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ABSTRACT Though many organizations have turned to developing and using business intelligence systems, not all have been successful in implementing such systems. These systems have social-technical dimensions with many elements and are very complicated. Numerous studies have been carried out on implementation and employment of business intelligence, but in the past studies only specific aspects and dimensions have been addressed. The aim of this study is to identify key factors in the implementation process of business intelligence in the Iranian banking industry. The present research is objectively applied as a survey study in implementation strategy. Also it is a descriptive study in terms of the research plan and data collection where two documentary and field study methods have been used for collecting data. The statistical population of this study comprises experts and professionals in information technology who are active in implementing solutions for business intelligence in the banking industry of Iran. In this study, 16 people were chosen based on non-random judgment sampling combined with targeted and snowball sampling as a statistical sample and their viewpoints were extracted and refined using the Fuzzy Delphi Technique. First through studying past research records and reviewing literature of effective factors in implementing business intelligence process, 37 factors were identified. Then by implementing five rounds of the Fuzzy Delphi Technique, 39 factors were confirmed as significant among 37 factors affecting the business intelligence implementation process in past studies and 10 factors proposed by experts. Also, these 39 factors were classified in nine main groups including organizational, human, data quality, environmental, system ability, strategic, service quality, technical infrastructure, and managerial factors. Managers and executives of business intelligence projects in Iran's banking industry can achieve the given objectives and results by considering such significant factors in planning and taking measures related to effective implementation of business intelligence.

KEYWORDS Banking industry, business intelligence, fuzzy Delphi technique, implementing business intelligence, key factors

1. INTRODUCTION

In recent years, business intelligence technologies have become a significant concept in information systems management, mixed with progressive organization culture and placed in the forefront of information technologies in supporting decision making. In

order to have a quick reaction to the market changes, organizations need managerial information systems to make different causal analyses about an organization and its environment. Meanwhile, business intelligence systems, which are the most complicated information systems, provide a tool based on which information needs of the organization are properly fulfilled. In fact, business intelligence systems provide updated, reliable and sufficient trade information making it possible to deduct and understand concepts lying in trade information through process of discovery and analysis (Azoff and Charlesworth 2004).

Gartner (2009), a leading company in business analysis, carried out research on 1500 information senior managers throughout the world and identified business intelligence as the first priority of technology. Thus, implementation and establishment of business intelligence systems have turned into a major priority for organizations' information senior managers (Yeoh and Koronios 2010). But implementation of business intelligence systems, like other organizational solutions for information technology, had different results in different companies. Some organizations have reported that their business intelligence systems have been successful while others reported that they failed in its implementation (Sangar and Iahad 2013). In fact today many organizations have adopted business intelligence systems for improving decision making process, however, not all implementations have been successful despite being used by so many organizations (Zare-Ravasan and Rabiee 2014).

Implementation of information systems at organization level has been a vital step that can lead to disorder and problems in the organization, especially regarding implementation of business intelligence systems where there are more complications and problems since such systems relate to decision making, which is a complex and abstract task influenced by an environment's potential and condition. Implementing a business intelligence system requires diverse infrastructure and is financially considered to be an expensive project implemented throughout an organization. Research shows that about 50-70 percent of business intelligence projects fail at the stage of implementation (Taqwa and Noori 2014). In fact, implementing business intelligence technology is often accompanied by much suffering of failures leading to waste of time and resources (Bargshady et al. 2014). Thus, while the market for business intelligence seems turbulent, establishment of business intelligence systems is complicated and expensive. Generally, development and implementation of business intelligence has high risks and hazards for organizations (Farrokhi and Pokoradi 2012). Therefore, despite the fact that implementing business intelligence has become a major priority for organizations' information senior managers, not all have been successful in its implementation (Yeoh and Koronios 2010).

Though most studies have been carried out on information systems to increase the understanding of information technology implementation and evaluate information technology, involvement in improving organizational performance and effectiveness, the majority of these studies consider implementation to be one of the general phases of technology transfer while for successful implementation it is required that each phase is considered and their activities are taken into account (Lai and Mahapatra 1997). Based on studies on business intelligence literature, different studies have been carried out on different fields including: vital factors of implementation success (Zare Ravasan and Rabiee 2014; Hwang et al. 2004; Yeoh and Koronios 2010; Ariachandra and Watson 2006; Olsak and Ziemba 2012; Yeoh and Popovic 2015; Hawking 2013; Vodapali, 2009), application and implementation of business intelligence (Ramarkrishnan et al. 2012; Popvic et al. 2012; Seah et al. 2010; Boyer et al. 2010; Wixom and Watson 2001; Grubljesic, 2014; Doodly 2015; Chasalow 2009), system performance (Lin et al. 2009), business intelligence system adoption (Ramamurty et al. 2008; Hwang et al. 2004), capabilities and applications of business intelligence (Isik et al. 2013; Moro et al. 2015; Isik et al. 2011), intelligence maturity (Najmi et al. 2010; Popovic et al. 2009), implementation readiness factors (Bagshady et al. 2014; Anjariny et al. 2012), and performance evaluation (Lin et al. 2009; Rouhani et al. 2012). But in each of these studies, implementation and establishment of business intelligence process has been examined in a different dimension, angle and aspect. In fact, in these studies, business intelligence implementation has not been inclusively examined by a systemic and holistic approach. Thus, the present study examines factors affecting the implementation process of

business intelligence based on process theory and approach. Therefore, it has identified and classified factors through studying related literature and considering factors affecting the implementation process of business intelligence such as organization readiness, system design and development, project management, system adoption, system abilities and intelligence maturity in the Iranian banking industry environment. In fact, the main problem in this study is to identify key effective factors in the implementation process of business intelligence in the banking industry of Iran.

2. RESEARCH: THEORETICAL PRINCIPLES AND BACKGROUND

In this section, given the subject, problem and methodology, the literature and research history including business intelligence, business intelligence in the banking industry, factors affecting business intelligence implementation, Delphi method and fuzzy sets are reviewed.

2.1 Business intelligence

Business intelligence is an umbrella term introduced by Howard Dresner of Gartner group in 1989 as a series of concepts and methods which, using fact-based computer systems, lead to improved decision making (Rouhani et al. 2012). Business intelligence is a comprehensive concept through which the whole organization decides to use information systems in the most effective manner in order to acquire timely and high quality information for decision making so that competitive advantages are created (Hocevar and Jaklic 2010). In the age of information explosion and information system formation and development in organizations, insular or integrated, the appropriate use and report making of information is an inevitable necessity. Thus, due to competitive economy and business, making organizational data meaningful and facilitating decision making process has been at the center of attention of experts in information technology and management science and business professionals (Howson 2008). Since the introduction of business intelligence, information systems have witnessed fast growth of systems and decision support software applications, as well as business intelligence systems, while organizations started moving toward a business intelligent environment to have a single image of reality through organizational data presented by the integrated architecture (Isik 2010).

Companies have increasingly recognized the significance of information technology as an enabler to achieve their own strategic objective. Regarding this, the concept of using information systems to support decision making has been companies' objective since the introduction of business based computer technologies. One information system with a specific purpose is named the "decision support system". Decision support systems are responsible for providing timely, related information with analytical abilities for managers' effective decision making. With increased demands for information systems for supporting decision making terms have been used such as data warehouse, knowledge management, data mining, participation systems, online analytical processing and finally business intelligence systems, which covers all of the preceding terms (Hawking 2013). Business intelligence systems are an integrated collection of tools, technology and programmed products used for collecting, integrating, analyzing, and accessing data. In simple words, the main tasks of business intelligence systems include intelligent exploration, integration, storage and multi-dimensional analysis of data taken from different information sources (Olszak and Ziemba 2007).

2.2 Business intelligence in the banking industry

Banking is a dynamic market with changing customer demands, intense competition, a need for strict control and management of risk. These are only some of the business environment features where modern banks do their operations. Better decision making management and processes in such a market determine the success or failure of banks. Thus, it is important to use business intelligence solutions in banks to provide decision makers with information sources in all of the bank's business sections in order to take action for solving problems and to have timely, high quality decision making (Erfani 2013). In fact banks need related and timely information to adapt to the new challenges of the complicated dynamic environment. To do so, banks collect data from different inside and outside sources while business intelligent tools lead to intelligent decision making using information technologies such as online analysis and data mining in the complicated

banking environment. Implementation of business intelligence systems in banks begins with collection, improvement and refinement of daily operational data from inside and outside sources while more low-cost data help banks use business intelligence possibilities to boost their relationship with customers, attract potential customers, and increase growth. In fact, business intelligence effectively relates business strategy to information technology to make use of the present infrastructure of information technology and skills (Curko and Bach 2007).

Banking is an arena where plenty of data is produced, thus, business intelligence applications can potentially benefit banks and increase the validity of this study. On the whole, banking has been significant as an active industry in adopting innovations related to information systems and technologies so that banking areas such as credit evaluation, branches' performance, electronic banking, and customer retention and classification have excelled in widely applied concepts of business intelligence and data mining techniques, data warehouse, and decision support systems (Moro et al. 2015).

2.3 Factors affecting business intelligence implementation

Implementing business intelligence systems can be very complicated. In addition to common problems in implementing information systems, there are other complicated problems such as integration, security, system scalability, managing the data warehouse, analysis tools and dashboards. Generally there are many problems regarding business intelligence implementation, the most significant of which include: system development and need for integration, profit and cost and its justification, confidentiality and legal problems, present and future of business intelligence, business process management, documentation and security of support systems, and moralities in failure of business intelligence projects (Turban et al. 2011). The costly and difficult project of business intelligence is distinct from other information technology projects in some fundamental aspects. The key distinctions identified between business intelligence projects and other information technology projects include: 1) these projects are business based, 2) support of business and information technology analysts is required in such projects, 3) the perfect definition of project requirements is impossible, 4) project management requires different approaches, 5) implementing solutions of business intelligence is the beginning of the work thus, broad tests are needed for system assessment, 6) due to the connection of users to project tools, changing management styles is vital, and 8) establishment of business intelligence in organizations is a program rather than a project (Analytics 2010).

