheless, there is a need for these initiatives to be aligned and coordinated in order to achieve even better business results. Therefore, interactions and influences between these two initiatives are very interesting for our research.

Consequently, the main purpose of the master thesis is to understand how concepts of BI maturity and CPM maturity are connected and how do they influence each other. However, Richards, Yeoh, Chong and Popovič (2014, p. 1) point out that there is still limited study about the BI impact on CPM. In the master thesis alignment of these two concepts is pointed out as well. We want to see how alignment of BI and CPM influences BI and CPM maturity and on the contrary if these concepts and their maturity influence the alignment in any way and if these influences are different for different groups of companies. Furthermore, we want to provide a better insight about the current state of BI and CPM initiatives in Slovenian large and medium size companies. Focus is to provide results about their maturity and alignment of CPM and BI initiatives by linking the theoretical concepts from the literature review and our research results. This can enable for the public as well as experts from the field to see the current state of these concepts in Slovenia and enable comparison with other studies from the field that also study CPM and BI concepts either in Slovenia or any other country. We would like for these results to be taken into account when preparing future work in this area and serve as a basis for further analysis and improvement.

Objective of the master thesis is to research the existing BI and CPM maturity models that were introduced and modified by different authors and look for the basis for the questionnaire that is used in the research. We select and introduce two different models that support our questionnaire and serve as the basis for research questions as well. Our second goal is to analyze the data that we gathered with the questionnaire in order to see how mature are Slovenian medium and large size companies in the field of BI and CPM and if these initiatives are coordinated and addressed accordingly. We want to get a better insight into how concepts of BI maturity, CPM maturity and their alignment influence each other in order to get an answer to the research questions. Furthermore, we want to link concepts of BI and CPM maturity with their alignment in order to see if there is any connection that should get more attention especially in future work. We also want to know how these project are carried out in Slovenian medium and large size companies in terms of common initiatives, people and priority since often CPM and BI concepts are mentioned together in the literature.

We want to know how BI and CPM initiatives are perceived inside companies and what their actual maturity is. We also want to know how projects or initiative are implemented inside companies and if there is a common perception of the concepts. For the purpose of master thesis and to answer these questions we defined two research questions:

*Q1:* Are BI and CPM projects aligned and carried out as common or separate projects in companies?

Basis for this question is discussed in the third chapter as well since Frolick and Ariyachandra (2006) make a distinction between both terms and also other authors that we referenced in that chapter make a clear distinction between BI and CPM concepts (Melchert,

Winter, & Klesse, 2004; Miranda, 2004). However, as pointed out Williams and Williams (2010) and also other authors (Aho, 2009) argue that these two concepts can be used as a complements because they are linked and if aligned with common strategy they can bring greater value for the company than if used individually. Therefore, we want to know how companies in practice take into account this findings and how are BI and CPM projects carried out. Either as individual projects that are not aligned or as common projects where people involved share the same goals, information and so on.

*Q2:* What is the role of BI and CPM alignment from the perspective of BI and CPM maturity?

Aho (2009, p. 5) points out that there is a strong connection between BI and CPM concepts and that there is a need for common BI and CPM strategy. In the third chapter of this work findings by Williams and Williams (2010, p. 1-2) are presented which suggest that the alignment of both concept is very important and thus influences the business performance improvements and help to achieve higher success rates in accomplishing business objectives. But is there also a connection between maturity of both concepts and between maturity and alignment of both? Questionnaire that we have used for research is constructed in a way that can also provide a clear picture about maturity levels of BI and CPM concepts which will help us make a connection between the alignment of both and their maturity levels. Questionnaire will be presented and explained in the fourth chapter.

For the purpose of master thesis, we use data from secondary in primary sources. Secondary sources are gathered from books and articles and presented in the reference list whereas for the primary sources we use a questionnaire that was developed for the purpose of international project PROSPER. For this purpose we use different research methods which are presented in the following:

- A comparative analysis between existing maturity models which also serves as a basis for the questionnaire that is used for empirical research. We select two maturity models that help to assess maturity levels of BI and CPM and are presented in more detail in first and second chapter.
- We use data from the existing researches in order to gain deeper insights into the subject as such and possibly make a comparison and distinction with our results. This should serve as a basis for better understanding of the subjects and support our research.
- Cluster analysis is used for the primary data sources that are gathered based on the questionnaire in order to find out how mature are Slovenian companies in the field of CPM and BI and how well are these initiatives aligned. With the help of analysis we try to make a distinction between different groups of companies and try to find out how concepts of BI maturity, CPM maturity and their alignment influence each other.

Structure of the master thesis is presented in the following. In the first chapter we introduce BI concept based on the literature review and how its perception changed throughout the years. We also study measurement of BI which is explained with the help of BI maturity models. Then, we present development process of maturity models and make a short overview of different models. At the end of the first chapter we present a selected BI maturity model that was introduced by Dinter (2012) where we closely examine maturity levels and dimensions of BI which also serve as a basis for the questions in the questionnaire that relate to BI concept. In the second chapter we present CPM and different levels of CPM. We shortly explain how CPM and its role in the company changed throughout the years. Later in this chapter we present selected maturity model that was introduced by Aho (2009, 2012). Similarly as for the BI we then examine CPM maturity levels and CPM maturity components that serve as a basis for the CPM part of the questionnaire. In the third chapter we address a topic of BI and CPM alignment where we emphasize its importance for the improved company's performance. We also make a short comparison between BI and CPM and introduce research findings regarding alignment of BI and CPM that was done by Williams and Williams (2010). In the fourth chapter we present methodology and questionnaire where we closely look into questions and support their selection with the literature review. In this chapter we also present data analysis and selection of methods and techniques for the analysis. In the fifth chapter we present results of the cluster analysis together with descriptive statistics. Discussion takes place in the sixth chapter where we look into different clusters and try to characterize them. We also introduce BI maturity, CPM maturity and their alignment in each of the clusters. At the end of the chapter we discuss relations and connections between these concepts and how do they influence each other based on the results of the analysis. After this chapter we make a conclusion that summarizes our findings.

# 1 BUSINESS INTELLIGENCE

When looking into the literature, there are many definitions of BI as such, however there is no definition that would be considered as universal (Wixom & Watson, 2012). The role of BI and its application have changed over the last years. In 90's BI intelligence was perceived from the technological point of view and therefore considered as technology approach. However, today it is considered as strategic capability which can also help organizations at being more competitive on the market (Negash & Gray, 2008). Questions regarding the implementation were substituted by questions regarding improvement of business value, strategic business alignment and solution architecture optimization (Williams & Williams, 2007). Inside many organizations when they create, collect, analyze and apply information, BI is considered as strategic capability (Raber, Winter, & Wortmann, 2012).

Wixom and Watson (2012, p. 194) say the following: "*Business Intelligence (BI) is a broad category of technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help its users make better decision.*" So we can understand BI as a common term for BI technologies such as OLAP as well as BI applications such as dashboards that

are built with the help of BI technologies (Wixom & Watson, 2012, p. 194). Central part of the BI system is so called data warehouse which integrates data from various transactional information systems for analytical activities (Gupta & Singh, 2014). As described by Negash (2004, page 178), data warehouse is used to present information that are complex to the decision makers as well as planners.

However, if we look at the enterprise application landscape, BI solutions are viewed as an essential part of it. They provide relevant information to the management of an organization as well as different departments in the organization. Therefore, they are supporting decision making process. BI is of high importance when it comes to information management in an organization (Arnott & Pervan, 2008). Richardson and Bitterer (2010) even say that in the last years BI was considered as most important technology priority, hence nowadays it is perceived as most important business priority. Looking from the other perspective, Luftman and Ben-Zvi (2010) say that although BI has become perceived as very important in recent years, there still remains a challenge of putting it into place. Regardless its importance it has to be noted that the impact on performance of an organization that it has is indirect and long term (Popovič, Coelho, & Jaklič, 2009).

## 1.1 Business Intelligence Maturity Models

One of the most appropriate measures for BI maturity is the level in the BI maturity model that an organization has reached (Raber, Wortmann, & Winter, 2013). Because of the impact that BI has, it requires comprehensive, systematic and transparent analysis of the BI solutions that organizations currently have. Looking from this perspective maturity models that are specific for BI can have a big impact and contribution (Dinter, 2012). Concept that provides explanation of maturity models can offer complete support for wide transformation and design activities required by BI because it covers such a wide area of issues from business to information technology (Raber, Winter, & Wortmann, 2012). According to Aho (2012) the main idea around maturity models is that maturity is a forward moving process where capabilities of an organization improve over time in qualitative as well as quantitative terms. If an organization gets itself into a higher maturity level it means that it is performing in a more efficient way.

Mettler and Rohner (2009) believe that maturity models are a certain way to recognize weaknesses and strengths of selected areas in an organization. They have different levels of maturity for defined areas. These levels can be used to assess organization as well as its development (Mettler & Rohner, 2009). According to Fraser, Moultrie and Gregory (2002) there has to be a process of evolutionary transformation from the starting point to desired stage in order to reach a targeted maturity state. Becker, Knackstedt, and Pöppelbuß (2009, p. 213) say: “A maturity model consists of a sequence of maturity levels for a class of objects. It represents an anticipated, desired, or typical evolution path of these objects shaped as discrete stages.” It is important to note that higher maturity level is not always ultimate goal

for every organization. Every organization or a company has to decide by itself if a higher maturity level is desired target state (Dinter, 2012). If maturity models are well defined they can integrate different dimensions for design, measurement and control of complex and diverse artifacts. Raber, Wortmann and Winter (2013) argue that consideration of these diverse dimensions that take into account different business aspects, technical aspects as well as aspects that are related to people, has to be done regularly in information systems design and management. When talking about maturity models, Raber, Wortmann and Winter (2013, p. 2) even say: "MMs provide a consistent design and management view on the subject at hand."

Lahrmann and Marx (2010b) describe essential maturity model characteristics as dimensions, maturity principle, number of audience and assessment approach. Some authors have even add some of the characteristics. In their paper of an overview of BI maturity models Lahrmann, Marx, Winter and Wortmann (2010a) say that dimensions, maturity concepts, the maturity principle, the levels and the assessment approach are maturity model characteristics that are very important.

Nevertheless it is important to note that maturity models in general are always biased since there will always be some subjective impact even if it is designed based on the empirical analyses (Dinter, 2012). In an overview of BI maturity models by Lahrmann, Marx, Winter and Wortmann (2010a) ten maturity models were analyzed from the perspective of content and methodology. Authors point out that there are certain shortcomings that existing maturity models in the field of BI have. Most of the models that were analyzed lack a theoretical foundation and in more than half of analyzed models not all relevant topics were taken into consideration which means that their comprehensiveness can be questioned. For example, topics such as infrastructure, applications and data which are considered as traditional IT topics are included and topics such as BI strategy (strategic alignment) and BI organization (BI competency centers) are not (Lahrmann, Marx, Winter, & Wortmann, 2010a). Also, there is a lack of sufficient documentation, although most of the models come out of a practice. Furthermore, only four maturity models were built on the basis of empirical data and not a single maturity model was assessed in scenarios from real world. Also, for those maturity models that were built on the basis of empirical data, there is no information regarding construction process either. In many cases there is a lack of transparent and sufficient description of the basic BI maturity concept which would help to understand what the purpose of maturity model is and what was actually measured (Raber, Winter, & Wortmann, 2012). Taking different models into consideration, there is no instrument that could reliably measure level of the BI maturity of an organization (Raber, Wortmann, & Winter, 2013).

Dinter (2012) says that maturity model can evolve if it is applied as well as revised continuously. Also, comparing results of different maturity model versions is very challenging and has to be considered when doing so.

## 1.2 Maturity Model Development

When it comes to process of maturity model development De Bruin, Freeze, Kaulkarni and Rosemann (2005) describe a development process or lifecycle model that consists of six phases. These are scope, design, populate, test, deploy and maintain. Lahrmann and Marx (2010b) call this basic maturity model development process. If we look into the first phase which is a *scope*, it sets the balance between reality which is complex and model simplicity on the other hand. It also determines the focus and recognizes stakeholders that are relevant and targeted public. Next is *design* phase which takes into consideration the design which is based on the requirements. It also outlines maturity principle concept, dimensions, sub-dimensions and levels structure. This is also foundation for the levels explanation. Bearing this in mind, the approach for the design process can be done bottom-up or top-down. Approach that is done bottom-up first determines characteristics and dimensions which represent maturity and then gets descriptions based on this. On the contrary, approach that is done top-down first starts with description of the levels. Next phase that is named *populate* defines relevant characteristics and assessment of the maturity is set. This also means that instruments for the assessment have to be defined in this phase. In the *test* phase model that was build is tested regarding completeness of the content and intended model scope accuracy. Reliability and validity test of the assessment instrument also takes place. When it comes to the *deploy* phase the model is deployed to independent community and initial stakeholders. At the end, in order to assure the evolution of the model, it needs to be maintained which is done in the phase *maintain* (Lahrmann & Marx, 2010b).

De Bruin, Freeze, Kaulkarni and Rosemann (2005) say that there are different exploratory research methods as well as their different combinations that are used when it comes to the design of maturity models. These are methods such as Delphi method, literature analysis, focus groups and case studies. According to Fraser, Moultrie and Gregory (2002) when it comes to construction of the maturity models quantitative research methods are used less commonly. Qualitative approach is also commonly used for testing. However factors that influence the decision about which research method to use are stakeholders, targeted audience and scope (Mettler & Rohner, 2009).

Maturity models can be also used for a backward process, which means that an organization can use it to choose a desired future state. And from this desired future state they can build a roadmap with the necessary activities that would lead to it. If maturity models are used often they can follow and support transformation process, therefore also help to achieve previously defined goals and external regulations (Dinter, 2012).

## 1.3 Maturity Model Overview

There certainly have to be some requirements in order for the maturity models to achieve and provide all the possible benefits that they can offer. Two of them are availability of data

and comprehensiveness. Comprehensiveness means to include all important parts for design, implementation and operating of a BI system (Dinter, 2012).

It is clear that existing BI maturity models have shortcomings that have to be addressed. One of them is *comprehensiveness* where the issue is that some maturity models only address certain problems that are very specific. Also, some maturity models are not very good in describing maturity levels. *Transparency* is problematic as well because there is little evidence or documentation about the development process. When it comes to *systematization***,** BI domain in maturity models does not always consists of dimensions. Problematic are also *empirical data* because very few BI maturity models also provide an evaluation of the model that is empirical. Not often also happens that public would get an access to the empirical data that come out from the maturity model application. However, if an organization would be able to access these empirical data it could compare its assessment results with the results of other organizations. This way it would be easier for them to position themselves among competitors. Last but not least are *assessment tools* because measurement instruments are provided only by few maturity models (Dinter, 2012).

In the table 1 an overview of BI maturity models is presented. This brief overview was done by Raber, Wortmann and Winter (2013) which updated previous overview done by Lahrmann, Marx, Winter and Wortmann (2010a). They updated it by one revised model and three models that were developed just before their paper was done.

*Table 1: Overview of BI Maturity Models*

| **Name of the model (year)** | **Source** | **Origin** |
|---|---|---|
| Watson et al. (2001) | (Watson et al., 2001) | Academia |
| SAS (2004, 2009) | (Hatcher and Prentice, 2004; Sas Institute, 2009) | Practice |
| Eckerson (2004, 2009) | (Eckerson, 2004; Eckerson, 2009) | Practice |
| SMC (2004, 2009) | (Chamoni and Gluchowski, 2004; Schulze et al., 2009) | Practice |
| Cates et al. (2005) | (Cates et al., 2005) | Academia |
| Dataflux (2005) | (Dataflux, 2005) | Practice |
| Sen et al. (2006, 2011) | (Sen et al., 2011; Sen et al., 2006) | Academia |
| HP (2007, 2009) | (Henschen, 2007; Hewlett, 2009) | Practice |
| Gartner (2008) | (Rayner and Schlegel, 2008) | Practice |
| Teradata (2008) | (Töpfer, 2008) | Practice |
| BIDM (2010) | (Sacu and Spruit, 2010) | Academia |
| EBIMM (2010) | (Chuah, 2010) | Academia |
| Lukman et al. (2011) | (Lukman et al., 2011) | Academia |

*Source: Raber, Wortmann and Winter (2013).*

As it can be visible from the table 1, most of the models originate from the practice and therefore lack proper documentation. There is also a lack of a proper evaluation in all the

models and appropriate construction processes were not published (Raber, Wortmann, & Winter, 2013).

## 1.4 Presentation of a Business Intelligence Maturity Model

Since it is comprehensive, overcomes the shortcomings of other maturity models and is therefore used in the research, we have choose to present more in the detail so called BI maturity model (biMM) that was presented in the paper by Dinter (2012). The model tries to eliminate the shortcomings that other BI maturity models have and in the latest version it covers all relevant BI design issues. This model is known of its wider use and its tradition is quite long. Therefore, in German speaking countries it is well known not just in the scientific community but also in practice (Dinter, 2012).

### 1.4.1 Development of the Model

Versions of the biMM model that we will present more in the detail in the master thesis have changed throughout the years. However, together with universities, Steria Mummert Consulting were the first that built it in 2004 (Dinter, 2012). Version that is still actual was a result of revision that took place in 2009 and took past experiences into account as well as incorporated current trends in BI (Schulze et al., 2009). So why is this important? Methodology of the research is following most of the requirements which were pointed out for the design of maturity model by Becker, Knackstedt and Pöppelbuß (2009).

The first requirement is if the model was compared with existing maturity models. It turns out that the version of the model which was audited in 2009 was *compared with other BI maturity models*. This model was also *developed iteratively*, which means that it was built throughout the years and it was *evaluated by different techniques*. The same as it goes for the evaluation, model was also *built based on several research methods* such as expert interviews, case studies and empirical analysis. *Many have seek for the BI specific maturity model* in their publications which means that the need was real and relevant. Also, in case of this biMM *benefits were taken into account very detailed*. Most of results of the survey and paper published regarding the biMM were aimed at practitioners, however there are also some scientific papers. It is important to note that before 2009 when the model was used in a study it was widely evaluated by experts from the field and even biMM assessment tool itself has been assessed with organizations in practice (Dinter, 2012).

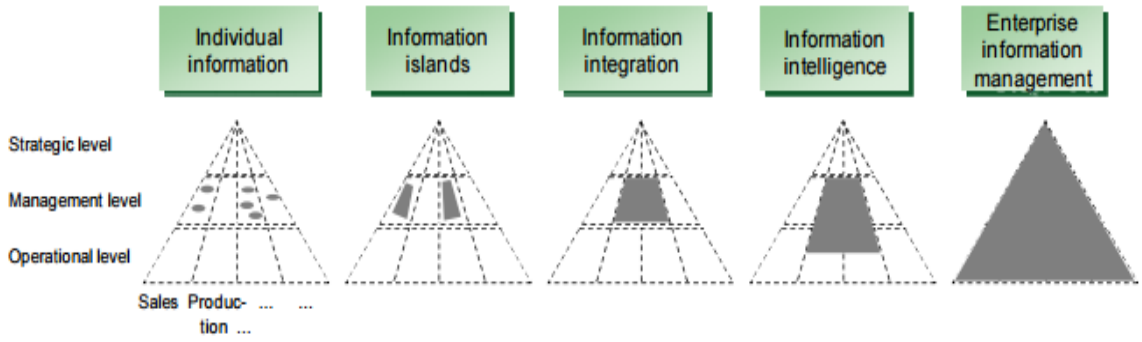
### 1.4.2 Maturity Levels

The purpose of the biMM is to take into account all important parts of operations as well as the development of BI systems and it should compensate the shortcomings of previous maturity models since it is very detailed. In accordance with widely known Capability Maturity Model (CMM) that will be presented later in our work, the biMM has five different maturity levels. These maturity levels begin with the initial phase or state, all the way to

perfect maturity stage and therefore actually demonstrate phases of BI maturity life cycle. It is important to note that the highest maturity level is not always the most desirable one which is also the case in this particular model and also other factors have to be taken into account when deciding about desired maturity level (Dinter, 2012).

As pointed out by Dinter (2012), below all the five maturity levels are shown in the figure 1 as well as BI proportion or penetration in organization hich is increasing throughout the levels.

*Figure 1: biMM Maturity Levels*




*Source: Dinter (2012).*

As we can see from the figure 1 there are different horizontal organizational levels such as operational, management and strategic levels and on the vertical there are displayed different functional areas such as purchasing, sales, finance, marketing, production and so on.

As already mentioned, model consists of five maturity levels from the initial stage which Schulze et al. (2009) name and describe as *individual information*, to the second stage called *information islands*, then third stage *information integration*, fourth stage *information intelligence* and the most mature fifth stage which was named *enterprise information management*.

In the *first stage* there are many shortcomings since also there are no processes that would be intended for the BI. Also, in this initial stage organizations run different queries that are not coordinated, but rather isolated and the benefits of BI tools are not used fully. This stage has many weaknesses such as lack of transparency, redundancies and there is also a lot of manual efforts needed.

At the so called information islands, which is the *second stage***,** on the level of departments there are already some coordinated activities underway and there are already some synergies because of the efforts for consolidation of collecting data, data storage and data analysis. Also, different BI tools are used which brings new possibilities for the analysis. Therefore

to some extent, because of automation and availability, organizations meet basic requirements for information systems.

