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Identification and classification of organizational level competencies for BI success

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ABSTRACT Business intelligence is a technology-oriented solution that businesses need to survive in today's competitive and constantly changing market. To gain the benefits of BI systems, it is important to evaluate, assess, and improve factors that have an influence on BI success. Organizational competencies can provide answers to the question of how companies could gain more benefits from BI systems. While investment in BI systems is increasingly growing, measures to evaluate effective organizational competencies leading to BI success are gaining more importance. Therefore, this research identified a number of effective organizational competencies that contribute to BI success. Using the developed questionnaire for determining the effect of organizational level success on BI success, the research data was gathered for the study. A chi-square test confirmed the effectiveness of all nineteen identified competencies. Then, an exploratory factor analysis (EFA) was carried out on the data in order to identify the underlying dimensions. In addition, competencies were grouped into six categories, namely data management, information system/information technology (IS/IT) development, financial resources, relationship management, IS strategy and human capital policies. As a result, these competencies can be used as a measure to evaluate an organization's status in holding some of the effective factors for BI success.

1. INTRODUCTION

1.1 BI success

Business intelligence (BI) is a modern information technology that helps organizations to collect, manage and analyze structural or non-structural data (Lin, Tsai, Shiang, Kuo, & Tsai, 2009) (Nyblom, Behrami, Nikkilä, & Solberg Søilen, 2012). BI has a fast growing market (Abzaltynova & Williams, 2013) that continuously introduces new trends such as cloud BI, social BI, and mobile BI and in the future "customized" BI (Wang, 2015). Nowadays, business environments are constantly changing (Hoppe, 2013), highly competitive, and increasingly uncertain (Banerjee & Mishra, 2015) that organizations' solutions for avoiding bankruptcy depend on

successful BI (Ranjan, 2008). In addition, organizations that utilize BI successfully can gain competitive advantages.

In successful BI, information technology and the business process and strategies must be aligned together, so enterprises can manage and benefit from their investments in BI by allocating BI resources, prioritizing projects, and minimizing the risk associated with BI implementations (Ranjan, 2008). Successful business intelligence can help organizations to make the best decision at the best time through integrating and analyzing data with decision support systems (Muntean, Gabriel Cabau, &Rinciog, 2014). Furthermore, successful BI provides the right information to the right people throughout the organization to improve strategic and tactical decisions (Li, Shue, &

Lee, 2008). Company return from IT investment is an important part of successful BI. In other words, when a BI system is successful, the company gains tangible benefits from their investments in it.

The opposite side of successful BI implementation is BI failure. Reports of BI failures can highlight the importance of successful BI. About 50%- 80% of business intelligence applications fail due to technological, organizational, cultural and infrastructural issues (Adamala & Cidrin, 2011). In addition, they report that most BI failures happened because of a number of issues, such as ignoring BI as a cross organizational business initiative, lack of management and sponsor commitments, lack participation of the business side and representatives, unavailable skilled staff, ignoring business analysis activities, lack of appreciation of the impact of dirty data on business profitability and lack of understanding of the necessity for and the use of meta-data (Chuah & Wong, 2013). All the failure reasons show that a number of organization and staff characteristics, which are called 'competencies,' play a crucial role for BI success. Competencies are related characteristics that prepare an organization to attain certain objectives. These characteristics can be categorized in two levels: organizational and individual. The effect of organizational level competencies on BI success is the topic of our study. As Worley et al. (2005) mentioned "Competencies can be analyzed at the level of an individual, gathering all the techniques allowing to facilitate the emergence, maintenance and development of personal competencies, but also at a collective level or even at an organizational level" (Worley, Chatha, Weston, Aguirre, & Grabot, 2005). Individual competencies are human resource capabilities that lead to better achievement of the predetermined objectives such as human resource skills, motivations, and behaviors that influence their performance and at least productivity. Although individual competencies are also very important in applying BI systems we limited our research scope to organizational level competencies. In general, organizational competencies are an organization's ability for optimizing use of available resources, setting short- and long-range goals, and developing the strategies and policies to achieve such goals. The concept of competencies first found its way into IS/IT studies in an attempt for supporting organizational IT/IS goals. Competencies have been found to have the potential to impact organizational success and to be relative to BI in particular. Specifically, it has been related to an organization's ability to derive benefits from their investment in IS (Chasalow, 2009).

The aim of this research is to determine the organizational level competencies that are necessary for BI to be applied successfully according to the BI success factors. Since the major reason that a large number of BI projects are considered to be failures is related to ignorance of organizational characteristics, the emergent competences identified in this research can help organizations understand the competencies that they need to build in order to benefit from their BI investments (Chasalow, 2009). Therefore, this research is directed towards developing a theoretical model for BI success. Although BI success is the positive value that an organization obtains from its BI investment, its definition differs from one organization to another. It depends on what benefits that organization expects (Sabanovic & Solberg Søilen, 2012) from its BI initiative. Benefits that are gained from improved profitability, reduced costs, and improved efficiency can be defined as BI success in an organization. For the purpose of this research, BI success is defined as the positive benefits of BI, which the organization may achieve as a result of implementing BI competencies as important elements in the success of information systems, and appear to have the potential to be of particular value in explaining achieving benefits from BI. This research will therefore seek to develop a model to help explain the organizational level competencies that would support the attainment of business value from BI. The developed model can be used as an instrument to improve the likelihood of an organization achieving benefits from their BI investments.

2. LITERATURE REVIEW

There are few studies about competencies that affect BI success. In this section, we study organizational level competencies related to IS/IT in addition to BI related competencies. First, competencies are described and then competency related research studies are introduced. The literature review is summarized in Table1 and Appendix A.

2.1. Competencies

"Competencies have been studied from two different perspectives: (i) As assets, skills, or

resources belonging to the company that allow an activity to be performed systematically (ii) As the activities themselves, that is, the operations that the firm is able to carry out by integrating a series of assets, emphasizing what the company *does* as opposed to what the company *has*" (En Escrig-Tena & Bou-Llusar, 2005).

Previous literature includes studies that have adopted different competency-derived approaches such as the strategic management field (Anderson & Sohal, 1999;Penrose, 1959; Selznick, 1957), the resource-based view (Danneels, 2002; Montealegre, 2002; Tyler, 2001; Wilcox kingl & Zeitham, 2001), the Dynamic Capability Theory (Huang, 2011), the competency-based competition (En Escrig-Tena & Bou-Llusar, 2005), the knowledge-based theory (Harzallah & Vernadat, 2001), core competencies of strategic business units (Bhamra, Dani, & Bhamra, 2010; Prahalad, 1994; Wang, Lo, & Yang,2004), competency for developing human resource (Worley, Chatha, Weston, Aguirre, & Grabot, 2005; Lee, 2010), and competency management within—and at the intersection of—knowledge management (Javanmard, Mashayekhi Nezamabadi, & Larki, 2010), project management (Crawford & Hassner Nahmias, 2010), supply chain competencies (SCC) (Green Jr., Inman, Birou, & Whitten, 2014), and computer science (Zouine & Fenies, 2015). Some of these studies on competency deal with IS/IT. Since the early 1990s, the researchers considered the sustainability of competitive advantage from IT (Peppard & Ward, 2004). The present research addresses the competencies studied in the IS/IT field. These competencies can be related to organizational factors or introduced as IS/IT capabilities that lead to better achievement in an organization.

Competencies are usually divided into two groups: organizational level competencies and individual competencies. Organizational competency is a term that has been used in the world of performance management for many years. It is routinely used by human resource professionals and by organizational change consultants to refer to the variety of employee skills (Nienabera & Sewdassb, 2016) that the company must have in order to achieve their plans (Coates & Associates, 2008). The current research focuses on non-individual competencies (organizational level competencies) studied in the IS/IT field.

2.2. BI related competencies

Competencies within the sphere of BI first appeared in the BI practitioner literature beginning with the Business Intelligence Competency Center (BICC). BICC encompasses a lot of issues: better use of BI across the organization, greater alignment and collaboration between business units, a BI strategy that supports the corporate strategy, standardized BI processes and initiatives, consistency of definitions, processes, and methodologies, and higher ROI from BI (Miller, Bräutigam, & Stefani, 2006). Miller and et al. (2006) introduced comprehensive competencies modeled in three dimensions: business skills, analytical skills, IT skills to support the development and support of BI in an enterprise. But, these competencies are primarily technical in nature and their focus is not on organizational level competencies (Miller, Bräutigam, & Stefani, 2006).