Moss and Atre (2003) suggested that 60% of business intelligence projects have failed due to inappropriate planning, weak project management, non-fulfillment of business requirements, undefined tasks, undesirable data, not understanding the significance of some parameters such as meta data, and those that have been implemented were of low quality (Moss and Atre 2003). In general, many business intelligence application programs have failed due to infrastructure, cultural, organizational and technical problems. Also, many business intelligence solutions have failed due to the final users' lack of access and not effectively meeting the final users' needs. Business intelligence projects have also failed due to not considering activities at the organizational level, non-commitment of business supporters, disinclination or lack of access of business representatives, lack of skillful and trained staff, lack of business activity analyses, lack of understanding of the impact of acquired information on business profitability, and lack of using information by users and staff (Chuah and Wong 2013).

As a whole it can be said that organizations implement decision making support systems to improve and deliver information required by decision makers and to support decision making activities. But results of studies indicate that all these systems are not successfully implemented, and predicted interests are not always realized. Thus, it is not surprising that business researchers and experts have become sensitive about determining key factors affecting implementation (Hartono et al. 2007). In this regard, it is said that the interventions to improve the success of information technology implementation is rooted in behavioral science, which using theories and models determines conditions and factors effective in its successful use (Kukafka et al. 2003). Also, in the past decades, contingency theory has become a stabilized basis in information systems and seven success variables in information systems have been determined as basic factors

including size, environment, strategy, structure, technology, duty and individual characteristics. Size refers to the volume indices, such as the number of employees or amount of income. Environment refers to the space around the system such as related industries. Strategy refers to the information property and quality of explaining the company's strategy. Structure refers to an organization's proportion to information system structure. Technology refers to the type of technology or complication of the implemented technology. Duty refers to various activities and their features, and finally individual characteristics refers to individual differences and their proportion to information system activities (Raber et al. 2013).

In general, in this study with regard to business intelligence system implementation as a process, it can be noted that choosing appropriate methodology for the system development, project team formation, project correct management and development requirement identification are topics raised in the system implementation stage. Success of the implementation stage depends on previous stages. When pre-implementation actions are fully done and there is enough readiness, the design and implementation stage begins. Post-implementation actions for business intelligence systems are summarized in topics such as business intelligence maturity, continuous improvement, performance management, and profitability of business intelligence. This stage indicates that system implementation in the organization is not periodical (Taqwa and Noori 2014). Thus, effective factors in implementing process of business intelligence include different factors in the implementing stage such as an organization's readiness, designing and methodology of development, project management, performance assessment and system maturity, system adoption, system capabilities, business and beneficiaries needs, and environmental factors. Therefore, in the present study, effective factors in implementing processes of business intelligence are reviewed through deep examination of the theoretical and empirical history related to the aforementioned dimensions and aspects. Based on this study's results, a list of factors affecting implementation of the process of business intelligence with the most popularity in the literature and research background is presented in Table 1.

Table 1 List of factors affecting the business intelligence implementation process.

Factors		References
F1	Flexible and extensible technical infrastructure	(Ansari et al. 2014) ; (Olbrich et al. 2012) ; (Yeoh and Koronios 2010) ; (Bargshady et al. 2014) ; (Vodapall 2009) ; (Anjariny et al. 2012) ; (Sangar and lahad 2013) ; (Yeoh et al . 2008) ; (Watson and Wixom 2007)
F2	Clear vision and objectives for business intelligence	(Bargshady et al. 2014) ; (Zare Ravasan and Rabiee 2014) ; (Ansari et al. 2014) ; (Hoseini et al. 2015) ; (Raisivanani and Ganjalikhan Hakemi 2015) ; (Yeoh and Koronios 2010) ; (Vodapall 2009) ; (Anjariny et al. 2012) ; (Sangar and lahad 2013) ; (Yeoh et al. 2008) ; (Dawson and Van Belle 2013)
F3	Planning and effective project management	(Bargshady et al. 2014) ; (Zare Ravasan and Rabiee 2014) ; (Hoseini et al. 2015) ; (Raisivanani and Ganjalikhan Hakemi 2015) ; (Hawking 2013) ; (Vodapall 2009) ; (Anjariny et al. 2012) ; (Sangar and lahad 2013) ; (Yeoh et al . 2008) ; (Ojeda and Ramaswamy 2014) ; (Ojeda-Castro et al. 2011) ; (Mungree et al. 2013)
F4	Senior manager's commitment and support	(Bargshady et al. 2014) ; (Piri,2014) ; (Zare Ravasan and Rabiee 2014) ; (Ansari et al. 2014) ; (Hoseini et al. 2015) ; (Ramamurthy et al. 2008) ; (Hawking 2013) ; (Grubljesic 2014) ; (Olbrich et al. 2012) ; (Yeoh and Koronios 2010) ; (Vodapall 2009) ; (Anjariny et al. 2012) ; (Wixom and Watson 2001) ; (Hwang et el. 2004) ; (Seah et al. 2010) ; (Sangar and lahad 2013) ; (Dawson and Van Belle 2013) ; (Yeoh et al. 2008) ; (Foshay and kuziemsky 2014) ; (Yeoh and Koronios 2010) ; (Howson 2008) ; (Watson and Wixom 2007)
F5	Usefulness and easy use of business intelligence system	(Haqiqatmonfared and Rezaei 2011) ; (Ramamurthy et al. 2008) ; (Grubljesic 2014) ; (Anjariny et al. 2012) ; (Sangar and lahad 2013) ; (Almabhoud and Ahmad 2010) ; (Dawson and Van Belle 2013)
F6	The flexibility and speed of response to changes in the business intelligence system	(Ronaqi and Feizi 2013) ; (Zare Ravasan and Rabiee 2014) ; (Hoseini et al. 2015) ; (Haqiqatmonfared and Rezaei 2011) ; (Ronaqi et al. 2014) ; (Raisivanani and Ganjalikhan Hakemi 2015) ; (Dooley 2015) ; (Yeoh and Koronios 2010) ; (Isik et al. 2011) ; (Sangar and lahad 2013) ; (Almabhoud and Ahmad 2010) ; (Dinter et al. 2011) ; (Howson 2008)
F7	Strong and suitable framework for data governance and quality	(Raisivanani and Ganjalikhan Hakemi 2015) ; (Hawking,2013) ; (Yeoh et l. 2008)
F8	User training	(Babamoradi 2012) ; (Zare Ravasan and Rabiee 2014) ; (Ansari et al. 2014) ; (Hoseini et al. 2015) ; (Raisivanani and Ganjalikhan Hakemi 2015) ; (Hawking 2013) ; (Grubljesic 2014) ; (Vodapall 2009) ; (Anjariny et al. 2012) ; (Sangar and lahad 2013) ; (Almabhoud and Ahmad 2010)

