

Assessing the Evaluation Models of Business Intelligence Maturity and Presenting an Optimized Model

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Abstract

The main purpose of this study is to present a new Business Intelligence Maturity Model according to the prior models and their available components to review the level of Business Intelligence maturity in organizations. The business maturity helps all organizations to get safe and effective operations without extra troubles and, executive expenses and trial & error through reporting and data analyzing. Today we can strongly claim that applying the business intelligence solution in an organization makes it more powerful and discriminates it from the others by the increase in competitiveness. This solution causes organizations to use competitive advantages and pioneer through available information. This is a practical research in which we use a survey descriptive method and matter. The result of the study is to create a new model in order to study the level of business intelligence maturity in the banking industry which has maturity levels including initial, immature, controlled, managed and mature, and effective infrastructures on BI system which contains technology, organizational culture, and rules.

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Introduction

Because the business intelligence maturity originates in a scientific method, it has increasingly legitimated and expanded across the organization. As a result, the business intelligence concept its technology usage has become famous. The business intelligence is an effective factor for business targeted analysis of the organization's competitors to make strategic decisions and even to make future rotations. The organization managers can evaluate strengths and weaknesses and the competitors' process by their skills, applications and technologies, data and information related to the capabilities. Thus, the decision makers proceed to make proper strategies align with the organization's main policy to be present and compete in business's challenging environment. Intelligent organizations are capable to have better anticipation and analysis of the competitors' strategy and learn from the failure and success. The Business Intelligent systems extract behavioral and functional patterns from current data in databases. These patterns help managers in programming and reporting to make strategic decisions. Organizations which do not pay attention to Business Intelligence, will fall behind the competitive market.

Organizations are always facing a lot of difficulties in data analysis and their information, so by passing a long time they reach to a stable level analysis. To restart Business Intelligence projects and anticipating the Business Intelligence in an organization, analytical maturity level of the organization (Business Intelligence solution maturity model) is a fundamental and critical issue. Therefore, by evaluating the Business Intelligence level in organizations we are able to draw a suitable road map in order to establish Business Intelligence. Many organizations lose out by implementing Business Intelligence without analyzing their maturity.

Applying the Business Intelligence capabilities in private and governmental agencies, are in lower levels in comparison with other organizations and we can declare that only some organizations benefit from this technology. One reason may be managers' little recognition toward this field and its capabilities. This lack keep out managers and they will not utilize Business Intelligence advantages.

Definition of business intelligence

Although an effective management makes a good opportunity for managers, it causes the business facing with the most difficult challenge (Li et al., 2008). In 2006, Gartner's CIO reviews showed Business Intelligence as the technology's hot topic, because these systems stress on projects in a way that enable users to effect on financial and business functions (Gartner, 2007).

The Business Intelligence literature lacks a confirmed global definition of the Business Intelligence (Wixom and Watson, 2007; Pirttimaki, 2010). In this case various definitions are presented in the following table:

Table 1 Business Intelligence definitions

Reference	Definition
Adelman & Moss, 2000	Business Intelligence is a word to describe a set of software products to collect, integrate, analyze and access the information to help organizations make efficient decisions.
Lu and Zhou, 2000	Business Intelligence is a wide concept which includes appropriate orientation of the whole organization. This concept deals with acquisition, management and analysis of a large number of data about copartners, products, services, customers and suppliers, functions and exchanges between them.
Cates, 2005	Business Intelligence, a new system, is not a software application with an independent project, it is a job framework including various technologies which are essential for converting data to information, information to knowledge. By this knowledge, the organization's managers are able to make better decisions and have more effective functions by designing operating programs for the organization.
Lonnqvist & pirttimaki, 2006	Business Intelligence is an organizational and systematic process in which the organization, get information from internal and external sources which are related to the functions, analyze and report them.
Browing, 2007	Business Intelligence involves business management including systems and technologies to collect, access and analyze the data and information about the company's functions. This system contributes to the managers to have extended knowledge of effective factors in company's functions- like sale, production measuring criteria and interoffice functions- they can help to make better business decisions.
Wells, 2008	Business Intelligence is an organization or enterprise ability in expressing, programming, anticipating, problem solving, abstract thinking, perception, invention and learning in order to increase organizational knowledge, supply information for decision making process, define support and access to the business goals.
Jordan & Ellen, 2009	Business Intelligence is a critical solution to help information-based organizations to make the intelligent business decisions to survive in business world.
Hocevar and Jaklic, 2010	Business Intelligence is a comprehensive concept by which the whole organization supplies information systems with the most effective method to use timely and high quality information in a way that information technology makes quality information. This concept should be supported by top managers and develop across the organization.
Glancy and Yaclav, 2011	Business Intelligence is a content on different business functions, by using the process method and advanced analytical techniques.

