OVERVIEW OF BUSINESS INTELLIGENCE MATURITY MODELS

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Today, companies wish to evaluate and justify their investments into Business Intelligence systems, which requires measurement of their business value and comparison with similar systems in other companies. Maturity models offer an adequate baseline for comparison. Maturity models define levels of definition, efficiency, manageability and measurement of the monitored environment. This paper briefly describes and analyzes six different maturity models that can be used for the maturity of BI systems assessment. An overview and analysis will show that most of the models do not cover the whole area of Business Intelligence, but they rather focus on a specific point of view and/or area of the problem domain. Results show that by using maturity models, only a short period of time is needed in order for one to discover the areas within the company or institution that need special, more intensive attention and work. Namely, results of the analysis often expose problematic areas that could be easily overlooked.

1. INTRODUCTION

Many companies have invested a lot of money into the renewal of business processes and the improvement of information systems in order to gain competitive advantage over competitors or to reduce costs. They need to adjust to market and other environmental changes, which require proactive actions and faster alignment to always-faster changes on the business market, both globally and locally.

Correct and in-time business decisions are crucial for companies and institutions to survive. In order to make correct business decisions, reliable,

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accurate and punctual information needs to be provided. One of the key areas for the past few years, where companies were investing a lot of money, was Business Intelligence (Computer Economics 2008). Return on investment for the Business Intelligence area is not easily proved. The influence of faster access to better and broader information on business decisions is not easily identified. Even more difficult is to assess and/or measure this influence on business results as a whole. We can use maturity models for this purpose.

Some of the maturity models are focused on other areas like Software Development, Knowledge Management, Performance Management and Data Management. They are still general enough so that they can be used for the Business Intelligence domain as well with slight modifications. Models developed for the BI domain are very few. Two of the most important advantages of the maturity model are in the easiness of understanding and in providing a tool for comparing different companies and/or parts of the company between each other.

The key factor in achieving better business value in the Business Intelligence area is realizing that the maturity level of the Business Intelligence within the company must match as much as possible the maturity level of the company itself. Only then the benefit of the Business Intelligence will be highest. Not only that the right information must be delivered to the right user at the right moment, but this also means that the information itself needs to be customized for that particular user's needs and delivered in a best suitable form for each user or group individually. One must also understand and know what the current maturity level of the Business Intelligence is and what needs to be done in order to move to the next level in order to increase business value for the company (Burton 2007a).

2. MATURITY MODELS AND BUSINESS INTELLIGENCE

2.1. Business Intelligence definitions

The term *Business Intelligence* (BI) was first used as a common name for describing *"concepts and methodologies for improvement of business decisions using facts and information from supporting systems"* in 1989 by Howard Dresner (Power 2007).

Business Intelligence has been defined in different ways. Definitions differ both depending on the moment of defining the term, and the perspective of the author. This paper summarizes BI definitions based on Azvine (2006) and Wells

(2008). They focus on the capability of the company to improve business efficiency and achieving higher business goals:

- *"Business Intelligence is all about capturing, accessing, understanding, analyzing and converting one of the fundamental and most precious assets of the company, represented by the raw data, into active information in order to improve business" (Azvine et al. 2006).*
- *"Business Intelligence is the capability of the organization or company to explain, plan, predict, solve problems, think in an abstract way, understand, invent, and learn in order to increase organizational knowledge, provide information to the decision process, enable effective actions, and support establishing and achieving business goals" (Wells 2008).*

2.2. Maturity model definitions

Maturity models are used to describe, explain and evaluate growth life cycles. The basic concept of all models is based on the fact that things change over time and that most of these changes can be predicted and regulated. Literature overview shows that models for different domains evolve gradually, that these same models are improved and changed over time and that authors often build and improve their models based on the past experience of other authors.