F9	User support	(Zare Ravasan and Rabiee 2014) ; (Ronaqi and Feizi 2013) ; (Ansari et al. 2014) ; (Hoseini et al. 2015) ; (Boyer et al. 2010) ; (Vodapall 2009) ; (Almabhoud and Ahmad 2010)
F10	Project leader and championship to lead and facilitate participation	(Hawking 2013); (Seah et al. 2010); (Chasalow 2009); (Ansari et al. 2014); (Hwang et el. 2004) ; (Yeoh et al. 2008) ; (Grubljesic 2014)
F11	Organization's ability to provide sufficient resources	(Piri 2014) ; (Zare Ravasan and Rabiee 2014) ; (Ansari et al. 2014) ; (Hoseini et al. 2015) ; (Raisivanani and Ganjalikhan Hakemi 2015) ; (Hawking 2013) ; (Grubljesic 2014) ; (Olbrich et al. 2012) ; (Anjariny et al. 2012) ; (Wixom and Watson 2001) ; (Watson and Wixom 2007) ; (Brooks et al. 2015)
F12	Integration capability of business intelligence system	(Nazari 2014); (Rouhani et al. 2012) ; (Ronaqi and Feizi 2013) ; (Ansari et al. 2014) ; (Haqiqatmonfared and Rrezaei, 2011) ; (Ronaqi et al., 2014) ; (Isik et al. 2013) ; (Dooley 2015) ; (Mahlouji 2014) ; (Yeoh and Koronios 2010) ; ; (Isik et al. 2011) ; (Vodapall 2009)
F13	Analysis capability of business intelligence system	(Najmi et at. 2010) ; (Ronaqi and Feizi 2013) ; (Hoseini et al. 2015) ; (Ronaqi et al.,2014) ; (Mahlouji 2014)
F14	Role of organizational communications	(Babamoradi 2012) ; (Olbrich et al. 2012) ; (Almabhoud and Ahmad 2010)
F15	Level of automation and maturity of organizational processes	(Ansari et al. 2014) ; (Hawking 2013) ; (Olbrich et al. 2012) ; (Grubljesic 2014) ; (Brooks et al. 2015)
F16	Involvement of end users	(Piri 2014); (Zare Ravasan and Rabiee 2014); (Hoseini et al. 2015); (Haqiqatmonfared and Rezaei 2011); (Raisivanani and Ganjalikhan Hakemi 2015); (Hawking 2013); (Grubljesic 2014); (Olbrich et al. 2012) ; (Vodapall 2009); (Anjariny et al. 2012); (Sangar and lahad 2013); (Dawson and Van Belle 2013) ; (Lupu et al. 2007); (Watson and Wixom 2007)
F17	Interaction and collaboration between business and information technology units	(Zare Ravasan and Rabiee 2014); (Ansari et al. 2014); (Khodaei and Karimzadehgan Moqadam 2014); (Vodapall 2009); (Thamir and polis 2015); (Dinter et al. 2011) ; (Williams and Williams 2004)
F18	Culture of continuous process improvement	(Khodaei and Karimzadehgan Moqadam 2014) ; (Lonnqvist and Pirttimaki 2006) ; (Williams and Williams 2004)
F19	Engineering culture of decision making process	(Khodaei and Karimzadehgan Moqadam 2014) ; (Popvic et al. 2012) ; (Williams and Williams 2004)
F20	Culture of using information and analytics	(Najmi et at. 2010) ; (Khodaei and Karimzadehgan Moqadam 2014) ; (Popvic et al. 2012) ; (Grubljesic 2014) ; (Chasalow 2009) ; (Foshay and kuziemsky 2014) ; (Lonnqvist and Pirttimaki 2006)
F21	The use of iterative development approaches in business intelligence projects	(Ansari et al. 2014) ; (Raisivanani and Ganjalikhan Hakemi 2015) ; (Hawking, 2013) ; (Grubljesic 2014) ; (Derarpalli 2013) ; (Yeoh and Koronios 2010) ; (Anjariny et al. 2012) ; (Castra and Ramaswamy 2014) ; (Howson 2008)
F22	The alignment of business intelligence strategy with organization's strategy	(Zare Ravasan and Rabiee 2014) ; (Khodaei and Karimzadehgan Moqadam 2014) ; (Hawking 2013) ; (Boyer et al. 2010) ; (Yeoh and Koronios 2010) ; (Dinter et al. 2011) ; (Tarokh and Mohajeri 2012) ; (Esmaeili 2015) ; (Mungree et al. 2013) ; (Williams and Williams 2004)
F23	Laws and regulations related to business requirements and limitations	(Ramarkrishnan et al. 2012) ; (Olbrich et al. 2012) ; (Sangar and lahad 2013)
F24	Quality and reliability of data resources	(Olbrich et al. 2012) ; (Isik et al. 2011) ; (Vodapall 2009) ; (Anjariny et al. 2012) ; (Wixom and Watson 2001) ; (Almabhoud and Ahmad 2010); (Dawson and Van Belle 2013) ; (Ansari et al. 2014) ; (Thamir and polis 2015)
F25	Sharing and presentation of Information	(Dooley 2015) ; (Hawking 2013) ; (Popvic et al. 2012)
F26	Choosing technology and tools appropriate to organization's conditions	(Zare Ravasan and Rabiee 2014) ; (Hawking 2013) ; (Grubljesic 2014) ; (Vodapall 2009) ; (Wixom and Watson 2001) ; (Sangar and lahad, 2013) ; (Castra and Ramaswamy 2014) ; (Ojeda-Castro et al. 2011)
F27	Effective change of management	(Zare Ravasan and Rabiee 2014) ; (Ansari et al. 2014) ; (Hawking 2013) ; (Yeoh and Koronios 2010) ; (Vodapall 2009) ; (Almabhoud and Ahmad 2010) ; (Olsak and Ziemba 2012) ; (Williams and Williams 2004)
F28	Using outside consultants	(Raisivanani and Ganjalikhan Hakemi 2015) ; (Hawking 2013) ; (Anjariny et al. 2012) ; (Yeoh et al. 2008) ; (Yeoh and Koronios 2010) ; (Sangar and lahad 2013)
F29	Interaction with vendors and choosing suitable suppliers	(Hawking 2013) ; (Sangar and lahad 2013)
F30	Balanced and strong combination of project team	(Ansari et al. 2014) ; (Hoseini et al. 2015) ; (Olbrich et al. 2012) ; (Yeoh and Koronios 2010) ; (Vodapall 2009) ; (Anjariny et al. 2012) ; (Yeoh et al. 2010) ; (Almabhoud and Ahmad 2010) ; (Ojeda - Castro and Ramaswamy 2014) ; (Ojeda - Castro et al. 2011)
F31	Competition setting in business	(Grubljesic 2014); (Olbrich et al. 2012); (Yeoh and Koronios 2010); (Hwang et el. 2004)
F32	Skills of information technology, business and analytical	(Hawking 2013); (Foshay and kuziemsky 2014); (Sangar and lahad 2013); (Friedman et al. 2003); (Cuza 2009); (Watson and Wixom 2007); (Tabarsa and Nazari poor 2014); (Olbrich et al. 2012)
F33	Quality of access to information	(Ronaqi and Ronaqi 2014); (Popvic et al. 2012); (Dooley 2015); (Isik et al. 2011); (Isik et al. 2013)
F34	Quality of information content	(Ronaqi and Ronaqi 2014); (Popvic et al. 2012); (Dooley 2015); (Lin et al. 2009)
F35	The precision, accuracy, and perfectness of data	(Ansari et al.,2014); (Hoseini et al. 2015); (Sangar and lahad 2013); (Almabhoud and Ahmad 2010)
F36	User friendliness and easy learning of business intelligence tools	(Hoseini et al. 2015); (Raisivanani and Ganjalikhan Hakemi 2015); (Sangar and lahad 2013)
F37	Precision of information at system output	(Haqiqatmonfared and Rezaei, 2011); (Dooley, 2015); (Isik et al., 2011); (Sangar and lahad 2013)

2.4 An overview of the Delphi method

The Delphi technique is one of the qualitative research methods used for reaching consensus in group decision making. Practically, the Delphi method is a series of questionnaires or consecutive rounds with controlled feedback attempting to reach consensus among a group of experts on a particular subject (Hasson and Mckenna 2000). This method relies on the supposition that consensus among experts is stronger than individual viewpoints. Thus, unlike survey research methods, the Delphi method's credit depends not only on the number of participants but on the scientific credit of expert participants. Thus, a number of participants between 5 and 20 would be enough (Rowe 2001).

The classic Delphi technique has always suffered low convergence of experts' opinions, high implementation cost and potential exclusion of some individuals' viewpoints. Thus, the traditional Delphi method concept of integration with Fuzzy theory was raised and in this regard, fuzzy Delphi method was invented by Kaufman and Gopta in 1990s (Cheng and Yin 2002; Hsu and Yang 2000). The Fuzzy Delphi method application for decision making and consensus on problems where parameters and objectives are not defined leads to valuable results. The significant feature of this method is presenting a flexible framework covering many obstacles related to imprecision and inaccuracy. Many problems in decision makings are related to imperfect and inaccurate information. On the other hand, decisions taken by experts are based on their individual qualification and are strongly subjective. Thus it is better for the data to be displayed by fuzzy numbers rather than definite numbers. The Fuzzy Delphi method's implementation rounds in fact is a combination of Delphi method implementation and analyses of information using definitions of fuzzy sets theory (Toy and Garai 2012).

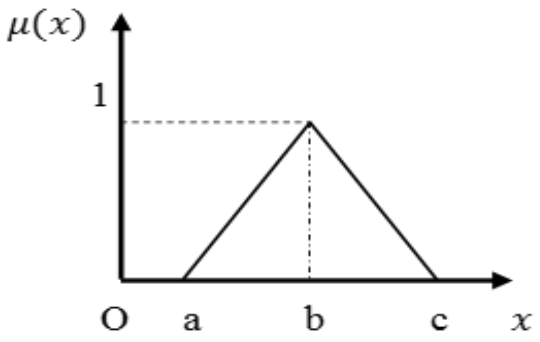

Figure 1 Triangular fuzzy number.

2.5 Fuzzy sets

In order to deal with the vagueness of human thought, Zadeh (1965) first introduced the fuzzy set theory. A fuzzy set is a class of objects with a continuum of grades of membership. Such a set is characterized by a membership function which assigns to each object a grade of membership ranging between zero and one. Fuzzy sets and fuzzy logic are powerful mathematical tools for modeling. Fuzzy sets theory provides a wider frame than classic sets theory, and this has contributed to its capability of reflecting the real world. Modeling using fuzzy sets has proven to be an effective way for formulating decision problems where the information available is subjective and imprecise (Kahraman et al. 2003b). It is possible to use different fuzzy numbers according to the situation. In applications, it is often convenient to work with triangular fuzzy numbers (TFNs) because of their computational simplicity; moreover, they are useful in promoting representation and information processing in a fuzzy environment. Therefore, in this paper, we use triangular fuzzy numbers. Triangular fuzzy numbers are a special kind of fuzzy set. A triangular fuzzy number can be denoted as: N = (a, b, c). Figure 1 is an illustration of the membership function of a triangular fuzzy number.

The membership function of triangular fuzzy numbers is:

$$\mu(x) = \begin{cases} \frac{x-a}{b-a} & \text{if} \quad a \le x \le b\,; \\ \frac{c-x}{c-b} & \text{if} \quad b \le x \le c; \\ 0 & \text{else} \end{cases}$$

Particularly, when a = b = c, triangular fuzzy numbers become crisp numbers.

That is, crisp numbers can be considered to be a special case of fuzzy numbers (Daghighi Masouleh et al. 2014). In this paper, after the data were collected, the fuzzy triangular numbers were converted into absolute fuzzy numbers by means of Minkowski.

3. RESEARCH METHODOLOGY

Since the results of the present study have the potential of being applied to planning and actions taken to implement business intelligence in the banking industry of Iran, this study is applied objective research and a survey in implementation strategy. Also, based on the research plan and method of data collecting, it is a descriptive study which uses two methods of documentary and field studies for collecting information. The statistical population of this study comprises experts and professionals in the field of information technology who are active in implementing solutions for business intelligence in Iran's banking industry. In the present study, 16 people were chosen in a nonrandom judgment sampling combined with targeted and snowball samplings as a statistical sample. Using the fuzzy Delphi method their opinions were extracted and refined. Experts' information was collected using a questionnaire so that each expert using the fuzzy approach expressed his/her opinion on the level of significance of factors affecting business intelligence implementation as well as on how to classify such factors in Liker fivefold spectrum and through verbal variables (very low, low, average, high and very high).