Furthermore, Chasalow (2009) presented five competency factors on the organizational level: learning organization, participative leadership style, clearly defined business goals, technological resource availability, and financial resource availability. He argues that these five factors have an impact on business intelligence success (Chasalow, 2009). As Chasalow mentioned in his dissertation, his work is one of the few studies that have been done on organizational factor effects on IS systems and also these studies are still in an initial stage. Also, his study did not attended to some factors like relationship management that have been introduced in this research and are one of a company's challenges for implementing information systems in some organizations.

In addition to that, Ghazanfari (2011) presented an expert tool to evaluate the BI competencies of Iranian enterprises and identified six factors for his evaluation model: analytical and intelligent decision-support, access to related experimentation and integration with environmental information, optimization and recommended model, reasoning, enhanced decision-making tools, and finally, stakeholder satisfaction (Ghazanfari, Jafari, & Rouhani, 2011). Their view of BI competencies is limited to BI specification. Their study is not about organizational level competencies, but they mention some competencies like stockholder's satisfaction that we recognize as organizational level competencies.

Furthermore, Isık et al. (2013) studied the effect of the decision environment on business intelligence capabilities for achieving BI success. According to their study, technological capabilities such as data quality, user access and the integration of BI with other systems are necessary for BI success (Isık, Jones, & Sidorova, 2013). Although their study focused on technical capabilities, some of the capabilities, like data quality, are grouped into organizational level competencies in other studies like Chasalow's study.

2.3. Studies on organizational level competencies in the IS/IT field

Because there are few research studies in the field of BI-related competencies, organizational level competencies in the IS/IT field have been studied too. Since BI is an IS system, not only studies about competencies in the IS/IT field have been studied in our research, but they can make our literature review more inclusive. Competencies related to an IS facilitate the relationships between organizational processes and structures for beneficial use of IS resources in order to accomplish organizational tasks and obtain organizational goals (Tarafdar & Gordon, 2007). One of the most cited articles about IS related capabilities is by Feeny and Willcocks (1998) in which they offer a competency model (Feeny & Willcocks, 1998). Their model, which was revised in 2006, suggested four tasks and nine capabilities that grouped into three categories: business and IT vision, delivery of IT services, and design of IT architecture that can help a company benefit from the technology (Willcocks, Feeny, & Olson, 2006).

Furthermore, there are other studies that have addressed the problem of value creation from IS investments in an organization as opposed to an IS functional perspective. Peppard, Lambert & Edwards (2000) developed a framework for mapping macro competencies and identified their related micro competencies. Four years later, Peppard and Ward (2004) offered an IS model that identified six domains of IS competencies which are themselves composed of micro IS competencies—25 in all. These domains involve strategy, IS contribution definition, IT capacities definition, exploitation, solutions and supply.

IT projects that help operational performance of the organization go back to 30 years ago (Doherty & Terry, 2009). As such,

Wade and Hulland (2004) defined three IS resources and capabilities that can be used for gaining market opportunities. They also proved that IS resources rarely have a direct effect on sustained competitive advantage (SCA), but they can indirectly lead to sustained performance (Wade & Hulland, 2004). In another study, Doherty & Terry (2009) examined the impact of IS capabilities on competitive positioning at the process level. Also, Ravichandran (2007) presented how IS capabilities can offer digital options that lead to firm agility by investing in IT. Similarly, Tarafdar and Gordon (2007) illustrate how six IS competencies could affect the conception, development and implementation of process innovations. On the other hand, some studies addressed IT competencies as components of other concepts. For example, Ngai, Chau and Chan (2010) defined IT competencies (IT integration and flexibility) as supply chain competencies. Also, the theory of competency rallying (TCR) was presented for the first time by Katzy and Crowston (2000). Crowston and Scozzi (2002) then introduced the TCR model and tested it in the context of OSS projects as a virtual organization (Ghapanchi, 2013).

While all the studies on IS/IT discussed above have adopted the resource-based view of IS/IT competencies, some other research studies have introduced different views. For example, Caldeira and Dhillon (2010) categorized organizational competencies into two groups: facilitating competencies and fundamental competencies that lead to information technology advantages within organizations (Caldeira, Mário; Dhillon, Gurpreet, 2010). Additionally, Chen & Wu (2011) developed a model of IT management capability of CIOs and found that information technology competencies affect IT management activity.

Although these IS related studies did not consider some competencies that are more important for BI like data quality or metadata that are mentioned in BI related competencies, they mentioned important competencies that are necessary for BI implementation as an IS system. IS related studies are summarized in this research, because considering IS related studies beside BI related competencies can show their similarities and differences.

A review of the related literature is summarized in Table 1.

Table 1 Constructs for IS/IT competencies

Source	Competency constructs	Dependent variables
Feeny & Willcocks, (1998) and Willcocks, Feeny & Olson (2006)	IS/IT governance, Business system thinking, Business-IS relationship building, Designing technical architecture, Making technology work, Informed buying of IT services, Contract facilitation, Contract monitoring, Vendor development	None
Peppard & Ward (2004)	Strategy formulation (Business strategy, Technology innovation, Investment criterion, Information governance) IS strategy (Prioritization, IS strategy alignment, Business process design, Business performance improvement, Systems and process innovation) IT strategy (Infrastructure development, Technology analysis, Sourcing strategies) Exploitation (Benefits planning, Benefits delivery, Managing change) Solutions (Applications development, Service management, Information asset management, Implementation management, Business continuity and security) Supply	Organizational performance
Doherty & Terry (2009)	Outside-in (External relationship management, Market responsiveness) Spanning (IS-business partnerships, IS management/planning) Inside-out (Infrastructure provision, IS technical skills, IS development, Cost-effective IS operations)	Sustainable improvements to competitive positioning
Wade & Hulland (2004)	External relationships management, Market responsiveness, IS business partnerships, IS planning and change management, IS infrastructure, IS technical skills, IS development capability, Operational efficiency	
Ravichandran (2007)	Digital Option (IT infrastructure flexibility, Application platform scope), IS Capabilities (Planning sophistication, Development capability, Support maturity, Operations capability), IT Investment Orientation	Organizational agility
Tarafdar & Gordon (2007)	Knowledge Management, Collaboration, Project Management, Ambidexterity, IT/Innovation Governance, Business-IS Linkage, Process Modeling	Process innovation
Ngai, Chau, & Chan (2010)	IT integration, IT flexibility	Supply chain agility
Caldeira & Dhillon (2010)	Fundamental competencies in delivering IT benefits which entail the following capabilities (Conducting IT strategic thinking and planning, Aligning IT with business processes and objectives, Deploying cost effective applications and systems, Conceptualizing the maintenance of data integrity and confidentiality, Facilitating behavior enrichment for technology adoption, Ability to ensure compliance with standard IT methods and procedures) Facilitating competencies in delivering IT benefits include the following capabilities (Selecting and managing IT staff, Providing ongoing IT training, Acquiring top management support in IT projects, Designing business processes for effective use of IT expertise, Maintaining systems consistency, Involving users in IT projects, Instituting SLAs (Service Level Agreements) with IT suppliers, Identifying and setting IT standards and procedures, Developing software in-house, Selecting and contracting IT vendors and IS consultants, Deciding on software sourcing strategies, Maintaining or decreasing system response time, Ensuring user application knowledge, Identifying business IS requirements, Increasing the credibility of the IT department, Increasing service accountability, Developing an IS architecture)	Delivering IT benefits
Chen & Wu (2011)	IT infrastructure, Business application, Business technology integration	IT management Activity effectiveness
Miller, Brautigam, & Stefani (2006)	Business skills (Linking to business strategy, Defining priorities, Leading organizational and process change), IT skills (Data quality), Analytic skills (The ability to discover and explore, Developing business rules, Developing user skills), Business skills, IT skills, and Analytic skills overlap (Defining BI vision, Managing programs, Controlling funding, Establishing standards, Technology blueprint, Mythology leadership, Adaptable infrastructure, Extracting data, Identifying data)	Business needs Organization and processes Tools and applications Data integration
Chasalow (2009)	Individual competencies (Strategic HR Management) Organizational competencies (Learning organization, Participative leadership style) Decision making (Clearly defined business goals, Technological resources availability, Financial Resources availability, Human Resources availability)	BI success
Rouhani, Jafari, & Ghazanfari, (2011)	Analytical and intelligent decision-support, Providing related experiment and integration with environmental information, Optimization and recommended model, Reasoning, Enhanced decision-making tools, Stakeholders' satisfaction	BI success
Popovic, Hackney, Simoes Coelho, & Jaklic, 2012	Data integration, Analytical capabilities, Information content quality, Information access quality, Use of information in business processes, Analytical decision-making culture	BI systems maturity
Isık, Jones, & Sidorova, 2013	Data quality, Integration with other systems, User access quality, Flexibility, Risk	BI success

3. RESEARCH METHODOLOGY

To answer the research question of "what are organizational level competencies for BI success?", first we identified organizational level competencies from the literature review.