Arisa Shollo, 2012	In one-dimension definition, Business Intelligence is considered as a set of technologies or a process, and in a multi-dimension definition, it is considered as a process, a set of technologies and a product.
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Banking industry and BI necessity

Today, Business Intelligence has converted to one of the basic management concepts and is involved in leading organizations. As Business Intelligence develops, organizations are more aware of business information and may analyze correct and timely data and information (Abdari, Esfidani, 2013).

The quick understanding of the customer needs and intelligent decisions are vital for economic organizations' survive and profit. This is possible by time-consuming reports in operational systems with no historical information and records. To have better customer service and efficient decision making it is necessary for managers to have intelligent analytical systems and decision helpers based on collected information.

In a Business Intelligence system, abstract data are processed and converted to information. Then the information is analyzed and analytical results are made. We get a vision toward customer behavior by the acquired knowledge which is applied to make decisions and improve banking functions. The knowledge extraction and latent patterns detection from big databases, cause Business Intelligence in banking by using methods like data mining, pattern processing and machine learning. There are samples of banking industry intelligence such as money laundering detection, customer validation, banking risk management, customer behavior anticipation and many other knowledge-based systems. The intelligent data will play significant role if they are based on comprehensive and complete customer information in Business Intelligence database. In today's changing and competitive business environment, access to timely, regular, summarized and simple information has a strategic role in financial functions like anticipation, business analysis and decision making. In the other words, access to appropriate information in appropriate time can supply appropriate tools to reach the bank goals. The Business Intelligence systems are a necessity to acquire knowledge through enormous data for banking industries to survive and attract customers.

BI maturity models

It is a challenge for organizations to affectively use Business Intelligence. It is a big point to have Business Intelligence but is not easy to use. It is difficult for organizations to understand how to invest on Business Intelligence method and move to higher maturity level.

As a result, it is important to choose a correct maturity model of the Business Intelligence which defines the process and contributes to the organization to align with information technology in a right way. Some organizations are placed in the low levels of maturity while the others are on the top. However, the Business Intelligence is in top priority of their endeavor which is an important element for business success. These organizations just concentrate on technology, because other indicators like individuals and business goals are parts of Business Intelligence. This method is based on meeting

all the organization needs in business and technology fields of Business Intelligence. (Rajteric, 2010).

Some Business Intelligence maturity models have been identified in literature which is expressed below:

4.1 Business Intelligence Development Model (BIDM)

Business Intelligence development model was presented in a technical report in Utrecht University of the Netherlands by Sacu and Spruit. This model involves six steps including: pre-defined report, datacenters, expanded organizational database, anticipation analysis, business function management and operational business intelligence (BPM). This model focuses on three viewpoints: people, process, technology.

This is a new model and there are no defined or web-based evidence. In addition, the investigation criteria of maturity level are not well specified. The model is more used in Business Intelligence development than Business Intelligence implementation (Sacu & Spruit, 2010).

4.2 Ladder of Business Intelligence (LOBI)

The Ladder of Business Intelligence (image 1) is a model to make information technology programming and its business performance (Cates et al, 2005). The model implements in three fundamental fields of technology, process and people, and performs at six levels: realities, data, information knowledge, perception and active intuition. Although it is written from a technical viewpoint and is performed in knowledge management, it is not complete. This model is not well-documented and evaluation standard of intelligence level is not well defined. It only concentrates on IT outlook and is not considered for the Business Intelligence elements (Chuah & Wong, 2011).