Following the initial framework preparation resulting from the research literature review, a questionnaire was set and designed. Then, 6 experts' opinions were used to evaluate the questionnaire. They were university professors and experts in information technology. Thus following the review of the questionnaire by these experts, their proposed ideas were exerted. Also given the fact that their factors and dimensions have been verified by experts using the Delphi technique, nominal and content validity of the measuring tool was confirmed by experts with a high score. To determine the questionnaire's reliability, the Cronbach alpha method was used with an alpha coefficient of 0.91 obtained for the questionnaire indicating an acceptable reliability.

3.1 Research implementation process

In this study, first a recognition of the present condition of this field was attained through examining the past research history. Then the research literature background related to factors affecting the implementation process of business intelligence was closely reviewed. As a result of this review, 37 factors affecting the implementation process were identified that are shown in Table 1. Then, using the initial framework of factors and running five rounds of the fuzzy Delphi technique, key factors affecting the implementation process of business intelligence in the Iranian banking industry were identified then classified. The method for running the fuzzy Delphi technique in the present study is explained in the following.

As pointed out, the Delphi panel members in this study were chosen in a non-random sampling and a combination of targeted (judgment) and chain (snowball) methods. In order to select experts and professionals, criteria such as sufficient knowledge and experience on the subject, inclination and enough time for cooperation in the research, and effective communication skills were considered, based on which 16 people were nominated as qualified by researchers for this study. These people were involved in implementing solutions, and plans and projects of business intelligence in the Iranian banking industry. The demographic situation and features of the Delphi panel experts in this study is presented in Table 2.

Table 2 Frequency distribution and percentage of respondents based on demographic characteristics.

	Activity background			Education			Age				Sex	
	+10 yrs	6-10 yrs	-5 yrs	PhD	Master	Bachelor	+45	36-45	26-35	-25	F	M
Frequency	2	9	5	8	5	3	4	5	6	1	5	11
Percent	12.5	56.25	31.25	50	31.25	18.75	25	31.25	37.5	6.25	31	69

In this study all experts expressed their opinions through a questionnaire on the significance and classification of factors affecting the implementation process of business intelligence on a Likert fivefold spectrum and trough verbal variables (very low, low, average, high and very high) using a fuzzy approach. Given Table 3 and Figure 2, the mentioned factors and variables are defined as triangular fuzzy number (Mousavi et al. 2015; Mirsepasi et al. 2013; Cheng and Lin 2002; Daghighi Masouleh et al. 2014). In the present study, absolute fuzzy numbers (χ) in Table 3 are calculated using a Minkowski equation as the equation (1) .

$$\chi = m + \frac{\beta - \alpha}{4}$$

Equation 1

In the above formula (α) is expressed as the lower limit (bound), (β) is expressed as the upper limit (bound) and (m) is the biggest membership degree. Also, each variable in the rounds of the fuzzy Delphi technique was obtained using equations (2) and (3):

$$A_i = \left(a_1{}^{(i)}, a_2{}^{(i)}, a_3{}^{(i)}\right), \qquad i = 1,2,3, \dots, n$$

Equation 2

$$A_{ave=}(m_1, m_2, m_3) = \left(\frac{1}{n}\sum_{i=1}^{n} a1^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a2^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a3^{(i)}\right)$$

Equation 3

Where A_i stands for the expert's opinion, ith and A_{ave} stand for the experts' opinion fuzzy mean. In this study, if in running Delphi technique rounds, the difference of opinions between experts ($\chi_i - \chi_j$) on the rate of significance and/or their agreement on their classification is lower than 0.1, consensus is reached and the opinion poll process stops (Cheng and Lin 2002). It is noteworthy that conditions for reaching consensus in the Delphi method are determined by the experts of the research and there isn't any particular rule for that, but the higher the number of procedures and the stricter the consensus condition, the more valid the Delphi results are (Fink 1984). Also to screen improper factors, a threshold must be chosen. Usually, the threshold is determined by the experts' subjective deduction and there is no general way or rule for determining that value. Threshold values affect the number of factors to be screened. Thus, given the objective of this study for identifying key factors affecting the implementation of business intelligence, threshold value for accepting factors was determined to be 0.75, i.e. equal to crisp value "high" for verbal variables in Table 2. In fact, in case of expert consensus, if the experts' final opinions mean (χ_j) on the rate of significance of factors and /or classification of factors reaches 0.75, then that factor is considered to be significant and/or the factors' classification is approved by experts. But if the experts' final opinions mean is lower than 0.75, then that factor is not considered to be significant and/or the factors' classification is rejected by them.

Table 3 Triangular fuzzy numbers of verbal variables.

Linguistic variables	Symbols	Fuzzy triangular numbers (m , α ,β)	Absolute fuzzy numbers (χ)
Very high	VH	(1, 0.25 , 0)	0.9375
High	H	(0.75, 0.15, 0.15)	0.75
Medium	M	(0.5, 0.25, 0.25)	0.5
Low	L	(0.25, 0.15, 0.15)	0.25
Very low	VL	(0, 0 , 0.25)	0.0625

Table 4 Mean expert opinions on the significance of factors affecting implementation of business intelligence in the first round of the opinion poll.

Factors	Triangular fuzzy mean (m,α, β)			Factors	Triangular fuzzy mean (m,α, β)			Factors	Triangular fuzzy mean (m,α, β)		
F	m	α	β	F	m	α	β	F	m	α	β
F1	0.86	0.21	0.07	F14	0.61	0.22	0.20	F27	0.63	0.19	0.19
F2	0.77	0.19	0.12	F15	0.64	0.21	0.19	F28	0.48	0.20	0.22
F3	0.78	0.20	0.11	F16	0.66	0.18	0.16	F29	0.53	0.21	0.21
F4	0.81	0.20	0.08	F17	0.73	0.20	0.14	F30	0.72	0.23	0.15
F5	0.67	0.19	0.18	F18	0.75	0.21	0.13	F31	0.58	0.22	0.19
F6	0.77	0.21	0.13	F19	0.72	0.18	0.16	F32	0.77	0.19	0.12
F7	0.64	0.23	0.17	F20	0.77	0.19	0.15	F33	0.69	0.18	0.15
F8	0.64	0.19	0.18	F21	0.58	0.19	0.19	F34	0.78	0.19	0.12
F9	0.53	0.21	0.21	F22	0.78	0.19	0.13	F35	0.80	0.18	0.11
F10	0.67	0.21	0.18	F23	0.61	0.21	0.21	F36	0.73	0.18	0.14
F11	0.78	0.23	0.10	F24	0.81	0.20	0.11	F37	0.80	0.19	0.11
F12	0.80	0.21	0.11	F25	0.61	0.22	0.20				
F13	0.78	0.20	0.11	F26	0.70	0.17	0.17				

Table 5 New factors proposed by experts in the first round.

Proposed factors affecting the implementation process of business intelligence in the Iranian banking industry	
F38	Standardization of technical infrastructure in the bank
F39	Senior managers' risk taking in modern technologies investment
F40	Quality of data extract, transformation, and loading process
F41	Appropriate architecture for business intelligence system
F42	Level of security in the business intelligence system
F43	Business intelligence technology compatibility with existing technologies
F44	Data integrity and consistency of data sources
F45	The use of project risk management
F46	Tendency of managers to adopt information technology innovations
F47	Set up business intelligence strategy

Table 6 Mean expert opinions on significance of factors affecting implementation of business intelligence in the second round of the opinion poll.

Factors	Triangular fuzzy mean (m,α, ß)			Factors	Triangular fuzzy mean (m,α, ß)			Factors	Triangular fuzzy mean (m,α, ß)		
F	m	α	ß	F	m	α	ß	F	m	α	ß
F1	0.89	0.20	0.07	F17	0.81	0.19	0.08	F33	0.77	0.16	0.13
F2	0.84	0.18	0.09	F18	0.88	0.20	0.07	F34	0.80	0.19	0.12
F3	0.86	0.19	0.08	F19	0.81	0.18	0.11	F35	0.86	0.19	0.08
F4	0.88	0.21	0.06	F20	0.80	0.18	0.12	F36	0.77	0.17	0.13
F5	0.70	0.18	0.17	F21	0.66	0.19	0.19	F37	0.84	0.19	0.08
F6	0.81	0.19	0.10	F22	0.86	0.19	0.08	F38	0.53	0.20	0.20
F7	0.75	0.18	0.14	F23	0.75	0.16	0.15	F39	0.73	0.19	0.15
F8	0.77	0.17	0.14	F24	0.88	0.20	0.08	F40	0.81	0.20	0.11
F9	0.64	0.19	0.19	F25	0.64	0.19	0.19	F41	0.72	0.19	0.16
F10	0.77	0.17	0.14	F26	0.86	0.19	0.08	F42	0.77	0.21	0.13
F11	0.81	0.21	0.10	F27	0.75	0.15	0.15	F43	0.67	0.21	0.18
F12	0.84	0.20	0.09	F28	0.66	0.19	0.19	F44	0.77	0.19	0.13
F13	0.80	0.19	0.12	F29	0.67	0.18	0.18	F45	0.70	0.21	0.16
F14	0.64	0.21	0.19	F30	0.81	0.19	0.11	F46	0.50	0.20	0.21
F15	0.66	0.19	0.19	F31	0.73	0.17	0.15	F47	0.80	0.19	0.12
F16	0.78	0.19	0.13	F32	0.80	0.19	0.11				

Table 7 Experts' difference of opinions on effective factors significance in the first and second rounds.