In the *third stage*, information integration goal is to establish BI solutions on the level of enterprise. This stage already includes BI solution with standardization and data integration, usage, availability and functionality. For the purpose of central database, organizations use data warehouse. Structures of the organization make operations and development of BI systems easier.

Information intelligence is the *fourth stage* where BI is already considered as a critical success factor. Especially departments on the operational level from the figure 1 as well as other departments get considerably more analytical information and this stage is further recognized by advanced analytics, processes and structures that are specific for BI.

The most mature, *fifth stage* is described as enterprise information management and has fully integrated operational and analytical systems. This enables business processes to be supported optimally and knowledge warehouse is set. BI is considered as necessary tool for corporate management and advanced analytical techniques such as advanced visualization or predictive analytics are used (Schulze et al., 2009).

### 1.4.3 Dimensions of Business Intelligence

BiMM is divided into three dimensions which are functionality, technology and organization whereas its structure is hierarchical and multidimensional (Schulze et al., 2009). Questions that are related to BI application and content are included in the functionality dimension as well as questions regarding BI significance in an organization and its usage. Technology dimension includes BI tools, their functionality and data and system architecture. Organization dimensions covers organizational processes, structures, profitability and BI strategy (Dinter, 2012).

Design objects are arranged into clusters based on categories for each dimension. In the table 2 which is shown in the following, dimensions, categories for each dimension as well as design objects for each category are presented whereas design objects attributes are taken into account only if in comparison to the previous maturity level they change significantly.

*Table 2: biMM Dimensions*

| **Functionality** | **Level 1**<br>**Single report view** | **Level 2**<br>**Departmental led business understanding** | **Level 3**<br>**Focusing** | **Level 4**<br>**Strategic Alignment** | **Level 5**<br>**Operation(al) integration** |
|---|---|---|---|---|---|
| **Scope** | | | | | |
| **Use** | Isolated, by individuals | Department-wide | Integrated by several organizational units | In all organizational units | In all organizational units and hierarchical levels |
| **Diffusion in application areas and business processes** | No dedicated use | In single applications and/or business processes | In relevant application areas and/or business processes | | In (almost) all application areas and/or business processes |
| **Data Architecture** | | | | | |
| **Content consolidation** | Non-existing or heterogeneous semantics | Specifically for (functional) departments | Selected business objects and/or across organizational units | Enterprise-wide uniform semantics | |
| **Business data management** | Not addressed | Isolated, limited activities | Integration of external data | Requirements (e.g. for data quality) met | Integration of unstructured data |
| **Penetration level** | | | | | |
| **Impact of BI** | No reliability | BI gains in importance | Promotion of and demand for the use of BI | BI as a corporate asset | BI as the basis for all decisions, critical impact of BI on organizational performance |
| **Use of synergies** | | | Promotion of synergy generation | Demand for synergies | |
| **Technology** | **Stage 1**<br>**Data Anarchy** | **Stage 2**<br>**Data mart** | **Stage 3**<br>**Data warehousing** | **Stage 4**<br>**Future-orientation** | **Stage 5**<br>**Information provided in real time** |
| **Technical architecture** | | | | | |

Table continues

*Table 2: biMM Dimensions (continued)*

| | | | | | |
|---|---|---|---|---|---|
| **Architecture** | No dedicated data storage | Data marts | (Dedicated) data warehouse | | Enterprise data warehouse |
| **Utilization of tools** | No BI tools | Heterogeneous tools | Standardization of technologies and tools | Broad range of tools for all requirements | |
| **Integration of/with operational processes** | | | Analysis of business processes | Right time BI;<br>Process oriented BI | Operational BI in all its facets |
| **Data management** | | | | | |
| **Data integration** | Manually | Loading programs | ETL methods and tools | Use of EAI and EII | Event-driven |
| **Technical data management** | Not existing | Manually, no automating (e.g. data quality assessment) | Use of tools and methods (profiling, repositories etc.) | Comprehensive; with defined responsibilities and processes | BI-specific(e.g. for master data management) |
| **Information design** | | | | | |
| **Analysis functionality** | Manual analysis | Ad hoc analysis (OLAP, reporting) | Planning | Warning function, forecast, scorecards, data mining | Advanced techniques of analysis and visualization techniques (predictive analysis, BI search, etc.) |
| **Reporting** | | Automatic report generation | Report distribution | | |
| **Information channels** | | | Provision of information via various topologies and/or terminals | Mobile BI | |
| **Organization** | **Stage 1**<br>**Initial** | **Stage 2**<br>**Project** | **Stage 3**<br>**Separate BI organization** | **Stage 4**<br>**Process-oriented IT** | **Stage 5**<br>**Enterprise-wide BI organization** |
| **Organization structure** | | | | | |
| **BI governance** | None | | Using IT governance structures | BI governance function | Comprehensive BI governance |

Table continues

*Table 2: biMM Dimensions (continued)*

| | | | | | |
|---|---|---|---|---|---|
| **BI organizational structure** | No defined roles and organizational units for BI | Internal, formalized standards | | Rudimentary BI competence center (BICC) | BICC with a comprehensive spectrum of tasks and competences |
| **Data ownership** | None | | Data owner without mandatory regulations | Business and technical data owner | |
| **Processes** | | | | | |
| **Processes** | No explicit processes | | Processes according to IT management | BI specific processes (e.g. requirements engineering and service management) | |
| **(System) Availability** | No explicit regulation | Information regulation | Regulation by SLA's | 24 hours x 7 days | |
| **Profitability** | | | | | |
| **Profitability calculations** | None | Project-related and costs-oriented | Multiple profitability calculations | Cross-project and benefit-orientated | |
| **Cost allocation** | | As a part of the total operation | Standard allocation model (CPU, …) | BI-specific (information billing) | |
| **Strategy** | | | | | |
| **BI Strategy** | | | BI activities according to IT strategy | Dedicated BI strategy | Comprehensive Business/IT-alignment |

*Source: Dinter (2012).*

There is also a questionnaire that helps later when calculating the maturity. Similarly as in the table 2, its structure is based on the categories and BI design objects whereas there are several questions for each characteristic in maturity levels and go more into the detail that is visible from the table 2 (Dinter, 2012).

# 2 CORPORATE PERFORMANCE MANAGEMENT

Before balanced scorecards (BSC) found its way into the literature, performance management mostly focused on financial aspects of an organization such as costs and budgeting. From the perspective of performance management, BSC then crossed the borders of internal organizations by looking at how business is perceived by shareholders and customers and also what is the origin for learning and innovation and how process performance looks internally (Aho, 2009). Kaplan (2009) pointed out that BSC is only a part of organizational performance as a whole which among traditional financial measures takes into account also other measures from areas such as customers, internal processes and learning and growth (Kaplan, 2009). Nevertheless, performance of BSC on the operational level is not very good (Aho, 2009). Performance monitoring is of crucial importance for companies in order to survive and compete on the market where there is constant change in the conditions under which they compete. Moreover, science about performance management was built around this idea. In order to achieve better results and goals in a more efficient way companies have to understand their performance and monitor it constantly. Also important is, that companies do not just take the right decisions but also that they take them at the right time. In order to deal with this challenging environment that companies operate in, they need appropriate tools to plan, execute and refine their performance management strategy. In sense, the most important tool of performance management in this case are timely, reliable and accurate data. Performance management is meant to support decision making and is part of business management which also means that it represents procedures and methods that are used by an organization in order to effectively manage personnel so that their actions are aligned with organization's strategy. That being said, in order for performance management to be effective, it has to integrate these measures, methods and procedures into one management system across organization (Aho, 2012). According to Cokins (2009) most of organizations were already practicing performance management and has therefore become for what we consider it today. Aho (2012) points out that processes, information, measures and intangible assets are integrated by performance management which therefore support phases that are involved in strategy implementation. This way it provides decision makers with relevant information. Additionally, in his paper from the context of performance management, technology is presented as an integrator and enabler which supports the overall initiative of performance management. Performance management is presented purely from an information and knowledge management point of view. Many times organizations only achieve automation of existing processes that are finance oriented and are not able to change or improve performance management processes (Aho, 2009). Simply, performance management can be addressed as a process that manages

the strategy of a company or even process of achieving the results and goals by executing the plans (Cokins, 2009). As it can be seen from the figure 2, performance management is further divided into two levels:

- Operational level and
- Strategic level.

Operational level deals with monitoring and optimization of processes whereas strategic level is where strategic key performance indicators (KPIs) and business goals are defined and redesign of processes is started (Aho, 2009).

*Figure 2: Levels of performance management*


*Source: Melchert, Winter and Klesse (2004).*

In most of the cases CPM is directed towards corporate level since the performance management scope is quite wide (Stevens, 2008).

CPM tries to enhance corporate performance and it integrates different concepts that were used by organizations in the past such as total quality management, performance management, BI and data warehousing. CPM makes it possible for an organizations to find connection between operation and strategy. This is possible with support of hard data for decisions making and better performance (Aho, 2009, p. 15).

Based on the data from their research Williams and Williams (2010, p. 2) argue that in terms of managerial toolkit, CPM has become mainstream tool. CPM is mostly used for budgeting, planning, forecasting and preparation of dashboards and scorecards. That being said, companies mostly exploit it for its basic value proposition which is usage of advanced planning and control methods in a systematic way. CPM enables a closed-loop system for performance control which is able to align, measure, manage and improve main parts of business performance (Williams & Williams, 2010, p. 2).

Different organizations perceive the concept of performance management in a different way. In some cases performance management is perceived as a mean to deal with data for predefined KPIs and standards. This of course means that companies which perceive it in this way leave many potential data on the table and do not use them. On the other hand companies can add analytical functions to their traditional measurements and therefore proactively seek for the trends also by monitoring processes. This way they can also create different scenarios for what can happen. This means that they establish a comprehensive strategy for performance management (Aho, 2012). Nevertheless, measurement as such can be used to assess how the company is progressing on its path to achieve its goals. Furthermore, to assess how business strategy and operations of a company are aligned, performance measurement comes into effect. In order to transform business strategy to results, measurement plays a big role (Frolick & Ariyachandra, 2006, p. 44).

## 2.1 Corporate Performance Maturity Model

In his paper Aho (2012) argues that although there are some models for assessing the maturity of BI in a company there is none for performance management maturity that would be valid in academic terms. Performance measurement means evaluating business results in order to discover effectiveness of a company and to find process problems and performance shortfalls (Kaplan, 2009).

Regarding the current maturity models in the area of performance management they are rarely based on empirical data. Therefore, selection indicators of certain maturity level are not obvious. Also, existing models don't examine the concept of performance management as a whole but rather take into account only certain aspects of it, for example BI or analytical capability (Aho, 2012). Companies should assess their performance on different levels in order for management to know if the company is operating based on the strategy, if it is implementing strategy sufficiently and if some corrective activities should be taken (Kaplan, 2009). However, performance measurement is mostly used by IT departments or financial departments and there is a need to move from performance measurement to managing performance proactively in order to achieve business goals (Stevens, 2008).

In addition to the model that will be presented in the following subchapter and was introduced by Aho (2012) in his earlier paper he presented also Capability maturity model

which serves as a basis for many existing maturity models (Aho, 2009). However, CMMs often lack academic point of view since they are mostly based on consulting practices (Aho, 2009, p. 7). Overall, there is plenty of different performance management models in the literature, however theoretical understanding of how these models contribute to the practices of performance measurement is inadequate (Bititci, Garengo, Ates, & Nudurupati, 2015, p. 3062)

## 2.2 Presentation of Performance Management Maturity Model

In the following Performance Management Index Model (PMI) that was constructed by Aho (2012) and is used to assess the maturity of performance management in an organization will be presented. Before we start it is important to point out that model as such also includes concept of BI. Model was built on the basis of five case studies from five large Finnish manufacturing companies from 2009 to 2011 and represent projects in the field of performance management and BI where author was working as a consultant. In these cases performance management concept was studied on a corporate level. Usually, existing models link performance management only to the strategic management point of view whereas PMI model discusses performance management from an information and knowledge management position. However, it should be also noted that in his previous study (Aho, 2009) mostly focuses on the area of information systems and BI and not so much on the connection between CPM and corporate strategy. Similarly as in later study, author selected five case studies from BI, CPM and data warehousing projects where he was working as a consultant in 2009.

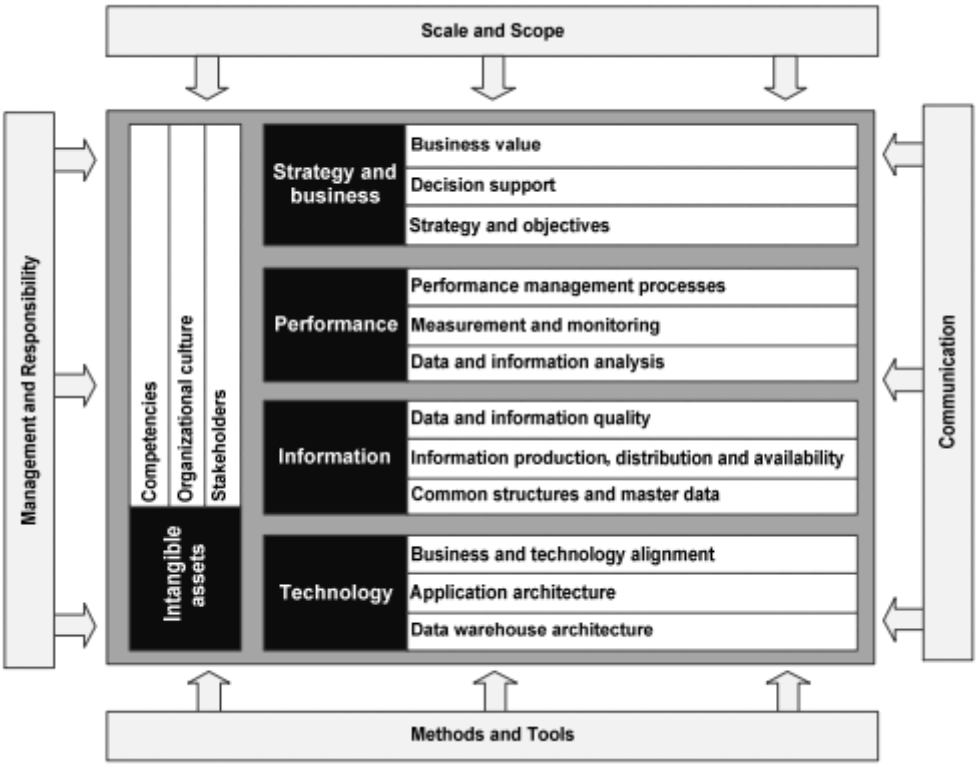
### 2.2.1 Performance Management Components

Important part of the model are the components that are built in the performance management. Performance management's key areas are actually explained by these components. Aho (2012) identified five main components:

- Information,
- Intangible assets,
- Performance,
- Strategy and business and
- Technology.

Usually a central component of most of the processes in performance management is technology. Together with other main four components is presented in the figure 3:

*Figure 3: The components of performance management*




*Source: Aho (2012).*

As we can see from the figure 3 there are also subcomponents in which each of the components is divided in. There are three subcomponents for each of the components. Also, on the edge of the figure there are four components that support five main components and can be used together with any of them. These are:

- Management and responsibility,
- Communication,
- Methods and tools and
- Scale and scope.

In the following, we will look at the five main components in more detail. First is the *Strategy and business* components which is all about the connection between the organizational strategy and business and performance management. So the question in this case is what the value of performance management for the company is and what the objectives of a company in strategic terms are. There is also a question about how much has control and management system of an organization integrated performance management since there should be a connection between the scorecards or measures and strategy of an organization in order to have a real information about its performance and therefore taking the most appropriate decisions. As it was mentioned before and it can be seen on the figure 3 the three subcomponents of the business and strategy component are: decisions support, business

value and strategy and objectives (Aho, 2012, p. 10). It is important to note that companies can use tools that are best designed but at the end it all comes down to the employees and the question if value of performance management is something that they truly believe in and use it in an effective way (Pulakos, 2009, p. 7).

Next component is *Performance* which is also divided in three subcomponents: performance management processes, measurement and monitoring, and data and information analysis. Measurement as a subcomponent mostly deals with balancing of different measures and costs of collecting the data that are used for these measurements (Aho, 2012, p. 9). When it comes to the second subcomponent it is important to note that different processes have to be aligned in order to follow the main purpose of performance management which is transformation of strategies into results (Axson, 2007). Companies also use data and information analysis so that they can make better decisions (Davenport, Harris, & Morison, 2010). Therefore, Aho (2012, p. 9) points out that in order for companies to know how to behave in the future or how to optimize some factors that influence organizational performance, they should not use just traditional reporting. Grigori et al. (2004, p. 341) go even further and claim that management information systems usually provide support for traditional reporting only and are not used for business processes performance measurement. This is also where BI can come into effect.

*Information* is a component that considers the concept of transformation from data into information. Aho (2012, p. 7) even argues that the main part of the maturity model is how to transform data into information and then this information into knowledge. Information component consists of three subcomponents: data and information quality, information production, distribution and availability, and common structures and master data. Information is an important component and Dresner (2008) went even further and introduced an Information Democracy concept which means that in order for an individual in a company to do the work he or she should have access to information that is needed for certain decision or job. Aho (2012, p. 7) says that even raw information should be accessible to individuals in order to do analysis which could lead from data to information and knowledge. Taticchi, Tonelli and Cagnazzo (2010, p. 13) say that one of the most important objectives today is to find a way how companies can transform data and information into activities that provide added value.

*Technology* is another component that according to Aho (2012, p. 11) enables performance management. Even more Aho (2010) says that technology is a strategic asset for a company. According to Salleh, Jusoh and Isa (2010) sophisticated information systems can influence effectiveness and efficiency of an organization in a positive way. This component has three subcomponents: business and technology alignment, application architecture, and data warehouse architecture. In his book Eckerson (2011, p. 27) argues that from technological perspective performance management is one of the latest if not the last business function that is being automated by software applications in a company. One should have in mind that

this is usually considered by companies and they do the right things but they are done in isolated way and separately. And on the contrary this is the real role of technology which can work as enabler to integrate applications and processes together in order to provide information that are needed for decisions makers (Aho, 2012, p. 11). If they are designed in an appropriate way, technology-enabled performance management processes can help companies in achieving greater productivity of their employees (Hunt, 2011, p. 189).

Component *Intangible assets* is the one that is in many cases when looking into existing maturity models not mentioned often. In the maturity model presented by Aho (2012, p. 8) this component addresses the stakeholders of performance management, how it is perceived by individuals, how do they make decision based on information about performance, how are employees trained and what kind of skills they have. In addition to this, aspect about organizational culture shouldn't be avoided neither. When it comes to promotion of effective performance management, organizational factors are in many cases the most critical issues (van Decker, 2011). The intangible assets component consists of three subcomponents: competencies, organizational culture and stakeholders. Furthermore, certain areas of organizational behavior such as trust, group dynamics, mentorship, communication, negotiation and leadership can actually have an impact on performance management system design and implementation (Karim, 2012, p. 5).

In his earlier work Aho (2009) explained a capability maturity model for CPM which was based on four components where each of the components had four subcomponents. Unlike his later model (2012), this model consists of six different maturity levels since it has additional 0 level (unaware). These 4 components are used to describe each of the CPM maturity levels and characterize management activities that are of a high importance for enabling CPM. Aho (2009, p. 13) listed the four components:

- Management and organization,
- Technology,
- People and culture and
- Processes.

*Management and organization component* addresses strategic decisions that were set, explains how CPM is managed and what are its benefits for a company. Aguinis, Joo, & Gottfredson (2011, p. 503) claim that many times companies don't recognize the potential benefits of performance management because focus of systems is usually very narrow and they only focus on certain aspects such as performance appraisal. *Technology component* takes into account IT point of view and how is it providing flexible infrastructure, enable business processes and share quality information in an organization. Third component *People and culture* deals with how people perceive CPM, how are they trained, how decisions are made and actions taken from the perspective of CPM and how people communicate in an organization and share information. *Processes* component includes CPM

initiative scope, deals with defining processes of CPM and how different methodologies are used. It also raises a question about how an organization measures its performance (Aho, 2009, p. 13). Each component with its subcomponents is presented in the table 3.