Then a questionnaire was designed to answer the question "Are these identified competencies effective in BI success?"

In order to test whether the designed questionnaire was valid and reliable, and

effective for answering the research question, we performed a validity test like EFA that classified constructs. The research steps as are follows in Figure 1:

(1) Specifying the domain of the construct, (2) identifying the competencies by literature review and making the Semi-structured interviews, (3) constructing an initial framework, (4) designing the questionnaire, (5) Collecting data (6) testing the hypotheses, (7) Assessing construct validity and reliability of the measures. In the following sections, each step is elaborated in more details and some of the steps are explained in Section 4: data analysis and results.

3.1 Specifying the domain of the construct

According to what is described in the literature review, there are different competency-derived approaches. Moreover, competency-based studies on BI are in their infancy and limited. However, there are more research studies on IS/IT related competencies in the literature. Therefore, additional competencies were extracted from other competency-based studies including both BI and IS/IT, which use a more resource-based approach to competency indices. The literature identifies two levels of competencies: individual level and organizational level. The present paper addresses the organizational level.

3.2 Identification of the competencies from the literature review and interviews

The first step is to identify the competencies. This can be done through adopting either a qualitative or quantitative approach. In our case, the competencies were developed through reviewing the literature on IS/IT and BI-related competencies. Initially, 35 IS/IT-related competencies at the organizational level were identified.

The next step was to examine the competencies identified for content validity. Content validity is whether or not the elements

in a given construct represent the underlying concept to be measured. In our case, we used two methods for determining content validity:

1) Conducting interviews to investigate if variables are transparent enough, appropriate and relative. Some variables like knowledge management, project management, and change management that are more reflective than formative were eliminated. As a result, 19 competencies were extracted from a total of 35 by eliminating or merging the elements. Appendix A outlines these 19 competencies and provides their related sources.

2) Developing an initial theoretical framework by grouping competencies in relevant constructs by an inductive reasoning method and via the help of experts who reviewed the elements in each group that are explained in the following sections.

3.3 Constructing an initial framework for determining the importance of competencies in BI success

Concepts comprise categories which in turn create the basis for the formation of a theory (Allan, 2003). The aim of categorizing competencies is indirectly to determine the importance of competencies in BI success, that is, how these 19 competencies lead to BI success.

The competencies were grouped into three BI related categories: IT infrastructure, IT governance, and resources. These categories and their variables are shown in Appendix A.

a) IT Infrastructure group: Miller et al. (2006) argue that "infrastructure refers to the hardware, software, networking tools, and technologies that create, manage, store, disseminate, and apply information".
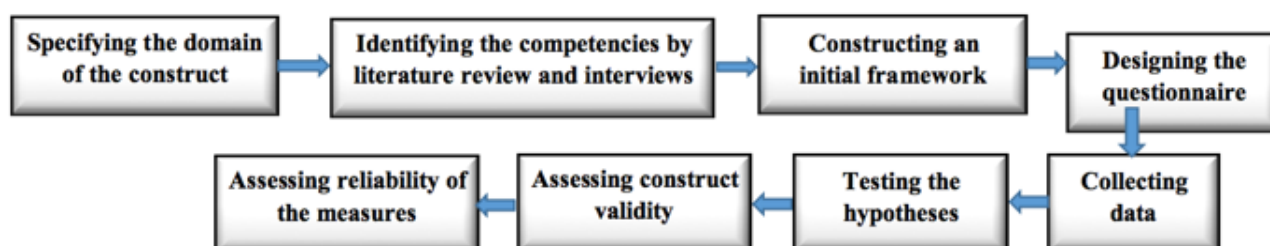

Figure 1 The research steps

A business intelligence infrastructure has to be responsive to various needs of a business on demand and in real time. Also, well-defined infrastructure ensures data quality and availability. The V_1 to V_7 group of variables was assigned to the IT infrastructure category as critical IT assets. It is crucially important to build and expand the necessary data and analytic infrastructure that is agile, stable, scalable, and integrated. Data quality and stewardship especially are important for developing metadata (Miller, Bräutigam, & Stefani, 2006).

b) BI Governance: this is a new term that a few references mentioned it. Turban et al. (2010) used BI governance for prioritizing BI projects and appropriate planning and forming an alignment with the business strategy as a factor for BI success. Beth (2006) also developed a BI governance framework and application portfolio that deals with the funding process, exceptions process, BI development process, tracking and measurements, and communications plan as governance mechanisms. The V_8 to V_{15} group of variables were assigned to the BI governance category, emphasizing the importance of strategy thinking to both sides of IS and business alignment to ensure BI success. It is evident that IS strategy is critical, however, it would be a waste of resources for both sides to overlook the business needs, and the alignment of business and IS strategy.

c) Facilitating Resource: this is critical for determining the relative success or failure of IT adoption. In fact, resource facilitation supports fundamental competencies (Caldeira, Mário; Dhillon, Gurpreet, 2010). Chasalow (2009) refers to financial resources and strategic human resources as organizational competencies for business intelligence success. Moreover, Miller et al. (2006) describe human capital as an important factor for BICC. V_{16} and V_{17} as financial resources and V_{18} and V_{19} were grouped into the human capital policies category that was included in Facilitating Resources. The implementation of BI systems does not just occur on one day and end there; they rather take place gradually over time and through data collection, hence there is the need for more financial support and budget allocation. On the other hand, even the best systems without utilizing skilled users could not amount to much, as a study asserts that inadequate education and training and lack of employees' morale and motivation cause the failure of ERP projects (Amid, Moalagh, & Zare Ravasan, 2012).

3.4 Questionnaire design

In the third step, a questionnaire was designed with three main sections. The first section of the questionnaire consisted of questions about the characteristics of the interviewees. The content of the second section entailed the description of BI success as described in the literature review. And the third section of the questionnaire included questions about the effect of the 19 competencies on BI success using a five-point-Likert scale ranging from (5) "highly effective" to (1) "highly ineffective", and additionally an "uncertain" option. The third section of the questionnaire was designed to measure the effect of the 19 organizational competencies on BI success in the organization.

3.5 Sample size and data collection

Using purposive sampling, the target population of this study was determined to include consultants and IT department members of the Ministry of Industries Mines and Trade. This study was conducted in Iran, because the environment in which Iranian organizations operate today is becoming more and more complex. Moreover, organizations and departments that are situated inside organizations face problems such as reduced budgets and amplified pressure from top managers to increase performance and profit and also from markets and consumers to lower the prices. In this kind of environment, managers must respond quickly, innovate, and be agile. Both private and public organizations are cognizant of today's business environment and pressures (Turban, Sharda, Delen, & King, 2010).

In October 2011, the ministry approved a sizable budget for BI implementation that came into effect. The sample size was a major

limitation in our study in terms of the available time. Additionally, some experts were not interested (e.g. due to lack of familiarity with the research subject) in cooperating with the research, especially, with the electronic form of the questionnaire. Consequently, the data was collected from questionnaires which were distributed among the minimum sample size of 80 individuals after removing none approved samples. There are different ideas about the minimum sample size in factor analysis. According to Lawley & Maxwell (1971), 51 more cases than the number of variables are enough.