Factors	Mean defuzzificated opinion		Difference of opinions rate	Factors	Mean defuzzificated opinion		Difference of opinions rate	Factors	Mean defuzzificated opinion		Difference of opinions rate
F	χ_1	χ_2	$\chi_2 - \chi_1$	F	χ_1	χ_2	$\chi_2 - \chi_1$	F	χ_1	χ_2	$\chi_2 - \chi_1$
F1	0.83	0.86	0.03	F17	0.72	0.79	0.06	F33	0.68	0.76	0.08
F2	0.75	0.82	0.07	F18	0.73	0.84	0.11	F34	0.76	0.78	0.02
F3	0.76	0.83	0.07	F19	0.71	0.80	0.089	F35	0.78	0.83	0.05
F4	0.78	0.84	0.04	F20	0.76	0.78	0.02	F36	0.72	0.76	0.04
F5	0.67	0.70	0.03	F21	0.58	0.66	0.08	F37	0.78	0.82	0.04
F6	0.75	0.79	0.04	F22	0.77	0.83	0.06	F38	-	0.53	-
F7	0.63	0.74	0.11	F23	0.61	0.75	0.14	F39	-	0.72	-
F8	0.64	0.76	0.12	F24	0.79	0.84	0.05	F40	-	0.79	-
F9	0.53	0.64	0.11	F25	0.61	0.64	0.03	F41	-	0.71	-
F10	0.66	0.76	0.09	F26	0.70	0.83	0.13	F42	-	0.75	-
F11	0.75	0.79	0.04	F27	0.63	0.75	0.12	F43	-	0.66	-
F12	0.77	0.82	0.05	F28	0.49	0.66	0.17	F44	-	0.75	-
F13	0.76	0.78	0.02	F29	0.53	0.67	0.14	F45	-	0.69	-
F14	0.61	0.64	0.03	F30	0.70	0.79	0.09	F46	-	0.50	-
F15	0.64	0.66	0.02	F31	0.57	0.73	0.16	F47	-	0.78	-
F16	0.65	0.77	0.12	F32	0.75	0.78	0.03				

Table 8 Mean expert opinions on the significance of factors affecting implementation of business intelligence in the third round of the opinion poll.

Factors	Triangular fuzzy mean (m,α, ß)			Factors	Triangular fuzzy mean (m,α, ß)			Factors	Triangular fuzzy mean (m,α, ß)		
F	m	α	ß	F	m	α	ß	F	m	α	ß
F7	0.78	0.16	0.13	F27	0.75	0.15	0.15	F41	0.77	0.17	0.14
F8	0.81	0.19	0.11	F28	0.75	0.16	0.16	F42	0.81	0.19	0.11
F9	0.69	0.18	0.18	F29	0.77	0.16	0.15	F43	0.77	0.17	0.14
F16	0.86	0.19	0.09	F31	0.77	0.17	0.14	F44	0.81	0.18	0.11
F18	0.91	0.21	0.05	F38	0.58	0.22	0.22	F45	0.78	0.19	0.13
F23	0.77	0.15	0.14	F39	0.78	0.18	0.13	F46	0.56	0.23	0.23
F26	0.89	0.21	0.07	F40	0.88	0.20	0.08	F47	0.86	0.19	0.08

Table 9 Expert differences of opinions on effective factors' significance in the second and third rounds.

Factors	Mean defuzzificated opinion		Difference of opinions rate	Factors	Mean defuzzificated opinion		Difference of opinions rate	Factors	Mean defuzzificated opinion		Difference of opinions rate
F	X_2	X_3	$X_3 - X_2$	F	X_2	X_3	$X_3 - X_2$	F	X_2	X_3	$X_3 - X_2$
F7	0.74	0.77	0.03	F27	0.75	0.75	0.00	F41	0.71	0.76	0.05
F8	0.76	0.79	0.03	F28	0.66	0.75	0.04	F42	0.75	0.79	0.04
F9	0.64	0.69	0.05	F29	0.67	0.76	0.09	F43	0.66	0.76	0.1
F16	0.77	0.84	0.07	F31	0.73	0.76	0.03	F44	0.75	0.80	0.05
F18	0.84	0.86	0.02	F38	0.53	0.58	0.05	F45	0.69	0.77	0.08
F23	0.75	0.76	0.01	F39	0.72	0.77	0.05	F46	0.50	0.56	0.06
F26	0.83	0.86	0.03	F40	0.79	0.84	0.05	F47	0.78	0.83	0.05

Table 10 Key factors affecting the implementation process of business intelligence based on related dimensions in the banking industry of Iran.

Dimensions (D)		Factors (F)
D1	Technical infrastructure	Flexible and extensible technical infrastructure (F1) - Choosing technology and tools appropriate to organization's conditions (F26) - Appropriate architecture for business intelligence system (F41) - Business intelligence technology compatibility with existing technologies (F43)
D2	Strategic	Clear vision and objectives for business intelligence (F2) - the alignment of business intelligence strategy with organization's strategy (F22) - Set up business intelligence strategy (F47)
D3	Managerial	Planning and effective project management (F3) - effective change of management (F27) - Balanced and strong combination of project team (F30) - The use of project risk management (F45)
D4	Organizational	Senior manager's commitment and support (F4) - Organization's ability to provide sufficient resources (F11) - Interaction and collaboration between business and information technology units (F17) - Culture of continuous process improvement (F18) - Engineering culture of decision making process (F19) - Culture of using information and analytics (F20) - Senior managers' risk taking in modern technologies investment (F39)
D5	Data quality	Strong and suitable framework for data governance and quality (F7) Quality and reliability of data resources (F24) - The precision, accuracy, and perfectness of data (F35) - Quality of data extract, transformation, and loading process (F40) - Data integrity and consistency of data sources (F44)
D6	Environmental	Laws and regulations related to business requirements and limitations (F23) - Using outside consultants (F28) - Interaction with vendors and choosing suitable suppliers (F29) - Level of competition setting in business (F31)
D7	Human	User training (F8) - Project leader and championship to lead and facilitate participation (F10) - Involvement of end users (F16) - skills of information technology, business and analytical (F32)
D8	System ability	The flexibility and speed of response to changes in the business intelligence system (F6) - Integration capability of business intelligence system (F12) - Analysis capability of business intelligence system (F13) - Level of security in the business intelligence system (F42)
D9	Service quality	Quality of access to information (F33) - Quality of information content (F34) - User friendly and easy learning of business intelligence tools (F36) - Precision of information at system output (F37)

Table 11 Expert opinion means on the rates of agreement in the classification of factors affecting implementation of business intelligence in the fourth round of the opinion poll.

Dimensions and factors (D, F)		Triangular fuzzy mean (m, α, β)			Dimensions and factors (D, F)		Triangular fuzzy mean (m, α, β)			Dimensions and factors (D, F)		Triangular fuzzy mean (m, α, β)		
D	F	m	α	β	D	F	m	α	β	D	F	m	α	β
D1	F1	0.78	0.20	0.12	D4	F17	0.73	0.19	0.15	D6	F31	0.73	0.21	0.14
	F26	0.73	0.19	0.15		F18	0.75	0.20	0.14	D7	F8	0.77	0.19	0.13
	F41	0.75	0.20	0.14		F19	0.75	0.20	0.14		F10	0.73	0.22	0.14
	F43	0.72	0.20	0.15		F20	0.78	0.19	0.13		F16	0.77	0.18	0.13
D2	F2	0.77	0.21	0.13		F39	0.73	0.21	0.14		F32	0.78	0.20	0.12
	F22	0.77	0.19	0.13	D5	F7	0.72	0.20	0.15	D8	F6	0.77	0.18	0.13
	F47	0.81	0.19	0.11		F24	0.77	0.18	0.13		F12	0.77	0.18	0.13
D3	F3	0.77	0.19	0.13		F35	0.80	0.18	0.12		F13	0.77	0.19	0.13
	F27	0.71	0.20	0.14		F40	0.78	0.21	0.12		F42	0.73	0.19	0.15
	F30	0.73	0.21	0.14		F44	0.73	0.18	0.15	D9	F33	0.77	0.21	0.13
	F45	0.72	0.20	0.15	D6	F23	0.77	0.21	0.13		F34	0.80	0.19	0.12
D4	F4	0.75	0.20	0.14		F28	0.73	0.21	0.14		F36	0.77	0.21	0.13
	F10	0.77	0.19	0.13		F29	0.72	0.19	0.16		F37	0.80	0.18	0.12

Table 12 Expert opinion mean based on the rate of agreement on the classification of factors affecting implementation of business intelligence in the fifth round of the opinion poll.

Dimensions and factors (D, F)		Triangular fuzzy mean (m, α, β)			Dimensions and factors (D, F)		Triangular fuzzy mean (m, α, β)			Dimensions and factors (D, F)		Triangular fuzzy mean (m, α, β)		
D	F	m	α	β	D	F	m	α	β	D	F	m	α	β
D1	F1	0.83	0.18	0.10	D4	F17	0.77	0.17	0.14	D6	F31	0.75	0.18	0.14
	F26	0.78	0.16	0.13		F18	0.78	0.18	0.13	D7	F8	0.78	0.18	0.13
	F41	0.80	0.17	0.12		F19	0.77	0.17	0.14		F10	0.77	0.18	0.13
	F43	0.80	0.17	0.12		F20	0.81	0.18	0.11		F16	0.78	0.16	0.13
D2	F2	0.80	0.17	0.12		F39	0.77	0.18	0.13		F32	0.81	0.19	0.11
	F22	0.80	0.17	0.12	D5	F7	0.78	0.18	0.13	D8	F6	0.78	0.16	0.13
	F47	0.86	0.19	0.08		F24	0.80	0.17	0.12		F12	0.78	0.16	0.13
D3	F3	0.81	0.18	0.11		F35	0.84	0.19	0.09		F13	0.78	0.18	0.13
	F27	0.76	0.17	0.12		F40	0.83	0.19	0.10		F42	0.75	0.16	0.15
	F30	0.78	0.16	0.13		F44	0.77	0.16	0.14	D9	F33	0.78	0.19	0.13
	F45	0.75	0.16	0.15	D6	F23	0.81	0.19	0.11		F34	0.83	0.18	0.10
D4	F4	0.78	0.18	0.13		F28	0.77	0.18	0.13		F36	0.80	0.18	0.12
	F10	0.81	0.18	0.11		F29	0.75	0.16	0.15		F37	0.81	0.17	0.11

Table 13 Expert difference of opinions based on the rate of agreement on the classification of factors affecting the implementation of business intelligence in the fourth and fifth rounds of the opinion poll.