*Table 3: CPM maturity components*

| Component | Subcomponent | Description |
|---|---|---|
| Management and Organization | Strategy and objectives | Describes how decisions are made in the organization (based on instinct vs. based on analytics). Encompasses also the consistency in shared focus and metrics. Defines how CPM strategies are linked to risk management and productivity targets. |
| | Organization | Defines the extent of support from C-level executives. Discusses things such as how the CPM initiative is organized? Is BICC set up? Is there local control or enterprisewide standards? How the partnership between IT, finance and business users is being established? |
| | Governance | Choices that organization make when allocating decision rights for CPM activities such as selecting and prioritizing projects, assuming ownership of technology, and controlling budgets and CPM investments. How governance policies are defined and enforced? |
| | Business value | Importance and contribution of CPM to the organization in terms of investments becoming efficient, ROI becoming positive, and CPM becoming indispensable. |
| Technology | Infrastructure | Encompasses the CPM architecture, its extent, analytical tools in place, and data warehousing. |
| | IT-business alignment | Encompasses how well IT capabilities are used to share information across the organization. Practices that address the extent to which IT is able to drive or enable transformation. |
| | Data governance | Defines how the data is being managed, are there common data definitions, what is the scope of common enterprise data. |
| | Data | Encompasses the quality of data, and data redundancy. |
| People and Culture | People | Encompasses how knowledge workers are empowered with timely information and insight. How much staff is needed to consolidate the information? |
| | Competencies | Encompasses the people's awareness of CPM, their understanding the value of information, and whether people can make actions based on CPM understanding. |
| | Communication | Encompasses the effectiveness of sharing information for mutual understanding, the methods used to promote information sharing and the partnership between IT and business. |
| | Culture | Encompasses the information sharing culture. |
| Processes | Scope | Encompasses the scope of CPM solution (silos vs. enterprise-wide solutions). |
| | Methodologies | Encompasses how well an organization is adapting methodologies such as Activity Based Costing (ABC), Total Quality Management (TQM), and Balanced Scorecards (BSC). |
| | Process definitions | Defines how CPM processes are planned and managed. Are CPM processes documented, understood, and being used in a decision-making? |
| | Performance measurement / metrics | Defines if metrics and rules are aligned with the organization. How CPM objectives are measured and tracked? Are key metrics reviewed on a periodical basis. |

*Source: Aho (2009).*

### 2.2.2 Maturity Levels

Maturity levels provide main characteristics for each of the development stage. The lowest level represents an initial stage where companies don't have a lot of capabilities in certain domains. If company achieves highest level this represents a total maturity (Becker, Knackstedt, & Pöppelbuß, 2009, p. 213). In the PMI model, five maturity levels were identified which were also based on the Capability Maturity Model that was introduced by Software Engineering Institute. However, in this case emphasis was made on performance management. Decision regarding the maturity levels was based on the existing theory and models (Aho, 2012, p. 5).

*Table 4: Maturity levels of CMM*

| **Maturity level name in CMM** | **Maturity level in construct** | **Description** |
|---|---|---|
| 1 - Initial | Information silos | The solutions are local; there are no common standards, no shared resources or management. As a result the management does not get a clear and consistent picture of the organization as a whole. |
| 2 - Repeatable | Understanding the value | The organization understands the value of performance management for its business. Organizational goals and objectives are defined. |
| 3 - Defined | Fact-based decision-making | Decisions are more often made based on facts, rather than management instinct. The organization's data is stored in a centralised data warehouse. |
| 4 - Managed | Analytical business | Business becomes mora analytical in key business areas. The metrics and scorecards are closely aligned to the organization's strategy |
| 5 - Optimized | Strategic tool | Performance management has become a strategic tool for management, and it is a central part of the organization's control and management system. Performance management is also strongly connected to the different phases of strategy implementation in the organization. |

*Source: Aho (2012).*

As we can see in the table 4 there are five maturity levels throughout which company can progress and show its development process the same as we were mentioning in the case of maturity levels in BI. Maturity in this constructed model are named: Information silos, Understanding the value, Fact-based decision making, Analytical business and Strategic tool. Furthermore, in the table 5 maturity levels are presented in more details based on the capabilities for each maturity level. As Aho (2012, p. 6) points out these capabilities are many times mentioned in the literature as key process areas for each of the maturity levels. Often, different aspects of maturity levels are not aligned therefore organizations have to try balancing all the aspects at one maturity level before they go to the higher level.

*Table 5: Maturity levels and capabilities*

| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
|---|---|---|---|---|
| - Poor quality data<br>- No defined measures<br>- Temporary ad-hoc solutions<br>- Solutions made for single business cases<br>- Reports built on operational information systems | - Operations and development plan<br>- Data marts<br>- Budgeting<br>- Creation of strategic goals<br>- Financially focused solutions<br>- Interactive reporting systems<br>- Formal performance management methods in use | - Top management support<br>- Management dashboards<br>- Common business vocabulary and master data<br>- Strategy execution and monitoring<br>- Planning and forecasting<br>- Key performance Indicators<br>- Data warehouses | - Competence centre<br>- Balanced metrics<br>- Individual and external stakeholder metrics<br>- Strategy planning and analysis<br>- Rolling forecasts<br>- Enterprise data warehouse (EDW) | - High quality data<br>- Strategy feedback and refinement<br>- Continuous strategic planning<br>- Strategy scorecards<br>- External data sources<br>- Integration between architectures and processes<br>- Service-oriented architecture (SOA) |

*Source: Aho (2012).*

As it can be seen in the table 4 and table 5, in the *first maturity level* (Information silos) performance management is not something organizations would be really aware of and there is no major support for it by the senior management. Even more, many times resistance against performance management can be detected. Organizations at this stage do not recognize the value of performance management and they lack strategic planning, goals are usually set and presented only once per year, performance measurement is not present a lot and not necessarily connected to strategic goals of an organization. Reporting and other processes of performance management are most of the time used only in individual situations and are informal. Data from different information systems are retrieved manually, common standards are usually not present nor is governance. However, there are some local solutions that usually concern only single business cases and there is no common basic infrastructure or architecture, applications are used only in single functional area and they are quite primitive. Overview of an organization is very difficult because access to information is not easy and there is a low quality and overlapping of data. Also overlapping of technologies and processes is present and there is no standard way of collecting the data (Aho, 2012, p. 12). Additionally, Falessi, Shaw and Mullen (2014, p. 83) say that when it comes to collecting data automation is also of a great importance if companies want to achieve greater maturity level.

When it comes to the *second maturity level* (Understanding the value) importance of performance management and information becomes more recognized by people in a company. Also, common procedures, structures and standards are already mentioned. For the capabilities to be implemented, development and operations plan is already present. Lack

of integration between data marts that exist is still present and therefore information is not easily accessible and is of low quality. Nonetheless, companies already have some reporting systems that are interactive and enable them to drill down data and reporting is not limited only to functional processes (for example purchasing, marketing or sales). In addition to reporting, budgeting is a process that gets the most attention. However, in most cases it is done annually and it is concentrated on the operational level. Performance management solutions are mostly financially focused and measurements are done at the level of departments. Also, getting the funds for performance management processes is not easy since there is a lack of internal support. In addition to everything above, companies at the level 2 already talk about starting the performance management competence center (Aho, 2012, p. 12-13). Since at this stage there is a little support for performance management, Amaratunga and Baldry (2002, p. 221) say that there are many options companies can use in order to impact the support for implementation of performance management efforts such as active communication, expressing the need for improvement in the company, trying to implement best practices, introducing reward system to encourage performance improvements and also changing the corporate culture in the company.

*Third maturity level* (Fact-based decision-making) is where the support from top management is already present since they can recognize the advantages that performance management can offer for a company. Also, instrument of performance management are used by middle management and senior management (management dashboards, metrics etc.). Fact-based decision-making is being practiced by individuals and they take their decisions based on how they understand performance management systems. When considering fact-based decisions making it has to be clear that in order for performance management to be effective it needs fact-based decision making based on data that are reliable and relevant (Macpherson, 2001, p. 13). Organizations at this stage use data warehouses and quality of data in the data warehouses at this levels is of a higher quality whereas there is less data marts in an organization. Also, data is collected from different sources and this is done consistently as well as cleansing, standardization and storage of data. At this point even high automation comes into effect, especially for collecting the financial data. Information is very important from the point of performance improvement and enabling initiatives across whole organization. From the technology point of view solutions for performance management are intended to support strategy monitoring and implementation. KPIs are defined in the performance management strategy and performance management is meant to monitor and communicate the strategy. Technology management and architectural design on the level of a company starts to evolve. Overall, at the level of the whole company common organizational culture starts to develop and people have better sense regarding the factors that are influencing the business. Different professionals from IT and business area start to work together and form a performance management competence centers. Also, the same standards, vocabulary and terms are used across a company and metrics are standardized (Aho, 2012, p. 13).

At the *fourth maturity level* (Analytical business) company is pushed toward success in strategic terms due to the culture of accountability and measurement that develops. Moreover, Tapinos, Dyson and Meadows (2005, p. 376) argue that in general culture of measurement should have its part in the modern management practices. Especially accountability is very important on the level of a company and it is expected from all performance owners. Analytics are used by top management for daily activities. There is high quality of data and information in an organization, hence constant observation of data is present since information is perceived as a critical factor for the business. In terms of asset, importance of data and information is comparable with people, money or machinery. Companies have a data warehouse that is centralized and dynamic so that it can adjust to the business needs that are changing constantly. Quality of data is also improved by data warehouse solutions and data warehouses provide such an information that is suitable for the business of the company. Trend analyses, pattern recognition and alternative scenarios are done with the help of performance data. Visualization is also used to help management visualize various scenarios that might happen. Learning from the business activities that happened in the past is very important and correlation between data in different forms is trying to be understood by the management. Company develops values and vision jointly whereas objectives and goals are communicated on the level of a company in an effective way. Future strategy is therefore supported by performance management which provides a feedback. Scorecards and metrics are closely connected to the business strategy of a company which connects employees that use dashboards and scorecards in a company closely to the strategy. Business strategy is driven by performance management which is used in an effective way. The end-users are teached to properly process data and therefore can use these data in an effective way to make tactical and strategic decisions. Regarding the performance management competence center at this level it has resources and funding that is needed in order to achieve its goals. Line management structure and competence center are separated so it has to report to the senior management directly where performance management also has its own sponsors (Aho, 2012, p. 13-14).

The *fifth maturity level* (Strategic management tool) is where measurement and accountability present a strong base for organizational culture that completely integrates goals and vision and has strong emphasis on management skills and strategic planning which are improving constantly. Performance management and culture of performance management are spread across the whole organization. Data quality improvement is supported by the end users which are sufficiently trained and act according to standards and procedures. Companies at this level are in mature state regarding performance management which also means that operations and development plans of performance management constantly change. People across company trust in information and use it at all levels in the company in an effective way. Quality of data is very high and it is fully integrated which also makes real-time analysis and reporting possible. Information is of a high importance also when companies are setting strategic, tactical or operational actions which enables them to achieve strategic goals. Main part of control and management system in a company at this

level is performance management which also helps companies to get a big picture about what is happening in a company. Operations are continuously improved with the help of performance management processes. Companies use scorecards and metrics fully and they are regularly revised based on continuous improvement. Predictive process indicators and results indicators are included in the scorecards which is perceived as strategy scorecard and is based on a strategy map. Strategy of a company and cause-effect relationships are presented by the strategy map. At this level companies have service oriented architecture (SOA) and analytical data are provided as a service. This is very convenient since practically any application can effectively use data that are in the central data warehouse which has stored all the important performance data. Since business and information needs change rapidly, information systems at this level have a lot of flexibility in order to adjust to these changes. Competence center is very dynamic and proactive at this stage. This level is usually most desirable one for the companies. Performance management at this level is not just limited to the company but also affects performance of other stakeholders such as customers or suppliers (Aho, 2012, p. 14).

As Aho (2009, p. 14) points out company can only proceed to the next maturity level if it has established lower maturity levels strongly. From perspective of BI or CPM this means that an organization has to have strong architecture that enables measurement. The higher maturity level that company achieves the better are control, predictability and effectiveness of its processes. Different aspect of maturity are not always balanced therefore it is important to try balancing them at the same maturity level and then trying to proceed to the next level. Hribar Rajterič (2010) further says that many times even departments inside the company have different levels of maturity.

# 3 BI AND CPM ALIGNMENT

Decision making inside a company can be improved with the help of BI tools, however BI doesn't offer any systematic way of planning, controlling, monitoring or how strategic business goals are implemented (Frolick & Ariyachandra, 2006). One the other hand CPM offers a way of business strategy and technological structure to be combined which helps companies going towards achieving common organizational goals (Aho, 2009).

Many times BI and CPM terms are used as a synonyms, however it has to be clear that these are different terms (Frolick & Ariyachandra, 2006). According to Melchert, Winter and Klesse (2004, p. 4054) CPM is more advanced than BI for two reasons:

- CPM focuses more on support of companies that are process-oriented in comparison to BI and
- CPM tries to bring closed-loop support which connects strategy formulation, process design and execution with BI.

CPM in conceptual terms represents deployment of BI solutions in strategic terms because BI is perceived as a backbone for CPM implementation and business processes that leverage BI are included in CPM (Miranda, 2004). Also, if we look from the IT point of view, many perceive CPM as an upgrade of BI because it provides an IT enabled approach to effectively formulate, modify and execute strategy (Frolick & Ariyachandra, 2006). CPM was in many cases still considered very narrowly and budgeting was the most popular process of performance management which was usually concentrated on operational level (annual budget). However, CPM introduced concepts and methodologies such as BSC, value based management and ABC (Activity-based costing) which upgraded purely financial point of view. Overall, CPM is highly linked to BI and in addition to this provides new concepts that traditional BI did not address (Aho, 2009, p. 5). Performance measuring and planning was usually more in the domain of CPM while performance measuring, managing and improving was more in the domain of BI (Williams & Williams, 2010, p. 7).

An important measure that made a difference in comparison to pure financial metrics is KPI (Key performance Indicator). It is a measure that shows how well organization is doing in a certain area of performance (Kaplan, 2009). Therefore, in the following an overall concept of CPM is presented which also includes KPIs.

*Figure 4: BI and CPM alignment*


*Source: Van Roekel, Linders, Raja, Reboullet and Ommerborn (2009).*

As we can see from the figure 4 vision statement moves towards the strategy and business goals. Strategy defines what should be done in order to reach the goals and critical success factors which are set preconditions to reach the goals. In order to know how the objectives

will be measured KPIs are set. They are presented by dashboards or scorecards in the BI environment. Dashboards are useful since end-user or in this case managers can drill down and analyze performance data in more detail. Data from operational information systems or other data sources are aggregated in a data warehouse. Afterall, for the purpose of CPM data systems have to share cleansed, consistent and reliable data in a flexible way (Aho, 2009, p. 6).

Throughout the years BI and CPM changed from applications that were used in the functional area to applications that are used on an enterprise level where demand of users as well as number of end users is rising. Companies now try to reduce costs of BI in a way that does not affect level of service quality that is provided to the end users. Therefore, BI and CPM strategy is needed in order for investments in BI technology to deliver actual business value (Aho, 2009, p. 10 - 11). Williams and Williams (2010, p. 1-2) list four main finding from their research regarding the CPM and BI alignment:

- 66% of companies that are using CPM and BI initiatives are trying to coordinate and align these initiatives in a formal way,
- 78% of companies try to align them so that the BI supports CPM,
- Companies that have coordinated BI and CPM initiatives are three times more likely to reach great business performance improvements than those that do not,
- Companies that have used BI and CPM technologies that were available in order to support their initiatives for business improvement achieved higher success rates in accomplishing business objectives in comparison to those that have not.

One fact that they stated and is fascinating is that 47% of respondents use BI for CPM purposes (probably for score-carding and dashboarding, however it is also possible that they use it for budgeting, root cause analysis of performance problems and future performance prediction). This data clearly show that there exist an overlap between the two initiatives and therefore creates a need for BI and CPM to be coordinated (Williams & Williams, 2010, p. 4).

*Table 6: Facts about BI and CPM*

| **Fact** | **CPM initiative (in %)** | **BI initiative (in %)** |
|---|---|---|
| Percent of companies that have the initiatives | 41 | 67 |
| Percent of companies that are considering the initiative | 23 | 15 |
| Percent of companies that recognize that their company would benefit from the initiative | 18 | 6 |
| Percent of companies that reported that the initiative had a positive performance effect | 61 | 80 |

*Source: Own work.*

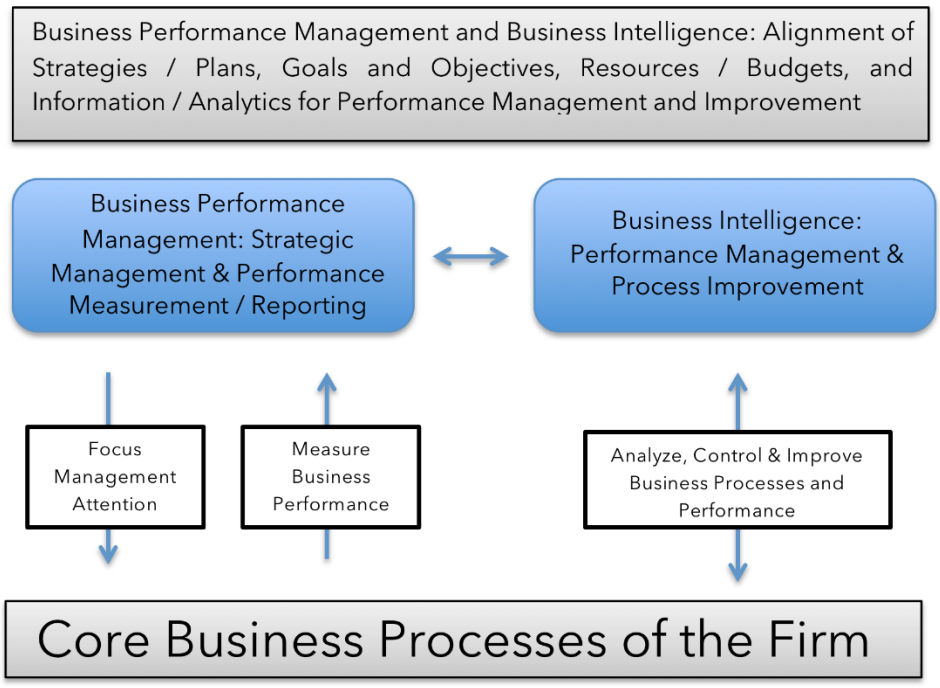
As we can see from the table 6 more companies have invested in BI initiatives (67%) than in CPM initiatives (41%) whereas 23% of companies are considering to start CPM initiative and 15% percent of companies are thinking about BI initiative. However, only 6% of companies recognize that their company would benefit from BI initiatives and 18% think the same for the CPM initiative. Overall, 80% of companies report that the BI initiative had a positive performance effect whereas the results for CPM initiative in this case is 61%.

CPM and BI initiatives are widely used by companies and have a good effect on performance even if used individually. However, it is important to note that alignment of these two initiatives can bring even greater business results if managed as a power combination (Williams & Williams, p. 4). When comparing technology products that enable BI and CPM and definition of both Williams and Williams (2010, p. 6) argue that they have two common things:

- They both use historical performance data and reference data about financial results, customers, business units, products and operational results in a great extent and
- When preparing scorecards, forecasts, dashboards and financial or operational reports they overlap.

Therefore, CPM and BI should be applied within the same framework that is coordinated. Example of such a framework is presented in the figure 5.

*Figure 5: Framework for CPM and BI implementation*




*Source: Williams and Williams (2010).*

Figure 5 clearly shows that the strategies, resources/budgets, goals, plans and information/analytics which have to measure, manage and improve performance should be aligned in order to use CPM and BI effectively. CPM is mostly focused on strategic management and reporting and performance management. For communicating and formulating the strategy and objectives as well as reporting on performance in CPM, balanced scorecards and strategy maps are usually used. For automated processes of strategy mapping and cascading performance targets to business units, advanced tools for CPM are used. These tools are also used for financial modeling, budgeting and financial reporting. When certain tool for financial modeling or budgeting is used it makes a data repository which is created only for particular CPM application. Therefore, data is not shared on the level of a company. However, as shown on the figure 5 BI focuses on process improvement and performance management. Business information and analytical applications are usually provided by BI from one source of enterprise data. According to Williams and Williams (2010, p. 8) this is also the main objective when coordinating CPM and BI initiatives. Core business processes of the firm represent sum of value chain activities in a company which determine business performance (Williams & Williams, 2010, p. 7).

When it comes to alignment and coordination of CPM and BI initiatives there are different mechanisms that companies can use individually or jointly such as joint governance and planning for CPM and BI, common definitions, data architecture & data stores, Liaison role between CPM and BI initiatives and formal competency centers with executive sponsorship (Williams & Williams, 2010, p. 10). Furthermore, Williams and Williams (2010, p. 10-11) argue that according to their research strong reward in terms of business performance exists for those companies that have CPM and BI initiatives which are coordinated. Also CPM initiatives are more likely to be started by the Chief Executive Officers (CEO) in those companies that have coordinated initiatives than in those that do not have coordinated initiatives. In this case companies are more likely to have CPM initiatives started by Chief Information Officers (CIO).