Maturity models are often derived from the generally acknowledged and recognized *Capability Maturity Model* (CMM), which has been developed for the software development process based on the *Maturity Thesis* (Humphrey 1989) by the Software Engineering Institute at Carnegie Mellon University in the USA (Team 2006). The maturity model consists of a model and questionnaire, which is used to assess the level of maturity of the development environment (Pivka 2006). *Key Process Areas* are defined inside each level of maturity, which are typical for that particular level and differ between models depending on the problem domain. Key Process Areas represent phases, which need to be completed by the organization in order to achieve a certain level of maturity. Skipping maturity levels is not possible (Borko 2001).There are several different approaches for assessing the maturity level of Business Intelligence on the market today. They are described in the following chapters of the paper.

3. BUSINESS INTELLIGENCE MATURITY MODELS

Effective use of Business Intelligence is quite a challenge for an organization. It also represents a potentially large benefit, which cannot easily be proven. Understanding how to leverage Business Intelligence investment and move to the next level of maturity can be very difficult for the organization.

The maturity model for Business Intelligence is important in this process since it describes the path and helps an organization to function in the right direction to better align information technology with its business efforts. Some organizations better fit with lower levels of maturity while others require higher levels of maturity and some need to put Business Intelligence in the center of their efforts, being a critical component for business success. These organizations do not focus on technology alone. Other factors like people and business goals have become a part of Business Intelligence in such organizations. This approach is based on fulfilling the needs of a whole organization on the business aspect, not just on the technology aspect of Business Intelligence.

The maturity model for Business Intelligence helps organizations understand where they are and how they can improve. It also offers a better understanding of these questions:

- Where in the organization is most of the reporting and business analysis done today?
- Who is using business reports, analysis and success indicators?
- What drives Business Intelligence in the organization?
- Which strategies for developing Business Intelligence are in use today?
- What business value does Business Intelligence bring?

The next sections will describe some of the maturity models used for BI today.

3.1. The Business Information Maturity Model

The *Business Information Maturity Model* is focused on increasing BI importance. It defines three key success factors for Business Intelligence: alignment and governance, leverage, and delivery. They cover seven key areas on which evaluation of Business Intelligence is performed: BI strategic position, partnership between business units and IT, BI portfolio management, information and analysis usage culture, process of improving business culture,

process of establishing decision culture, and technical readiness of BI/DW (Williams et al. 2007). The main characteristics of the Business Information Maturity Model are (Williams et al. 2003):

1st level: Everyday use of information is conducted in the same unstructured way as before the Data Warehouse was introduced. Benefits of the Data Warehouse are visible in the form of faster and in time access to information. Demands for information are focused to question *"what"* business users want to access and are usually in a form of data elements, which are passed from end users to the IT department.

2nd level: The organization begins to realize that the role of information for business needs to be defined if it wants to leverage the investment. End users are no longer interested solely in *"what"* they need, they start to seek the answer to *"why"* the information is needed. Besides that, they approach information needs in terms of "*who*", "*when*" and "*where*" this information fits into the business processes that support business goals.

3rd level: In the final stage of Business Intelligence maturity, all parts of the organization are involved where information is used. The organization now tries to find *"how"* existing processes can be improved if the information is available and *"how"* information, put into business use, can best be used in business processes. The focus is moved to the management of the business processes and introduction of the organizational changes. The organization recognizes the fact that decision processes, before the introduction of the in time information, are not optimal and it tries to replace them with new decision processes, which optimize the usage of information throughout the whole organization.

If an organization wants to leverage the full potential of Business Intelligence, then the way the business is done needs to be changed. Changes include redefined roles of information inside the organization, change of information request definition, and change of information use conduct (Williams et al. 2003).

3.2. TDWI's Business Intelligence Maturity Model

Wayne Eckerson originally developed *TDWI's Business Intelligence Maturity Model* in 2004. This model focuses mainly on the technical aspect for maturity assessment. Maturity is being evaluated through eight key areas: Scope, Sponsorship, Funding, Value, Architecture, Data, Development and

Delivery. Each of the eight aspects is graded with the following five grade scale: Infant, Child, Teenager, Adult, and Sage (Eckerson 2007b).

