Business Intelligence Maturity: The Economic Transitional Context Within Slovenia

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This article proposes a new maturity model with three related dimensions (technological, information quality, and business) and provides its empirical analysis within Slovenian organizations. With the use of K-means clustering, the naturally present maturity groups are identified. This article is an attempt to establish clear directions for further business intelligence development in transition economy settings. The findings hold important implications for commercial enterprise success.

Keywords: business intelligence; business intelligence maturity; maturity models; clustering; K-means; information quality; information management; transition economy

INTRODUCTION

The economic, political, and managerial challenges of the transition from a centralized to a free market economy are significant and complex. The clear characteristics of this transition are the extent of market liberalization and the power of the consumer to set prices and thus determine demand for goods and services. This has necessitated the creation and sequestration of previously government-owned resources to private enterprises, including independent financial institutions (Fischer & Gelb, 1991).

Slovenia was the most developed of the six republics of the former Socialist Federal Republic of Yugoslavia and its transition to a market economy has been less painful compared with other Eastern and southern European countries due to its relatively good economic position at the beginning of the transition, and many reforms including stabilization of the economy, the liberalization of trade, and the abolition of most duties which resulted in increased product market competition (Janson, Ceece–Kecmanovic, & Zupančič, 2007). The Republic of Slovenia is now a well-established and influential member of the European Union (EU) and NATO with thriving competitive enterprises that are essentially free from government interference.

The long-term sustainability and growth of the economy depends on the extent and success of private enterprises and their management. Significant evidence exists that IT and IS are important for competitive advantage and service delivery performance (Grant, Hackney, & Edgar, 2009). While investments in IT have been regularly contributing to economic growth in developed countries, the result of such investments is not so clear in the context of transition economies (Samoilenko, 2008).

Previous research on IT and IS in developing, emerging, and transitional economies is primarily focused on the adoption (Prasad & Heales, 2008; Soja, 2009), implementation (Soja, 2006; Talwar & Back, 2009; Wenger, Dhillon, & Caldeira, 2005), and economic (Roztocki & Weistroffer, 2004; Rupino da Cunha & Videira, 2006) aspects of these technologies. However, relatively little research has been reported on issues encountered during the employment of IS and IT in transitional economies (Roztocki & Weistroffer, 2009). This article is an attempt to address this shortage.

The broad focus of this article is to study a specific initiative of IT, for example, business intelligence, and how it can improve business effectiveness within the scope of a transitional economy through the case of Slovenia. Business intelligence (BI) is widely accepted as one of the most important initiatives in the field of IT as a means to improve business performance (Jourdan, 2008). Yet, BI needs to be much more than only an IT initiative (among others, it requires new management approaches and organizational changes) to be of value to organizations (Wells, 2008). BI has been one of the top technological priorities of Chief Information Officers (CIOs) in large international organizations (Erjavec et al., 2010; Gartner, 2010), more specifically, from 2006 to 2009 it was ranked as the number one priority. In 2005 Slovenian organizations were lagging a few years behind organizations in developed countries since BI only held fifth place among technological priorities (Erjavec...
et al., 2010). Although interest in BI grew in 2009, its status (third place) in Slovenia still calls for significant managerial attention to achieve a level of sophistication, for example, maturity, that is comparable with the international community. The reason for this situation is that Slovenian organizations are generally still more intensively concerned with IS support for operational business processes and the implementation of enterprise resource planning (ERP) systems (Erjavec et al., 2010). However, these are recognized as the necessary infrastructure for BI.

Based on all these facts, the narrow focus of this article is to study the concept of BI maturity (via a maturity model we have developed) in Slovenia and identify the factors that influence the levels of BI maturity which can be attributed to the characteristics of a transition economy.

THEORETICAL BACKGROUND

BI

BI is a broad and complex initiative which has been defined and discussed differently by several authors, such as Arnott and Pervan (2005), Howson (2007), and Trkman, McCormack, de Oliveira, and Ladeira (2010), and thus does not have a unanimous definition. English (2005) points out that the problem of many of the available definitions is their sole focus on technical infrastructure. According to Wells (2008), BI is not about processes, technologies (e.g., tools and applications), and data, but is instead about the ability of an organization to plan, predict, solve problems, think abstractly, comprehend, enable effective actions, and help to establish and achieve business goals. Based on this definition and the definitions of others, BI can be seen as a board initiative comprising three interdependent segments: (1) the BI system (BIS), (2) quality information, and (3) the usage of information in the business of the organization. These three segments are separately discussed in the following subsections.