Williams and Williams (2010, p. 12) say that executives of a companies that do not have aligned BI and CPM initiatives have a feeling that they have sufficient analytical tools and business information required for business improvement which is not the case and may lead to some lost opportunities from the business performance perspective. On the other hand, companies that have aligned both initiatives usually have 4 things in common:

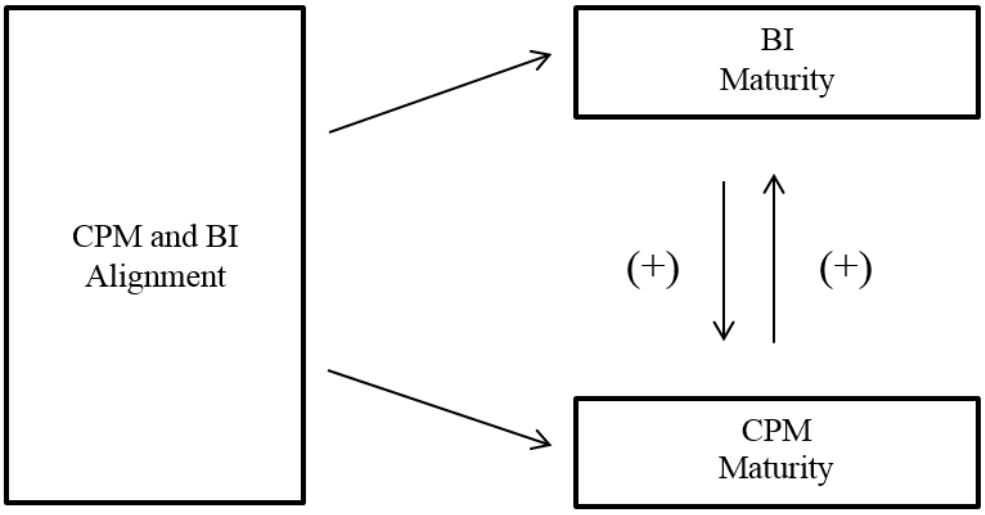
- Organizational alignment,
- Business process alignment,
- Budget alignment and
- Data and technical architecture alignment.

Regarding the *Organizational alignment* people and teams that work on CPM and BI initiatives have a common responsibility to connect CPM performance measurement with

BI performance management and improvement. *Business process alignment* is also important which means that the same business processes are trying to be improved by both teams that work on CPM and BI initiatives and priorities are the same for both as well. *Budget alignment* means that funds which are meant for the performance measurement are used for the initiatives in a rational way. *Data and technical architecture alignment* means that the same data architecture as well as sufficient technical architecture is used for both initiatives which helps to automate processes of CPM and provides BI for managing and improvement of business processes which provides dashboard and scorecard results (Williams & Williams, 2010, p. 12-13).

Williams and Williams (2010, p. 18) say: "BPM establishes a performance measurement baseline. BI can automate the performance measurement process, and it can deliver business information, analytical tools and structured decision support to improve the core processes that drive the ability to achieve targeted business performance." This is why we are interested in relationships and influences between these concepts and how are they different for different groups of companies. In the figure 6 we try to illustrate these relationships and influences.

*Figure 6: Interaction between CPM maturity, BI maturity and their alignment*




*Source: Own work.*

As presented there are some interactions between CPM maturity and BI maturity concepts and between alignment and each of the concepts as well. This means that concepts influence each other in a way and with our data analysis we want to see what are the influences and relationships and what the role of alignment in these interactions is. We also want to know if the alignment influences the maturity of CPM and BI. Based on the previous discussion and findings from the literature (Williams & Williams, 2010) we can expect that if companies have BI and CPM well aligned this influences CPM and BI maturity in a positive

way. What is also interesting for this master thesis is how these interactions are different for different groups of companies.

# 4 METHODOLOGY AND ANALYSIS

Methodology of the master thesis is prepared in such way that it is supported by the literature review which was done in the first three chapters. For the purpose of the analysis we use a questionnaire which will be presented and explained in the subchapter 4.1. The whole questionnaire can be seen in the Appendix 2. For the purpose of analysis we used IBM SPSS Statistics and Microsoft Excel software. In this chapter we start with the discussion and explanation of the questionnaire in order to gain a better insight regarding the structure of the questions for the purpose of data analysis. We conclude this chapter with data analysis where we also present our research design, methodology and techniques that we used for the analysis. After this chapter discussion takes place.

## 4.1 Questionnaire

In the master thesis research is carried out based on an empirical study and for that matter we have used a questionnaire that was prepared for the international project "Process and business intelligence for business excellence - PROSPER" which studied alignment of different concepts such as Business Process Management, Social Business Process Management, Corporate Performance Management and Business Intelligence. Research was carried out by Faculty of Economics University of Ljubljana. For the purpose of the master thesis we use only parts of the questionnaire which refer to CPM and BI concepts, alignment of these two concepts as well as demographical questions in order to make discussion easier. The questionnaire is provided in Appendix 2. Our main focus was on the maturity of each of the concepts as well as their alignment which was studies with the help of literature review that focused on BI and CPM concepts and their maturity. Questions were formed based on the literature review and we explain them in the following.

First part of the questionnaire consists of questions regarding the CPM that are derived from the model presented by Aho (2009, 2012). Questions are named as CPM-1 (for the first question) to CPM-10 (for the last question). Subject as such and the base for the questions are discussed in the section 2.2.1 Performance Management Components and questions can be arranged based on the components that are presented in the figure 3 and table 3. For the CPM questions 5 point Likert scale was used where 1 represent complete disagreement with the statements and 5 represent complete agreement with the statement. We also provided an option X which means "Don't know". Questions are prepared based on the model presented by Aho (2009, 2012) where he explained different maturity levels from the perspective of different components. In the study only certain part of it is included since the questionnaire would be too extensive which would influence the response rate. We have included questions for components: strategy and business, performance, technology, intangible assets, methods

and tools, management and responsibility, communication and scale and scope. However, there are no questions that would relate to information component, since it would interfere with the other construct, particularly with BI maturity.

If we take components from Aho (2009) into consideration, statements that are used in the questionnaire are presented in the following. For the component *Management and Organization* we have used the following statements: CPM is used as a strategic management tool to monitor the implementation of the strategy and obtain feedback on the implementation of the strategy, and then the analysis results are used to improve / change the long-term development of the organization; there is a department (department, unit) or a CPM-related person in the organization and coordinates the related activities at the level of the entire organization; strategic goals are systematically structured (cascaded) to the level of organizational units / processes / individuals. For the component *People and Culture* we have used statements: the evaluation of the work and the reward system are based on the performance measurement system; there is employee awareness of the importance and role of CPM in the organization. Their decisions and activities are based on the understanding of the CPM; there is a culture of measurement and responsibility in the organization. For the component *Processes* we use statements: the performance measurement system is set up to protect against local optimization (e.g. optimizing performance of units, individuals, rather than optimizing the organization's performance); the relevance of key indicators is checked periodically or by events that significantly affect organizational changes; the organization has successfully adopted CPM methodologies, such as a Balanced Scorecard (BSC). And for the dimension *Technology* we have used a statement: we use information technology in the organization, which is specifically designed to support and monitor the implementation of the strategy.

Second part of the questionnaire consists of questions regarding the BI which are derived from the model presented by Dinter (2012). Questions for BI concept are named from BI-1 (for the first question) to BI-10 (for the last question). The base for their preparation is presented in the section 1.4.3 Dimensions of Business Intelligence where questions can be grouped together based on dimensions and their categories which were presented in the Table 2. In the case of BI concept we used 5 point semantic differential scale where respondents had to evaluate their company's maturity for different dimensions of BI on the scale from 1 to 5 where 1 represents the lowest maturity level and 5 represents the highest maturity level. We also provided an option X which means "Don't know". Questions are prepared based on the model presented by Dinter (2012) where she explains different maturity levels from the perspective of different dimensions and categories of these dimensions. In this study for each category only one question is constructed so that the questionnaire is not too long. We cover all the categories of dimension: scope, data architecture, penetration level, technical architecture, data management, information design, organization structure, processes, profitability and strategy.

In this part we have tried to answer the following questions regarding *Functionality dimension*: what is the scope of using business intelligence systems in your organization; what is the level of maturity of the data architecture in your organization; what is the importance of using business intelligence in your organization. For the *dimension Technology* we used following questions: what is the level of maturity of the technology architecture of business intelligence in your organization; what is the level of maturity of data integration in your organization; what types of BI tools do you use. And for the *Organizational dimension* we used questions: what is the organizational structure related to business intelligence in your organization; what is the level of maturity of BI processes (e.g. requirements analysis, service management in this field) in your organization; what is the level of assessing the profitability of business intelligence in your organization; what is the level of strategic BI planning in your organization.

The third concept of CPM and BI alignment is studied with four questions from IPA-1 (for the first question) to IPA-4 (for the last question). This construct is prepared from the start since there is no existing model from which we can derive the questions. Therefore, it was prepared based on an extensive literature review. In order to be confident regarding the questions that they indeed measure the same concept, exploratory factor analysis was carried out as a part of the study and is not specifically addressed in the master thesis. This confirms that all four questions belong to this construct. For the questions 5 point Likert scale is used where 1 represents complete disagreement with the statement and 5 represents complete agreement with the statement. We also provide an option X which means "Don't know". Questions are prepared based on the literature review and for easier representations we will look into each of the questions in more detail.

*IPA-1:* Corporate performance management projects and programs are coordinated with business intelligence projects and programs. There is strong communication between CPM and BI groups, between leaders or individuals who carry out activities in both areas.

Williams and Williams (2007, p. 3) show that BI can contribute to the performance of different business processes. This suggests that strong coordination between different departments and people is needed in order for BI to work properly. Therefore, selection of this question is appropriate since coordination of both concept also results in better performance and thus we can conclude that alignment is taken into consideration.

*IPA-2:* The terminology in both CPM and BI areas is consistent. Common terms are used in both fields; there is a dictionary of these terms.

Aho (2009, p. 12) points out that one of the drivers of CPM deployment is the fact that companies should have same business terms and definitions across the company and development of common business terms is seen as company proceeds throughout

development process of CPM (Aho, 2009, p. 13). Importance of common terms is even expressed in the subcomponent Data governance that is presented in the table 3.

*IPA-3:* The data obtained through the BI system is the basis for the definition of business goals.

According to Melchert, Winter and Klesse (2004, p. 4054) goal and metrics orientation is one of the main four elements of CPM (along with process automation, methodology support and IT support). In order for a company to have a measurement and management of processes established, business goals are set based on the strategy and converted to metric for process measurement and management. For formulation of metrics and goals, collecting and analyzing the data, IT process and support is needed since CPM itself does not provide it. And this is where the role of BI comes into effect. Illustration of such an example is shown in the figure 2 where BI has a role on operational level. Analysis of strategic KPIs is done on the strategic level and if reason for deviation from planned goals is in the inadequate strategy it has to be adjusted accordingly. This also influences the fourth question that is presented in the following. According to Melchert, Winter and Klesse (2004, p. 4054) CPM provides a control system with a feedback loop which links the preparation of strategy, design of a process and execution with BI.

*IPA-4:* The BI system is used to monitor the implementation of the strategy, so that it can monitor the achievement of business objectives at different levels.

After questions regarding BI, CPM and their alignment, we also use some additional questions regarding characteristics of the company for easier discussion that will take place in the next chapter. Therefore, fourth part of the questionnaire consist of questions regarding characteristics of the company and demographic questions in order to have a better knowledge about the units of the population. In this part we asked recipients regarding number of employees in their company, revenues of the company in the year 2015, what is company's statistical classification of economic activity, what is respondent's level of education, his or her position in the company, number of years working on current position and which department is respondent working in.

Survey was prepared and sent to the recipients in May 2016. It was prepared in an online as well as paper form in order to receive as many adequate responses as possible. Survey was sent to the medium and large size companies in Slovenia. List of companies was exported in several steps from a GVIN.com and iPiS Marketing Manager portals since we had to export companies for each Slovenian region separately and we needed physical as well as electronic mail addresses from the companies which we were not able to extract only from one source. Afterward, this data was combined and manually reviewed in order to avoid any possible errors. We operated with 1.398 companies in this final list.

All the results from answered questionnaires that we received represent a dataset on which we performed data analysis and one answered questionnaire represents a unit whereas units do not depend one on another. Our dataset is actually two dimensional metrics where rows represent individual units and columns represent different attributes. Each attribute represents an individual question from the questionnaire. Therefore, for analyzing the BI concept 10 attributes are used as well as for the CPM concept. And for the BI and CPM alignment analysis four attributes are used. Regarding the measurement scale there are different types of attributes (nominal, ordinal, interval, and ratio) and selection of the measurement scale influences further analysis. For our analysis we select the ordinal scale which means that we can put values in order whereas value 2 is better than value 1, value 3 is better than value 2 and so on. Attributes in our case can have values from 1 to 5 in accordance with 5 point Likert scale and additional value 6 which represent an answer "Don't know". On this scale value 1 means "Strongly disagree" and value 5 stands for "Strongly agree".

### 4.2 Data Analysis

For the purpose of our work we use exploratory research since we don't provide exact hypothesis but rather a research questions that are not strictly defined and are provided at the beginning of the thesis. Therefore, there are no hypothesis that we try either to confirm or reject. We want to see how mature companies are regarding BI and CPM and if projects of BI and CPM in companies are aligned and therefore carried out as a separated or common projects. We also want to see how maturity of BI and CPM, their alignment as well as effects of this alignment are different for different groups of companies. In accordance with this, we decided regarding the appropriate method and technique used for data analysis.

For the data analysis clustering was selected as a data analysis methods. Clustering is a technique which helps to understand and see different patterns that might occur in the dataset. Data are divided into different clusters or groups where data and therefore units in a cluster are more similar to each other than to those in other clusters (Guha, Rastogi, & Shim, 2001, p. 35). In the master thesis units are divided into clusters based on the 24 attributes that are prepared based on the questions from the questionnaire which is discussed and explained in previous subchapter. Cluster analysis technique is a part of broader method of data mining which is about gaining useful information that was not known to us before. Sumathi and Sivanandam (2006, p. 40) say: "It is an exploratory data analysis, trying to discover useful patterns in data that are not obvious to the data user."

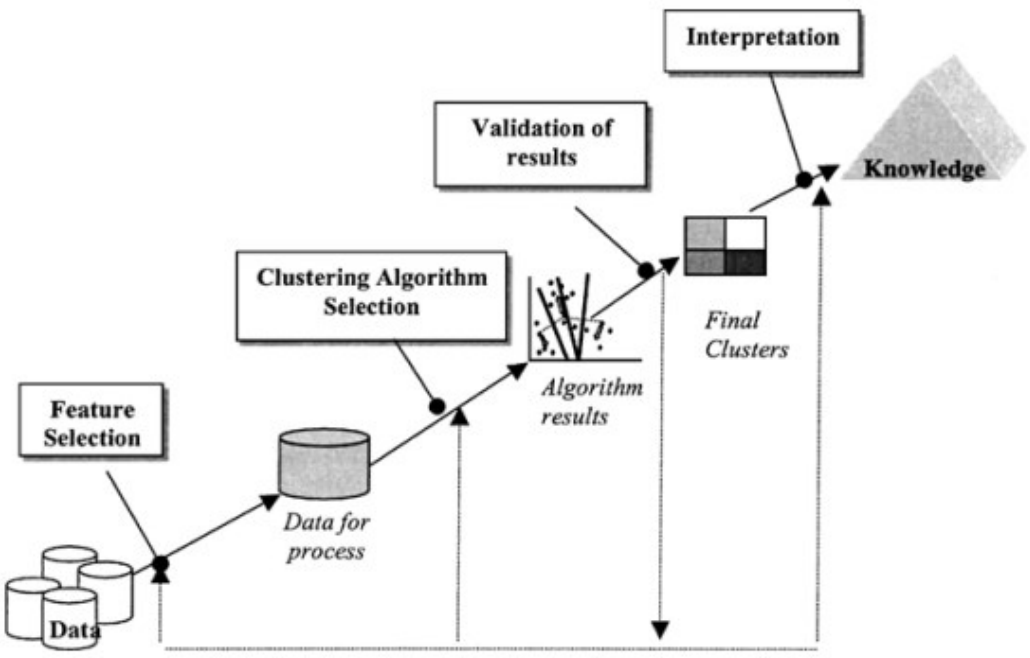
Tan, Steinbach and Kumar (2005, p. 8-11) say that the most commonly used techniques in data mining are:

- Classification,
- Clustering,

- Association analysis,
- Regression and
- Deviation detection.

As already mentioned we selected clustering and will therefore not go into detail regarding other techniques. In the figure 7 clustering process is presented.

*Figure 7: Clustering Process*




*Source: Halkidi, Batistakis and Vazirgiannis (2001).*

As we can see from the figure 7, according to Halkidi, Batistakis and Vazirgiannis (2001, p. 108-109) there are four main steps in the process of clustering:

- Feature selection,
- Clustering algorithm,
- Validation of the results and
- Interpretation of the results.

*Feature selection* is the first step where we have to decide about the features which will serve as a basis for the clustering process in order to encode as much information as possible that is relevant to us. The next step is *Clustering algorithm*, which means that in this step appropriate algorithm has to be chosen which as a results brings to the definition of dataset clustering scheme. Next is *validation of the results* where we verify if results of clustering algorithms are correct. This is done with the help of certain techniques. *Interpretation of the results* is the last step where the conclusion is provided.

For the purpose of master thesis, features are represented by the questions which analyze the maturity of BI concept (questions from BI-1 to BI-10) and CPM concept (questions from CPM-1 to CPM-10) as well as their alignment (question from IPA-1 to IPA-4).

For the selection of appropriate clustering algorithm we had to look into the literature. In accordance with Halkidi, Batistakis and Vazirgiannis (2001, p. 110) we present algorithm classification that was proposed by them:

- *Partitional clustering* tries to break data set into different groups that do not overlap. They try to set an integer number of partitions which helps optimizing specific criterion function which might highlight global or local data structure and optimization that takes place is a procedure which is iterative.
- *Hierarchical clustering* can do two things, such as divide large clusters or merge clusters that are smaller into larger ones. As a results it produces so called dendrogram, which is a tree of clusters and identifies how related clusters are. If we want to get a clustering in which the number of groups is precisely defined and where the groups do not overlap each other, the dendrogram must be cut at the desired level.
- *Density-based clustering* operates with the idea to use density condition in order to join neighboring objects from data set into groups or clusters.
- *Grid-based clustering* is a type of algorithm which is used mostly in case of spatial data mining. Their basic characteristic is to divide the space into a finite set of cells over which they then perform all operations.

We decided to choose K-means clustering technique that was proposed by MacQueen (1967) and it fits into Partitional clustering. K-means clustering is widely used since it is appropriate for different types of data and it is simple to use as well as covered broadly in the literature in more detail (Tan, Steinbach, & Kumar, 2005). It attempts to find K groups, where the K - number of groups must be specified by the user before the implementation of the algorithm. As a representative of partitional algorithms, K-means is based on the criterion function that it tries to optimize. K-means uses the sum of squared errors (SEE) which is one of the most often used criterion function in partitional clustering (Jain, Murty, & Flynn, 1999, p. 278). Equation for the sum of squared errors is presented with equation (1).

$$E=\sum_{i=1}^{c}\sum_{x\in C_i} d(x, m_i) \qquad (1)$$

In the equation (1) d(x, $m_i$) represents Euclidian distance between x and $m_i$. $m_i$ stands for center of cluster $C_i$. The role of criterion function E is to make the distance between each point in the cluster and center of this cluster as low as possible. At the beginning algorithm sets a set of c cluster centers. The dataset objects are then assigned to the clusters based on the nearest center and algorithm then recomputes the centers again. This is an iterative

process and stops when the cluster centers don't change anymore (Halkidi, Batistakis, & Vazirgiannis, 2001, p. 112).

The purpose of data analysis is to see the similarity between different attributes and to get the clusters where each cluster has homogeneous units that can be described with certain demographical characteristics and maturity levels for BI and CPM. Clustering in this case is appropriate because our goal is to get the clusters where units have similar BI maturity, CPM maturity as well as alignment between these two concepts and also individual attributes. We want to compare clusters among themselves based on introduced attributes and look for the similarities and differences between different clusters. We want to find cluster where units or companies will have similar values for attributes and comparison between these attributes among different clusters will hopefully help us answer our research questions.

Before going into the results presentation we should point out that out of 1.398 questionnaires sent to the Slovenian medium and large sized companies we have received 171 questionnaires answered with valid responses. These questionnaires were either received by post (and then we had to manually reenter the results into an online survey) or respondents solved an online form of questionnaire directly. This means that we have reached 12,23% response rate which is lower but comparable with other studies where authors surveyed a population of Slovenian medium and large size companies (Lukman, Hackney, Popovič, Jaklič, & Irani, 2011; Škerlavaj, Indihar Štemberger, Škrinjar, & Dimovski, 2007; Škrinjar, Hernaus, & Indihar Štemberger, 2008) where response rates ranged from 13,9% to 16,9%.

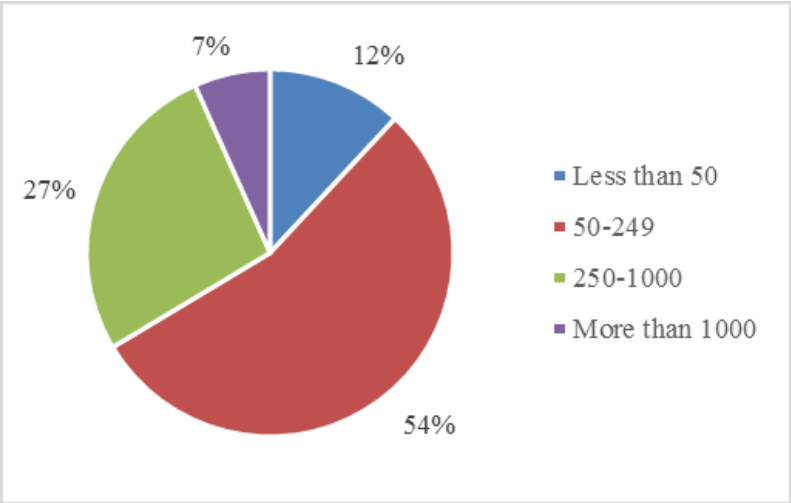
# 5 RESULTS

As already mentioned, out of 1.398 questionnaires sent we have received 171 questionnaires with valid responses which translates into 12,23% response rate. After we eliminated units that answered to majority of questions with "Don't know" our data set was reduced to 139 units and 24 attributes for these units. 10 attributes that were based on questions from CPM-1 to CPM-10 were used to measure CPM maturity, 10 attributes that were based on questions from BI-1 to BI-10 were used to measure BI maturity and four attributes that were based on questions from IPA-1 to IPA-4 were used to measure alignment of CPM and BI concepts.