Although the subject-to-variables (STV) ratio of the sample size is 4.2 (that is under 5), expletory factor analysis was conducted because the KMO is 0.62, which is above the "average" threshold of 0.5 (Amid, Moalagh, & Zare Ravasan, 2012; Kaiser, 1974), and the Bartlett test p-value is less than 0.05, which suggests a good correlation. Demographically, 5.8% of the respondents had a PhD degree, 46.37% had an M.E. degree, and 47.83% had a B.E. degree. Of these, 4.48% of the respondents were classified as university professors, while 41.79% were executives/managers, and 53.73% were IT department employees that they had work experience in the area of BI tools.

4. DATA ANALYSIS AND RESULTS

In this stage, the collected survey data from the questionnaire was used for testing the research hypothesis. It was necessary to determine the statistical distribution of the collected data from the third part of the questionnaire. Subsequently, based on the distribution of data, either a parametric or non-parametric test was performed to prove the hypothesis:

H$_1$: Do V (i=1 to 19) competencies have effects on BI success?

The next step in the development of this type of measurement was to test the construct validity and reliability. Construct validity exists if the items accurately represent the underlying concepts that are being measured (Boudreau, Gefen, & Straub, 2001).

Therefore, some tests were performed on the data collected from the third part of the questionnaire.

4.1 Hypothesis test

In order to evaluate the effectiveness of 19 competencies on BI success, the results should support the hypothesis. As previously mentioned, these 19 items were included in the third part of the survey questionnaire

constituting the hypothesis: H$_1$. Do V (i=1 to 19) competencies have effects on BI success?

One of the most accepted ways to identify the distribution of the data, statistically, is the one-sample Kolmogorov–Smirnov test. The Kolmogorov–Smirnov test compares the observed cumulative distribution function for a variable with a specified theoretical distribution, which may be normal, uniform, Poisson or exponential (Lilliefors, 1967). Many statistical parametric tests require normally distributed variables. The one-sample Kolmogorov–Smirnov test can be used to test whether or not a variable is normally distributed (Hollander & Wolfe, 1973). According to our test results, the p-value of all 19 items was less than 0.05, which shows that their distribution was not normal; hence there was a need for a statistical non-parametric test to prove H$_1$. Therefore, a chi-square test was used to determine whether the frequencies of the upper categories of Likert questionnaire, (5) "highly effective" and (4) are higher than other categories (i.e. 1, 2, and 3). That is, the residual (R^2) values of categories (5) and (4) of the Likert scale are to be higher than categories (3), (2), and (1).

The chi-square test procedure (Cochran, 1954) tabulates a variable into categories and computes a chi-square statistic. This goodness-of-fit test compares the observed and expected frequencies in each category to test whether all categories contain the same proportion of values or test that each category contains a user-specified proportion of values.

A significance level below 0.05 for all the 19 items indicates that the observed frequencies differ from expected frequencies in each category and the average rate of frequencies do not significantly differ by category. On the other hand, the residual (R^2) of each category of items, which is equal to the observed frequency minus the expected value, shows that differences between observed frequencies (nonparametric tests, chi-square test) in (4) and (5) are a lot more than the expected frequencies and are completely positive. Thus, based on the significance level and residual test for all items, it can be concluded that all of the 19 competencies are highly effective for BI success in an organization.

4.2 Exploratory factor analysis

In this study, we use an exploratory factor analysis (EFA) as a statistical approach to determine the correlation among the variables in a dataset. This type of analysis provides a

factor structure (a grouping of variables based on strong correlations). EFA is good for detecting "misfit" variables. In general, an EFA prepares the variables to be used for cleaner structural equation modeling. An EFA should always be conducted for new datasets (Statwiki, 2012).

An EFA was used to examine the dimensions evidenced in the data and the loading of the items on the empirically specified dimensions of effective organizational competencies for success.

Principal component analysis was used to extract the factors with the Varimax rotation method to simplify the interpretation of the factors. The Guttman-Kaiser rule was applied to determine the number of capability factors. At this point, only factors with Eigen values of one or more were retained. A Kaiser-Meyer-Olkin (KMO) and Bartlett's test were conducted prior to the EFA. In addition, the KMO (Kaiser, 1958) examines whether the partial correlations among variables are small (Momeni & Mehrafzoon, 2013). Bartlett's test determines (Bartlett, 1950) whether the correlation matrix is an identity matrix, which

would indicate that the factor model is inappropriate. The KMO is 0.62, which is above the "average" threshold of 0.5 (Amid, Moalagh, & Zare Ravasan, 2012; Kaiser, 1974), and the Bartlett test p-value is less than 0.05 which suggests good correlation. According to Hair et al. (1998), factor loadings over 0.3 meet the minimal level, over 0.4 are considered more important, and 0.5 and greater are practically significant. It is also suggested that the loadings over 0.71 are excellent, over 0.55 good, and over 0.45 fair (Amid, Moalagh, & Zare Ravasan, 2012). The factor analyses conducted in this study are assessed according to these criteria and because the chi-square test proved the effectiveness of the factors before the EFA, factor loadings over 0.45 are considered suitable for EFA.

The 19 variables were grouped into six categories of factors which had an Eigen value greater than one and factor loading greater than 0.45, and the interpretation variable was 70.8. Moreover, the extraction variances of the 19 variables were greater than 0.61. Table 1 summarizes the results of factor loading.

Table 2 The results of EFA and reliability test

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6
Factor (1), Data management:						
V_7: Metadata tools availability	0.8					
V_6: Data quality improvement	0.78					
V_5: Well-defined data environment including stewardship and metadata	0.74					
V_4: Integration of data sources	0.48					
Factor (2), IS/IT development:						
V_3: Applications development		0.84				
V_2: IT flexibility		0.81				
V_1: IS architecture framework		0.64				
Factor (3), Financial resources:						
V_{16}: Funding for acquiring BI tools and building related systems			0.82			
V_{15}: Sourcing strategy			0.74			
V_{17}: Funding for building and maintaining an analytical data environment			0.73			
Factor (4) Relationship management:						
V_8: External relationship management				0.8		
V_{11}: Stakeholder planning and management				0.66		
V_{10}: Service level definition				0.65		
V_9: IT vendor and consultant development				0.51		
Factor (5) IS strategy:						
V_{12}: Business processes and IS/IT alignment					0.77	
V_{13}: IS strategy alignment					0.77	
V_{14}: IS prioritization strategy					0.46	
Factor (6) Human capital policies:						
V_{19}: Ongoing IT training						0.85
V_{18}: selection, evaluation and management of (especially IT) staff						0.71
Eigen value	5.08	2.51	2.04	1.44	1.24	1.14
% of variance	26.75	13.21	10.73	5.58	6.52	6.02
Cronbach's alpha	0.79	0.8	0.77	0.69	0.6	0.61

4.3 Factor denominations

The factors were named based on the meaning and functionalities of the competencies that were related to each factor (Momeni & Mehrafzoon, 2013). The names and content of the six factors are shown in Table 2. The following section offers an elaboration of each of the factors, which are based on explanations or model dimensions of their criteria-related resources.

Factor (1) Data management: This refers to capturing, storing and maintaining a large volume of data to support BI analysis (Chasalow 2009). Qualitative data is the most important part of an analysis. Capturing and storing metadata helps to create various reports from various dimensions. Here, data management is defined as how data can be integrated and validated in a proper way to be more profitable.

Factor (2) IS/IT development: This refers to the competencies that allow an organization to develop or experiment with new technologies. So, infrastructure must be flexible and IS architecture has to be designed in a way that allows development (Wade & Hulland, 2004).

Factor (3) Financial resources: First described by Chasalow (2009), financial resources deal with the availability of financial resources to support the collection and maintenance of BI tools. Many IS implementation projects failed because of a lack of financial resources. Although availability of the resources facilitates BI success, financial resources are an important competency that determines success and failures of these projects.

Factor (4) Relationship management: The aim of relationship management is to increase the connectivity with consumers, suppliers and other trading partners. One of the IS systems' (like SCM, CRM) tasks is facilitating relationships of organizations with their partners (Aziza, Oubrich, & Solberg Søilen, 2015). So well defined management systems can lead to IS systems like BI. Schaarschmidt, Walsh, Kortzfleisch (2015) mentioned interacting with external parties on a macro level of governance, which we considered a relationship management factor in IT governance groups.