Technological Viewpoint—BIS

Typically a BIS is composed of technological components (i.e., software tools and applications) and processes that together enable the production of potentially useful information. The first component of BIS is a set of data sources that provide the input data. The most common type of input is transactional systems which store data about transactions carried out in the organization. These systems store the majority of an organization’s structured data. Another potential data source are stand-alone databases (e.g., spreadsheets and personal databases), which are created individually by analysts to produce the desired business information. However, using these databases can be problematic because they are likely to contain human errors (since they are manually created from various sources) and manipulated data (which show a “beautified” truth). Other inputs are also potentially useful. An example is external data from the environment of the organization (e.g., internet web pages) which could be used to gather information about competitors or even for the foreseeing of market behavior. An approach that supports operational decisions is real-time BI, which acquires data from various systems, analyzes it in near real-time and delivers it to information workers (Watson, Wixom, Hoffer, Anderson–Lehman, & Reynolds, 2006).

One goal of the BIS should be to provide an integrated, unified, and consistent view of the whole business of the organization. There are different ways to achieve this. One important way is through a data warehouse, which is a tool for the centralized storage of data, so that this data can be analyzed in various manners. However, for different reasons, such as a lack of technical know-how, many organizations still do not use a data warehouse. In any case, what really matters is the logical integration of data, for example, a single version of the truth.

The last part of a BIS involves the various tools that can be used to produce, analyze, and deliver information. Howson (2007) refers to these tools as front-end tools, namely interactive reporting tools, Online Analytical Processing (OLAP), analytical applications (e.g., for “what–if” analyses), data mining tools, and dashboards.

Information Viewpoint—Information Quality

The main goal of a BIS is to produce and deliver accurate information to users of the system, such as managers at various organizational levels. The set of factors that influences the meaning and indirectly the value of information for the recipient can be described by the concept of information quality. The quality of information is a multidimensional concept that has been addressed by many researchers. The literature proposes multiple conceptual frameworks and simple lists of criteria for the evaluation of quality information (some surveys can be found in Davenport, 1997; Eppler, 2006; Kahn, Strong, & Wang, 2002). One of the broadest conceptual frameworks for information quality is Eppler’s framework which was developed through an analysis of 20 existing frameworks and the consolidation of the criteria from these frameworks. Due to the analytical development, the breadth, and generality of Eppler’s framework, the authors chose it to evaluate the information quality in this research, although some less important criteria in the context of BI was omitted. Eppler’s framework consists of 16 criteria divided into two groups. The first group of criteria relates to the quality of information content, namely its comprehensiveness, accuracy, clarity, conciseness, consistency, correctness, timeliness, and applicability. The second group relates to the quality of access to information and consists of the following criteria: convenience, speed, traceability, interactivity, maintainability, security, currency, and accessibility.

Business Viewpoint—Information in the Business

Better information by itself does not substantially lead to an increase in business performance and efficiency (Collins, 2001). Instead, the key question is what organizations are doing with this information (Howson, 2007) and how differentiation
is achieved. BI can foster business value if it is used in the
business of an organization adding value to products and/or ser-
VICES, managing business risk, and reducing the cost of business
processes and the cost of providing products and/or services
to customers (Marchand, 2000). The main areas of BI use
are within business process management and within decision-
making activities, especially within managerial processes.
Information should be used in business process manage-
ment for: (1) identifying difficulties in processes, (2) assess-
ning processes, and (3) introducing innovations into processes.
The creation of business value with decision-making can be
achieved if the available information is used for: (1) reducing
the uncertainty of decisions, (2) fast responsiveness to the busi-
ness environment, and (3) the adaptability of the organization’s
strategy. Another area where information can be used to create
business value is in the improvement of management processes.
For this reason it is important that the BI projects are aligned
with the organization’s strategy.

Maturity in the BI Context

Lönnqvist & Pirttimäki (2006) discuss the determination of
the BI value as one of the most crucial reasons for applying
measurement to the BI initiative. Maturity is a concept that is
important in many business areas/domains since it can charac-
terize the capability and level of advancement of the studied
initiative. Maturity models are used for evaluation, improve-
ment (Fisher, 2004), and for the development of an approach to
increase the capability of a specific area within an organization
(Ahern, Turner, & Clouse, 2001). These models started appear-
ing on a large scale after the introduction of the Capability
Maturity Model (CMM). Today more than 200 different maturity
models have already been proposed (Weber, Curtis, &
Gardiner, 2007), such as in the field of innovation management,
knowledge management, and project management. Similarly,
many BI/BIS maturity models are available in the professional
and scientific literature (Hribar Rajterič, 2010), such as the
BI Maturity Model (Chamoni & Gluchowski, 2004) and the
TDWI Business Intelligence Maturity Model (Eckerson, 2004).
Analysis of these models revealed two important shortcomings:
(1) their incomplete view of BI; and (2) their reliance on simple
theoretical assumptions instead of rich empirical data.