## 5.1 Descriptive statistics

Majority of the companies in the population have 50 to 249 employees which amounts to 54% of the population, while only 7% of the companies have more than 1.000 employees. 12% of the companies have less than 50 employees and 27% of the companies have between 250 and 1000 employees. Structure of the companies based on number of employees is shown in the figure 8.

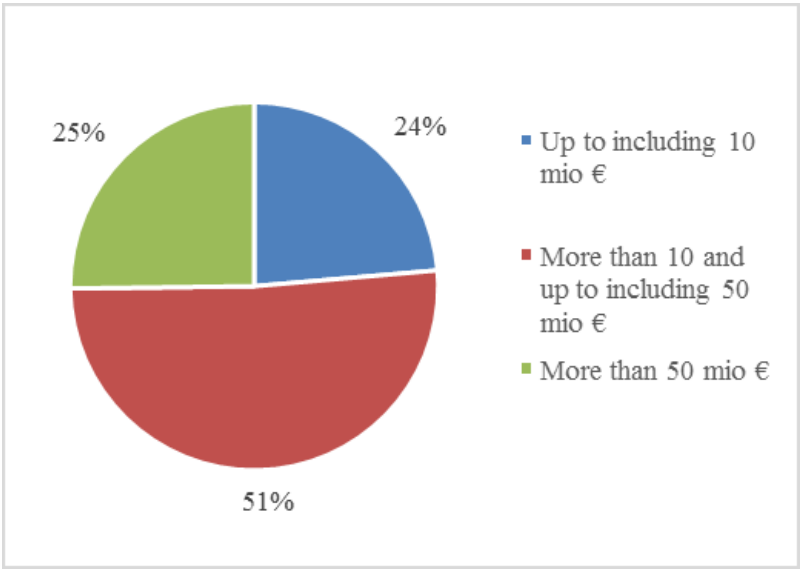
*Figure 8: Structure of the population based on the number of employees*




*Source: Own work.*

Structure of the population based on the revenue in year 2015 can be seen in the figure 9. 51% of the companies in the population had more than 10 and up to including 50 million euros of revenue in year 2015. 25% of the companies have more than 50 million euros of revenue per year for the year 2015, while 24% of companies have up to and including 10 million euros of revenue per year (stated for the year 2015).

*Figure 9: Structure of the population based on the revenue in year 2015*

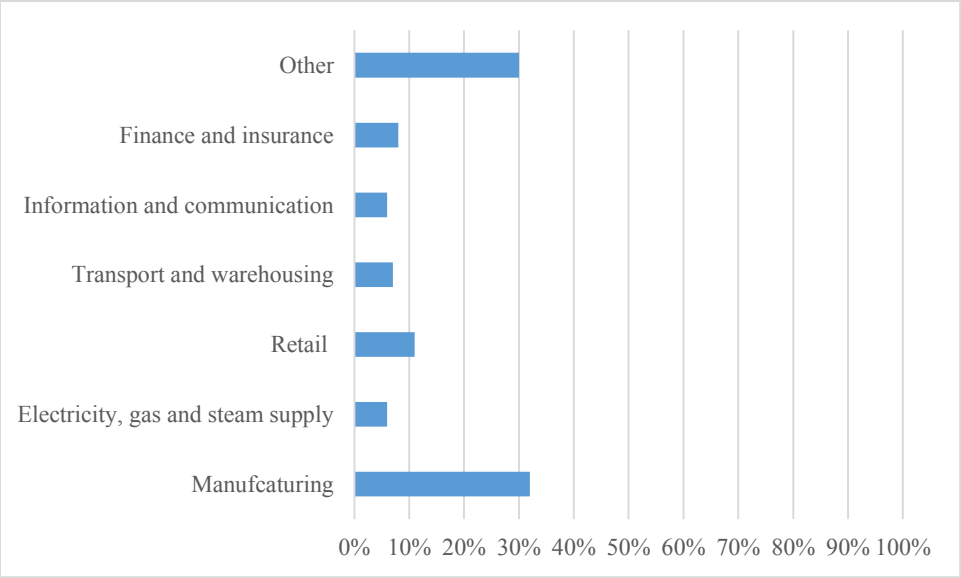



*Source: Own work.*

Based on statistical classification of economics activity 30% of all the companies are manufacturing companies whereas 11% of companies work in retail industry or are engaged in maintenance and repair of motor vehicles. 8% of companies work in financial and

insurance industry whereas 7% of companies work in transportation or warehousing. Only 6% of the companies work in ICT (information and communication technology) industry. The same percent of companies work in the field of electricity, gas and steam supply. Statistical classification of economics activity for the companies in population is presented in the figure 10.

*Figure 10: Companies based on the statistical classification of economic activity*




*Source: Own work.*

Descriptive statistic for the attributes that measure CPM maturity, BI maturity and alignment of the CPM and BI is shown in the following tables. Tables present mean, standard deviation, minimum and maximum value and additionally absolute frequencies for all possible values are presented in the figures.

*Table 7: Descriptive Statistics for attributes that represents elements of CPM*

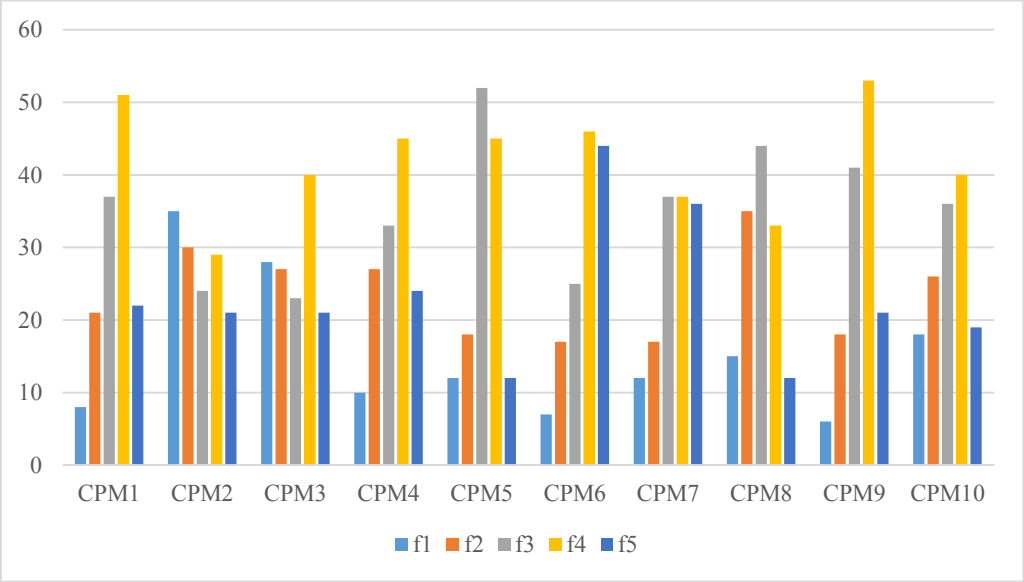
| Attribute | CPM1 | CPM2 | CPM3 | CPM4 | CPM5 | CPM6 | CPM7 | CPM8 | CPM9 | CPM10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 3,43 | 2,79 | 2,99 | 3,33 | 3,2 | 3,74 | 3,49 | 2,94 | 3,47 | 3,12 |
| Std. Dev. | 1,100 | 1,417 | 1,380 | 1,182 | 1,055 | 1,175 | 1,242 | 1,128 | 1,037 | 1,240 |
| Min | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Max | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

*Source: Own work.*

As we can see from the table 7 attribute CPM6 has the highest mean value of 3,74 and represents a statement: the relevance of key indicators is checked periodically or by events that significantly affect organizational changes. The lowest mean value can be identified for the attribute CPM2 which represents a statement: there is a department (department, unit) or a CPM-related person in the organization and coordinates the related activities at the level

of the entire organization. The mean value in this case is 2,79. The lowest standard deviation is for the attribute CPM9 which represents a statement: there is a culture of measurement and responsibility in the organization. The highest standard deviation is identified for attribute CPM2. Minimum value for all the attributes is 1 whereas maximum value is 5.

*Figure 11: Frequencies for CPM attributes*




*Source: Own work.*

As we can see from the Figure 11 where on one axis attributes for CPM are presented (from CPM1 to CPM10) and on the other their frequencies, for six out of ten attributes value 4 has the highest frequency. In the case of attribute CPM2 value 1 has the highest frequency, in case of attribute CPM5 value 3 has the highest frequency whereas for the attribute CPM7 values 3 and 4 have the same frequency of 37. In case of attribute CPM8 value 3 has the highest frequency.

*Table 8: Descriptive Statistics for attributes that represents elements of BI*

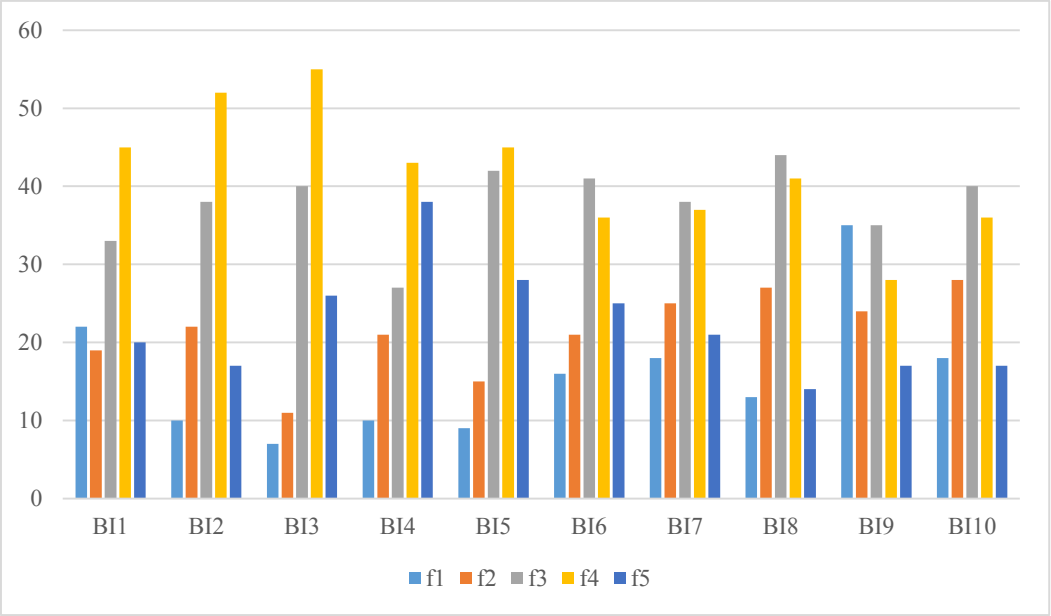
| **Attribute** | **BI1** | **BI2** | **BI3** | **BI4** | **BI5** | **BI6** | **BI7** | **BI8** | **BI9** | **BI10** |
|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 3,16 | 3,32 | 3,58 | 3,56 | 3,49 | 3,24 | 3,13 | 3,12 | 2,76 | 3,04 |
| Std. Dev. | 1,287 | 1,103 | 1,040 | 1,240 | 1,124 | 1,243 | 1,250 | 1,123 | 1,353 | 1,215 |
| Min | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Max | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

*Source: Own work.*

In table 8 attributes for the BI maturity and their values for mean, standard deviation, minimum and maximum are presented. The highest mean value of 3,58 is for the attribute BI3 which refers to the question BI-3 from the presented questionnaire: what is the importance of using business intelligence in your organization. However, it is important to

note that the mean value for attribute BI4 is 3,56 and refers to the question: what is the level of maturity of the technology architecture of business intelligence in your organization. Standard deviation is the lowest for the attribute BI3 whereas the highest standard deviation is in case of attribute BI9 which refers to the question: What is the level of assessing the profitability of business intelligence in your organization. The minimum value for all the attributes in the case of BI is also 1 and the highest is 5.

*Figure 12: Frequencies for BI attributes*




*Source: Own work.*

In figure 12 frequencies of BI attributes are presented. And as it can be seen in the case of first three attribute which belong to technology dimension value 4 has the highest frequency. The same is true for the attribute BI4 and BI5 whereas in the case of attribute BI6 value 3 has the highest frequency. In case of the last four attributes value 3 has the highest frequency. However, if we look at the attribute BI9 we can see that the value 1 and value 3 actually have the same frequency of 35 which is also the highest for this attribute.

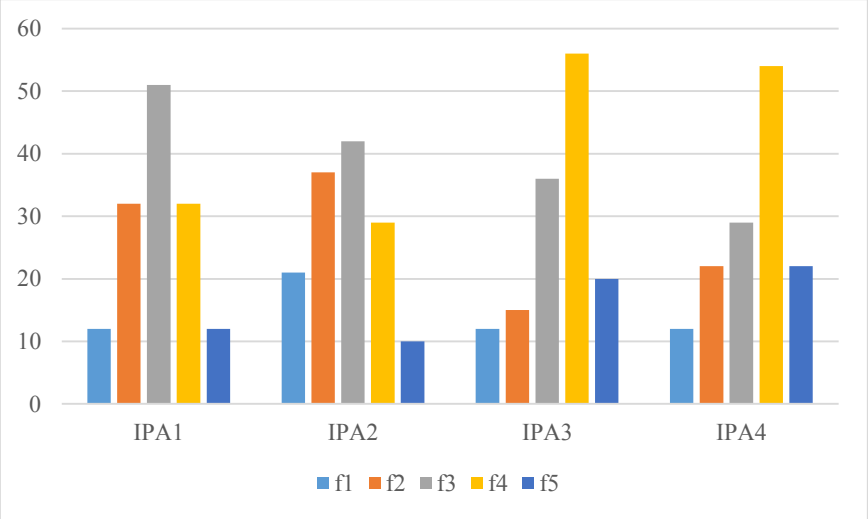
*Table 9: Descriptive Statistics for attributes that represent elements of alignment of CPM and BI*

| Attribute | IPA1 | IPA2 | IPA3 | IPA4 |
|---|---|---|---|---|
| Mean | 3 | 2,78 | 3,42 | 3,38 |
| Std. Dev. | 1,077 | 1,153 | 1,126 | 1,180 |
| Min | 1 | 1 | 1 | 1 |
| Max | 5 | 5 | 5 | 5 |

*Source: Own work.*

In the case of attributes that represent elements of alignment of CPM and BI and are presented in the table 9, mean value of 3,42 is the highest for attribute IPA3 which represents a statement: the data obtained through the BI system is the basis for the definition of business goals. The lowest mean value of 2,78 is in case of the attribute IPA2 which represent a statement: the terminology in both CPM and BI areas is consistent. Common terms are used in both fields; there is a dictionary of these terms. Standard deviation of 1,077 is the lowest in case of attribute IPA1 and the highest in case of attribute IPA4. Minimum value in case of all four attributes is 1 and maximum 5.

*Figure 13: Frequencies for attributes of CPM and BI alignment*



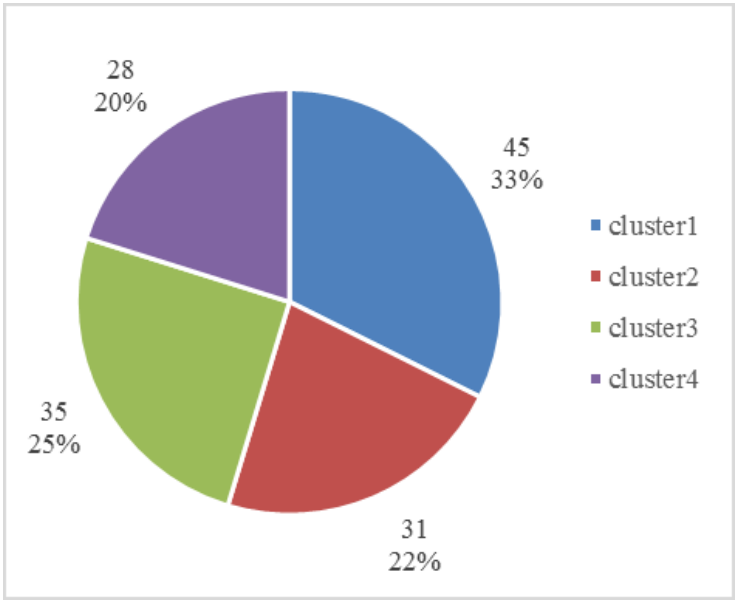

*Source: Own work.*

As it is clearly seen from the figure 13 attributes IPA1 and IPA2 have the highest frequency for value 3 whereas attributes IPA3 and IPA4 have the highest frequency for value 4. In case of attributes IPA1, IPA3 and IPA4 the highest frequency is more than 50. In case of attribute IPA2 values are therefore more evenly distributed in comparison with other three attributes.

## 5.2 Clustering

To allocate units into clusters we have used all 24 attributes for CPM, BI and their alignment. As already discussed in the chapter 4, method that is used for cluster analysis is K-means clustering where number of clusters is specified in advance. Most of the existing maturity models use four, five or six clusters for the analysis (Lukman, Hackney, Popovič, Jaklič, & Irani, 2011, p. 215). Therefore, we also considered this numbers and decided to use four clusters for the analysis because it was the most reasonable from the perspective of interpretation and future comparison with results of other researches. We tried different number of clusters and number four gave us the most appropriate results for interpretation. Therefore, number of units that was allocated to each cluster is shown in the figure 14.

*Figure 14: Number of units in clusters*

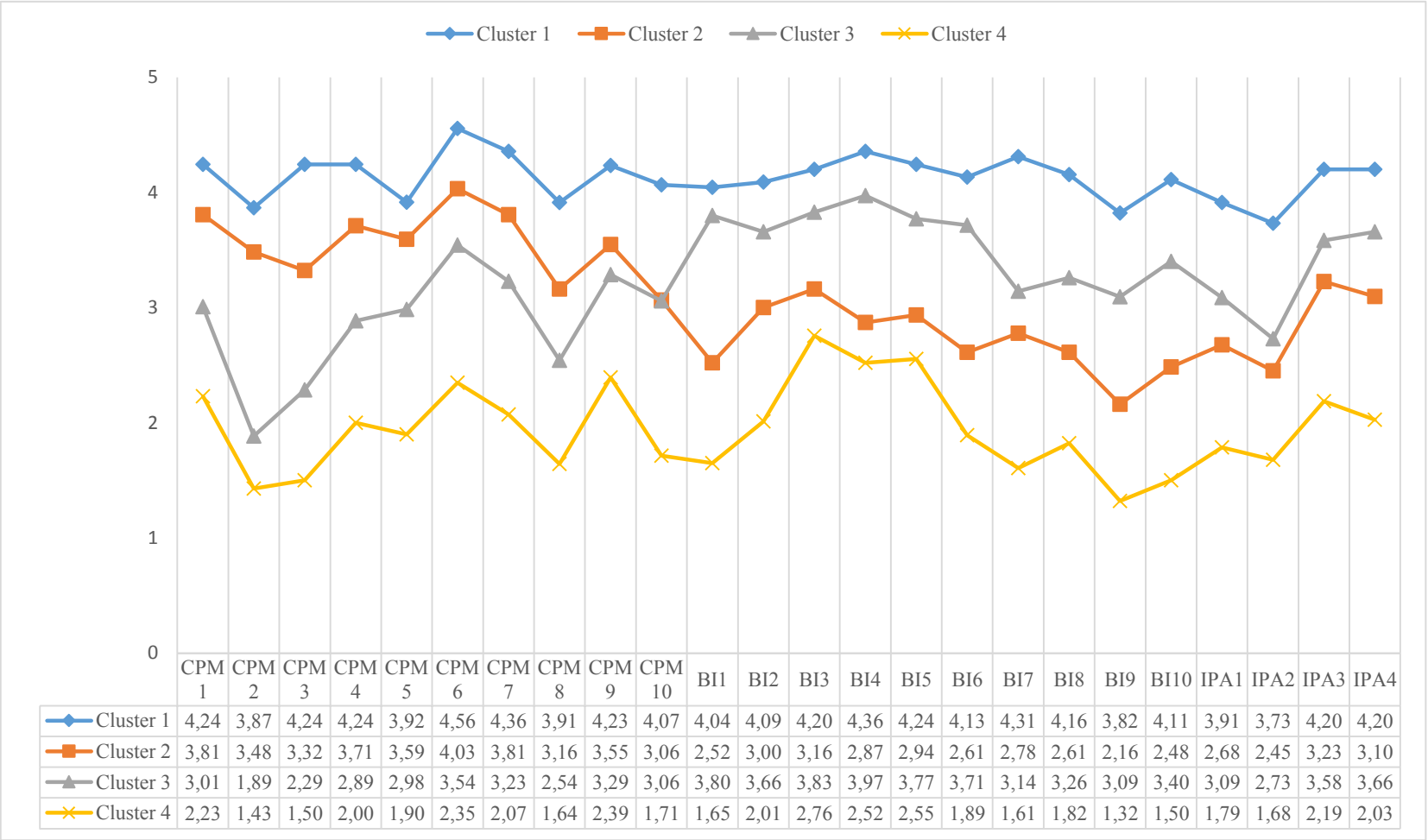



*Source: Own work.*

As we can see, 33% of units were allocated to cluster1 which is also cluster with the most units, 25% were allocated to cluster3, 22% of units to cluster2 and 20% of units (which equals to 28 units) were allocated to cluster4.