Dimensions and factors (D, F)		mean defuzzificated opinion		difference of opinions rate	Dimensions and factors (D, F)		mean defuzzificated opinion		difference of opinions rate	Dimensions and factors (D, F)		mean defuzzificated opinion		difference of opinions rate
D	F	X_4	X_5	$X_5 - X_4$	D	F	X_4	X_5	$X_5 - X_4$	D	F	X_4	X_5	$X_5 - X_4$
D1	F1	0.76	0.81	0.05	D4	F17	0.72	0.76	0.04	D6	F31	0.72	0.74	0.02
	F26	0.72	0.77	0.05		F18	0.73	0.77	0.04	D7	F8	0.75	0.77	0.02
	F41	0.73	0.79	0.05		F19	0.73	0.76	0.02		F10	0.71	0.75	0.04
	F43	0.71	0.79	0.08		F20	0.77	0.80	0.03		F16	0.75	0.77	0.02
D2	F2	0.75	0.79	0.04		F39	0.72	0.75	0.04		F32	0.76	0.79	0.03
	F22	0.75	0.79	0.04	D5	F7	0.71	0.77	0.06	D8	F6	0.75	0.77	0.02
	F47	0.79	0.83	0.04		F24	0.75	0.79	0.03		F12	0.75	0.77	0.02
D3	F3	0.75	0.80	0.05		F35	0.78	0.82	0.04		F13	0.75	0.77	0.02
	F27	0.70	0.75	0.05		F40	0.76	0.80	0.05		F42	0.72	0.75	0.02
	F30	0.72	0.77	0.05		F44	0.73	0.76	0.04	D9	F33	0.75	0.77	0.02
	F45	0.71	0.75	0.04	D6	F23	0.75	0.79	0.05		F34	0.78	0.81	0.03
D4	F4	0.73	0.77	0.04		F28	0.72	0.75	0.04		F36	0.75	0.78	0.04
	F10	0.75	0.80	0.05		F29	0.71	0.75	0.04		F37	0.78	0.80	0.02

4. DATA AND FINDINGS ANALYSIS

As stated in the previous section, researchers have examined and reviewed the research literature related to factors affecting the implementation process of business intelligence. The results of these reviews, according to Table 1, were the identification of 37 factors affecting the implementation process. Using this initial framework of factors and running five rounds of fuzzy Delphi, key factors affecting implementation processes of business intelligence in the Iranian banking industry were identified and classified. A summary of the results from running several rounds of the Delphi technique is presented as follows. In the first round of the Delphi technique, experts commented on the significance rate of factors affecting implementation processes of business intelligence in the Iranian banking industry. Using Table 3 and equations (2) and (3), fuzzy mean experts' opinions in the first round (m, α, ß) are presented in Table 4. Also, experts were asked to comment on other significant factors affecting the implementation process of business intelligence in the banking industry of Iran. Thus, based on the experts' opinions, 10 new factors affecting the implementation process of business intelligence were proposed, as shown in Table 5.

In the second round, in addition to reflecting

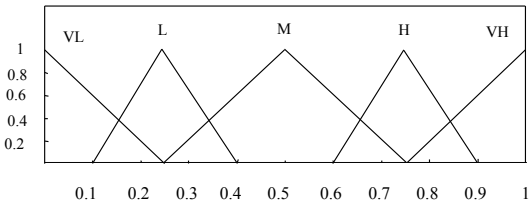

Figure 2 Verbal variable definition (Fuzzy triangular number).

the results of the first round of expert opinions, given the results of first round, they were asked to present new and corrective opinions on the significance rate of factors in the first round and give their proposed factors. Using Table 3 and equations (2) and (3), the expert opinion fuzzy mean (m, α, ß) in the second round is shown in Table 6. Also, using equation (1), the expert opinion defuzzification mean in the first round (χ_1) and second round (χ_2) and expert difference of opinions ($\chi_2 - \chi_1$) in the first and second rounds on the significance of factors affecting implementation of business intelligence are shown in Table 7. Given the results shown in Table 7, regarding 26 factors affecting implementation of business intelligence from Table 1 including rows 1- 6, 10-15, 17, 19-22, 24, 25, 30, and 32-37 there was a consensus due to the mean difference of opinions ($\chi_2 - \chi_1$) lower than 0.1, so that factors in rows 5,14,15, 21,and 25 are rejected due to their final mean (χ_2) lower than 0.75 while other factors were significant and approved.

In the third round of the fuzzy Delphi technique opinion poll, experts were informed of the first and second rounds' opinion results and given the results of the previous rounds new and corrective opinions of experts on the significance rate of 21 remaining factors were obtained. Using Table 3 and equations (2) and (3), the expert opinions fuzzy mean (m, α, ß) in the third round is presented in Table 8. Also, using equation (1), Table 9 shows the defuzzificated mean of expert opinions in the second round (χ_2) and third round ($\chi 3$) as well as experts difference of opinions ($\chi_3 - \chi_2$) on the significance of factors affecting implementation of business intelligence in the second and third rounds. Given the results in Table 9 on the remaining factors, consensus was reached due to the mean difference ($\chi_3 - \chi_2$) lower than 0.1 so that the three factors in rows 9, 38, and 46 were rejected due to their final mean (χ_3) which was lower than 0.75, while other factors were identified as significant key factors. In general, based on the opinion poll in rounds 1, 2, and 3, a total of 39 key factors affecting implementation of business intelligence were approved by experts and 8 factors were considered to be less significant.

Based on results of experts opinions in rounds 1, 2 and 3, 39 significant key factors affecting implementation of business intelligence were approved by consensus. First, these factors were classified in 9 groups as shown in Table 10 based on research literature, opinions of university professors, concept similarity and their role in implementation of business intelligence, then they were presented as proposed aspects for the experts' final opinion poll. It is to be noted that without going through this round it couldn't be claimed that a reliable and integrated list is prepared (Schmidt 1997). Thus, in the fourth round of the Delphi poll, experts were asked to give their opinions on the rate of agreement on this type of classification. Using Table 3 and equations (2) and (3), the fuzzy opinion mean (m, α, ß) of experts in the fourth round is presented in Table 11.

In the fifth round of the Delphi technique, in addition to reflecting the result of the fourth round to experts, given the result of the previous round on classification of key factors affecting implementation process of business intelligence, they were asked to give their corrective opinions on the agreement rate with this classification again. Using Table 3 and equations (2) and (3), the expert fuzzy opinion mean (m, α, β) in the fifth round is presented in Table 12. Also using equation (1), Table 13 shows the defuzzificated mean expert opinions in the fourth round (χ_4) and fifth round (χ_5) and expert difference of opinions (χ_5- χ_4) in the fourth and fifth rounds on the rate of agreement on classification of key factors affecting implementation of business intelligence. Given the results of Table 13, experts reached consensus on the proposed classification of key factors due to a mean difference of opinions ($\chi_5 - \chi_4$) lower than 0.1 and this proposed classification was approved as the experts' final opinion mean (χ_5) was not lower than 0.75.

Therefore, it can be concluded that significant factors affecting the effective implementation of business intelligence in the Iranian banking industry includes 9 dimensions: organizational, human, data quality, environmental, system ability, strategic, service quality, technical infrastructure and managerial, as shown in Figure 3.

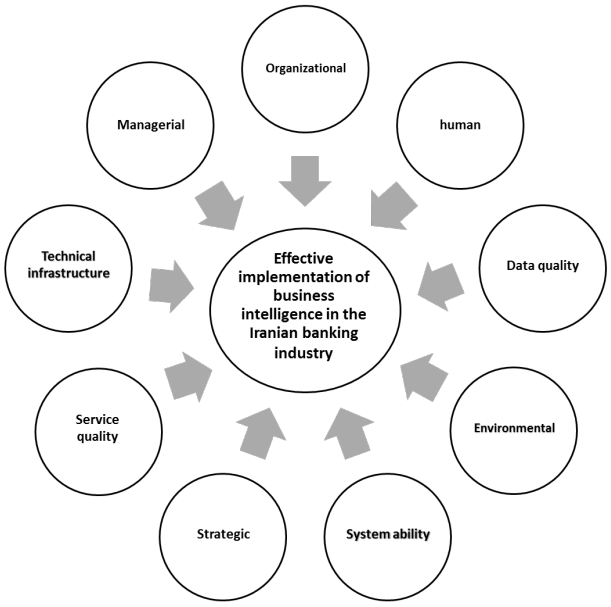

Figure 3 Key factors affecting implementation process of business intelligence.