Factor (5) IS strategy: This is defining organizational strategies in a way that integrates IS with business (Peppard & Ward, 2004). For BI success in an organization, organizational strategies must be well defined in a way that information systems meet the business needs. Besides, business strategy must consider IS needs.

Factor (6) Human capital policies: This is a very well defined system that can benefit an organization without well trained users. The human resources importance for IS success, especially in BI, is clear as described before and is considered to be individual competencies. But, human capital policies are permanent and continuing policies and the processes of an organization for selecting, evaluating and training IT and business staffs in a way that helps BI implementation and usage.

Table 2 illustrates which competency (V_i) has been grouped into which factor (j). On the other hand, Appendix A illustrates relationships of the initial theoretical framework with competencies (V_i) and factors (j). As described earlier, the research theoretical framework groups competencies into three categories. The framework was then revised by EFA, so competencies which were assigned to the IT infrastructure category were divided into factor (1) and factor (2); the BI governance category was divided into factor (4) and factor (5); the facilitating resources category was divided into factor (3) and factor (6). V_{15} (Sourcing strategy) which was primarily grouped as one of the IT governance category, by EFA has been grouped into factor (3). Figure 2 also shows the factors and the initial framework relationships.

4.4 Reliability

Reliability is another aspect of the measurement scale to be evaluated in this step. This concept refers to the extent to which repeated use of the measurement scale would give the same results (Straub, 1989). The analysis of reliability is reported in Table 2 as composite reliability, and was entirely consistent with the factor analysis. Table 1 outlines Cronbach's alpha based on standardized items where values above the minimum of 0.6 for F_4, F_5, and F_6 are unacceptable, and above the minimum of 0.7 for F_1, F_2, and F_3 are considered acceptable.

For the reliability of the questionnaire, the Cronbach's alpha was estimated to be 0.86 (greater than 0.7), which implies good reliability of the instrument (Amid, Moalagh, & Zare Ravasan, 2012; Nunnally, 1978).

4.5 Discriminant validity

Discriminant validity refers to the extent to which factors are distinct and uncorrelated. The rule is that variables should relate more strongly to their own factor than to another factor. Two primary methods exist for determining discriminant validity during an EFA. The first method is to examine the pattern matrix. In order to have discriminant validity, variables should load significantly only on one factor.

The second method is to examine the factor correlation matrix, as shown in Table 2. Correlations between factors should not exceed 0.7. A correlation greater than 0.7 indicates a majority of shared variance (0.7 * 0.7 =49% shared variance) (Statwiki, 2012). As can be seen from the factor correlation matrix in Table 3, correlations between all factors are under 0.7 which supports the discriminant validity.

Table 3 Correlation matrix of factors

	F(1)	F(2)	F(3)	F(4)	F(5)	F(6)
F(1)	1.000					
F(2)	.361	1.000				
F(3)	.260	.512	1.000			
F(4)	.122	.278	.357	1.000		
F(5)	.338	.425	.385	.356	1.000	
F(6)	-.161	.170	.295	.215	.220	1.000

5. DISCUSSION

This paper presented a competency model as illustrated in Figure 2. Interpretations of factors and practical usages of this model are discussed in the following sections.

5.1 Interpretation of factors

According to our findings, there is no similar research that has presented effective competencies for BI success by studying previous research in IS fields. One of the differences between research studies about IS and BI related competencies is the emphasis of BI related research studies on data management and its factors that also were shown in EFA results. EFA shows that the data management factor has the highest variance, among other factors. This is due to the fact that a BI system's goal is analyzing data for exploring useful information for decision makers and it makes data management a critical factor for BI success. The importance of data management is highlighted in many sources and articles, such as Işık (2010) who defined data sources, data types, and data reliability as BI capability; or Cox (2010) who identified information availability, information quality, and information quantity as effective elements that improve decision-making speed and quality.

Factor (2), IS/IT development, is an organization's ability to develop applications, architecture and infrastructure of IS without which data cannot be gathered and managed perfectly. Therefore, this factor is considered to be a base or infrastructure for data
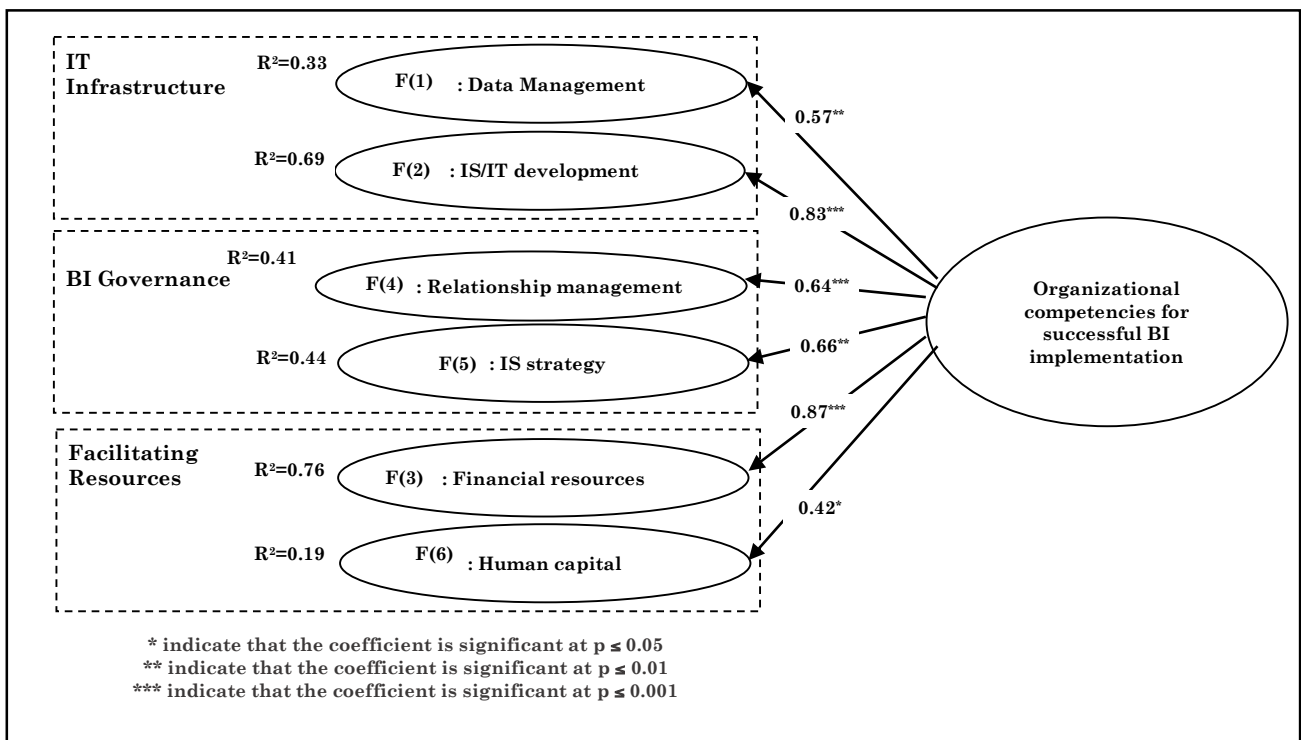

Figure 2 The model of organizational level competencies effects on BI success

management. Most of the articles in which Factor (2) is referred to have mentioned application development capability as a competency and they have ignored the importance of architecture and system flexibility for implementing new information systems or developing new features for existing systems. In this article, IS/IT development refers to both soft (application) and hard (infrastructure) abilities and their flexibility of an organization for BI success.

Financial resource is not considered to be an IS ability, however, it provides the ground for other capabilities and because of their importance in IS implementation, we cannot overlook them, especially in BI implementation which is a time-bound development process. The importance of financial resources ignored in most articles related to IS competencies except Chasalow's study that emphasized its importance. As an initial classification, the sourcing strategy is classified into IT governance groups and funding for acquiring BI tools funding for building and maintaining an analytical data environment, classified into resource facilitation groups. Sourcing strategy that is classified into financial resources refers to both sides of the funding strategies of sourcing and selection of supplies. By grouping the sourcing strategy competency into financial resources factors, the first side of the competency (funding strategies of sourcing) was highlighted.