Centroids in the following figure 15 represent mean value for each attribute in each cluster. We can see that the cluster1 has the highest mean values for every attribute while cluster4 has the lowest mean values for all of the 24 attributes. Cluster2 and cluster3 have mean values in between whereas cluster 2 has higher mean values for the attributes that measure CPM maturity, while cluster 3 has higher mean values for the attributes that measure BI maturity. For the attribute CPM10 cluster2 and cluster3 have the same mean value of 3,06. Interesting are also attributes that measure alignment between CPM and BI and are marked as IPA1, IPA2, IPA3 and IPA4 in the figure 15. As mentioned, cluster 1 has the highest value also for these attributes and cluster 4 has the lowest value whereas cluster 3 has a higher mean value for these attribute in comparison to the cluster 2. Further interpretation of these results will be done in the next chapter.

*Figure 15: Centroids for each attribute in the cluster*

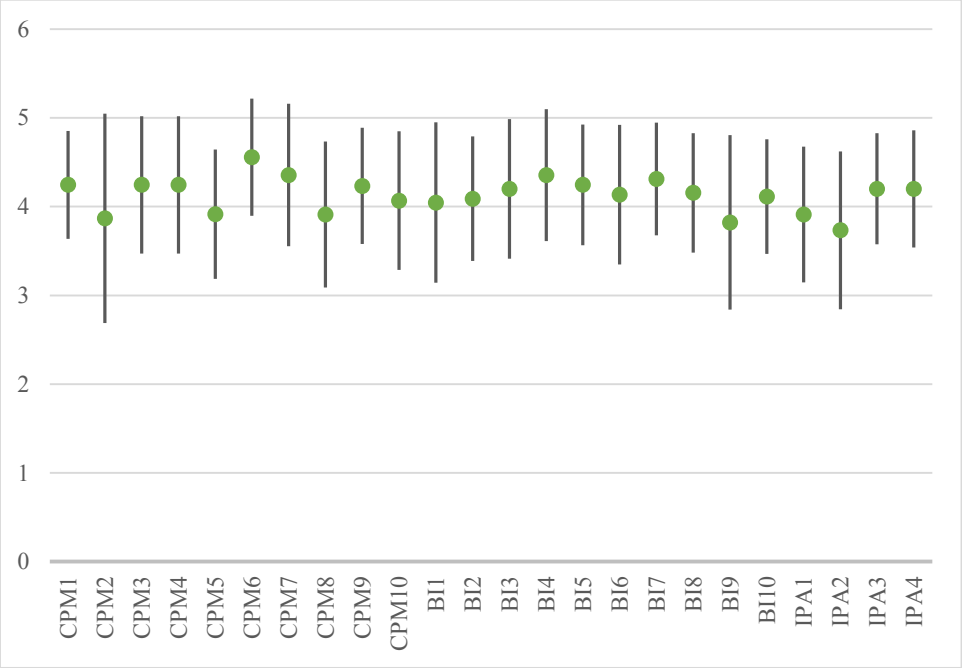



| | CPM 1 | CPM 2 | CPM 3 | CPM 4 | CPM 5 | CPM 6 | CPM 7 | CPM 8 | CPM 9 | CPM 10 | BI1 | BI2 | BI3 | BI4 | BI5 | BI6 | BI7 | BI8 | BI9 | BI10 | IPA1 | IPA2 | IPA3 | IPA4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cluster 1 | 4,24 | 3,87 | 4,24 | 4,24 | 3,92 | 4,56 | 4,36 | 3,91 | 4,23 | 4,07 | 4,04 | 4,09 | 4,20 | 4,36 | 4,24 | 4,13 | 4,31 | 4,16 | 3,82 | 4,11 | 3,91 | 3,73 | 4,20 | 4,20 |
| Cluster 2 | 3,81 | 3,48 | 3,32 | 3,71 | 3,59 | 4,03 | 3,81 | 3,16 | 3,55 | 3,06 | 2,52 | 3,00 | 3,16 | 2,87 | 2,94 | 2,61 | 2,78 | 2,61 | 2,16 | 2,48 | 2,68 | 2,45 | 3,23 | 3,10 |
| Cluster 3 | 3,01 | 1,89 | 2,29 | 2,89 | 2,98 | 3,54 | 3,23 | 2,54 | 3,29 | 3,06 | 3,80 | 3,66 | 3,83 | 3,97 | 3,77 | 3,71 | 3,14 | 3,26 | 3,09 | 3,40 | 3,09 | 2,73 | 3,58 | 3,66 |
| Cluster 4 | 2,23 | 1,43 | 1,50 | 2,00 | 1,90 | 2,35 | 2,07 | 1,64 | 2,39 | 1,71 | 1,65 | 2,01 | 2,76 | 2,52 | 2,55 | 1,89 | 1,61 | 1,82 | 1,32 | 1,50 | 1,79 | 1,68 | 2,19 | 2,03 |

*Source: Own source.*

However, mean value for each attribute is not sufficient to conclude which attributes describe each of the clusters and discussion can't be done only based on this information. Appropriate measure would be standard deviation which is a measure of how spread out numbers are. Therefore, we have calculated standard deviation for each attribute in each of the clusters and we add and subtract standard deviation from the mean value for each attribute in the clusters. This way we have calculated high value (mean value plus standard deviation), mean value and low value (mean value minus standard deviation). We have visualised how distributed values are for each attribute in each of the clusters. Results are visually presented in the following four figures.

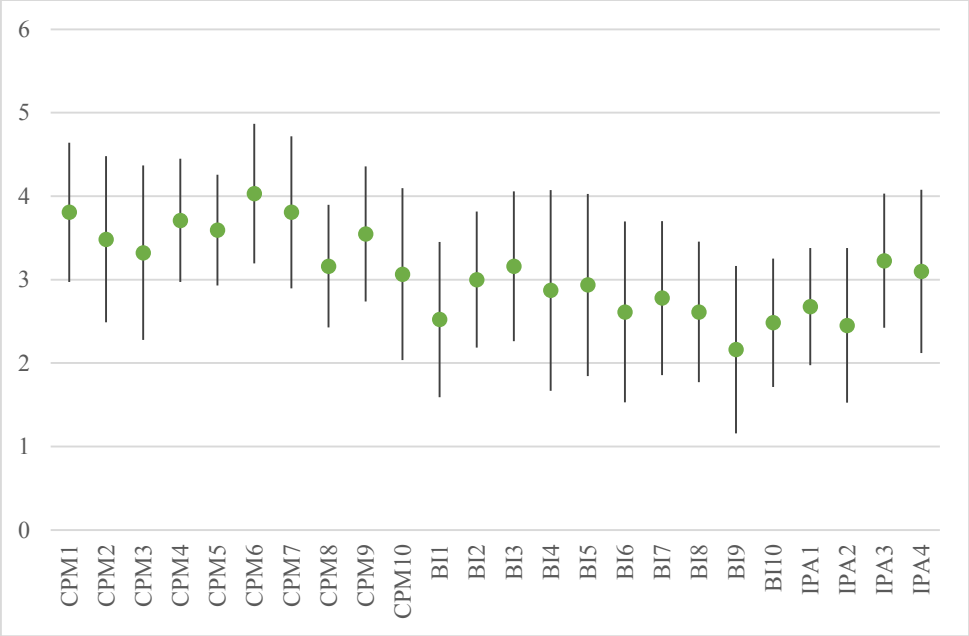
*Figure 16: Distribution of values for Cluster1*




*Source: Own work.*

Figure 16 clearly shows that there are certain attributes where values are quite distributed and therefore it is not the most appropriate to characterize clusters1 with them. Such attributes are CPM2, BI1 and BI9. Therefore, in the discussion we will try to avoid these attributes for the cluster characterization. However, there are also certain attributes where distribution is smaller and are more appropriate for the discussion. Such attributes are CPM1, CPM6, CPM9, BI5, BI7, BI8, BI10, IPA3 and IPA4. Consequently, we include this attributes when we interpret the characteristics of a cluster.

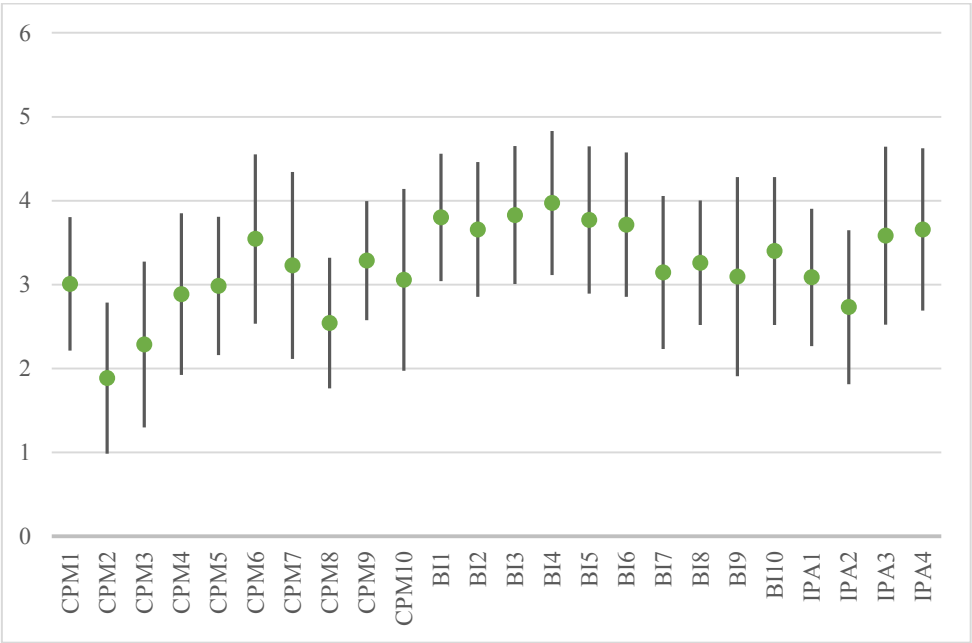
*Figure 17: Distribution of values for Cluster2*




*Source: Own work.*

Figure 17 represent a distribution of values in cluster2. Attributes that we should avoid for the discussion are CPM2, CPM3, CPM10, BI4 (which also has the highest distribution), BI5, BI6 and BI9. For the discussion and characterization of a cluster we can confidently use attributes CPM4, CPM5, CPM8, BI10 and IPA1.

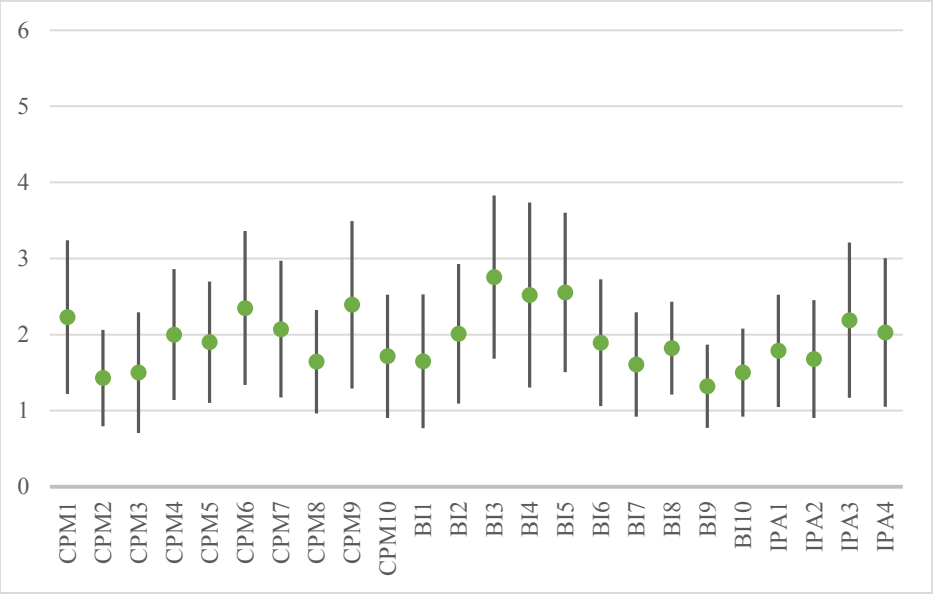
*Figure 18: Distribution of values for Cluster3*




*Source: Own work.*

For the discussion in cluster3 we should use attributes CPM1, CPM5, CPM8, CPM9, BI1, BI2, BI3, BI8 and IPA1 since distribution of values here is the smallest. On the other hand, attributes CPM6, CPM7, CPM10, BI9 and IPA3 should be avoided for the opposite reason. This data is presented in the figure 18.

*Figure 19: Distribution of values for Cluster4*




*Source: Own work.*

Distribution of values in cluster4 is presented in the figure 19. As it can be seen, attributes that should be avoided when making any conclusion regarding cluster characteristic are especially CPM1, CPM6, CPM9, BI3, BI4, BI5 and IPA3. On the contrary when selecting the attributes for the characterization of the cluster attributes CPM2, CPM8, BI7, BI8, BI9 and BI10 should be considered.

# 6 DISCUSSION

In the discussion we first interpret the clusters and try to characterize them. For this matter we use mean values for each attribute in each cluster which is presented in the Figure 15 and distribution of the values that is visually presented with the help of standard deviation in the figures 16, 17, 18 and 19 for each cluster individually. Additionally, we discuss answers to our research questions and what conclusions can we make based on the results that we got with the data analysis.

## 6.1 Cluster 1

We can see from the Figure 15 that cluster1 has the highest mean values for every attribute. Therefore, we can conclude that the companies included in this cluster are the most mature companies from the perspective of CPM and BI. However, based on the standard deviation we cannot claim that each attribute characterizes cluster1. Companies in cluster1 use CPM as a strategic management tool which helps to monitor how strategy is implemented in the company and to receive information about strategy implementation to use results of the analysis for improving/monitoring long-term organization development. This means that they are aware of a strategic importance that CPM as a concept can bring to the long-term development and performance of an organization. Companies in the cluster1 also verify the adequacy of key indicators periodically or based on the events that significantly influence organization changes which is according to Aho (2012, p. 20) a characteristic that the most mature companies have from the perspective of the strategy and business dimension. Companies in this cluster have also a strong culture of measuring and responsibilities which is also a characteristic that companies in the fifth level of maturity usually have according to the model presented by Aho (2012).

From the BI perspective companies in the cluster1 have high maturity level of data integration. Data integration is automated and companies use tools for data management and data integration which according to Dinter (2012, p. 5-6) is something that characterizes companies that are the most mature from the perspective of data management in BI concept. Organizational culture regarding the BI is high in this cluster which means that employees are aware of the importance that BI can have for the company. Companies have responsible person or competency centers for BI where tasks and competences are identified. Process maturity in the field of BI is high and processes are identified and actively managed. Also, level of strategic planning of BI is high. Companies have strategies for BI and these strategies are aligned with their business strategies. Aho (2009, p. 10-11) points out that in order for BI and CPM to deliver actual business value companies need BI and CPM strategy. Based on the results we can conclude that companies in the cluster1 are aware of this fact and are acting accordingly since their BI strategies are aligned with business strategies. Also BI and CPM initiatives are well aligned which shows that IT and business people work towards the same goals and are coordinating their activities in order to improve their overall performance. Data that companies obtain by using BI systems are the foundation for defying business objectives. BI system is used to monitor strategy implementation and enables to monitor if business objectives at different levels are achieved. This clearly indicates that BI and CPM initiatives are properly coordinated in the companies and are therefore delivering greater value than if used individually.

45% percent of companies in this cluster are manufacturing companies and 21% of the companies are working in retail. 51% of the companies in this cluster have number of employees between 50 and 249. Most of the companies in this cluster (56%) have annual

revenues from 10 to 50 million euros and 84% of companies have more than 10 million euros of annual revenues. This is quite reasonable since this levels of BI and CPM maturity and alignment requires proper investments in these fields.

Overall, companies in this cluster have high maturity level of CPM as well as BI and what is also important to note is that CPM and BI initiatives are well aligned. This means that companies in the cluster are mature companies that are well aware of the CPM and BI importance as well as their alignment. There is high level of cooperation between business and IT people which can enable CPM and BI initiative to be coordinate properly. Cluster1 is also cluster with the most of the units from the population (32%) and we can therefore conclude that 32% of the Slovenian medium and large size companies are mature in terms of CPM and BI initiatives and these initiatives are well aligned.

### 6.2 Cluster 2

In cluster2 companies have relatively high maturity level of CPM, higher than the companies in cluster3 and cluster4 but lower than companies in cluster1. These companies have strategic objectives systematically elaborated to the level of organization units, processes and individuals. Performance measurement system protects against local optimization. So it is set to optimize organizational performance instead of optimizing performance of units or individuals. Individuals inside organization are more aware of CPM importance than individuals in cluster3 and cluster4 but less aware than individuals in cluster1. Their decisions and activities are based on understanding of CPM. As we can see, CPM as a concept is important for the companies in this cluster.

Companies in the cluster2 don't have BI strategy that is aligned with their business strategy, and there is still room for improvement in the field of BI, especially when it comes to the scope of usage where mostly individuals use BI in isolated cases. Companies also don't measure how profitable BI is. In comparison to CPM, BI maturity is lower than CPM maturity. CPM projects and programmes are less coordinated with BI projects and programmes than they are in cluster1 and cluster3. There is also a weak communication between CPM and BI groups and between leaders and individuals that do activities in both fields. Based on the results we can assume that in these companies BI is mostly considered by IT people that recognize its value for individual cases, however strategic importance of BI is still not recognized.

31% of companies in this cluster are manufacturing companies, 14% of the companies are working in the field of transportation and warehousing and the same percent of companies in financial and insurance industries. Therefore, we can see that the presence of service oriented companies is greater than in cluster1. Also, 10% of the companies work in the field of electricity, gas and steam supply. 57% of companies have between 50 and 249 employees and 37% of companies have between 250 and 1000 employees. Interesting is also that no

company in this cluster have less than 50 employees whereas in the cluster1 12% of companies have less than 50 employees. This indicated that in order for company to be mature in the area of CPM and BI, size of the company isn't important since companies in the first cluster have the highest maturity in comparison with other clusters. 75% of companies in this cluster also have more than 10 million euros of annual revenues.

Based on this results we can conclude that companies in this cluster are using the benefits that CPM initiative can offer, however they have a lot of room for improvement in the area of BI. BI is not used in sufficient extent and this is probably also the reason why alignment between CPM and BI for these companies is not so important. These companies are interesting in comparison with the companies from cluster3 because they are more mature in terms of CPM but less mature in terms of BI.

### 6.3 Cluster 3

Companies in the cluster3 don't use CPM as a strategic tool of management that is used to monitor strategy implementation. Employees are less aware of CPM importance than individuals in cluster1 and cluster2. Their decisions and activities are not based on understanding of CPM. There is low culture of measuring and responsibilities. Performance measurement system is not set in a way that it would protect against local optimization. Therefore, companies here lack a clear CPM strategy that would provide a basis for even greater benefits of BI which is used in greater extent in comparison to CPM.

There is a wide scope of using BI inside these companies. BI is used when needed in all organizational units and all hierarchical levels but still less than in cluster1. Maturity level of business processes in the field of BI is higher than in cluster2. Processes are defined and actively managed. Internal and external data is integrated and maturity level of data architecture compared to cluster 2 is higher. CPM projects and programmes are more coordinated with BI projects and programmes in comparison to cluster2. CPM and BI groups communicate more which indicates that business and IT people work together and try to complement each other. This clearly shows that higher alignment of CPM and BI can enable to really exploit the potential of BI since maturity level of BI in this cluster is higher than in cluster2. Also, since mean values of BI attributes that present technological aspect of BI are close on to another in all four clusters this means that technological aspect of BI itself is not the one that makes the difference. Technological aspect itself is mostly addressed by IT people but in order to exploit true potential of BI, business people have to recognize its value and be included as well. Organizational part of BI is the one that makes the difference in maturity and if companies in this cluster would achieve higher maturity levels of CPM as well this would enable even better results.

In this cluster percent of manufacturing companies is only 20% whereas percent of companies that work in the field of finance and insurance is 13%. From the results we can

see that the percent of service oriented companies in this cluster is greater than in cluster2 and cluster1 which brings us to conclusion that service oriented companies have greater need for BI and CPM alignment which enables them to really exploit the benefits that BI can offer if properly coordinated with CPM. This is probably the reason that BI is more mature since CPM is more mature in manufacturing companies. 53% of companies in this cluster have between 50 and 249 employees and percent of companies that have annual revenues in the amount greater than 10 million euros is 72%. It is important to note that this cluster has the highest percentage of companies that have annual revenues greater than 50 million euros (31%). This is probably also the reason why companies have more mature BI initiative since these investments require more money. However, if BI and CPM are properly aligned, there is higher probability for greater return on investment which should be sufficient reason for companies to invest more time and energy in order to coordinate and align these initiatives.