Challenges of Increasing BI Maturity in a Transition
Economy—Research Questions

The following research questions were formulated in relation
to BI and its maturity:

1. What are the types and characteristics of BI maturity levels
in Slovenian organizations?
2. How can organizations in small transition economies achieve
economic progress through higher levels of BI maturity?
To gain an insight into the potential of BI in Slovenian com-
panies we conducted empirical research to elicit data on the
current state of BI maturity. While developing the proposed
maturity model we followed the directions for methodically
well-founded designs and evaluations of maturity models pro-
vided by Becker, Knackstedt, and Pöppelbuß (2009). In par-
cular, we performed a review of existing maturity models and
case studies and, based on our understanding of BI (as presented
in the previous subsections), we iteratively developed and vali-
dated our research instrument. Following the above directions a
set of questions was devised, for example, a non-formal matur-
ity model. The use of the existing BI maturity models is not
suitable because of their previously described shortcomings. A
universal and complete assessment of the BI maturity level will
serve as the basis for uncovering the key weaknesses (Qi) and
gaps of BI in Slovenian organizations. The necessary steps for
boosting BI maturity (Qi,i) can be derived through synthesizing
the research findings and the findings reported in the literature.
Through these findings we analyze the influence of transitional
economy’s (business) environment on BI maturity. The motiva-
tion for this research is to provide insights into the subsequent
organizational development and competitive performance of
Slovenian organizations.

METHODOLOGY

The research questions will be addressed essentially through
an empirical study which was undertaken with the develop-
ment of a questionnaire to elicit data on the key elements of BI
maturity, for example, the level at which they are being under-
taken. Following pre-testing, the final questionnaire contained
33 questions (see Table 1 for examples) about BI elements
(which were grouped together based on their affinity). The
questionnaire also included three general questions (industry,
number of employees, and income) to reflect the demographic
structure of the respondents. A structured questionnaire was
administered with a combination of a 7 point Likert scale and
7 point semantic differentials. The survey using the devel-
oped questionnaire was undertaken in spring 2008 and sent to
the CIOs of all medium- and large-sized Slovenian organiza-
tions listed in the database of the Agency of Public Records
and Related Services. At the time of the data gathering, 1,329
Slovenian organizations met the criteria and were eligible for
inclusion in the study.

Before proceeding to a maturity level analysis, the reliability
and validity measures of the model were examined. We strictly
adhered to statistical indicators confirming that individual ele-
ments of our proposed model meet all the required criteria to be
included in the appropriate perspective: technological, informa-
tion quality, or business (see Figure 1). The loadings of items
associated with the perspectives being measured were tested
against the value .60 (Hulland, 1999) and were safe to retain.
Without exception, the composite reliability of each individu-
al perspective is higher than .80 (Werts, Linn, & Jöreskog,
1974) and in general near .90, showing the high internal con-
sistency of the indicators measuring each perspective. Further,
### TABLE 1
Examples of questions from the survey

**A** What is the level of **data integration** for analytical decisions within your organization?\(^a\)

<table>
<thead>
<tr>
<th>Data in the sources are mutually inconsistent.</th>
</tr>
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<tbody>
<tr>
<td>1234567X</td>
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</table>

**B** Asses the quality level of available information for analytical decision making within your organization.\(^b\)

<table>
<thead>
<tr>
<th>The information is easily understandable to the target group.</th>
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<td>1234567X</td>
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</table>

**C** In terms of managing business processes the available information within our organization’s business processes . . .

<table>
<thead>
<tr>
<th>. . . exposes the problematic aspects of current business processes and makes stakeholders aware of them.</th>
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<td>1234567X</td>
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</table>

\(^a\) 2 statements with 7 point semantic differentials in-between  
\(^b\) 7 point Likert scale where: 1 = Not Existent, 7 = Very much present, X = Don’t know  
\(^c\) 7 point Likert scale: 1 = Strongly Disagree, 7 = Strongly Agree, X = Don’t know

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**FIG. 1.** Snake diagram of the best clustering with four clusters (color figure available online).
the assessed discriminant validity showed that the loadings of individual items on corresponding elements are larger than the item cross loadings.