Both internal and external data gathered from suppliers and stakeholders are important to determine BI success. On the other hand, continued relationships with IT vendors (Solberg Søilen & Hasslinger, 2012) and consultants are necessary for having a better understanding of an organization's IT needs. Therefore, relationship management is another important ability, as well. It is one of the top and long-running concerns of the senior management that the organizational strategies are in alignment with the business strategy as well as the IS strategies. Research studies show that businesses rely on IT to execute the company strategy and the top priority is building the foundation for execution, which is the IT infrastructure and digitized business processes that automate the core capabilities of the enterprise.

Businesses should have strategic directions about IS investments that lead to alignment between IT strategy and business processes (Peppard, Lambert, & Edwards, 2000). The requirement for alignment of the organization's IS/IT strategy with the business's underlying goals and objectives was apparent. In IS strategy definition, IS/IT governance imply an important role for integrating the IT effort with business strategy and processes (Willcocks, Feeny, & Olson, 2006). In a similar way, BI governance responsible for arranging strategies, structures, processes, and activities of BI for a business is an important factor for BI success. Factor (5), IS strategy, is a strategy part of BI governance that refers to IS and business strategy and their alignment. This factor is the most referred to, directly and indirectly, among other factors that suggests the importance of IS and business strategies and their alignment.

Human resources determine how BI has been used in the organization. Skill, knowledge, and motivation of users (both business and IT users), such as IT skills, statistical and analytical knowledge, creativity and market knowledge are critical for working with BI systems, which are achieved through selecting, evaluating, and managing staff and ongoing IT training. Although human resource abilities refer to individual competencies, management of individual competencies and an organization's policies for directing them refer to organizational level competencies. Some articles like Peppard & Ward (2004) or Chasalow's study have mentioned human resource strategy and development importance. There is more need for specific studies about its importance in information systems; the gap is obvious among research studies in this subject area.

5.2   Practical usages

The results of the factor analysis indicate that the organizational competencies for BI success can be evaluated based on six main factors. To measure the maturity of these factors, an organization should be evaluated by nineteen criteria through questions about organizational competencies. Using the extracted loads of each criterion within its factor, the maturity of the organizational competencies can be measured and depicted on a chart (for the six factors). By comparing the "as is" situation of these six factors with the "to be" situation the probability of BI success can increase as revealed through interviews with the experts of the studied organizations.

Since BI success criteria may differ from one organization to another, in addition, the criteria defined for BI success have influence on the importance of defined competencies; BI

critical success criteria must be defined in the organization first. Also, defining BI success criteria helps the organizations that is going to implement BI to measure the fulfillment of these criteria. Periodic evaluation of success criteria and their relative competencies can lead to continuous system performance improvement and better utilization of the information system.

The present research introduced a new measurement instrument by using a competency-based approach to BI, which helps companies achieve BI success. It should be noted that the authors utilized a case study to propose a valid measurement model. Nevertheless, it is believed that it can be generalized to apply to similar organizations, which plan to implement BI. The authors believe that the results of this research can help organizations make better decisions with regard to implementing BI, and shed light on effective organizational competencies according to critical success factors (CSFs) of BI implementation.

6. CONCLUSION AND FUTURE RESEARCH

The purpose of the study was to introduce new competency measurements on the organizational level for BI success. In this way, first we reviewed related literature about competencies and BI success. After we specified our research domain to the organizational level and IS/IT or BI related competencies, competencies of presented models in this domain were extracted and decreased to 19 competencies by combining and interviewing. Then, the questionnaire was developed that asked about the 19 competencies effect on BI success in its Part 3, which contains an explanation of the BI success definition in Part 2 (Part 1 was assigned to the respondent profile). All 19 of the competencies effects on BI success was approved by a chi-square test. An EFA, conducted to test the validity, grouped the 19 competencies into six factors that are grouped in the initial framework (IT infrastructure, BI governance, and Facilitating resources). The six factors are named and described completely in this article.

BI systems are new to Iranian companies and there are only limited numbers of companies that are familiar with BI systems. That was a limitation for this study. On the one hand, the number of experts who were qualified enough for participating in the study was limited. Nonetheless, some experts declined to participate and answer the questionnaire.

Indeed, this study is not comprehensive in relation to organizational competencies for BI success. This is because the scope of the study is limited due to the elimination of some competency constructs: knowledge management competencies (Alpar, Engler, & Schulz, 2015) that incude the capturing, filing and categorization of the information (Oubrich, 2011), business process competencies, project management competencies, and learning organization competencies (which were among the 40 competencies explored). Since these competency constructs can be in turn defined as independent study projects for future research, we found them to be beyond the boundaries of a single study.

7. REFERENCES

Abzaltynova, Z., & Williams, J. (2013). Developments in Business Intelligence Software. Journal of Intelligence Studies in Business, 3(2), 40-54.

Adamala, S., & Cidrin, L. (2011). Key Success Factors in Business Intelligence. Journal of Intelligence Studies in Business, 1(1), 107-127.

Agostino, A., Solberg Søilen, K., & Gerritsen, B. (2013). Cloud solution in Business Intelligence for SMEs – vendor and customer perspectives. Journal of Intelligence Studies in Business, 3, 5-28.

Allan, G. (2003). A critique of using grounded theory as a research method. Electronic Journal of Business Research Methods, 2(1): 1-10.

Alpar, P., Engler, T., & Schulz, M. (2015). Influence of social software features on the reuse of Business Intelligence reports. Information Processing and Management, 51, 235–251.

Amara, Y., Solberg Søilen, K., & Vriens, D. (2012). Using the SSAV model to evaluate Business Intelligence Software. Journal of Intelligence Studies in Business, 3, 29-40.

Amid, A., Moalagh, M., & Zare Ravasan, A. (2012). Identification and classification of ERP critical failure Factors in Iranian industries. *Information Systems, 37:* 227–237. doi:10.1016/j.is.2011.10.010

Anderson, M., & Sohal, A. S. (1999). A study of the relationship between quality management practices and Performance in small businesses. International Journal of Quality & Reliability Management, 16(9): 859–877.

Aziza, A., Oubrich, M., & Solberg Søilen, K. (2015). The impact of CRM on QoE : An exploratory study from mobile phone industry in Morocco. Journal of Intelligence Studies in Business, 5(2), 22-35.

Bartlett, M. (1950). Test of significance in factor analysis. British Journal of Psychology, 3: 77–85.

Banerjee, M., & Mishra, M. (2015). Retail supply chain management practices in India: A business intelligence perspective. Journal of Retailing and Consumer Services, 2-12.

Beth, L. (2006). 'BI Governance. http://66.132.247.206/uploads/BCG_pub_BIG overnance.pdf.

Bhamra, R., Dani, S., & Bhamra, T. (2010). Competence understanding and use in SMEs: an UK manufacturing perspective. International Journal of Production Research, 1-15.doi: 10.1080/00207541003738873

Boudreau, M., Gefen, D., & Straub, D. (2001). Validation in information systems research: a state-of-the-art assessment. MIS Quarterly, 25(1):1-16.

Caldeira, M., & Dhillon, G. (2010). Are we really competent? Assessing organizational ability in delivering IT benefits. Emerald group publishing limited: 1-25.

Chasalow, L. (2009). A model of organizational competencies for business intelligence success. ProQuest,

Dissertation, Virginia Commonwealth University.

Chen, Y.-C., & Wu, J.-H. (2011). IT management capability and its impact on the performance of a CIO. Information & Management, 48: 145–156. doi:10.1016/j.im.2011.04.001

Chuah, M.-H., & Wong, K.-L. (Eds.). (2013). the Implementation of Enterprise Business Intelligence: Case Study Approach. Journal of Southeast Asian Research, 1-15. doi:10.5171/2013.369047

Cochran, W. G. (1954). Some methods of strengthening the common chi-square tests. Biometrics, 10: 417451.

Cox, C. (2010). Balancing decision speed and decision quality. ProQuest, Dissertation, California: Faculty of the College of Business Administration.