Alignment of CPM and BI in cluster3 is higher than alignment in cluster2 and also BI maturity is higher than in cluster2. However, CPM maturity is lower in comparison to cluster2. Therefore we can assume that alignment construct and BI maturity are more connected than alignment construct and CPM maturity. This also means that CPM can be used without BI easier than BI without CPM since alignment of both in this cluster is greater in comparison to cluster2. Based on this we can also assume that in the companies usually business people are responsible for CPM initiatives whereas IT people are usually responsible for BI initiatives.

### 6.4 Cluster 4

Companies in cluster4 have very low CPM as well as BI maturity. There is no department, unit or individual that would work on CPM and coordinate CPM activities on the organizational level. Employees are not aware of CPM role and importance. Their decisions are not based on understanding of CPM. Companies are not using CPM methodologies such as BSC. We can conclude that CPM initiative is not present in the company and certain aspects of it are only used in individual cases.

Regarding BI there are no specific roles and organizational units for BI inside companies. Processes in the field of BI are not defined therefore maturity is very low. Companies do not perform estimates of BI profitability. Also, there is no BI strategy in the companies so there is no strategic planning of BI either. The same as for CPM we can conclude that there is no strategic thinking about the BI initiative and certain parts of BI are only used in individual cases.

Consequently CPM projects and programmes are not coordinated with BI projects and programmes and there is no communication between CPM and BI groups. Terminology in the field of CPM and BI is not aligned and they do not use the same expressions. So in terms of CPM and BI initiatives companies in this cluster are very immature. In comparison to

other clusters, companies in this cluster are smaller since 20% of the companies have less than 50 employees. 65% of companies have annual revenues in amount greater than 10 million euros which is less than in first three clusters. This is probably also the reason why BI initiatives and CPM initiatives are not used broadly since they require greater financial investments. However, 35% of companies in this clusters are manufacturing companies and 13% of companies work in the field of transportation and warehousing.

### 6.5 Cluster Analysis Summary

We can summarize that companies in cluster4 didn't yet achieve sufficient level of CPM and BI but have started to implement certain elements of BI (especially technological aspects) since this aspect is not so difficult to implement. Implementing certain technological solutions is less demanding while putting strategic view on these tools is more difficult. On the other hand, those that have high maturity level of BI have recognised that alignment of BI and CPM is also very important. BI and CPM alignment is actually the one that makes it possible for companies to get a real value out of BI, especially organizational part of BI whereas technological part is not so important. Therefore, we can conclude that influence of CPM and BI alignment is the strongest when influencing BI maturity and on the contrary BI is the one that compels the coherence of both. From the perspective of "business pull" and "technology push" concept that was presented by Eardley, Shah and Radman (2008, p. 644-646) we can clearly see that the technology push is stronger since IT people are more aware of the importance and therefore BI drives the alignment. On the other hand Aho (2009, p. 11) says that one of the issues that organizations face is that they mistakenly think implementation of CPM is driven by technology which isn't the case and supports our finding that CPM is mostly carried out by business people. Otherwise, CPM is supported by technology but it is driven by business processes that are strategically aligned (Aho, 2009, p. 11). As mentioned before, overall we can assume that CPM initiatives are mostly in the domain of business people whereas BI initiatives are in the domain of IT people in the companies. Results also show that alignment of both construct and BI maturity are more connected than alignment of the constructs and CPM maturity which is especially visible when comparing cluster2 and cluster3. Therefore, we confirm our conclusion that BI drives toward alignment between CPM and BI since CPM alone is easier to use than BI alone because IT people that are in this case mostly responsible for this initiative lack business knowledge and business perspective that would deal with the initiative on strategic level.

CPM and BI are commonly presented in the literature as highly connected and concepts that should be aligned (Williams & Williams, 2010). Aho (2009) even includes BI as a part of CPM in his paper. However, results of our research show that this is not necessarily the case and that a lot of companies are still using CPM and BI initiatives as a separate projects. Role of alignment is very important for the BI and CPM maturity however it is of higher importance for BI maturity. Encouraging fact is also that 32% of Slovenian medium and large size companies have mature BI and CPM initiatives which is also possible because of

proper alignment between them. However, there is clearly still room for improvement since no other group of companies have achieved sufficient level of maturity for both BI and CPM. Companies in cluster2 should put more emphasis on alignment of BI and CPM which will consequently bring to better use and maturity of BI as well. And companies in cluster3 should put more emphasis on CPM initiative in order to start following companies in cluster1.

# CONCLUSION

Throughout the master thesis we tried to look at different aspects of BI and CPM concepts since they are often addressed in the literature either separately or commonly. At the beginning we looked into the literature for the explanation of the CPM and BI concepts and we first described the concept of BI to see how the perception of it changed throughout the years. We also looked at the CPM concept and then discussed the importance that alignment of these two concepts can have for companies. What was also very important for our master thesis is the maturity of both concepts which is usually measured with the help of maturity models. For that matter we presented two maturity models and described them more in detail since they were also used for the research.

The main purpose was to see how CPM and BI maturity influence each other and what kind of connection exists between them. Also, we wanted to see how alignment of these two concepts influences maturity of both and how is this different for different groups of companies. The first objective was to look into existing maturity models which also represented a basis for our questionnaire. We also wanted to see how mature are Slovenian companies in these areas and therefore analyzed the data that we gathered with the questionnaire and divided companies into four different clusters based on BI and CPM maturity and their alignment. We have achieved the purpose since we found out what are the influences between CPM and BI initiatives as well as between their alignment and each of the concepts. We found out that alignment of BI and CPM concepts is very important in order to really use BI comprehensively. We also concluded that "technology push" is stronger than "business pull" and that alignment is driven by BI since IT people are more aware of its importance and are usually responsible for BI projects. On the other hand we concluded that CPM is mostly considered by the business people. We also achieved our objectives since we choose and looked more into detail two maturity models that also served as a basis for questions related to BI and CPM concepts. Additionally, with the help of cluster analysis, we analyzed how mature are companies in the field of CPM, BI and how are these initiatives aligned. We also found out that CPM and BI initiatives are carried out in companies differently and they are also differently aligned. There are some companies that have well aligned initiatives and also companies that do not align initiatives at all. However, we confirmed that companies that have both initiatives well aligned can gain greater benefits. We concluded that companies that put more effort on BI have recognized that alignment is very important as well. However, we also found out that there are still companies that

consider BI and CPM initiatives as a separate projects and they are also carried out accordingly. Therefore, there is still a lot to improve for companies from the perspective of BI and CPM alignment.

Since there is a limited study of influences that exist between BI, CPM and their alignment this master thesis brings another view on the connections that exist between these three concepts. Also, unlike the majority of studies it includes analysis of BI and CPM maturity as well as their alignment all in one place. Therefore, it provides additional, more in depth insight for better understanding of the areas studied. Results of the master thesis can be used in practice for companies to realize the importance that alignment of BI and CPM initiatives can have for better business results. Additionally, this work can be used by academics in order to continue and deepen the research of the influences and connections between these concepts as results show that they can bring greater results if considered commonly and therefore they should be also studied as a connected concepts.

The main limitation of the master thesis was that not in all recipient companies, that we sent questionnaire to, the most relevant person answered the question. We have sent a common questionnaire that included questions regarding BPM, social BPM, CPM, BI concepts and alignment of these concepts. Therefore, not necessary the most appropriate person for all the areas was providing the answers in certain company. Moreover, there was always only one person replying to the questionnaire. This means that the answers might also be perceived more as an opinion and not objective hard data. Another limitation is that number of clusters should be considered for further discussion since decision about it was subjective, based on the existing researches.

The topic discussed has the potential for further research. In future work wider analysis might be done with the help of interviews since we had to limit number of questions in the questionnaire. This might provide even more in depth and objective results since the interviewer could choose the most relevant person from the company to be interviewed. Also, for better understanding other methods could be used such as Structural equation modeling, especially to study the relationships. Topic provides an interesting field for studies that can benefit both academic as well as business world.

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# APPENDICES

## Appendix 1: Summary in Slovene language

V prvem poglavju magistrskega dela smo na osnovi pregleda literature predstavili koncept poslovne inteligence ter naredili pregled pojmovanja in dojemanja poslovne inteligence, kar se je spreminjalo skozi leta. Raziskovali smo zrelost poslovne inteligence, ki se meri s pomočjo zrelostnih modelov. Pri slednjih je bil predstavljen proces razvoja ter izveden kratek pregled različnih zrelostnih modelov. V zaključku prvega poglavja smo predstavili izbran zrelostni model (Dinter, 2012), kjer smo podrobno opisali posamezne ravni zrelosti in različne dimenzije poslovne inteligence, kar nam je predstavljalo tudi osnovo za pripravo vprašanj, ki so se navezovala na koncept poslovne inteligence. V drugem poglavju smo predstavili management uspešnosti poslovanja in izpostavili različne nivoje zrelosti le-tega. Na kratko smo predstavili tudi spreminjanje vloge in dojemanja managementa uspešnosti poslovanja skozi leta ter predstavili izbran zrelostni model (Aho, 2012). Podobno kot smo storili v prvem poglavju, smo tudi znotraj drugega poglavja izpostavili različne ravni zrelosti managementa uspešnosti poslovanja in njegove dimenzije, ki so predstavljale osnovo za pripravo vprašanj, ki so se nanašala na koncept managementa uspešnosti poslovanja. Tretje poglavje smo posvetili usklajenosti poslovne inteligence in managementa uspešnosti poslovanja, kjer smo poudarili njeno pomembnost pri izboljšanju uspešnosti podjetja. Predstavili smo tudi rezultate raziskave o usklajenosti obeh konceptov, ki sta jo izvedla Williams in Williams (2010). V četrtem poglavju je sledila predstavitev metodologije in vprašalnika, ki je bil poslan podjetjem, in podrobna predstavitev vprašanj ter podkrepitev izbire le-teh z relevantno literaturo. V tem poglavju smo bolj podrobno predstavili tudi analizo podatkov in izbiro ustrezne metode in tehnike za analizo. Peto poglavje zajema predstavitev rezultatov analize, kjer gre za uporabo tehnike razvrščanja v skupine, in predstavitev rezultatov opisne statistike. V šestem poglavju smo pripravili diskusijo, kjer smo bolj podrobno pogledali štiri skupine podjetij in skušali najti karakteristike, s katerimi bi lahko opisali posamezne skupine. Prav tako smo za vsako skupino predstavili zrelost poslovne inteligence, managementa uspešnosti poslovanja ter njuno usklajenost. Na osnovi rezultatov analize smo na koncu poglavja diskutirali o povezavah med obema konceptoma in o tem, kakšni so vplivi med njima. Na koncu pa je sledil še sklep, ki je povzel naša spoznanja.

Uspešnost podjetij v poslovnem okolju je pogojena s tem, da morajo nenehno meriti, spremljati ter analizirati svojo uspešnost (Bosilj Vukšić, Pejić Bach, & Popovič, 2013, str. 613). Za merjenje uspešnosti podjetja uporabljajo management uspešnosti poslovanja (Richards, Yeoh, Chong, & Popovič, 2014, str. 1) – torej proces, ki sistematično pomaga pri planiranju uspešnosti podjetja. Na osnovi operativnih in finančnih ciljev lahko podjetja merijo svojo uspešnost in na podlagi teh izvedejo ustrezne korektivne ukrepe (Williams & Williams, 2010, str. 5). Management uspešnosti poslovanja je z vidika podjetij izjemno pomemben in se ga pogostokrat omenja kot poslovno inteligenco naslednje generacije (Aho, 2010, p. 1-2). Definicija poslovne inteligence, ki sta jo uporabila Williams in Williams (2010, str. 5-6), pravi naslednje: »Poslovna inteligenca je sistematičen pristop za

zagotavljanje in uporabo poslovnih informacij in uporabo analitike za izboljšanje poslovne uspešnosti.« Kot navajajo M. Anandarajan, A. Anandarajan in Srinivasan (2012), se je poslovna inteligenca najprej uporabljala kot izraz za orodja za analizo podatkov. Kasneje se je razumevanje poslovne inteligence razširilo in je bila obravnavana kot skupek vseh delov, ki so vključeni v integrirano infrastrukturo za podporo odločanju (Baars & Kemper, 2008). Jasno je, da se management uspešnosti poslovanja in poslovna inteligenca v literaturi pojavljata kot ločena koncepta, vendar sta se skozi leta vse pogosteje pričela pojavljati tudi skupaj, saj se lahko uspešno dopolnjujeta. Z vidika izvajanja oziroma implementacije se management uspešnosti poslovanja in poslovna inteligenca različno izvajata, saj so nekatera podjetja bolj zrela na tem področju, medtem ko druga manj in posledično ne izkoriščajo vseh možnosti in prednosti, ki jih oba koncepta ponujata. Nekatera podjetja celo uporabljajo management uspešnosti poslovanja in poslovno inteligenco ločeno, medtem ko ju druga podjetja ne le uporabljajo, temveč tudi koordinirajo in usklajujejo, z namenom doseganja boljših rezultatov. Vsekakor obstajajo avtorji, ki zagovarjajo, da bi se oba koncepta morala obravnavati enotno in skušajo najti njune podobnosti. Nekateri avtorji jasno ločujejo oba koncepta in skušajo pojasniti kako se dopolnjujeta. Na drugi strani pa so avtorji, ki skušajo pojasniti kako zelo pomembna je usklajenost managementa uspešnosti poslovanja in poslovne inteligence za zagotavljanje večjih koristi podjetjem (Williams & Williams, 2010, str. 4). Za nas najbolj pomembno je vprašanje o tem, če se podjetja tega dejansko zavedajo in če tudi sprejemajo odločitve, ki bi odražale to zavedanje. Realnost je namreč pogosto drugačna. Na podlagi rezultatov svoje raziskave Williams in Williams (2010, str. 4) trdita, da se management uspešnosti poslovanja in poslovna inteligenca uporabljata ločeno, vendar pa vseeno prispevata k boljši uspešnosti podjetij. Ne glede na to pa je usklajenost obeh konceptov potrebna za doseganje še boljših poslovnih rezultatov. Zato so za naše delo povezanost in vplivi med zrelostjo poslovne inteligence, managementom uspešnosti poslovanja in njuno usklajenostjo pomembni.

Glavni namen magistrskega dela je razumeti, kako sta koncepta zrelosti managementa uspešnosti poslovanja ter zrelosti poslovne inteligence povezana in kako medsebojno vplivata drug na drugega. Richard in drugi (2014, str. 1) izpostavljajo, da še vedno obstaja omejeno število raziskav o vplivu poslovne inteligence na management uspešnosti poslovanja. V magistrskem delu je izpostavljena usklajenost obeh, saj smo želeli preveriti, kako usklajenost vpliva na zrelost obeh in obratno, kako zrelost kakorkoli vpliva na usklajenost in če so ti vplivi različni za različne skupine podjetij. Hkrati smo želeli z delom ponuditi vpogled v trenutno stanje na področju managementa uspešnosti poslovanja in poslovne inteligence v slovenskih srednje velikih in velikih podjetjih. S povezavo teoretičnih konceptov iz literature in rezultatov naše raziskave smo želeli zagotoviti rezultate o zrelosti obeh konceptov ter njuni usklajenosti. To namreč omogoča javnosti, kot tudi strokovnjakom s tega področja, vpogled v trenutno stanje teh dveh konceptov v Sloveniji in primerjavo z ostalimi raziskavami, ki prav tako analizirajo management uspešnosti poslovanja in poslovno inteligenco tako v Sloveniji kot tudi v drugih državah. Želimo si, da bi rezultati

lahko omogočili vpogled pri pripravi nadaljnjih del na tem področju in služili kot osnova pri pripravi nadaljnjih analiz ter izboljšav.

Cilj magistrskega dela je raziskati obstoječe zrelostne modele poslovne inteligence in managementa uspešnosti poslovanja, ki so služili kot osnova pri pripravi vprašalnika za raziskavo. Izbrana in predstavljena sta dva modela, ki podpirata izbrana vprašanja in služita kot osnovi za raziskovalni vprašanji. Naš drugi cilj je analizirati podatke, ki smo jih zbrali z vprašalniki. S tem želimo izvedeti, kakšna je raven zrelosti poslovne inteligence in managementa poslovne uspešnosti podjetij v Sloveniji ter kakšna je usklajenost obeh konceptov, in s tem dobiti boljši vpogled v to, kakšni so vplivi med temi tremi koncepti. Prav tako želimo povezati koncepta zrelosti poslovne inteligence in managementa uspešnosti poslovanja z njuno usklajenosti ter ugotoviti, če je kateri od povezav v prihodnosti potrebno posvetiti več pozornosti. Hkrati pa nas je zanimalo, kako se projekti poslovne inteligence in managementa uspešnosti poslovanja izvajajo v podjetjih, z vidika skupnih pobud, zaposlenih in prioritet.

Da bi spoznali zrelost obeh konceptov znotraj podjetij in dobili vpogled v obravnavo, kako se projekti izvajajo znotraj podjetij in če obstaja enotno dojemanje obeh konceptov, smo oblikovali dve raziskovalni vprašanji.

*Raziskovalno vprašanje 1:* So projekti poslovne inteligence in managementa uspešnosti poslovanja v podjetjih usklajeni in se izvajajo kot skupni ali ločeni projekti?

Frolick in Ariyachandra (2006) namreč ločita oba koncepta, s čimer se strinjajo tudi nekateri drugi avtorji (Melchert, Winter, & Klesse, 2004; Miranda, 2004). Kljub temu pa so nekateri avtorji (Williams & Williams, 2010; Aho, 2009) mnenja, da se lahko koncepta uporabljata komplementarno, saj sta povezana. Če pa sta usklajena tudi s skupno strategijo, lahko zagotavljata še večjo vrednost, kot če se uporabljata individualno. Na podlagi slednjega nas je zanimalo, kako podjetja upoštevajo ta spoznanja in kako se projekti poslovne inteligence in managementa uspešnosti poslovanja izvajajo v praksi. Torej ali se izvajajo kot individualni projekti, ki niso usklajeni, ali kot skupni projekti, kjer zaposleni stremijo k istim ciljem?

*Raziskovalno vprašanje 2:* Kakšna je vloga usklajenosti poslovne inteligence in managementa uspešnosti poslovanja z vidika zrelosti obeh?

Aho (2009, str. 5) pravi, da obstaja močna povezava med konceptoma poslovne inteligence in managementa uspešnosti poslovanja ter da obstaja potreba po skupni strategiji. V magistrskem delu so predstavljene tudi ugotovitve, do katerih sta s svojo raziskavo prišla Williams in Williams (2010, str. 1-2), in nakazujejo na to, da je usklajenost obeh konceptov izjemno pomembna ter da vpliva na izboljšanje uspešnosti poslovanja podjetij in znatno doprinaša pri doseganju poslovnih ciljev. Pri čemer pa se je potrebno vprašati, če obstaja

povezava med zrelostjo obeh konceptov in tudi med zrelostjo in usklajenostjo obeh? Vprašalnik, ki smo ga uporabili v magistrskem delu, je zastavljen tako, da nam pomaga prepoznati zrelost poslovne inteligence in managementa uspešnosti poslovanja, kar nam je pomagalo pri prepoznavanju povezav med usklajenostjo in zrelostjo obeh.

Za namen magistrskega dela smo uporabiti podatke tako iz primarnih kot tudi sekundarnih virov. Slednje predstavljajo knjige ter članki, ki so zbrani v seznamu literature, medtem ko smo za primarni vir uporabili vprašalnik, ki je bil pripravljen za namen mednarodnega projekta PROSPER. Za ta namen smo torej uporabili različne metode raziskovanja, ki so predstavljene v nadaljevanju.

Primerjalna analiza med obstoječimi zrelostnimi modeli je služila kot osnova za pripravo vprašalnika, ki je bil uporabljen za empirično raziskavo. Izbrali smo dva zrelostna modela, ki pomagata pri ocenjevanju zrelosti poslovne inteligence in managementa uspešnosti poslovanja. Oba modela smo bolj podrobno predstavili tudi v prvem in drugem poglavju magistrskega dela.

Podatki iz obstoječih raziskav so nam služili kot osnova za boljše razumevanje tematike in podpora naši raziskavi, uporabljeni pa so bili tudi z namenom boljšega vpogleda v tematiko in morebitno primerjavo z našimi rezultati.

Tehnika razvrščanja v skupine je uporabljena za analizo primarnih podatkov, ki smo jih zbrali z vprašalnikom, da bi izvedeli, kakšna je raven zrelosti poslovne inteligence in managementa uspešnosti poslovanja podjetij v Sloveniji in kako sta ta dva koncepta usklajena med seboj. S pomočjo te tehnike smo podjetja razdelili v 4 skupine, ki so si med seboj različne glede na zrelost in usklajenost obeh konceptov. Prav tako pa smo želeli izvedeti, kakšni so vplivi med temi koncepti za te štiri skupine podjetij.