5. CONCLUSION AND PROPOSALS

Organizations are often faced with problems such as data congestion and redundancy, insufficient information and knowledge and low quality of needed reports. Thus, for timely decision making in the minimum time by senior management, decisions are usually made based on their experiences, which in turn leads to increased risk of decision making or even decreased output of their decision making. Business intelligence is a tool to be used by organizations to collect and analyze structured and unstructured data and information, and is a suitable response to the aforementioned challenges. Though many organizations have turned to developing and using business intelligence systems, not all have been successful in their implementation. Thus, it is very important to examine the reasons for failure in implementing business intelligence projects and identify factors affecting their implementation. The aim of the present study is to identify key factors affecting implementation of business intelligence in the Iranian banking industry. Thus, in this study, by running five rounds of the fuzzy Delphi technique, among 37 factors affecting the implementation process of business intelligence in the past studies as well as 10 factors proposed by experts, finally 39 factors were identified and approved as significant. Also, the 39 factors were classified in 9 main groups, as shown in Table 10. In fact, it can be concluded that the significant factors affecting the effective implementation of business intelligence in the Iranian banking industry include 9 dimensions: organizational, human, data quality, environmental, system ability, strategic, service quality, technical infrastructure and managerial, as shown in Figure 3. Accordingly, managers and executives of implimentation projects of business intelligence in the Iranian banking industry can achieve the intended results and objectives by considering these important factors in planning and actions taken for the efficient implementation of business intelligence. Achievements of this study not only can help banks to successfully implement business intelligence systems but also help researchers in conducting future research in this field. For future research and study of how each key factor affects the efficient implementation of business intelligence systems during different phases of project implementation and to examine the rate of these factors' effects and interrelationship

between them, the authors propose a cognitive mapping methodology, case studies and an interpretive structural modeling approach.

6. REFERENCES

AlMabhouh, A., and Ahmad, A. (2010). *Identifying Quality Factors within Data Warehouse*. Proceedings of the 2nd International Conference on Computer Research and Development, November 2-4, Cairo, Egypt, 65-72.

Analytics8, (2000). *8Ways that Business Intelligence Projects are Different and How to Manage BI Project to Ensure Success*. From www.Analyltics8.com

Anjariny, A., Zeki, A., and Husnayati, H. (2012). *Assessing Organizations' readiness toward Business Intelligence Systems: A Proposal Hypothesized Model*. International Conference on Advanced Science Applications and Technologies, 213 - 218.

Ansari, R., Khojaste, N., and Abedi Sharbiani, Ak. (2014). Study of Technological, Organizational, Process and Business Factors Affecting Successful Implementation of Business Intelligence System in the Internet Service Companies (case study: Shuttle co.). *Modern Marketing Research Journal*, 4(4), 146-166.

Ariyachandra, T. and Watson, H. J. (2006). Which Data Warehouse Architecture is most successful? *Business Intelligence Journal*, 11(1), 4-6.

Azoff, M., and Charlesworth, I. (2004). The New Business Intelligence. A European Perspective, *Butler Group*, White Paper.

Babamoradi, M. (2012). *Study of Sociology on Bank Business Intelligence (Case Study: Keshvarzi Bank)*, M. S. Thesis, Science and Research Branch, Islamic Azad University, Tehran, Iran.

Bargshady, G., Alipanah, F., Abdulrazzaq, A.W., and Chukwunonso, F. (2014). Business Inteligence Technology Implementation Readiness Factors. *Journal Technology (Sciences and Engineering)*, 68(3), 7–12.

Boyer, J., Frank, B., Green, B., Harris, T., and Van De Vanter, K. (2010). *Business Intelligence Strategy: A Practical Guide for Achieving BI Excellence*. MC Press, USA.

Brooks, P., El-Gayar, O., and Sarnikar, S. (2015). A Framework for Developing a Domain Specific Business Intelligence Maturity Model: Application to Healthcare. *International Journal of Information Management*, 35, 337–345.

Chasalow, L. (2009). *A Model of Organizational Competencies for Business Intelligence Success*. Doctoral Thesis, Dept. of Information Systems, Virginia Commonwealth University, U.S.

Cheng, C.H., and Lin, Y. (2002). Evaluating the Best Mail Battle Tank Using Fuzzy Decision Theory with Linguistic Criteria Evaluation. *European Journal of Operational Research*, 142, 174-186.

Chuah, M.H., and Wong, K.L. (2013). The Implementation of Enterprise Business Intelligence: Case Study Approach. *Journal of Southeast Asian Research*, 1-15.

Curko, K., Bach, M.P., and Radonic, G. (2007). *Business Intelligence and Business Process Management in Banking Operations*. Proceedings of the ITI 2007 29th Int. Conf. on Information Technology Interfaces, June 25-28, Cavtat, Croatia, 57-62.

Cuza, AL.I. (2009). the Influence of Culture Characteristics upon the Implementation of Business Intelligence Management. *University Iasi, Romania: Review of International Comparative Management*, 10(5), 934-941.

Daghighi Masouleh, Z., Allahyari, M.S., and Ebrahimi Atani, R. (2014). Operational Indicators for Measuring Organizational E-readiness Based on Fuzzy Logic. *Information Processing in Agriculture*, 1, 115 –123.

Dawson, L., and Van Belle, J.P. (2013). Critical Success Factors for Business Intelligence in the South African Financial Services Sector. *SA Journal of Information Management*, 15(1), 1-12.

Derarpalli, S. (2013). *Agile Business Intelligence Development Core Practices*. Master Thesis, University of Boras, Sweden.

Dinter, B., Schieder, C., and Gluchowski, P. (2011). *Towards a Life Cycle Oriented Business Intelligence Success Model*. Proceedings of the Seventeenth Americas Conference on Information Systems, Detroit, Michigan, August 4th-7th, 1-10.

Dooley, D. (2015). *An Empirical Development of Critical Value Factors for System Quality and Information Quality in Business Intelligence*

Systems Implementations. Doctoral Thesis, College of Engineering and Computing, Nova Southeastern University, Florida, U.S.

Erfani, E. (2013). *Study of Relationship between Business Intelligence and Bank Processes in Iranian Modern Banking*, 1st. Conference on monetary and Bank management Development (Tehran), TV Center of International Conferences, 1-16.

Esmaeili, M. (2015). *Business Intelligence*. 1st. Edition, Fadak Asiatis Publication, Tehran.

Farrokhi, V., and Pokoradi, L. (2012).The Necessities for Building a Model to Evaluate Business Intelligence Projects-Literature Review. *International Journal of Computer Science and Engineering Survey (IJCSES)*, 3(2), 1-10.

Fink, A. (1984). Consensus Methods: Characteristics and Guidelines for Use. *American Journal of Public Health*, 74(9), 979-983.

Foshay, N., and Kuziemsky, C. (2014). Towards an Implementation Framework for Business Intelligence in Healthcare. *International Journal of Information Management*, 34, 20–27.

Friedman, T., Buytendijk, F., and Biscotti, F. (2003). Readiness for BI: Toward the BI Competency Center. *Gartner Research*, 1–6.

Gartner. (2009). Gartner EXP Worldwide Survey of More than 1,500 CIOs Shows IT Spending to Be Flat in 2009. Retrieved from: http://www.gartner.com

Grublješič, T., Coelho, P.S., and Jaklič, J. (2014). The Importance and Impact of Determinants Influencing Business Intelligence Systems Embeddedness. *Issues in Information Systems*, 15(1), 106-117.

Haqiqatmonfared, J., and Rezaei, A. (2011). Presentation of Evaluation Model for Business Intelligence Performance Based on Fuzzy Network Analysis Process. *Beyond Management Journal*, 4(16), 7-38.

Hartono, E., Santhanam, R., and Holsapple, C. (2007). Factors that Contribute to Management Support System Success: An Analysis of Field Studies. *Decision Support Systems*, 43(1), 256-268.

Hasson, F., Keeney, S., and McKenna, M. (2000). Research Guidelines for the Delphi Survey Technique. *Journal of Advanced Nursing*, 32(4), 1008-1015.

Hawking, O. (2013). *Factors Critical To the Success of Business Intelligence Systems*. Doctoral Thesis, Victoria University, Australia.

Hocevar, B., and Jaklic, J. (2010). Assessing Benefits of Business Intelligence Systems. *Journal of Management*, 15(1), 87-119.

Hoseini, F., Abbasnejad, T., and Banshi, E. (2015). Idetification and Rating of Success Vital Factors of Business Intelligence Systems in Treatment Industry with Mixed Approach. *Information Technology Management Research Journal*, 3(11), 47-70.

Howson, C. (2008). *Successful Business Intelligence: Secrets to Making BI a Killer App*. McGraw-Hill, New York.

Hsu, T.H., and Yang T.H. (2000). Application of Fuzzy Analytic Hierarchy Process in the Selection of Advertising Media. *Journal of Management and Systems*, 7, 19-39.

Hwang, H., Ku, C., Yen, D.C., and Cheng, C. (2004). Critical Factors Influencing the Adoption of data warehouse Technology: a Study of Banking Industry in Taiwan. *Decision Support Systems*, 37.

Isik, O., Jones, M. C., and Sidorova, A. (2011). Business Intelligence (BI) Success and the Role of BI Capabilities. Intelligent Systems in Accounting, *Finance and Management*, 18(4), 161–176.

Isik, O. (2010). *Business Intelligence Success: An Empirical Evaluation of the Role of BI Capabilities and the Decision Environment*. Doctoral Thesis, University of North Texas, U.S.

Isik, O., Jones, M. C., and Sidorova, A. (2013). Business Intelligence Success: The Role of BI capabilities and decision environments. *Information and Management*, 50 (1), 13-23.

Kahraman, C., Ruan, D., and Dogan, I. (2003b). Fuzzy Group Decision Making for Facility Location Selection. *Inform Sci*, 157, 135–153.

Khodaei, A., and Karimzadeghan Moqadam, D. (2014). The Feasibility of Implementing Business Intelligence in Insurance Industry. *Insurance Supplement to the Bulletin*, 29(4), 165-187.