The main characteristics of the grading levels are (Eckerson 2007a, Eckerson 2007b):

- **Infant**

This first level is composed of two phases: *Prenatal* and *Infant.* Operational reporting is typical for the Prenatal phase. Spreadmarts, on the other hand, are typical for the Infant phase.

The *Prenatal* phase lasts until a data warehouse is created. Most companies have an established operational reporting system with a standard set of static reports. Reports are usually built into operational systems and limited to that individual system. This makes adjustment and fast delivery of customized reports very difficult. Lack of agility forces business users to take actions themselves resulting in partial data sources, typical for the next phase.

In the *Infant* phase, a company is faced with numerous partial data sources called *Spreadmarts*. Eckerson (2004) defines Spreadmarts as spreadsheets or desktop databases which are used as a replacement for regional data warehouses. Each of them contains a specific set of data, metrics and rules with a small or no correlation at all between each other, operational reports or analytical systems. Fragmented data sources are producing conflicting views on business information. They undermine the effective decision-making process supported by strategic goals, and prevent a clean and consistent view to all events in the company.

- **Child**

At this level, knowledge workers join the community of BI users. Information demands are gathered on the department level and cover only the needs of the same department members. Companies at this level usually buy their first interactive reporting tool, which knowledge workers then use to drill the data. They are also capable of analyzing trends and past data. Importance is focused on understanding correlation in the data and to gain understanding of the past business actions. Regional data warehouses are built on this level. They are not linked to each other. Definitions and rules are limited to an individual regional data warehouse. Data is usually retrieved directly from the operational

systems. This kind of data does not allow interdepartmental consolidation and analysis.

- **Teenager**

The company recognizes the need and starts to use a standardized set of project and development methodologies, including best practices, learning on past experience and extensive use of external consultants. BI management is taken over by a group of people from different departments under the lead of the BI program manager. Software solutions for BI are being developed on a common data model using a common platform. The company recognizes the value of consolidating regional DW into a centralized DW. A centralized DW enables the company to perform enterprise-wide analysis, bridging the border of individual departments gaining new knowledge. The company is introducing new BI solutions like dashboards customized for each individual user group. These dashboards include key performance indicators (KPIs). Use of BI is spread among regular users and enables knowledge workers interactive reporting and analysis.

- **Adult**

BI develops from a tactical to a strategic business level at this stage and becomes the central IT system driving daily operations of the company. Processes are monitored using dashboards. Key performance indicators and business performance are used to compare the actual state with the strategic goals of the company. The main characteristics of the Adult level are: centralized management of BI data sources, common architecture of the data warehouse, fully loaded with data, flexible and layered, delivery in time, predictive analysis, performance management, and centralized management. The company often builds a special BI team independent from the organizational structure reporting directly to the executive management. Language and metric rules are unified across the company. The BI system includes all the data in the company, not just part of it. A fully loaded data warehouse is therefore dynamic and enables quick adjustments to new business needs. Designers have split the architecture to individual abstract layers preventing changes on one layer to influence other layers. The data warehouse is integrated with its data sources in real time. The company starts using a more accurate and more complex prediction and modeling tools.

- **Sage**

Companies at this level are turning BI system capabilities into technical and business services and are moving development back to basic organizational units through Centers of Excellence (COE). The main characteristics of this level are: *distributed development*, *data services*, and *extended enterprise*. The most typical usage of the BI system is creation user customized reports, KPIs, and other information services. The central information management group is responsible for management of the enterprise data warehouse as a repository for all enterprise information, while the development of customized solutions is left to distribute groups. For faster development of solutions, service oriented architecture (SOA) is used. Adequately trained and certified developers (both internal and external) can then combine data services and the BI system into new solutions. A number of users is dramatically increased. Business and IT are aligned and cooperative. BI provides services with high added value, bringing high business value and competitive advantage.