Vprašalnik, ki je bil uporabljen za magistrsko delo, je bil sestavljen iz treh delov, ki so se nanašali na zrelost poslovne inteligence, zrelost managementa uspešnosti poslovanja in usklajenost obeh. Za zrelost managementa uspešnosti poslovanja smo uporabili deset vprašanj, ki so bila pripravljena na osnovi izbranega modela (Aho, 2009, 2012) in ki obravnava različne ravni zrelosti iz zornega kota različnih komponent. Vprašanja zajemajo naslednje komponente: strategijo in poslovanje, uspešnost, tehnologijo, neopredmetena sredstva, metode in orodja, vodenje in odgovornost, komunikacijo ter obseg. Nismo pa vključili komponente informacije, saj posega v drug konstrukt, predvsem v zrelost poslovne inteligence. Za konstrukt poslovne inteligence je bilo uporabljenih deset vprašanj, ki so bila oblikovana na osnovi izbranega modela (Dinter, 2012), ki predstavlja različne ravni zrelosti poslovne inteligence iz zornega kota dimenzij oziroma kategorij teh dimenzij. Smo pa v tem delu zastavili po eno vprašanje za vsako kategorijo dimenzij poslovne inteligence: obseg, podatkovna arhitektura, stopnja penetracije, tehnična arhitektura, upravljanje podatkov, oblikovanje informacij, organizacijska struktura, procesi, donosnost in strategija. Tretji del

vprašalnika se je nanašal na usklajenost konceptov poslovne inteligence in managementa uspešnosti poslovanja ter zajema štiri vprašanja. Ta konstrukt je bil pripravljen na novo, saj ni bilo nobenega obstoječega modela, ki bi ga lahko uporabili za ta namen. Konstrukt je bil pripravljen na osnovi obsežnega pregleda literature.

Za namen magistrskega dela smo se odločili, da ne bomo skušali potrjevati hipotez, temveč smo v začetku zastavili dve raziskovalni vprašanji. Ker smo želeli raziskati, kako so različne skupine podjetij zrele na področju poslovne inteligence in managementa uspešnosti poslovanja, kako sta ta dva konstrukta usklajena ter kakšni so medsebojni vplivi, smo temu primerno izbrali tudi tehniko razvrščanja v skupine. Ta metoda pomaga razumeti in prepoznati različne vzorce v podatkovni zbirki. Podatki so razdeljeni v različne skupine, znotraj katerih so si podatki in posledično enote bolj podobne med seboj kot pa enotam v drugih skupinah (Guha, Rastogi & Shim, 2001, str. 35). V magistrskem delu smo enote razdelili na podlagi 24 atributov, ki so bili izpeljani iz vprašalnika oziroma vprašanj. V naboru različnih algoritmov smo se odločili za uporabo algoritma K-means, ki je eden najbolj enostavnih za uporabo. Pri uporabi algoritma K-means je potrebno število skupin določiti vnaprej. Večina obstoječih zrelostnih modelov uporablja štiri, pet ali šest skupin (Lukman, Hackney, Popovič, Jaklič, & Irani, 2011, str. 215), zato smo se tudi sami odločili, da uporabimo štiri skupine, saj je bilo to z vidika interpretacije in primerjave rezultatov najbolj primerno. Naredili smo analizo z različnim številom skupin in pri štirih skupinah dobili najbolj primerne rezultate za interpretacijo. Želeli smo namreč oblikovati skupine, znotraj katerih so enote homogene in jih lahko opišemo z določenimi demografskimi karakteristikami ter tudi z ravnjo zrelosti na področju poslovne inteligence in managementa uspešnosti poslovanja. Torej, želeli smo dobiti skupine, znotraj katerih bodo imele enote podobno raven zrelosti obeh konceptov, njuno usklajenost kot tudi posamezne atribute. Skupine smo želeli tudi primerjati med seboj na osnovi teh atributov in najti podobnosti ter razlike med njimi.

Pred pričetkom analize smo 1.398 podjetjem poslali vprašalnike in dobili 171 rešenih vprašalnikov. Vprašalnike smo prejeli po pošti in jih ročno vnesli v spletno anketo ali pa so posamezniki izpolnili spletno anketo neposredno. Kar se tiče strukture populacije, je sledeča: 54 % podjetij v populaciji ima med 50 in 249 zaposlenih, medtem ko ima samo 7 % podjetij več kot 1000 zaposlenih. 51 % podjetij je imelo v letu 2015 več kot 10 do vključno 50 milijonov evrov prihodkov, 25 % pa je imelo prihodke višje od 50 milijonov evrov. 24% podjetij je imelo prihodke nižje od 10 milijonov evrov. Po razvrščanju v skupine je bilo 33 % enot razporejenih v skupino 1, ki je tudi skupina z največ enotami. 25 % enot je bilo razporejenih v skupino 3, 22 % enot v skupino 2 in 20% enot v skupino 4. Kar se tiče vrednosti atributov, ima skupina 1 najvišjo povprečno vrednost za vse atribute, medtem ko ima skupina 4 najnižjo vrednost pri vseh 24 atributih. Skupina 2 in 3 imata povprečne vrednosti nekje vmes, vendar pa ima skupina 2 višjo povprečno vrednost za atribute, ki merijo zrelost managementa uspešnosti poslovanja, skupina 3 pa ima višjo povprečno vrednost pri atributih, ki merijo zrelost poslovne inteligence. Torej, skupina 1 je najbolj zrela

tako na področju poslovne inteligence kot tudi na področju managementa uspešnosti poslovanja, oba koncepta pa sta med seboj tudi zelo dobro usklajena. Skupina 1 je tudi skupina z največ enotami iz populacije (32 %), zato lahko povzamemo, da je 32 % podjetij v Sloveniji zrelih na obeh področjih in ima projekte tudi dobro usklajene. Podjetja v skupini 2 dovolj dobro izkoriščajo prednosti, ki jih ponuja management uspešnosti poslovanja, imajo pa še veliko prostora za izboljšave na področju poslovne inteligence. Ta se ne uporablja v dovoljšni meri, kar je verjetno tudi razlog, da projekti obeh niso dovolj dobro usklajeni. V skupini 3 je usklajenost projektov poslovne inteligence in managementa uspešnosti poslovanja boljša kot v skupini 2. Kljub temu je zrelost managementa uspešnosti poslovanja nižja, kot v skupini 2. Na podlagi tega tudi sklepamo, da sta zrelost poslovne inteligence in usklajenost obeh konceptov bolj povezana kot pa zrelost managementa uspešnosti poslovanja in usklajenosti. V skupini 4 pa projekti niso usklajeni, saj gre za podjetja, ki so nezrela na področju poslovne inteligence in managementa uspešnosti poslovanja.

Če torej povzamemo, smo skozi magistrsko delo želeli pregledati različne vidike poslovne inteligence in managementa uspešnosti poslovanja, saj se v literaturi pogosto pojavljata ločeno, v nekaterih primerih pa tudi skupaj. Zelo pomembna za nas je bila tudi zrelost obeh konceptov, ki se jo ponavadi meri s pomočjo zrelostnih modelov, zato smo v magistrskem delu omenjena dva tudi bolj podrobno predstavili. Glavni namen magistrskega dela je bil prepoznati, kako poslovna inteligenca in management uspešnosti poslovanja vplivata drug na drugega in kakšne povezave obstajajo med njima. Prav tako smo želeli raziskati, kako usklajenost teh dveh konceptov vpliva na zrelost obeh in kako se to razlikuje med različnimi skupinami podjetij. Prvi cilj je bil torej pregledati obstoječe zrelostne modele, zato izbrana zrelostna modela predstavljata tudi osnovo za vprašalnik, ki je bil uporabljen v raziskavi. Seveda smo želeli videti tudi, kakšna je zrelost podjetij v Sloveniji na teh dveh področjih. To smo naredili z analizo podatkov, ki smo jih pridobili z vprašalnikom ter podjetja razdelili v štiri skupine, na osnovi zrelosti poslovne inteligence in managementa uspešnosti poslovanja ter njune usklajenosti. Namen magistrskega dela smo dosegli, saj smo ugotovili, kakšni so vplivi med zrelostjo obeh konceptov ter med usklajenostjo in obema konceptoma. Ugotovili smo, da je usklajenost izjemno pomembna, če želimo poslovno inteligenco zares uporabljati celostno. Prav tako smo ugotovili, da je tehnološki potisk (ang. *technology push*) močnejši kot pa poslovni poteg (ang. *business pull*) in da je usklajenost v veliki meri odvisna od poslovne inteligence, saj se ljudje, ki delujejo na področju informacijske tehnologije, veliko bolj zavedajo njene pomembnosti in so ponavadi tudi odgovorni za projekte poslovne inteligence. Po drugi strani pa smo tudi spoznali, da so za projekte managementa uspešnosti poslovanja ponavadi odgovorni ljudje s poslovnega področja. Dosegli smo tudi zastavljene cilje, saj smo si bolj podrobno ogledali dva zrelostna modela, ki sta služila tudi kot osnova za pripravo vprašanj. S pomočjo tehnike razvrščanja v skupine smo tudi ocenili, kakšna je zrelost poslovne inteligence in managementa uspešnosti poslovanja in preučili, če so ti projekti med seboj usklajeni. Ugotovili smo, da se tovrstni projekti v podjetjih izvajajo zelo različno, saj jih nekatera podjetja izvajajo usklajeno, medtem ko druga ne. Ne glede na to smo potrdili, da so bolj uspešna tista podjetja, ki imajo te projekte usklajene. Sklenili smo,

da so podjetja, ki posvečajo več pozornosti poslovni inteligenci, že ugotovila, da je usklajenost obeh konceptov pomembna. Kljub temu pa nekatera podjetja te projekte še vedno izvajajo povsem ločeno in med seboj niso usklajena, kar pomeni, da obstaja še veliko prostora za izboljšave z vidika usklajenosti.

Ker je mogoče najti omejeno število raziskav, ki obravnavajo vplive med poslovno inteligenco, managementom uspešnosti poslovanja in usklajenostjo med njima, magistrsko delo prinaša dodaten pogled na povezave, ki obstajajo med omenjenimi tremi koncepti. Poleg tega, za razliko od drugih del, obravnava zrelost poslovne inteligence, managementa uspešnosti poslovanja in njuno usklajenost na enem mestu, kar prinaša dodaten in bolj poglobljen vpogled za boljše razumevanje raziskovanega področja. Rezultati so uporabni za podjetja, saj lahko z njimi dobijo vpogled v pomembnost, ki jo ima usklajenost obeh proučevanih konceptov za boljše poslovne rezultate. Poleg tega je lahko uporabno tudi za akademsko stroko, za nadaljnje in bolj poglobljene raziskave na področju vplivov in povezav med proučevanimi koncepti. Rezultati namreč kažejo, da lahko ti koncepti prispevajo k uspešnosti v še večji meri, če so enotno obravnavani in usklajeni, zato bi bilo smiselno, da se jih tudi raziskuje enotno – kot povezane koncepte.

Glavna omejitev magistrskega dela je bila, da niso v vseh podjetjih, katerim smo poslali vprašalnike, na le-te odgovarjale najbolj relevantne osebe za obravnavana področja. Poslali smo namreč en vprašalnik, ki je zajemal vprašanja o managementu poslovnih procesov, sodelovalnem managementu poslovnih procesov, managementu uspešnosti poslovanja, poslovni inteligenci in usklajenosti teh konceptov. Kar pomeni, da ni nujno v vseh primerih na vprašanja odgovarjala najbolj primerna oseba za vsa področja. Poleg tega je na celotni vprašalnik vedno odgovorila samo ena oseba. To pomeni, da lahko odgovore na vprašanja obravnavamo bolj kot mnenja in ne objektivna dejstva. Prav tako je lahko število skupin, ki smo jih izbrali, predmet nadaljnjih razprav, saj je bila odločitev o tem subjektivna in sprejeta na osnovi predhodnih raziskav.

Tema, ki smo jo v magistrskem delu obravnavali, bi lahko bila predmet nadaljnjih raziskav. V prihodnosti bi se s pomočjo intervjujev lahko opravila širša analiza, saj je bilo število vprašanj omejeno. To bi lahko pripeljalo do še bolj poglobljenih in objektivnih rezultatov, saj bi lahko za intervju izbrali najbolj primerno osebo za posamezno področje. Za še boljše razumevanje bi lahko uporabili tudi druge metode, kot je na primer modeliranje strukturnih enačb, predvsem za raziskovanje odnosov oziroma razmerij. Tema namreč predstavlja zanimivo področje za raziskovanje in je lahko zanimiva tako za akademsko kot tudi poslovno stroko.

## Appendix 2: Questionnaire in Slovene

## Management uspešnosti poslovanja

*Management uspešnosti (angl. Corporate Performance Management, Business Performance Management, Enterprise Performance Management, v nadaljevanju CPM) je managerki pristop, namenjen optimiziranju razvoja in izvedbe poslovne strategije, tako da je strateško planiranje tesno povezano z operativno izvedbo strategije. Uspešnost poslovanja se neprestano meri in analizira, rezultati pa se uporabljajo za spremembe in izboljšave poslovnih procesov, poleg tega pa povratno vplivajo na spremembo obstoječe in pripravo nove strategije.*

| CPM | MANAGEMENT USPEŠNOSTI POSLOVANJA | |
|---|---|---|
| Prosimo vas, da označite, v kolikšni meri se strinjate z naslednjimi trditvami. | | 1 = sploh se ne strinjam; 5 = popolnoma se strinjam; X = ne vem, ne morem oceniti |
| CPM-1 | *CPM uporabljamo kot strateško orodje managementa, s katerim se spremlja izvajanje strategije in se pridobivajo povratne informacije o izvedbi strategije, potem pa se rezultati analize uporabljajo za izboljševanje/spreminjanje dolgoročnega razvoja organizacije.* | 1 2 3 4 5 X |
| CPM-2 | *V organizaciji obstaja služba (oddelek, enota) ali oseba, ki se ukvarja s CPM in koordinira s tem povezane aktivnosti na ravni celotne organizacije.* | 1 2 3 4 5 X |
| CPM-3 | *Organizacija je uspešno privzela metodologije CPM, kot je na primer uravnoteženi sistem kazalnikov (Balanced Scorecard – BSC).* | 1 2 3 4 5 X |
| CPM-4 | *Strateški cilji so sistematično razdelani (kaskadirani) do ravni organizacijskih enot/procesov/posameznikov.* | 1 2 3 4 5 X |
| CPM-5 | *Sistem za merjenje uspešnosti je postavljen tako, da varuje pred lokalno optimizacijo (npr. optimizacijo performanc enot, posameznikov, namesto optimizacije performanc organizacije).* | 1 2 3 4 5 X |
| CPM-6 | *Ustreznost ključnih kazalnikov se preverja periodično ali na podlagi dogodkov, ki pomembno vplivajo na organizacijske spremembe.* | 1 2 3 4 5 X |
| CPM-7 | *Ocena dela in sistem nagrajevanja temeljita na sistemu merjenja uspešnosti.* | 1 2 3 4 5 X |
| CPM-8 | *V organizaciji obstaja zavest zaposlenih o pomenu in vlogi CPM. Njihove odločitve in aktivnosti temeljijo na razumevanju CPM.* | 1 2 3 4 5 X |
| CPM-9 | *V organizaciji obstaja kultura merjenja in odgovornosti.* | 1 2 3 4 5 X |
| CPM-10 | *V organizaciji uporabljamo informacijsko tehnologijo, ki je specifično oblikovana za podporo in nadzor izvajanja strategije.* | 1 2 3 4 5 X |

**Poslovna inteligenca**

*Poslovna inteligenca (poslovno obveščanje, poslovna analitika, angl. Business Intelligence, v nadaljevanju BI) zajema vse procese in sisteme (npr. podatkovna skladišča, področna podatkovna skladišča, analitična orodja, npr. orodja za poročanje, ad-hoc analitika – OLAP, analitika v pomnilniku, orodja za načrtovanje, opozarjanje, nadzorne plošče, podatkovno rudarjenje), ki preoblikujejo neobdelane (surove) podatke v smiselne in uporabne informacije. Omogoča učinkovito, sistematično in namensko analizo organizacije in njenega konkurenčnega okolja.*

| BI | POSLOVNA INTELIGENCA | | |
|---|---|---|---|
| Prosimo vas, da označite, kako bi ocenili zrelost poslovne inteligence v vaši organizaciji po naslednjih dimenzijah (X = ne vem, ne morem oceniti). | | | |
| Trditev A | | | Trditev B |
| BI-1 | Kakšen je obseg uporabe sistemov poslovne inteligence v vaši organizaciji? | | |
| *BI uporabljajo posamezniki v osamljenih primerih.* | | 1 2 3 4 5 X | *BI se uporablja v vseh primerih (ko je to potrebno), v vseh organizacijskih enotah, na vseh hierarhičnih ravneh in na vseh področjih uporabe.* |
| BI-2 | Kakšna je raven zrelosti podatkovne arhitekture v vaši organizaciji? | | |
| *V organizaciji ne obstaja management poslovnih podatkov. Pomen podatkov ni opredeljen ali pa je neenoten (med enotami, procesi).* | | 1 2 3 4 5 X | *Notranji (strukturirani in nestrukturirani) in potrebni zunanji podatki so popolnoma integrirani. Dosežena je potrebna raven kakovosti podatkov.* |
| BI-3 | Kakšen je pomen uporabe poslovne inteligence v vaši organizaciji? | | |
| *Ocenjujemo, da pomen BI ni relevanten.* | | 1 2 3 4 5 X | *Odločanje temelji na uporabi BI. Ocenjujemo, da ima BI kritičen vpliv na uspešnost poslovanja.* |
| BI-4 | Kakšna je raven zrelosti tehnološke arhitekture poslovne inteligence v vaši organizaciji? | | |
| *Ne obstajajo namenske baze podatkov za BI.* | | 1 2 3 4 5 X | *Uporablja se podatkovno skladišče na ravni celotne organizacije.* |
| BI-5 | Kakšna je raven zrelosti integracije podatkov v vaši organizaciji? | | |
| *Integracija podatkov je ročna.* | | 1 2 3 4 5 X | *Integracija podatkov je avtomatizirana. Uporabljajo se orodja za management in integracijo podatkov.* |
| BI-6 | Kakšne vrste orodij za BI uporabljate? | | |
| *Ne uporabljamo namenskih BI orodij; analize delamo ročno.* | | 1 2 3 4 5 X | *Uporabljamo širok nabor BI orodij in tehnik, kot so npr. orodja za pripravo poročil, za ad-hoc analitiko (OLAP), analitiko v pomnilniku, načrtovanje poslovanja, opozarjanje, napovedovanje, nadzorne plošče, mobilni BI, podatkovno rudarjenje, napovedno analitiko in druge napredne tehnike analitike in vizualizacije.* |

| BI-7 | Kakšna je organizacijska struktura, povezana s poslovno inteligenco, v vaši organizaciji? | | |
|---|---|---|---|
| *Ne obstajajo specifične vloge in organizacijske enote za poslovno inteligenco (obveščanje, analitiko).* | 1 2 3 4 5 X | *Imamo odgovorno osebo ali kompetenčni center za poslovno inteligenco (podatkovno analitiko ali podobno) s celovitim naborom opredeljenih nalog in pristojnosti.* |
| BI-8 | Kakšna je raven zrelosti procesov na področju BI (npr. analiza zahtev, management storitev na tem področju) v vaši organizaciji? | |
| *Procesi na tem področju niso opredeljeni.* | 1 2 3 4 5 X | *Procesi so opredeljeni in jih aktivno managiramo.* |
| BI-9 | Kakšna je raven ocenjevanja dobičkonosnosti poslovne inteligence v vaši organizaciji? | |
| *Ne delamo ocen dobičkonosnosti BI.* | 1 2 3 4 5 X | *Izvajamo medprojektne in v koristi usmerjene analize dobičkonosnosti.* |
| BI-10 | Kakšna je raven strateškega načrtovanje BI v vaši organizaciji? | |
| *Ne obstaja strategija BI.* | 1 2 3 4 5 X | *Imamo strategijo za področje BI, ki je usklajena s poslovno strategijo.* |

**Usklajenost managementa uspešnosti poslovanja (CPM) in poslovne inteligence (BI)**

| IPA | USKLAJENOST CPM/BI | |
|---|---|---|
| Prosimo vas, da označite, v kolikšni meri se strinjate z naslednjimi trditvami. | | 1 = sploh se ne strinjam;<br>5 = popolnoma se strinjam;<br>X = ne vem, ne morem oceniti |
| IPA-1 | *Projekti in programi managementa uspešnosti poslovanja so koordinirani s projekti in programi poslovne inteligence. Obstaja močna komunikacija med skupinama za CPM in BI, med vodji ali posamezniki, ki izvajajo aktivnosti na obeh področjih.* | 1 2 3 4 5 X |
| IPA-2 | *Terminologija na obeh področjih CPM in BI je usklajena. Na obeh področjih se uporabljajo skupni izrazi; obstaja slovar teh izrazov.* | 1 2 3 4 5 X |
| IPA-3 | *Podatki, pridobljeni s sistemom BI, so podlaga za opredelitev poslovnih ciljev.* | 1 2 3 4 5 X |
| IPA-4 | *Sistem BI se uporablja za spremljanje izvajanja strategije, tako da omogoča spremljanje doseganja poslovnih ciljev na različnih ravneh.* | 1 2 3 4 5 X |