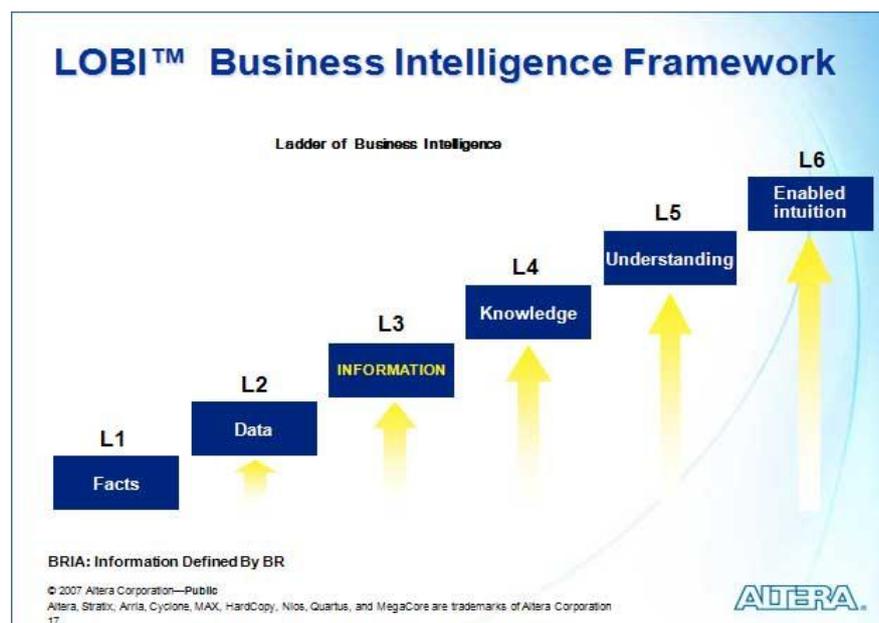


Figure 1: Ladder of Business Intelligence (Altera Corporation, 2007)

4.3 Information Evolution Model

SAS as the leader of Business Intelligence, developed an information evolution model in order to help enterprises evaluate information use quality to guide their business. This model that is illustrated in image 2, enables organizations to objectively evaluate their use of information sources and place itself in one of the five levels: operation, consolidation, integration, optimization, innovation. Information technology can design an application more effectively while the organization knows in which level it locates and this improvement, makes a progress business efficiency. There is no need for an organization to access a high level of information evolution in order to recognize the business as intelligent. The absolute issue is that the organization abilities improve to a higher level.

There is a different model use in every organization while the process goes forward by the business goals. However, there are similar problems and interests for an enterprise which is actively dealing with the model (SAS, 2011).

This model has four fundamental dimensions including: process, people, culture and infrastructure (Hatcher & Prentice, 2004).

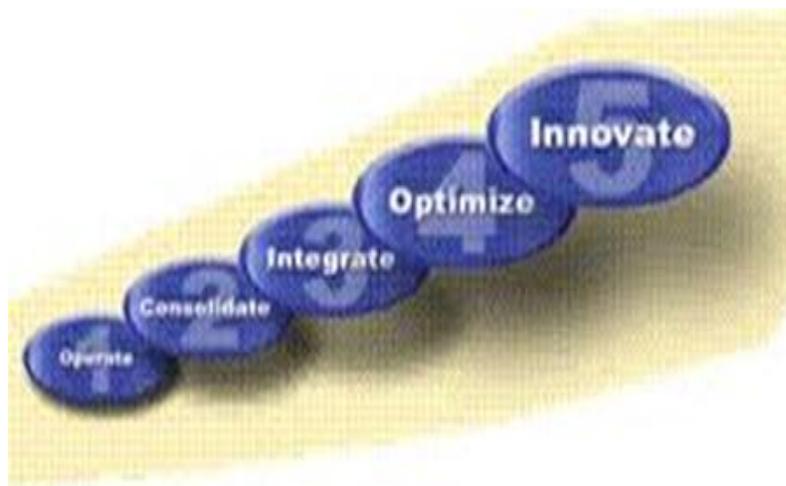


Figure 2: Maturity Information Model (Hatcher & Prentice, 2004)

4.4 Gartner's Maturity Model

Gartner's Maturity Model is based on three basic fields of human resources, processes and technology and involves interoffice standards in five maturity levels. These five levels include: unconscious, tactical, concentrated, strategic and pervasive (Rayner et al., 2008).