To find the number and the types of maturity levels so that their characteristics can be analyzed (i.e., to answer research question Q1) clustering was chosen as the data analysis method. Before conducting the clustering, only 4, 5, or 6 maturity groups were considered since these are the numbers most commonly found among the over 200 maturity models in existence.

Clustering divides the data into groups (i.e., clusters) so that the units within a cluster are more similar to each other than the units in different clusters (Guha, Rastogi, & Shim, 2001). The main concern in the clustering process is to reveal the organization of patterns into “sensible” groups which allows for the discovery of similarities and differences, as well as to derive useful conclusions about them (Halkidi, Batistakis, & Vazirgiannis, 2001). This research aimed to cluster the factors/key practices that influence BI maturity (each one was measured by one of the 33 questions) based on how they appear in practice and thus they should be derived from gathered empirical data.

The K-means algorithm (MacQueen, 1967) was chosen because it is of one of the most commonly used clustering algorithms: it is simple, useful for a wide variety of data types, and independent of the order of data units (Tan, Steinbach, & Kumar, 2005). The K-means algorithm, which essentially optimizes the sum of squared errors (SSE), is already extensively explained in the literature (e.g., Tan et al., 2005).

The clusters found in the process of clustering are not known a priori; however, the result still has to undergo some kind of evaluation in most applications (Ramze Rezaee, Lelieveldt, & Reiber, 1998). To produce the optimal clustering (i.e., the separation of BI maturity factors into individual maturity levels) and also to later on decide which number of maturity levels (4, 5, or 6) is most suitable for this data, we relied on both a quantitative and a qualitative evaluation. The quantitative evaluation was based on a relative criterion (Theodoridis & Koutrombas, 2006)—in this case the SSE metric (the most common evaluation metric used with the K-means algorithm). We plotted the SSE values against the number of clusters and connected the points by a straight line to see if a distinctive knee was visible at a specific number of clusters. Such a knee would indicate the most optimal number of maturity levels. In the qualitative evaluation domain experts were used to interpret the results and to check for the consistency, integrity, and logicality of these results.

EMPIRICAL FINDINGS

Survey and Descriptive Statistics

The survey resulted in 181 valid responses, representing a 13.9\% response rate. The response rate is comparable to other similar studies surveying the whole population of Slovenian medium- and large-size organizations (e.g., Škerlavaj, Štemberger, Škrinjar, & Dimovski, 2007; Škrinjar, Hernaus, & Indihar Štemberger, 2008).

Since the data analysis technique that was used cannot process the answer “not known,” 141 responses were useful for the data analysis. The number of useful responses in consideration of the population size is sufficient for a 7.8% margin of error at a 95% confidence level and a conservative estimate of response distribution of 50%. The purpose of the maturity assessment in this study is to undertake a comparative analysis for which the most relevant information is the direction and the scale of the differences. The planned margin of error of 8% (which corresponds to a sample size of 149) does not significantly influence the findings of this study and the discussion of them since it cannot change the relationships between the maturity values on individual elements (i.e., questions) and the found maturity levels (i.e., clusters). Consequently, the achieved sample size of 141 units is appropriate. Based on the number of employees, the respondents had the following shares: 37% of organizations with 50–249 employees, 21% of organizations with 250–499 employees, 19% of organizations with 1,000 and more employees, 13% of organizations with 500–999 employees, and 10% of organizations with 1–50 employees. The structure of respondents by industry type reflects the population of Slovenian medium- and large-sized organizations given that non-profit organizations were excluded from the study.

Clusters of BI Maturity

The optimal number of clusters had to be determined in order to assess groupings. Since the quantitative evaluation did not clearly favor any of the clusters, the most appropriate K based on a qualitative evaluation was chosen. The following four clusters were finally produced: “cluster 1” with 27 members (19%), “cluster 2” with 46 members (33%), “cluster 3” with 31 members (22%), and “cluster 4” with 37 members (26%). Figure 1 shows a snake diagram of the discovered cluster centroids.

DISCUSSION

In the following section the characteristics of the identified maturity clusters are discussed within the context of the research questions.

The “Cluster 1” Group

Organizations in this group are those with the lowest presence of transactional systems and stand-alone databases. Data warehouses are still not visibly used and the data integration of the source systems is the worst among all the groups. The most intensively used front-end tools are static reports. They use less interactive reports and even less advanced front-end tools.