Crawford, L., & Hassner Nahmias, A. (2010). Competencies for managing change. International Journal of Project Management, 28: 405–412. doi:10.1016/j.ijproman.2010.01.015

Danneels, E. (2002, September 19). The dynamics of product innovation and firm competences. Strategic Management Journal, 23: 1095–1121. doi:10.1002/smj.275

Doherty, N. F., & Terry, M. (2009). The role of IS capabilities in delivering sustainable improvements to competitive positioning. Journal of Strategic Information Systems, 18: 100–116. doi:10.1016/j.jsis.2009.05.002

EnEscrig-Tena, A. B., & Bou-Llusar, J. C. (2005). A Model for Evaluating Organizational Competencies: An Application in the Context of a Quality Management Initiative. Decision Sciences, 36 (2): 221-257.

Exploratory Factor Analysis - Statwiki. (2012). Statwiki: http://statwiki.kolobkreations.com/wiki/Exploratory_Factor_Analysis

Feeny, D., & Willcocks, L. (1998). Core IS capabilities for exploiting information technology. Sloan management review, 39(3): 9-21.

Fourati-Jamoussi, F. and Niamba, C.N. (2016) An evaluation of business intelligence tools: a cluster analysis of users' perceptions. Journal of Intelligence Studies in Business. Vol 6, No 1. Pages 37-47.

Ghazanfari, M., Jafari, M., & Rouhani, S. (2011). A tool to evaluate the business intelligence of enterprise systems. Scientia Iranica E, 18(6): 1579–1590. doi:10.1016/j.scient.2011.11.011

Ghazanfari, M., Jafari, M., & Rouhani, S. (2011). A tool to evaluate the business intelligence of enterprise systems. Scientia Iranica E, 1579–1590.

Green Jr., K., Inman, R., Birou, L., & Whitten, D. (2014). Total JIT (T-JIT) and its impact on supply chain competency and. Int. J. Production Economics, 147, 125–135. doi:10.1016/j.ijpe.2013.08.026

Hair, J., Black, W., Babin, B., & Anderson, R. (2010). Multivariate data analysis (7th ed.). NJ, USA: Prentice-Hall, Inc. Upper Saddle River.

Harzallah, M., & Vernadat, F. (2001). IT-based competency modeling and management: from theory to practice in enterprise engineering and operations. Computers in Industry 48: 157-179.

Hermosillo Worley, J., Chatha, K., Weston, R., Aguirre, O., & Grabot, B. (2005). Implementation and optimization of ERP systems: A better integration of processes, roles. Computers in Industry, 56: 620–638. doi:10.1016/j.compind.2005.03.006

Hollander, M., & Wolfe, D. (1973). Nonparametric Statistical Methods. Wiley: 21–132.

Hoppe, M. (2013). The intelligence worker as a knowledge activist – an alternative view on intelligence by the use of Burke's pentad. Journal of Intelligence Studies in Business, 59-68.

Huang, K.-F. (2011). Technology competencies in competitive environment. Journal of Business Research, 64: 172–179. doi:10.1016/j.jbusres.2010.02.003

Isik, Ö. (2010). Business intelligence success: an empirical evaluation of the role of bi.

ProQuest, Dissertation, Texas: University of North Texas.

Isik, O., Jones, M. C., & Sidorova, A. (2013). Business intelligence success: The roles of BI capabilities and decision environments. Information & Management, 50: 13–23. doi:10.1016/j.im.2012.12.001

Miller, G. i., Bräutigam, D., & Stefani, G. (2006). Business Intelligence Competency Centers a Team Approach to Maximizing Competitive Advantage. In Canada: SAS Institute.

Momeni , A., & Mehrafzoon, M. (2013). Critical Factors of Competitive Intelligence in the Power Plant Industry: The Case Study of MAPNA Group. Journal of Intelligence Studies in Business, 3(1), 31-43.

Muntean, M., Gabriel Cabău, L., & Rînciog, V. (2014). Social Business Intelligence: A New Perspective for Decision. 12th International Symposium in Management. 124, pp. 562 – 567. Timisoara, Romania: Procedia - Social and Behavioral Sciences. doi:10.1016/j.sbspro.2014.02.520

Javanmard, H., Mashayekhi Nezamabadi, E., & Larki, N. (2010). Surveying the Organizational Competencies for Implementing the Knowledge Management in Markazi Province's Gas Company, Iran. IEEE 2010: 531-533. IEEE. doi: 978-1-4244-5540-9/10

Jayanthi, R. (2008). Business justification with business intelligence. The journal of information and knowledge management systems, 38(4), 461-475. doi: 10.1108/03055720810917714

Kaiser, H. (1958). The Varimax criterion for analytic rotation in factor analysis. Psychometrika, 23(3): 187–200.

Kaiser, H. (1974). An index of factorial simplicity. Psychometrika 39: 31–36.

Lee, Y.-T. (2010). Exploring high-performers' required competencies. Expert Systems with Applications, 37: 434–439. doi:10.1016/j.eswa.2009.05.064

Li, S., Shue, L.-Y., & Lee, S.-F. (2008). Business intelligence approach to supporting strategy-making of ISP service management. Expert Systems with Applications, 35: 739–754.

Lilliefors, H. W. (1967). On the Kolmogorov-Smirnov tests for normality with mean and variance unknown. Journal of the American Statistical Association, 62: 399-402.

Lin, Y.-H., Tsai, K.-M., Shiang, W.-J., Kuo, T.-C., & Tsai, C.-H. (2009). Research on using ANP to establish a performance assessment model for business intelligence systems. Expert Systems with Applications 36: 4135–4146.

Montealegre, R. (2002). A process model of capability development: lessons from the electronic commerce strategy. Organization Science, 13(5), 514-531. http://www.jstor.org/stable/3086075

Ngai, E. W., Chau, D. C., & Chan, T. (2010). Information technology, operational, and management competencies for supply chain agility: Findings from case studies. Journal of Strategic Information Systems: 118. doi:10.1016/j.jsis.2010.11.002

Nienabera, H., & Sewdassb, N. (2016). A reflection and integration of workforce conceptualisations and measurements for competitive advantag. Journal of Intelligence Studies in Business, 6(1), 5-20.

Nunnally, J. (1978). Psychometric Theory. McGraw-Hill, NY.

Oubrich, M. (2011). Competitive Intelligence and Knowledge Creation - Outward insights from an empirical survey. Journal of Intelligence Studies in Business, 1, 97-106.

Penrose, E. T. (1959). The theory of the growth of the firm. Oxford, UK: Basil Blackwell, Londres.

Peppard, J., & Ward, J. (2004). Beyond strategic information systems: toward an IS capability. Journal of Strategic Information Systems, 13: 167–194. doi:10.1016/j.jsis.2004.02.002 (Peppard & Ward, 2004)

Peppard, J., Lambert, R., & Edwards, C. (2000). Whose job is it anyway? : Organizational information competencies for value creation. Information system journal, 10: 291-322. (Peppard, Lambert, & Edwards, 2000)

Popovic, A., Hackney, R., Simoes Coelho, P., & Jaklic, J. (2012). Towards business intelligence systems success: Effects of maturity and culture on analytical decision making. Decision Support Systems, 54: 729–739. doi:10.1016/j.dss.2012.08.017

Prahalad, C. K., & Hamel, G. (1994). Strategy as a field of study: Why search for a new paradigm? Strategic Management Journal, 15(S2): 5–16. doi:10.1002/smj.4250151002 (Prahalad, 1994)

Ravichandran, T. (2007). IT Competencies, Innovation Capacity and Organizational Agility: Performance

Impact and the Moderating Effects of Environmental Characteristics. CIST, INFORMS: 1-23.

Sabanovic, A., & Solberg Søilen, K. (2012). Customers' Expectations and Needs in the Business Intelligence Software Market. Journal of Intelligence Studies in Business, 2, 5-20.

Schaarschmidt, M., Walsh, G., & Kortzfleisch, H. (2015). How do firms influence open source software communities? A framework and empirical analysis of different governance modes. Information and Organization, 25, 99–114.

Selznick, P. (1957). Leadership in administration: A sociological perspective. New York: Harper & Row.

Solberg Søilen, K., & Hasslinger, A. (2012). Factors shaping vendor differentiation in the Business Intelligence software industry. Journal of Intelligence Studies in Business, 3, 48-54.