This model is often used to review input data and BI development level. Moreover, it is used to have a total evaluation of the organization's maturity and each department. By suggesting the model, we can resolve the incompatibility among the departments and as a result the total maturity will increase. This is a well-documented model which has many evidences to express it (Rajteric, 2010).

The OPM3 Maturity Model is suitable for organizational project management and the CMM1 Maturity Model is appropriate to be used in software engineering process and systems and the TWDI Maturity Model is proper to design and make databases and each of these models includes some effective factors of Business Intelligence but in Gartner’s Business Intelligence Model there is a stress on its practical business viewpoints along with technical viewpoint (Nazemi, 2012).

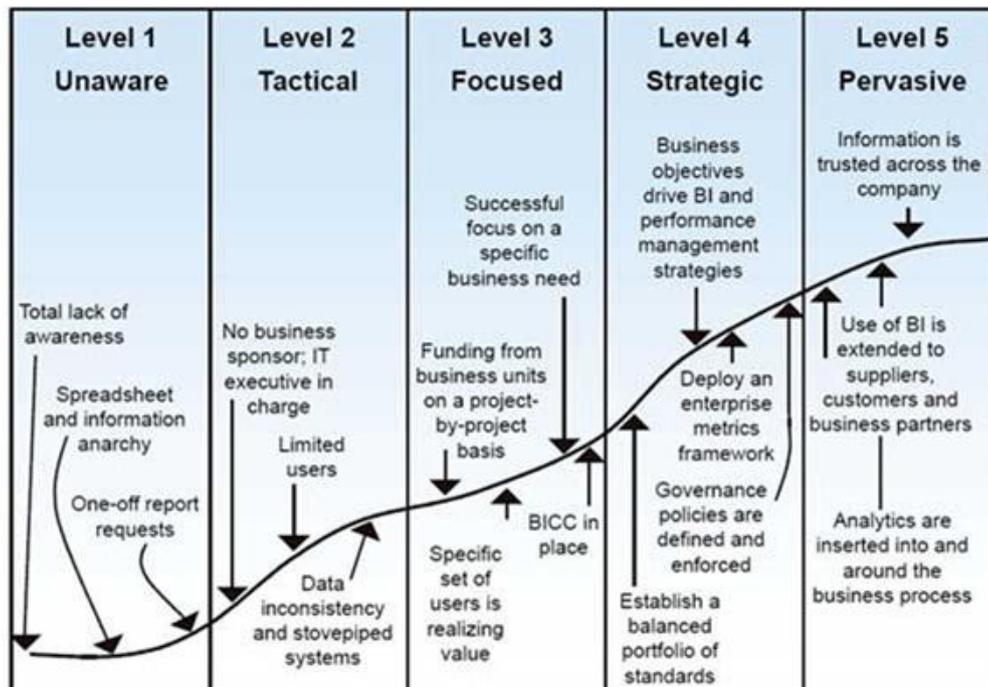


Figure 3: Gartner’s Maturity Model (Gartner, 2010)

4.5 Service-Oriented Business Intelligence Maturity Model (SOBIMM)

The use of new methods such as Service-oriented Architecture (SOBI) or Event-driven Architecture (EDA), resulted in making this model. The three models solve the problems of information technology integration in an organization. Service-oriented Architecture is a pattern to organize and use distributed abilities which may be under the control of different property areas and can be used from different technical categories. The Event-driven Architecture is a pattern for communications in Service-oriented Architecture which is performed by the events and services that are the reactive event processes (reacts to input events, and the output produced events).

An application recognizes an event and informs the problems in EDA Architecture, while the other controlling applications may receive the information and react by the services.