The information quality of this group is also generally the lowest of all the groups. Its biggest weaknesses are information comprehensiveness, the convenience of accessing information and information processing, and delivery speed. The weak
information quality is partially a consequence of the absence of advanced technological infrastructure, especially front-end tools, which would serve the information needs of business users. The low scores in the BI business perspective reveal that this group is also absolutely the weakest group in this perspective. Most critical is the usage of information in business processes. The highs and lows of this group are similar to the highs and lows of the “cluster 1” and “cluster 2” groups; however, the scores of this group are obviously lower.

Based on the discovered characteristics of this group in the context of BI maturity, it has been named “immature organizations”. These organizations represent the smallest proportion (i.e., 19%) of Slovenian organizations.

The “Cluster 2” Group

The “cluster 2” group members are using a considerable amount of transactional systems. This group already uses data warehouses, which affects their solid level of data integration and data consistency. Organizations in this group rely more on interactive reports. They are the second strongest group when it comes to the use of more advanced front-end tools (e.g., OLAP and data mining). In general this group performs second best in the technological perspective of BI.

From the information quality perspective, this group has a low level of trust in the content of its information, such as, the members are obviously not convinced of the correctness of their information. The main reason for this is the introduction of a data warehouse which reveals anomalies in the data. On the other side, the levels of information access quality elements, which can be positively influenced by technology (e.g., timeliness, traceability), are higher than those of the “immature organizations” group.

Further, the highs and the lows of the “cluster 2” group are similar to those of the “cluster 3” and the “immature organizations” group. Yet the most obvious difference is the presence of the strategic alignment of the BI projects, where this group performs second best. BI projects are very important for this group, which is exemplified through the availability of more advanced technological components. This group is doing a good job using information in the decision-making process and is also reducing the costs of business based on information. In the business perspective, this group is clearly more mature than the “immature organizations” group.

Taking all the described characteristics of this group into consideration, we called it the “technologically advanced organizations” group. These organizations, which represent the majority of Slovenian organizations (i.e., 33%), are attempting to introduce BI foremost through their BIS and will achieve the potential business value of BI with a longer delay since they are not concentrating on information quality and on how to use the information in their business. Most of the “technologically advanced organizations” are bigger organizations with regard to the number of their employees. The reason for this could be that these organizations have more manpower in the IS department. Viewing Slovenian organizations through their yearly income reveals that both of the highest income categories are dominated by “technologically advanced organizations”, which is not surprising since the often considerable investments in the BIS are easier to realize for organizations with a high income.

The “Cluster 3” Group

Organizations in the “cluster 3” group employ more transactional systems than the other groups, they have the strongest presence of data warehouses, and also have the most integrated and consistent data. They are leading in the use of OLAP and are the best in the use of analytical applications, data mining, and dashboards. Instead of relying on static reports, which are being used less than in the other groups, they instead turn to interactive reports. Clearly this group is the most advanced of all groups in terms of the technological perspective.

The information quality of this group is high since it leads in some elements of information quality and is the second best with the other elements. This is a consequence of it having the most advanced technological infrastructure of all groups and good information management, which is concerned with ensuring high quality information content.

Members of this group are generally doing the best of all groups in the business perspective of BI. They use information to assess their business processes and (although a little less intensively) to detect difficulties/inefficiencies in these processes, to optimize their business processes, to reduce the uncertainty of their decisions, to quickly react to events in their business environment, and to adapt their strategy. Information management is not only employed to manage risk and to lower costs, but also partially to add value to their products/services.

All of these characteristics led to the decision to name this particular group the “mature organizations” group. This research shows that there are slightly more (22%) mature than immature Slovenian organizations. The lion’s share of “mature organizations” have 50–249 employees, which suggests that organizations which are medium-size in Slovenian circumstances are reaching maturity on a larger scale than bigger organizations with regard to the number of their employees.

The “Cluster 4” Group

Organizations in the “cluster 4” group are clearly leading in the use of stand-alone databases, and are employing an average extent of transactional systems. Although the use of data warehouses is low, the data are well integrated and consistent, which makes this group very interesting. They are the strongest group in the use of static reports and interactive reports. The situation changes when it comes to the use of advanced BI elements, where this group is ranking just before the weakest group. This group is therefore technically on the more immature side.
“Cluster 4” achieves the highest values of all groups for some elements (e.g., information traceability) in the information quality perspective. Such good information quality had to be supported with non-technical means, such as policies and standards. This indicates that the high information quality is a consequence of strong information management in these organizations and not advanced technology, which is the reason for some weaker information quality elements (convenience, speed, interactivity, and comprehensiveness).