Kukafka, R., Johnson, S.B., Linfante, A., and Allegrante, J.P. (2003). Grounding a New Information Technology Implementation Framework in Behavioral Science: A Systematic Analysis of the Literature on IT

Use. *Journal of Biomedical Informatics*, 36, 218–227.

Lai, V.S., and Mahapatra, R.K. (1997). Exploring the Research in Information Technology Implementation. *Information and Management*, 32 (4), 187–201.

Lin, Y.H., Tsai K.M., Shiang W.J., Kuo T.C., and 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.

Lonnqvist, A., Antti, S. and Pirttimki, V. (2006).The Measurement of Business Intelligence. *Information Systems Management*, 23(1), 32 — 40.

Lupu, A. R., Bologa, R., Lungu, I. and Bra, A. (2007). *The Impact of Organization Changes on Business Intelligence Projects*. Proceedings of the 7th WSEAS International Conference on Simulation, Modeling and Optimization, Beijing, China, September 15- 17, 414-418.

Mahlouji, N. (2014). *A Method for Modeling and Analyzing Different Approaches to Agile BI*. Master Thesis, Polytechnic University of Catalonia, Barcelona, Spain.

Mirsepasi, N., Tolouee Oshloqi, A., Meamarzadeh, GH. , and Pydaei, M. (2010). Designing a Model for Human Resources Excellence in the Iranian Government Agencies Using Fuzzy Delphi Technique. *Journal of Management Studies, Islamic Azad University*, 87, 1-23.

Moss, L. T. and Atre, S. (2003). *Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support-Applications*. Addison-Wesley Professional.

Moro, S., Cortez, P., and Rita, P. (2015). Business Intelligence in Banking: A literature Analysis from 2002 to 2013 Using Text Mining and Latent Dirichlet Allocation. *Expert Systems with Applications*, 42, 1314–1324.

Mousavi, P., Yousefi Zenouz, R., and Hassanpour, A. (2015). Identification of an Organization's Information Security Risks in the Banking Industry Using the Delphi method Fuzzy, *Journal of Information Technology Management*, University of Tehran, 7(1), 163 – 184.

Mungree, D., Rudra, A., and Morien, D. (2013). A *Framework for Understanding the Critical Success Factors of Enterprise Business Intelligence Implementation*. Proceedings of the Nineteenth Americas Conference on Information Systems, Chicago, Illinois, August 15-17, 1-9.

Najmi, M., Sepehri, M., and Hasherni, S. (2010). The Evaluation of Business Intelligence Maturity Level in Iranian Banking Industry. *IEEE*, 466-470.

Nazari, V. (2014). *Study and Presentation of Business Intelligence Maturity Model Using Fuzzy Deduction (case study: currency unit of Central Bank),* M.S. Thesis, Science and Research Branch, Islamic Azad University, Tehran, Iran.

Ojeda-Castro, Á., Ramaswamy, M., Rivera-Collazo, Á., and Jumah, A. (2011). Critical Factors for Successful Implementation of Data Warehouses. *Issues in Information Systems*, 7(1), 88-96.

Ojeda-Castro, Á., and Ramaswamy, M. (2014). Best Practices for Successful Development of Data Warehouses for Sell Businesses. *Issues in Information Systems*, 15(1), 277-284.

Olbrich, S., Pöppelbuß, J., and Niehaves, B. (2012).*Critical Contextual Success Factors for Business Intelligence: A Delphi Study on Their Relevance, Variability, and Controllability*. 45th Hawaii International Conference on System Sciences, Hawaii, USA, January 4–7, 4148–4157.

Olszak, C.M., and Ziemba, E. (2007). Approach to Building and Implementing Business Intelligence System. Inter Disciplinary Journal of Information, *Knowledge and Management*, 2, 135-148.

Olszak, C. M., and Ziemba, E. (2012). Critical Success Factors For Implementing Business Intelligence Systems in Small and Medium Enterprise on the Example of Upper Silesia, Poland. *Interdisciplinary Journal of Information*, 7(2), 129-150.

Piri, F. (2014). *Identification and Prioritization of Success Key Factors in Implementing Business Intelligence (case study: Saderat Bank of Iran).* M.S Thesis, science and research Branch, Islamic Azad University, Tehran

Popovic, A., Coelho, P.S., and Jaklic, J. (2009). The impact of Business Intelligence System Maturity on Information quality. *Information Research*, 14(4), 1-26.

Popovic, A., Hackney, R., Coelho, P., and Jaklic, J. (2012). Towards Business Intelligence

Systems Success: Effects of Maturity and Culture on Analytical Decision Making. *Decision Support Systems*, 54, 729–739.

Raber, D., Wortmann, F., and Winter, R. (2013). *Situational Business Intelligence Maturity Models: An Exploratory Analysis*. IEEE Computer society, 46th Hawaii International Conference on System Sciences, 3797-3806.

Raisivanani, I., and Ganjalikhan Hakemi, F. (2015). Designing Adaptive Neuro- Fuzzy Deduction System for Evaluating Development of Business Intelligence System in Software Production Industry. *Information Technology Management Journal*, 7(1), 46-85.

Ramakrishnan, T., Jones, M.C., and Sidorova, A. (2012). Factors Influencing Business Intelligence (BI) Data Collection Strategies: An Empirical Investigation. *Decision Support Systems*, 52, 486–496.

Ramamurthy, K., Sen, A., and Sinha, A.P. (2008). An empirical Investigation of the Key Determinants of Data Warehouse Adoption. *Decision Support Systems*, 44, 817–841.

Ronaqi, M.H., and Feizi, K. (2013). Evaluation of Business Intelligence System Performance Using Fuzzy Analysis. *Professional Journal of Technology Growth*, 9(34), 53-59.

Ronaqi, M., and Ronaqi, M. (2014). Presentation of Business Intelligence Maturity Model among Iranian Organizations. *Professional Journal of Technology Growth*, (38)10, 38-44.

Rouhani, S., Asgari, S., and Mirhosseini, S.V. (2012). Review Study: Business Intelligence Concepts and Approaches. *American Journal of Scientific Research*, 50, 62-75.

Rouhani, S., Ghazanfari, M., and Jafari, M., (2012). Evaluation Model of Business Intelligence for Enterprise Systems Using Fuzzy TOPSIS. *Expert Systems with Applications*, 39, 3764–3771.

Rowe, G., and Wright, G. (2001). Expert Opinions in Forecasting: The Role of the Delphi Technique. Principles of Forecasting, *Springer US*, 125-144.

Roy, T.K., and Garai, A. (2012). Intuitionistic Fuzzy Delphi Method: More Realistic and Interactive Forecasting Tool. *Notes on Intuitionistic Fuzzy Sets*, 18(2), 37-50.

Sangar, A.B., and Iahad, N.B.A. (2013). Critical Factors That Affect the Success of Business Intelligence Systems (BIS) Implementation in an Organization. *International Journal of Scientific and Technology Research*, February, 2(2), 176-180.

Seah, M., Hsieh, M. H., and Weng, P. (2010). A Case analysis of Savecom: The Role of Indigenous Leadership in Implementing a Business Intelligence system. *International Journal of Information Management*, 30(4), 368–373.

Schmidt, R.C. (1997). Managing Delphi Surveys Using Nonparametric Statistical Techniques. *Decision Sciences*, 28(3), 763-774.

Tabrasa, G.H., and Nazarpouri, A.H. (2014). *Management Based on Organizational Intelligence*, 1st. Edition, Ketabe Mehrban Nashr Institute, Tehran.

Taqwa, MR., and Nouri, E. (2014). *Business Intelligence*, 1st. Edition, Allame Tabatabaei University Publication, Teheran.

Tarokh, M.J., and Mohajeri, h. (2012). *Business Intelligence (Dynamic Look at Business)*, 1st. Edition, Khaje Nasialdin University Publication, Tehran.

Thamir, A., and Poulis, E. (2015). Business Intelligence Capabilities and Implementation Strategies. International *Journal of Global Business*, June, 8 (1), 34-45.

Turban, E., Sharda, R., Aronson, J. E., and King, D. (2011). *Business Intelligence: A Managerial Approach*. Prentice Hall.

Vodapalli, N.K. (2009). *Critical Success Factors of BI Implementation*. Master Thesis, IT University of Copenhagen, Copenhagen, Denmark.

Williams, S., and Williams, N. (2004) Assessing BI Readiness: The Key to BI ROI. *Business Intelligence Journal*, 9, Summer, 1-11.

Wixom, B.H., and Watson, H.J. (2001).An Empirical Investigation of the Factors Affecting Data Warehousing Success. *MIS Quarterly*, 25(1), 17-41.

Watson, H., and Wixom, B. (2007). The Current State of Business Intelligence. *IEEE Computer Society*, 9(40), 96-99.

Yeoh, W., Koronios, A., and Gao, J. (2008). Managing the Implementation of Business Intelligence Systems: A Critical Success Factors Framework. *Enterprise Information Systems*, 4, 79 -94.

Yeoh, W., and Koronios, A. (2010). Critical Success Factors for Business Intelligence Systems. *Journal of Computer Information Systems*, 50(3), 23-32.

Yeoh, W., Popovic, A. (2015). Extending the Understanding of Critical Success Factors for Implementing Business Intelligence Systems. *Journal of the Association for Information Science and Technology*, 67(1) 134-147.

Zadeh, L.A. (1965). Fuzzy sets. *Info Control*, 8, 338–353.

Zare Ravasan, A., and Rabiee Savoji, S. (2014) .An Investigation of BI Implementation Critical Success Factors in Iranian Context. *International Journal of Business Intelligence Research*, 5(3), 41-57.