There are two major obstacles on the path from Infant to Sage: *Gulf* and *Chasm.*

Gulf combines challenges and obstacles preventing a company to move from the Infant to the Child level despite building the first data warehouse, which is normally a sign of progress to a higher level of maturity. The problem is in poor planning, poor data quality, enterprise culture, and in the intensity of spreadmarts usage.

Chasm combines challenges and obstacles preventing a company to move from the Teenager to Adult level. To overcome this obstacle, Enterprise Data Warehouse is usually built. Initiative usually comes from management. The goal is to unite independent regional data warehouses to achieve a more consistent view on distributed business information and reports on all aspects of the company.

Eckerson (2007b) estimates that many people can quickly tell if the patterns in the model are aligned with their BI program and if the model is a useful tool helping to understand the past, the present and the future. Besides assessment of the BI maturity, the value of the model is also in helping people to realize that their effort is not isolated and that they share challenges and obstacles with other people in the company. BI groups often start their work with enthusiasm, which diminishes quickly when groups are faced with cultural, organizational and technical challenges.

3.3. Gartner's Maturity Model for Business Intelligence and Performance Management

Gartner's Maturity Model for Business Intelligence (BI) and Performance Management (PM) recognizes five levels of maturity: *unaware*, *tactical*, *focused*, *strategic*, and *pervasive*. It is used for the assessment of the input effort, and BI and PM maturity. Assessment includes three key areas: *people, processes*, and *metrics and technology* (Burton 2007b). The main characteristics of the maturity levels are (Rayner et al. 2008):

- **Unaware**

This maturity level is often described in the literature as "information anarchy", whose indicators are inconsistent data, incorrect and inconsistent data interpretation, and constant changes struggling to fulfill individual or departmental information needs. Usage of spreadsheets is high, while use of reporting tools is limited. A company does not have defined metrics for performance management. A company is not devoted to and does not understand the importance of the BI and PM. Information management is left to the IT department, which is also responsible for reporting. Funding comes from the IT budget and is charged to a cost center.

- **Tactical**

Companies at this level start to invest into BI. Often the incentives for first projects come from IT management. Metrics are usually used on the department level only. Common metrics do not exist or are inconsistent. Most of the data, tools, and applications are in "silos". Companies at this level often use off-the-shelf software, with few or no modifications, to accommodate company needs. Users are often not skilled enough in order to take advantage of the system. Management does not trust the quality and consistency of the information provided. That leads to low support and inadequate funding of BI projects.

- **Focused**

A company at this level achieves its first success and brings some of the business benefits from BI, but it is still focused on a limited part of the organization. Sponsorship usually comes from a business unit or department or is a member of senior management responsible for IT. Management dashboards are often requested at this level. Their goal is to optimize the efficiency of individual departments or business units, but is not related to the broader

company goals. Inconsistencies in metrics and/or goals of individual business units or departments are very common. Users are trained for basic functionalities of data retrieval systems. Funding of BI projects comes from one or more business units. Data is not integrated at this stage and is available through stovepiped solutions, usually not integrated among each other. These solutions are often closed software applications, covering only a fraction of business, but usually from the very data capture to reporting. Business Intelligence Competency Center (BICC) is being formed, where experts from business and IT are joined together in order to fulfill the user needs (Hostmann et al. 2006).

- **Strategic**

Companies at this level have a clear business strategy for BI development. Sponsors come from the highest management. Companies at this level often decide to include BI and PM into critical business processes. Information is available to all employees of the company. Usage of BI and PM is often extended to suppliers, business partners, and occasionally to customers. BICC centers are formed that include experts from business areas and IT, having enough resources and funding to achieve their goals. A strategic framework is established that combines financial and other strategic goals with measurements on the operational, departmental and functional level of the company. Data management policy and data quality metrics are in place. Data quality is under constant supervision. Strategic information becomes trustworthy and is used for strategic decision-making. Users are adequately trained for data processing and are able to use them effectively for strategic and tactical decisions.