The “cluster 4” group is the second best group in the business perspective in general. This group has a quite specific characteristic, which is not similar to the other groups. Its members use information to add value to products/services more than to reduce their costs. The weakest points are innovations in business processes, strategy adaptability, cost reduction, and strategic alignment of the BI project.

Based on the characteristics of this interesting and noticeable group (their share is 26%) we named it the “organizations with advanced information management” group. They have either been unwilling (e.g., they did not want to invest in an expensive BIS) or unable (e.g., they did not have the necessary know-how) to work with advanced BIS components. The majority of “organizations with advanced information management” are smaller organizations in terms of the number of their employees. A potential explanation of this could be that a smaller number of employees should be easier to manage without advanced technology and that the critical mass of employees with the necessary know-how for developing and introducing a BIS is not available. From the perspective of the yearly income, the lowest income category is dominated by “organizations with advanced information management”. This indicates that one of the reasons for not introducing advanced BI technology could be financial since the income of these organizations is low and does not allow expensive investments in their BIS.

A BI Maturity Model in Relation to the Transitional Economies Context

The above observations are summarized in the model presented in Figure 2, which was derived to capture the main findings and illustrate the insights gained from the research so that it facilitates “transitional” success within Slovenian companies. The model shows four distinct BI maturity levels (represented by the small titled boxes) that were empirically found among Slovenian organizations. The larger gray arrows represent the journey to a higher level of BI maturity. Empirical findings suggest two paths from immature to mature organizations: (1) through technologically advanced organizations, or (2) through organizations with advanced information management. For each maturity level the most important areas for improvement are described. It is observed that some characteristics of the business environment in Slovenia impede organizations’ progress to a higher level of BI maturity. This situation is represented by the largest box, which denotes the transitional economy (business) environment. The inside of this box has some smaller grey arrows that point downward (opposite to the bigger arrows). These arrows represent the negative influences of a transitional economy environment on the efforts of organizations to advance the maturity of their BI.

It is important to note the key negative characteristics of transitional economies in the upper left box. Each characteristic is defined with a unique ID (e.g., 11) so that they can be mapped to an area for improvement. Consequently, it is clear which characteristic negatively influences which area for improvement.

One of the many reasons that inhibit the transition to higher levels of BI maturity through a negative influence on certain areas/elements of BI maturity are the characteristics of a transitional economy. In fact, these characteristics reduce the BI absorptive capacity (Zahra & George, 2002) in Slovenian and all transition economies in general. The transitional economy characteristics have a stronger suppressing effect on advancements of using information in the business than on the introduction of BI technology. Relatively limited use of advanced analytical technologies in the early stages is also a characteristic of BI in developing countries (Bose, 2009), possibly depending on the absorptive capacity, which is lower than the absorptive capacity for less sophisticated technologies. Despite this, part of the suppressing effect on using advanced analytical technologies can be attributed to the absence of the necessary technical and business skills (I2 in Figure 2), a mix of skills which is commonly better supported in developed countries (Anderson-Lehman, Watson, Wixom, & Hoffer, 2004) but which is likely lacking in transitional economies (Khalfan & Gough, 2002). From the technological perspective, an important characteristic is the lagging in IS development for operational business processes (I1 in Figure 2), which can be attributed to the fact that Slovenian organizations are still working on the introduction of ERP solutions (Erjavec et al., 2010), which lowers the level for integration and consistency of the data that flow into the BIS. An important fact that negatively influences some maturity elements/areas is the low level of willingness to change and the low business flexibility (I3 in Figure 2), which are typical of transition economies. The slow adoption of state-of-the-art management concepts is another reason (I4 in Figure 2) that reduces the extent of changes, which are realized in business processes after the BIS starts to be introduced/updated. However, according to Williams & Williams (2006) these changes are a prerequisite for harvesting business value from the introduction of the BIS.

The empirical findings suggest that there are two different ways of progressing to a mature BI, namely through technological advancements or mature information management practices. These two ways are illustrated in the maturity model in Figure 2.