Straub, D. (1989). Validating Instruments in MIS Research. MIS Quarterly 13(2): 147-169.

Tarafdar, M., & Gordon, S. R. (2007). Understanding the influence of information systems competencies on process innovation. Journal of Strategic Information Systems, 16: 353–392. doi:10.1016/j.jsis.2007.09.001

Turban, E., Sharda, R., Delen, D., & King, D. (2010). Business Intelligence: A Managerial Approach, second edition. Pearson, New Jersey.

Tyler, B. B. (2001). The complementarity of cooperative and technological competencies: a resource-based perspective. Journal of engineering and technology management, 18: 1-27.

Wade, M., & Hulland, J. (2004). The resource-based view and information systems research: review, extension, and suggestions for future research. MIS Quarterly 28(1): 107-142.

Wang, C.-H. (2015). A novel approach to conduct the importance-satisfaction analysis for acquiring typical user groups in business-intelligence systems. Computers in Human Behavior, 1-9.

Wang, Y., Lo, H.-P., & Yang, Y. (2004). The constituents of core competencies and firm performance: evidence from high-technology. Journal of engineering and technology management, 21: 249-280.doi:10.1016/j.jengtecman.2004.09.001

Wilcox Kingl, A., & Zeitham, C. P. (2001). Competencies and firm performance: examining the causal ambiguity paradox. Strategic Management Journal, 22(1), 75–99. Doi: 10.1002/10970266(200101)22:1

Willcocks, L., Feeny, D., & Olson, N. (2006). Implementing Core IS Capabilities: Feeny-Willcocks IT Governance and Management Framework Revisited. European Management Journal, 24(1): 28–37. doi:10.1016/j.emj.2005.12.005

Worley, J., Chatha, K., Weston, R., Aguirre, O., & Grabot, B. (2005). Implementation and optimization of ERP systems: A better integration of processes, roles, knowledge and user competencies. Computers in Industry, 56, 620–638. doi:10.1016/j.compind.2005.03.006

Zouine, A., & Fenies, P. (2015). A new evaluation model of ERP system success. Journal of Intelligence Studies in Business, 5(1), 18-39.

8. APPENDIX A

The organizational competency descriptions and related sources.

	ID	Competency	The ability	Related sources
IT Infrastructure	V_1	IS architecture framework	The type of IS architecture framework determines the development and maintenance ability of the system	(Caldeira, & Dhillon, 2010)(Chasalow 2009)(Feeny, & Willcocks, 1998)(J. Miller, Bräutigam, & Stefani, 2006)(Peppard & Ward, 2004)
	V_2	IT flexibility	IT flexibility is a part of the IT infrastructure ability that facilitates quick and easy adaption of new technology launches (some references mentioned connectivity, compatibility and modularity as IT flexibility factors)	(Miller, Bräutigam, & Stefani, 2006)(Ngai, Chau& ,Chan, 2010)(Ravichandran, 2007) (Agostino, Solberg Søilen, & Gerritsen, 2013)
	V_3	Applications development	To develop/acquire and implement information, systems and technology solutions that satisfy business needs (not only to develop applications in-house but also to contract out IT products and services)	(Caldeira, & Dhillon, 2010)(Doherty & Terry, 2009)(Peppard & Ward, 2004)(Peppard, Lambert, & Edwards, 2000)(Wade & Hulland, 2004)
	V_4	Integration of data sources	To link information systems and share information among different functions and parts of a supply chain	(Chasalow, 2009)(Chen & Wu, 2011)(Miller, Bräutigam, & Stefani, 2006)(Ngai, Chau& , Chan, 2010)
	V_5	Well-defined data environment including stewardship and metadata	To manage and maintain metadata and to administer technical metadata and ensure its adjustment with business metadata (stewardship)	(Chen & Wu, 2011)(Miller, Bräutigam, & Stefani, 2006)
	V_6	Data quality improvement	To have and improvement cycle for collecting, correcting, accreting, and validating data and improving data quality	(Caldeira, & Dhillon, 2010)(Chen & Wu; 2011)(Miller, Bräutigam, & Stefani, 2006) (Fourati-Jamoussi & Niamba, 2016)

	V_7	Metadata tools availability	To have and use metadata tools regularly across the organization	(Chen & Wu, 2011)
BI Governance	V_8	External relationship management	To manage linkages between the IS function and stakeholders outside the firm	(Doherty & Terry, 2009)(Peppard & Ward, 2004)(Peppard, Lambert, & Edwards, 2000)(Wade & Hulland, 2004)
	V_9	IT vendor and consultant development	To have an outreach list and contact IT/e-business service suppliers. The ability to have long relationships with vendors and consultant that sure supporting the implemented system	(Caldeira, & Dhillon, 2010)(Feeny, D.F; Willcocks, L.P, 1998)(J. Miller, Bräutigam, & Stefani, 2006)(Willcocks, Feeny, & Olson, 2006)
	V_{10}	Service level definition	The establishment of service level agreements, and their monitoring, evaluating, measuring, and managing; which is an element of informed buying	(Caldeira, & Dhillon, 2010)(Feeny, & Willcocks, 1998)(J. Miller, Bräutigam, & Stefani, 2006)(Peppard & Ward, 2004)(Peppard, Lambert, & Edwards, 2000)
	V_{11}	Stakeholder planning and management	To identify key business, human resources, and technical stakeholders to clarify the benefits of the change; and planning and managing their expectations	(Caldeira, & Dhillon, 2010)(Ghazanfari, Jafari, & Rouhani, 2011)(Miller, Bräutigam, & Stefani, 2006)(Peppard & Ward, 2004)
	V_{12}	Business processes and IS/IT alignment	To integrate IT efforts with business purposes and activity and to determine how IS can deliver the 'best practice' in operational processes and organizational activities	(Caldeira, & Dhillon, 2010)(Peppard & Ward, 2004)(Tarafdar & Gordon, 2007)(Wade & Hulland, 2004)(Willcocks, Feeny, & Olson, 2006)
	V_{13}	IS strategy alignment	Business strategies should support and be aligned with IS strategies and vice-versa (i.e. strategic alignment). According to the alignment IS and business are in the same direction	(Caldeira, & Dhillon, 2010)(Miller, Bräutigam, & Stefani, 2006)(Miller, Bräutigam, & Stefani, 2006)(Peppard & Ward, 2004)(Peppard, Lambert, & Edwards, 2000)
	V_{14}	IS prioritization strategy	To prioritize technology investments and to balance information technology demand and resource requirements to maximum return from investments	(Chen & Wu, 2011)(Miller, Bräutigam, & Stefani, 2006)(Peppard & Ward, 2004)(Peppard, Lambert, & Edwards, 2000)
	V_{15}	Sourcing strategy	To stablish criteria and processes to evaluate the cost-benefit of supply options and contracts with suppliers, to outsourcing IT services, and custom designed applications	(Caldeira, & Dhillon, 2010)(Feeny, & Willcocks, 1998)(Willycocks, Feeny, & Olson, 2006)
Facilitating Resources	V_{16}	Funding for acquiring BI tools and building related systems	To provide and anticipate required funding to develop an enhanced use of the systems	(Chen & Wu, 2011)
	V_{17}	Funding for building and maintaining an analytical data environment	Funding for maintaining or improving systems' response time and the level of IT service delivery and funding for improving data quality and availability	(Chen & Wu, 2011) (Agostino, Solberg Søilen, & Gerritsen, 2013)
	V_{18}	Select , evaluate, and manage (especially IT) staff	To recruit an individual who was involved in BI projects and evaluate their technical skills	(Caldeira, & Dhillon, 2010)(Miller, Bräutigam, & Stefani, 2006)(Peppard & Ward, 2004)(Peppard, Lambert, & Edwards, 2000) (Amara, Solberg Søilen, & Vriens, 2012)
	V_{19}	Ongoing IT training	To develop staff skills to use computers and software applications and to deploy their skills to ensure technical, business and personal skills meet the needs of the organization	(Caldeira, & Dhillon, 2010)(Chen & Wu, 2011)(Peppard & Ward, 2004)(Peppard, Lambert, & Edwards, 2000)