- **Pervasive**

At this level, BI and PM become pervasive across all areas of the business and across part of the corporate culture. BI and PM systems become a part of the business processes. They provide flexibility to adapt to the fast business changes and information demands. A company has proactive and dynamic BICC. Information is trustworthy and used at different levels of the company. Users are well trained and measured by their ability to support data quality and policy management. Users at different levels have access to information and analysis needed for creating a business value and influence business performance. Results are measurable and linked to specific goals. Usage of BI is available to suppliers, business partners and customers.

Gartner uses this model for evaluating general business maturity and the maturity of individual departments or business units. Results showed that many companies have their departments at different levels of maturity. The model can help identify these bottlenecks, encourage discussions between departments and thus help improve the general maturity level as well as the maturity level of individual departments and/or business units.

3.4. AMR Research's Business Intelligence/Performance Management Maturity Model, Version 2

AMR Research is a company focused on research in the BI area and performance management (PM). They have developed a four-level framework improved maturity model for BI and PM. Key characteristics of this model are (Hagerty 2006):

- **Level 1:** *Reacting – where have we been?*

Most projects are of tactical nature and deal with the improvement of access to operational data, reducing reporting periods/delays and increasing visibility, efficiency and success of individual departments. Data delivery is maintained on the department level and historical events. Organization depends on desktop tools and "ad-hoc" queries performed by individuals with very little or no consolidation at all.

- **Level 2:** *Anticipating – where are we now?*

Projects tend to move from tactical to a more strategic orientation and are visible both inside as well as between linked departments. Important data is on current efficiency and success. Dashboards are being used as a basic user information tool. Data becomes more important, delivered at close to real-time.

- **Level 3:** *Collaborating – where are we going?*

Business is driven by clearly defined operational and financial metrics. *Key Performance Indicators* (KPIs) are built into organizational strategies enabling the identification of current and future business opportunities. Groups are well aware of responsibilities for their decisions; therefore, they are motivated to cooperate with other groups within the organization. Dashboards and performance indicators are used to consolidate business goals and resources within the organization. This leads to a better use of current data for planning

the future business actions. Such plans are used as guidelines rather than limitations.

- **Level 4:** *Orchestrating – are we all on the same page?*

Business goal identification is done in a top-down approach. The goal is a common, agreed and rational view of the organization. The "detect and react" principle becomes live in its true sense of the word, when organizations adjust the model and implementation to the slightest changes in the dynamic markets. Business runs based on measurable success factors. Expectations are clearly defined for all and aligned with BI initiatives. Philosophical and cultural aspects are considered for BI and PM along with the technical aspect.

Research results on the maturity state for BI and PM performed in 2006 revealed that not all companies are trying to reach the highest level of maturity. Business culture is the biggest obstacle in terms of human behavior change, which represents the roots of the company and how the company operates. This behavior cannot be modified easily (Hagerty 2006).

3.5. Business Intelligence Maturity Hierarchy

The *Business Intelligence Maturity Hierarchy* consists of four stages, developed in knowledge management. These are: data, information, knowledge and wisdom. The main characteristics of the hierarchical maturity model for BI are (Deng 2007):

- **Stage 1:** *Data*

An organization at this level collects, cleanses, standardizes and keeps data from different sources consistent. The goal at this stage is to establish integrated, clean and high quality data. This is a starting point for introducing DW and BI.

- **Stage 2:** *Information*

An organization starts using integrated and high quality data by assigning a meaning to them. At the higher levels of this stage, an organization is capable of identifying key success factors and key performance indicators (KPIs) and uses them to produce dashboards so that information on business performance and activities are clearly defined and easy to read and understand.

- **Stage 3:** *Knowledge*

BI at this stage is used to perform root cause and what-if analysis, searching for patterns, which in turn help an organization to identify root data for individual trends so that this knowledge can then be used in business processes. An advanced form of this stage is building an expert system, which combines discrete samples to produce a new knowledge based on past experience.