Members of the technologically advanced organizations group, which represent up to one-third of organizations, are still
considering BI projects primarily or exclusively as IT implementation projects. These organizations have not yet embraced the broad understanding of BI which is the only one that can foster business value and consequently contribute to the economic development of Slovenia. It is evident that in Slovenia the importance of IT for business, at least at the declarative level, has been recognized but managers are often still unaware that, parallel to the introduction of the technology, appropriate managerial concepts (e.g., business process management, business performance management, analytic customer relationship management) also have to be developed. These managerial concepts are on one side facilitated by IT while, on the other, BI can add to the performance of the organization only if it is employed within these concepts. We anticipate that this is recognized foremost in those organizations with a clear ownership structure that have already successfully completed the process of their transition.

The group of organizations with an advanced level of information management is clearly aware of the importance of data and information for their business. Although the maturity indicators for this group show that they are ensuring data integrity, a unified view of their business and the generally high quality of the information content, this is achieved without the use of advanced IT (i.e., BIS components). However, this adoption is recognized as increasing the efficiency of the processes which produce and provide information.

The reasons for the differentiation of BI maturity cannot be solely attributed to the constraints of the (economic) environment but can also be ascribed to the reasons that drive the introduction of BI. When do Slovenian organizations decide to start the BI initiative and why?

The driving reasons (Klaves, 2003) for implementing BI are the competiveness of the business environment and the amount of data available for business decision-making. For companies working in highly competitive and information-intensive industries, BI is critical for understanding business operations, increasing customer satisfaction, and taking advantage of new opportunities. A main characteristic of transition economies due to the change from a central planning system to a free market economy is an increase in the environment’s competiveness. However, the competiveness of individual sectors in a transitional economy grows at different speeds and is also influenced by the level of globalization of Slovenian organizations. This is reflected through the industries dimension in the results of the analysis. This analysis revealed that BI is mature in the manufacturing industry and the service industry. The weakness of the service sector is the absorption of information in business processes, where it lags behind the Slovenian average. This can
be explained by the relatively small scale of these companies that makes it easier to oversee their operations without using the information that would be provided by a BIS. The biggest shares of immature organizations can be found in the construction industry (30% of all companies in this industry), which at least in Slovenia was in previous years (until the worldwide recession) undergoing exceptional expansion and consequently had less competitiveness. Similarly, there is a large share of immature organizations in the electricity, gas, and water supply industry (30% of all companies in this industry) and in the transport, storage, and communication industry (21% of all companies in this industry). Despite the appearance of competition in these industries, a de facto monopoly is still common (e.g., in the supply of electrical energy). Another interesting sector is the financial sector which has the greatest share of mature organizations (43% of all companies in this industry) and organizations with advanced information management (57% of all companies in this industry). This is a consequence of financial organizations adapting to regulators’ requirements (e.g., the Basel Accord) that risks have to be managed with appropriate information management. Despite the strong requirements for information management, a little less than half of the companies were able (or needed) to establish the high maturity of their BI technology infrastructure.

Since the study was undertaken in Slovenia the general applicability of the results from all aspects is limited. The maturity (measurement) model (consisting of BI elements and perspectives) is independent of the environment because it has a theoretical basis and was developed following an adequate methodology. However, it can be expected that the specifics of the transition environment influence future analysis of the state of BI maturity. The comparison with other existing, yet less extensive, and partially overlapping surveys (Gartner, 2010; Henschen, 2009) reveals that Slovenia, as a post-transitional country, lags slightly behind the international community in BI adoption. This is consistent with the current situation: while its GDP puts Slovenia among “advanced economies” (IMF, 2010), investments in IT still place Slovenia in the pool of transitional economies (Domadenik, Farčnik, & Koman, 2010). Although the comparisons clearly show the impact of a centrally planned economy and subsequent transition on the maturity of BI in Slovenia, this finding cannot be fully generalized to all transitional countries since, as part of Yugoslavia, Slovenia already had a more open economy and society than countries of the Eastern Bloc. Although IT today is accessible everywhere, differences between transition countries in the maturity of this technology can be expected as the conditions for their adoption are determined by the economic environment. This is visible when comparing Slovenia with the international community. Even bigger differences between Slovenia and other transitional countries can be justifiably expected in the area of information management and information usage. Even though the barriers that impede the adoption of BI are similar in other transition countries (Soja, 2006), their intensity is different since Slovenia already had an advantage before other transitional countries regarding factors I2, I3 and I4 (see Figure 2) at the beginning of its transition. It was possible to detect the development of an entrepreneurial culture already in the 1970s (Vahčič & Petrin, 1990), which facilitated the faster development of management practices and change culture. Because Slovenia is often used for benchmarking other transitional countries, it may be expected to play a similar role in the area of BI maturity (development) and therefore the findings of this study can be used in other transitional countries to plan and achieve a faster improvement (leapfrogging) in some segments of BI. However, further research modification might be necessary to validate the (maturity) model in an international environment.