The purpose of Service-oriented Business Maturity Model is to solve problems including information integration deficiency, low focus on Business Intelligence, reliability, poor programming and quantitative and qualitative criteria requirement (Shaaban et al, 2011).

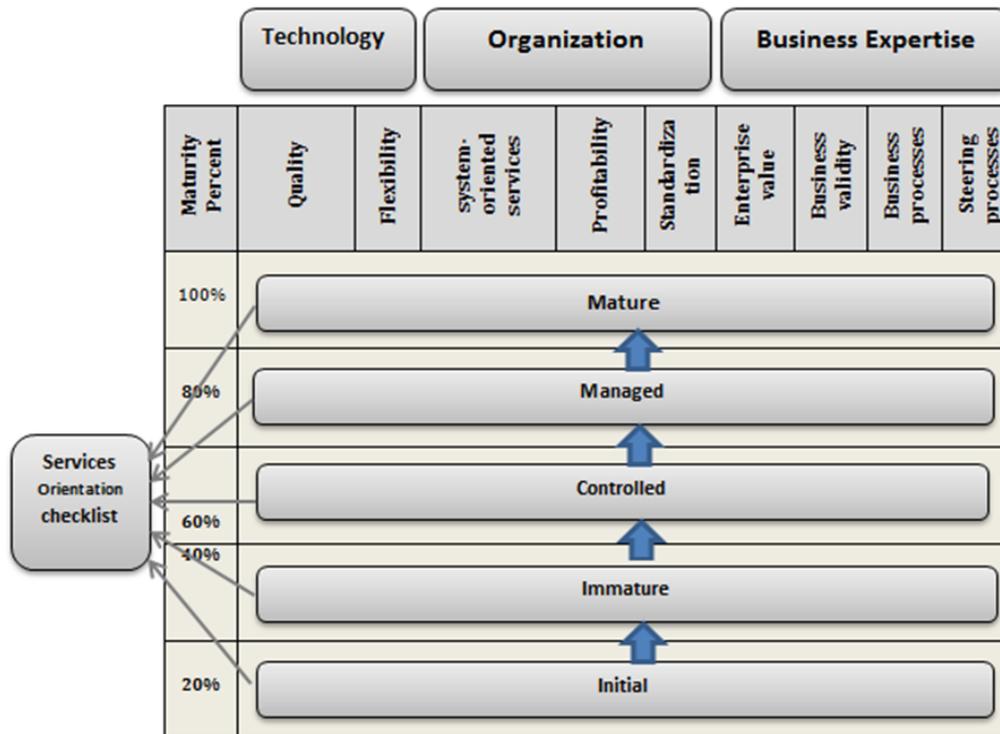


Figure 4: Service-oriented Business Intelligence Maturity Model (Shaaban et al., 2011)

As displayed in figure, this model is divided to five classification levels (initial, immature, controlled, managed and mature) and three dimensions (technology, organization and business proficiency) and a service-oriented checklist. The technology aspect is used in the two criteria including quality (database, datacenters and analytical services) and technical flexibility. The organization dimension address some subjects like service-oriented system and profitability. The business proficiency address four criteria including organization value, business credibility, business service and leadership processes.

Owing to the integration of the model, service checklist was considered as a question source of the service evaluation questions. The answers supply a score for each maturity level.

BI maturity models conclusion

As we studied in the research, different models have been presented to evaluate the Business Intelligence maturity level in the organization. Each model had specific conditions of the analytical population and the studied organization and included various dimensions and indicators. In this study, we try to review the most important maturity evaluation models by using valid references which is presented in the following table:

Table 2 Business Intelligence Maturity models' indicators

No.	Reference	Desired indicators
1	William et al. (2007)	The strategic place of Business Intelligence- collaboration between the business and information technology department- Business Intelligence functions management- information use and analysis- business culture improvement procedure- decision-making culture creation procedure- Business Technology technical preparation- database.
2	Eckerson (2007)	Limitation- support-investment- value- architecture- data- development- delivery
3	Sacu & Spruit (2010)	People- process- technology
4	Cates et al (2005)	People- process- technology
5	Kasnik (2008)	core infrastructure optimization- infrastructure optimization of business efficiency- infrastructure optimization of software platform
6	Hagerty (2006)	People- process- technology
7	Hawlett, 2007	Business ability- information technology- strategy and program management
8	Deng (2007)	No special indicator is defined in this model.
9	Davenport & Harris (2007)	No special indicator is defined in this model.
10	Hatcher & Prentice (2004)	Process- people- culture- infrastructure
11	Lahrman et al. (2011)	Technology- data- effect
12	PMI (2003)	Evaluation preparation, evaluation, improvement design, implementation for improvement- ... process
13	Paulk et al. (2006)	Process- information technology- human resources
14	Rayner et al (2008)	Process- human resources- interoffice technology and Standards
15	Nazemi (2012)	No special indicator is defined in this model.
16	Sayyadi & Farazmand (2011)	Information quality- database- architecture- information technology- analysis- culture or behavior- strategy and design management
17	Ronaghi & Ronaghi, (2014)	No special indicator is defined in this model.
18	Tan et al. (2011)	Information quality- fundamental data management- database architecture- analysis
19	Hawking, 2011	Software architecture- standards and processes- governance- information and analysis
20	Lahrman et al., 2011	Business Intelligence abilities- Business Intelligence methods- Business Intelligence information technology- organizational support in Business Intelligence development system
21	Chuah (2010)	Database- information quality- knowledge process
22	Shaaban et al. (2011)	Technology- organization- business proficiency

Why a new model?

According to the above contents we are able to describe the problems of previous models in comparison with the benefits of the new model:

- None of the previous models are designed for banking industries.
- The previous models were not domesticated, but the new one is localized in Iran.
- The previous models did not focus on confirmed criteria of technology and their necessity in the model.
- In the new model most of the components with maximum repetition are used.
- The new model presents improvement percentage for each step to reach complete maturity.
- The required information and documentation are unavailable or incomplete in some of the prior models.
- Complete focus on BI in the new model.
- The new model is more simple and easy-understanding than the previous models.
- Maturity model is integrated with technology acceptance models to create the new model.
- None of the previous models explain their maturity level, but the new model defines it by using technology acceptance models.

Towards a new model

Regarding to the studies and review of available models, Service-oriented Business Intelligence Maturity Model (SOBIMM) is suitable for the sample. So this model is selected as the basic model. But its components and subcomponents have totally changed and selected on the basis of banking industries. Some of the available dimensions and indicators in prior models have been added to the model. As we notice in diagram 2-7, some dimensions and indicators in different models are more emphasized and applied including: people, process, technology, culture.

According to the emphasis on these factors and the sample review, there are effective components in most of the models. For this reason we add them to our conceptual model and localize the model. In the other words, this model is integrated with dimensions and components of technology acceptance models to achieve an appropriate model for evaluation of Business Intelligence maturity level by using proper components.