- **Stage 4:** *Wisdom*

At this last stage, business productivity should be considerably higher than before. People should make sound, in time and efficient business decisions so that their organization should gain a great competitive advantage in time to deliver, business goals, product development and service quality.

3.6. The Infrastructure Optimization Maturity Model

The Infrastructure Optimization Maturity Model enables a move from reactive to proactive service management. Using this model, one can assess different areas comprising the company infrastructure. One of these areas is BI. The model defines three classes for infrastructure optimization: C*ore Infrastructure Optimization* (Core IO), *Business Productivity Infrastructure Optimization* (BPIO), and A*pplication Platform Infrastructure Optimization* (APIO). Business Intelligence fits into two classes: BPIO and APIO.

The ***BPIO class*** focuses on business process simplification with an integrated approach to unified communication, cooperation, business management, search for business information and business intelligence. Management of IT technologies becomes highly automated and proactive.

The ***APIO class*** focuses on making better business decisions through the delivery of higher quality data needed by employees to make decisions on all levels of business.

A company can be placed into one of the four levels of maturity for each class: *basic*, *standardized*, *rationalized* or *advanced* (for APIO), and *dynamic* (Kašnik, 2008).

4. BUSINESS INTELLIGENCE MATURITY MODELS ANALYSIS

Usually companies developing BI tools and systems, as well as different consultancies, develop the BI maturity models. IT companies developing software solutions are developing maturity models to assess their own maturity or the maturity of their customers and partners. Maturity assessment is often used for marketing purposes and as an advice to customers on how to move to a higher level, which includes their software and/or services. Consultancies are sometimes dealing with the assessment of the maturity level for BI systems, but are often backed by BI vendors and are, therefore, biased. Recommendation often includes the advice that BI assessment should be done by an external expert, which can be used as a marketing approach to boost the software sales. If a company does not posses their own expertise and experience in the BI domain, then hiring an external expert reduces the risk of overspending for the new BI initiative. Besides the companies mentioned above, there are also individual authors developing maturity models. These are usually highly recognized experts in the field of BI, DW, Data Management, Performance Management, Knowledge Management or independent educational institutions performing trend and market research. Naturally, none of the models cannot be viewed as 'perfect'.

A common characteristic of all BI maturity models, except for the CMM model and models for other areas, is that they are poorly documented - often on one or two pages. Some of them are incomplete or are not described well enough. Others often can leave the impression that their author has tried to apply a model from a different domain, while leaving important information out intentionally or not. This may be due to the business value of such models, enabling their authors to use them commercially.

Other models are still well documented, but are difficult to understand, do not suit the BI domain or cover only a specific aspect of the BI problem domain. BI is such a broad area, so that the quality maturity model covering both technological and non-technological aspects is hard to develop. Therefore, one can understand authors, who have limited their model to only some of the BI aspects. Additional difficulty represents the fact that BI is one of the fastest growing and developing areas, having numerous guidelines for development. The models described above will be evaluated in the following chapters.

4.1. TDWI's Business Intelligence Maturity Model

This model was originally developed for the assessment of data warehouse maturity and has been through time renamed the Business Intelligence Maturity Model, because of the fast development of the Business Intelligence area. Through the history of model documentation, the author has gradually upgraded the description of the model with new findings from the business intelligence area, while keeping the basic model characteristics. This enables the comparison of different assessments made with different model versions. Maturity models are subject to change and growth, like any other theoretical models. They need to be supplemented and adjusted to new findings, so that they keep true value and produce reliable and comparable results.

The current version of the model defines five levels of maturity and represents a sound basis for assessment of maturity from the technical viewpoint. The model needs additions with new viewpoints on business intelligence, especially from the cultural and organizational view. TDWI is one of the few consultant companies which made not only the questionnaire, but also the evaluation criteria and classification publicly available.