**CONTRIBUTIONS**

The present research makes two main contributions:

1. The development and validation of a new maturity model that covers the entire breadth of BI (covering the BIS, quality information, and the usage of information in the business of the organization) and overcomes the weaknesses of existing BI maturity models that mainly focus on the technical aspects, for example the BIS. Another weakness of the existing BI maturity models is that the elements (e.g., good practices) that describe the maturity levels of existing maturity models were created and grouped together based on the subjective assumptions of the model developers. These assumptions are not supported by any empirical data and may thus result in an invalid maturity model. The maturity model developed here overcomes this weakness by gathering empirical data about the elements that affect BI maturity and then by systematically (i.e., through clustering) grouping them into maturity groups so that the identified groups correctly describe the BI maturity levels in Slovenian organizations. One of the most interesting findings of this empirical study was the detection of a group of technologically advanced organizations as well as a group of organizations with advanced information management, which highlight the important insight that there are two different paths from immature to mature organizations.

2. The analysis of the specifics of BI initiatives and their maturity in relation to the Slovenian economy, along with the identification of negative influences, for example impeding characteristics (I1, I2, I3 and I4 in Figure 2) of the transitional economy context on BI maturity improvement attempts. To the best of our knowledge, no previous studies exist that analyze the specific issues of BI in transitional countries. Studies on the implementation and use of IS/IT in developing, emerging, or transitional countries often do not point out the specifics of the economic environment which clearly has an important influence on the business and consequently on the use of IT/IS (Roztocki, Weistroffer, Morar, & Nasirin, 2007). Although some studies of BI have been made in
transitional countries (e.g., Panian, 2008) one study on BI and on Service Oriented Architecture was conducted in Croatia, where they often do not move beyond mainstream IT research (Roztocki et al., 2007) in the sense they do not explore the influences of the transition economy. Similarly, a case study conducted in a Romanian public institution (Ghilic–Micu, Stoica, & Mircea, 2008) does not explain the transitional environment circumstances, even though it took place in a typical transitional environment. It would be possible to partially derive the success factors and BI maturity in transition countries from studies on the employment of IS/IT. However, each type of IS has its own specifics which create the need for separate research. An important differentiating element of BIS lies in their usage, or purpose to provide information to support management processes. Specifically, management practices and managerial attitudes in transitional countries are not yet totally attuned to a free market economy (Roztocki & Weistroffer, 2009), which is also supported by this study (I4 in Figure 2—inadequate adoption of state-of-the-art management practices). Research on the problems of Enterprise Systems implementation in Poland has shown that a key challenge with many IT implementations in emerging economies is the shortage of employees’ knowledge and education (Soja, 2006). This finding is consistent with one of the findings of the current study (I2 in Figure 2—a lack of adequate knowledge and resources), which is not very surprising since BIS are a type of enterprise system.

The findings and contributions of this study can provide important guidelines for organizations in transitional and other developing countries with a lower level of BI maturity and also for those attempting the introduction of BI primarily as a technological project.

CONCLUSION

BI is an important and challenging initiative that organizations are introducing and continuously improving to visibly gain business value. Through this article the authors have explored the role and impact of approaches to BI as a means to improve business performance. BI has been introduced in a broad perspective through a view that was derived from the existing literature and an empirical analysis. The authors identified key elements of BI through three related perspectives: the technological, information quality, and business perspectives. We presented the notion of maturity which is an important concept that influences a complex system such as BI.

The empirical study revealed the naturally existing maturity groups of BI in Slovenian companies. Despite Slovenian organizations lagging behind the global state of the technological area of BI, the results clearly show that within the small and open Slovenian transition economy there is no homogeneous BI maturity state and that many organizations have already successfully introduced BI solutions which they are using to boost their competitive performance.

The research presented insights into the main challenges facing Slovenian organizations in the field of BI. These insights were related to the context of transitional economies through the identification of key transitional economy characteristics which reduce the absorptive capacity of BI. Consequently, through the adoption of existing and successful practices, Slovenian organizations may achieve and defend their competitive advantages in the context of the economic transition and development. Hence, the authors have achieved their purpose of exploring BI maturity within a Slovenian context thus, allowing others to draw a parallel in context when seen from the perspective of a transitional economy.

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REFERENCES