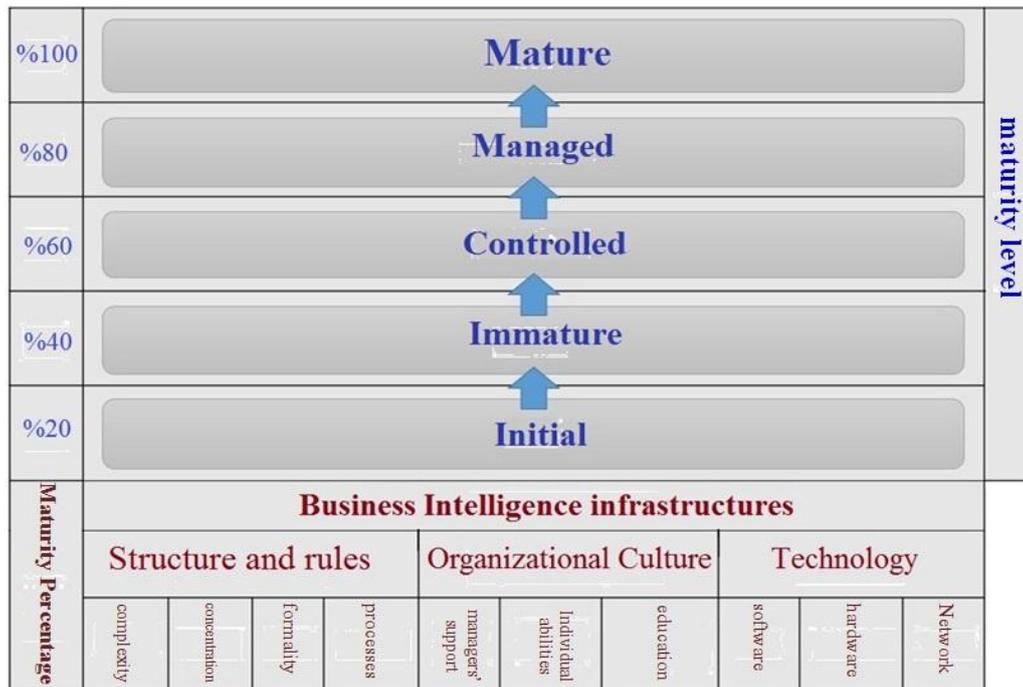


Figure 5: conceptual model

As it is displayed in Figure 5, the model includes five maturity levels: initial, immature, controlled, managed and mature. In the model we allocated 20% for each level which will be corrected in the final research model by using experts' ideas. Three main components have been considered for the model regarding to technology acceptance models which involves: technology, culture and organizational environment, structure and rules. Each component contains subcomponents which will be expressed.

Technology

Technology is for Business Intelligence including essential softwares for Business Intelligence and the required network in Business Intelligence.

Software: Software is a set of computer applications, procedures and documents which are responsible to do different functions on a computer system.

Hardware: Hardware is an important branch of computer science, which involves the whole physical and tangible elements of a computer.

Network: network is a set of multiple service providers and clients who are linked together. Servers play the service role and clients, play the customer role.

Culture and Organizational Environment

Culture and organizational environment includes three components including top manager support, people's abilities, and education which will be individually expressed in the following.

Manager support: The amount of constructive communication between the organization managers and the staff which is helpful and supportive is called manager support (Rezaeyan, 2005: 443)

People abilities: The most important and vital property of every organization is its human resource. Quality and human resource abilities are the most significant factors for the organizations to survive and life. Skillful human resource makes a formidable organization.

Education: Education means teaching, instructing and training versus breeding (Moein, 2006). Education is a learning-based experience to make rather stable changes in people, to enable them to do their jobs and improve abilities, change skills, knowledge, attitude and social behavior (Seyyed Javadeyn, 2002).

Structure and Rules

The structure and rules component has four subcomponents including complexity, formalization, centralization and processes that are described in the following.

Complexity: By complexity, we mean the amount of functions or subsidiary systems which are implemented in an organization (Daft, 2008: 27).

Formalization: Formalization refers to the amount of organizational job standards. In formal organizations, organizational relations are exactly expressed in writing for the staff and are based on the organization chart; and if needed, further changes will be noticed formally by the manager; but in informal organizations the relations are orally expressed and if there is a need, they will change normally.

Centralization: Centralization in the authority hierarchy is called to the level of authorities which have the decision-making power. When decisions are made in top levels of the organization, it is called a centralized organization. When decisions are conceded to the low organizational levels, it is called a decentralized organization (Daft, 2008).

Process: A process is a set of consecutive and relevant functions in which a specific product is produced and is dependent to special inputs to make the product that provides a background for its right actions.

Conclusion

In the present era, organizations and enterprises do not concern about the information collection and storage in massive databases, instead now their main obsession is to effectively apply a lot of data which are stored in big databases. Organizations do not invest on storing huge information records, however the value is in latent data which involve in the records and contribute managers in making immense organizational decisions and is able to anticipate the organization's position in future. Business Intelligence systems supply tools to meet organizational information needs properly. Since the Business Intelligence use and selection is a modern approach, organizations need to analyze their choice to ensure its rationality and accuracy.

The business development life cycle is reviewed and assessed by organizational maturity models. Every organization should use a standard maturity model to implement Business Intelligence to pass the process levels and reach maturity.

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