There is also a web-based tool available, which can be used for a quick assessment of the own BI maturity level. This tool is accompanied with additional documentation, which in detail describes reasons for Gulf and Chasm obstacles. The documentation also describes approaches to move across these two obstacles to the next level of maturity. The documentation is freely available on the Internet.

4.2. Gartner's Maturity Model for Business Intelligence and Performance Management

Gartner's maturity model, compared to TDWI's, also offers a more non-technical view and discusses maturity from the business-technical aspect. Besides the description of the main characteristics, there are also guidelines for improvement and challenges that need to be faced on a path to higher levels. Each subarea has specific questions helping a company to perform a self-evaluation. Guidelines are represented as a framework for business intelligence and performance management, defining layers and components that need to be integrated and aligned in order to bring a better defined strategic vision and plan for implementing business intelligence initiatives (Hostmann et al. 2006).

61

Criteria for individual maturity level classification are not defined. Classification is possible only based on the main characteristics for individual maturity levels, except for the classification of the readiness of business users and IT employees, where classification criteria are built into a spreadsheet with questions. The model is documented excellently and has many additional documents available for explanation and clarification. Only a few of these documents are freely available on the internet since most of them are available only to paying customers as a subscription.

4.3. AMR Research's Business Intelligence/Performance Management Maturity Model, Version 2

Despite the name of this model, it focuses less on business intelligence, while emphasizing performance management, which is usually based on the Balanced Scorecard methodology. This is only a small part of business intelligence, although John Hagarty, responsible for research in AMR Research said: *"Performance Management is a natural evolution of Business Intelligence"* (Schuk 2005).

Business intelligence is considered to be a platform for efficient business and is defined as a 'means of transport', enabling more effective information delivery (Kasabian 2007). This is also a reason why the same model is sometimes referred to as the *Performance Management Maturity Model,* or by some other name from the performance management domain (Montgomery 2008), which shows inconsistent purpose and use of the model.

Key areas, focused by the model, are: technology, processes, and people (responsibility, flexibility). Detailed analysis of the model is not possible because of the lack of available documentation. Criteria for individual maturity level classification are also not defined and there is no questionnaire, which is a very common part of maturity models. This is due to the fact that AMR Research is a consultant company. All available literature was obtained from IBM Cognos Software web pages and is used for software promotion.

4.4. Business Information Maturity Model

This maturity model represents a new perspective on maturity and, in that sense, brings added value to the business intelligence maturity assessment domain. Business intelligence maturity is assessed mainly from the cultural perspective. It is based on the management perspective and focused on vision

and cultural changes in information use, which should lead to higher profits and business efficiency.

Authors are using the TDWI model for the technical aspect of maturity assessment. They suggest that the technical part of the maturity assessment should be done with TDWI's on-line tool and are describing it as a *"useful diagnostic tool for the identification of technical-implementation risks"* (Williams et al. 2007). This quote can be considered as a reference for the TDWI's on-line tool for BI maturity assessment since the authors are TDWI business partners and the quote can potentially represent a joint promotion of the companies TDWI and DecisionPath.

The maturity model is well documented. Apart from the rough description of each maturity level, we can also find a method description, on which the model is based, a description of the business intelligence technical infrastructure putting business intelligence into a broader picture, and a description of common mistakes and risks when introducing and implementing business intelligence initiatives. There is also a list of questions helping us perform a self-evaluation of business intelligence maturity and serves primarily for the identification of risk areas.

Criteria for individual maturity level classification are not defined. There is only a grading scale for evaluating statements in *Business Intelligence Readiness Assessment*, which ranges from 1 to 5, where 1 stands for "do not agree", 3 stands for "neutral", and 5 stands for, "I strongly agree" (Williams et al. 2007).

4.5. Business Intelligence Maturity Hierarchy

This model is related to the field of knowledge management. It represents an interesting approach, but the model itself may be considered as incomplete. The author is a data warehouse expert and uses maturity levels from a technical point of view. Knowledge management is used only for maturity level names. Available documentation is only in the form of one paper and is far too superficial for a more thorough analysis of the model. The idea behind this model is intriguing and interesting, but the model itself still needs a lot of work to be more exactly defined. This could be tricky though since knowledge management is a very soft area which deals with areas, which are difficult to measure.

4.6. The Infrastructure Optimization Maturity Model

This maturity model deals with business intelligence in the areas of measuring the efficiency of reporting, analysis and data warehouse. The model is very incomplete in the business intelligence area. We must consider though that business intelligence is only a part of the model's domain. Criteria for individual maturity level classification are not defined. The model claims that it addresses the business view as well, but it mostly talks about the products and technologies. The main reason to assess the maturity of the company using this model is to sell products. Assessment done with this model can be used to prepare an offer for a particular customer.

Along with the absolute value of the maturity assessment, a company gets also comparative analysis with other companies. Since there is no mentioning of time restraints, number of participants and any other information on how the analysis should be done, these results cannot be considered as reliable.

5. CONCLUSION

An overview of the business intelligence maturity model literature reveals that most of the models do not cover the domain as a whole, but rather only some specific parts of it.

The maturity model is beneficial in evaluating the business intelligence maturity of the company since it can be used to determine which areas need special attention. The model exposes areas, which would otherwise be easily overlooked. Companies, which want to get a fast and rough estimate of business intelligence maturity or want to compare their maturity with other companies, should use one of the recognized models offering evaluation and/or comparison.

When a company wants to get a more accurate result for the maturity level, it should use multiple maturity models expanding the key areas they want to cover and getting more information on the current state and possible challenges they have to overcome in order to reach a higher level of maturity and to increase the business value. When using multiple models, one must bare in mind that results from different models are not directly comparable. The reason lies in the fact that metrics, areas, levels and criteria are not standardized.

When a decision is made to use a single maturity model assembled from other different maturity models, one must put a considerable amount of effort to adequately supplement a combined maturity model, questionnaire and

classification criteria. It would be wise to include additional factors that influence the desired area of business intelligence within the company or are linked to user satisfaction, user readiness for further development, system acceptance, system quality from the content point of view, customization to specific user groups, volume of customized reports and analysis, etc.

Specialized business intelligence terminology should be replaced with terminology used in a company or should give a good explanation of these terms. The ordinary user is usually not an expert in business intelligence and will not understand specific terminology. In this way, true users of business intelligence systems can be included in the company enabling the detection of gaps between different user groups. Analysis of the information collected in a recommended way revealed that the development team has a totally different view on business intelligence as other users have. This may lead to a wrong business intelligence development strategy and implementation leading away from helping improve business goals.

The main addition brought by combined and with additional factors is detecting the organizational climate and differences in understanding actual BI users, which are not identified using standard maturity models. The cause can be in specific user groups (management, IT personnel).

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PREGLED MODELA ZRELOSTI POSLOVNE INTELIGENCIJE

Sažetak

Danas sva poduzeća žele procijeniti i opravdati svoje investicije u sustave poslovne inteligencije, što zahtijeva mjerenje poslovne vrijednosti takvih sustava i usporedbe sa sličnim sustavima u drugim poduzećima. Modeli zrelosti pružaju odgovarajuću temeljnu vrijednost za takvu usporedbu. Oni utvrđuju razine u kojoj se takvi sustavi implementiraju, kao i njihovu učinkovitost, upravljivost i mjerljivost okoline koja se promatra. U ovom se radu kratko opisuje i analizira šest različitih modela zrelosti koji se mogu koristiti za procjenu zrelosti sustava poslovne inteligencije. Pregled i analiza navedenih modela pokazuju da većina ne prikazuje cijelo područje poslovne inteligencije, već se koncentrira na posebno gledište, ili, pak, na problemsko područje. Rezultati pokazuju da se, korištenjem modela zrelosti, u kratkom vremenu mogu otkriti područja kojima je potrebno obratiti posebnu pozornost. Naime, rezultati ovakve analize često ukazuju na područja koja je lako previdjeti.