

Nº 34

AD-MINISTER

UNIVERSIDAD EAFIT · MEDELLÍN · COLOMBIA · JANUARY - JUNE 2019 · ISSN 1692-0279 · E-ISSN: 2256-4322

ARASH GHASHAMI

MAHMOOD ALBORZI

FARZAD MOVAHEDI
SOBHANI

REZA RADFAR

JEL: M00, M10, M15

DOI: 10.17230/ad-minister.34.8
www.eafit.edu.co/ad-minister



UNIVERSIDAD
EAFIT[®]

A MODEL FOR IMPLEMENTATION OF INTELLIGENT BUSINESS SOLUTIONS ON THE BASIS OF THE LEVEL OF BI MATURITY: AN IRANIAN EXPERIENCE

UN MODELO PARA LA IMPLEMENTACIÓN DE SOLUCIONES EMPRESARIALES INTELIGENTES CON BASE EN EL NIVEL DE MADUREZ EN INTELIGENCIA DE NEGOCIOS: UNA EXPERIENCIA IRANÍ

ARASH GHASHAMI¹

MAHMOOD ALBORZI²

FARZAD MOVAHEDI SOBHANI³

REZA RADFAR⁴

JEL: M00, M10, M15

RECEIVED: 30/11/2018

MODIFIED: 23/01/2019

ACCEPTED: 21/05/2019

DOI: 10.17230/ad-minister.34.8

www.eafit.edu.co/ad-minister

ABSTRACT

The purpose of this research is to provide a basis for choosing the approach to implementing business intelligence systems based on the maturity of the organization.

This research not only recommends considering the level of business intelligence maturity while planning for the implementation, but also recommends the use of IT governance levers in order to increase the level of efficient usage of such systems.

In this research, while analyzing the subject by experts in the Delphi Fuzzy method, these ideas have been reviewed and verified in nearly 109 organizations responding to the questionnaires. The result of this research is a fuzzy inference engine that suggest the best execution package required, by entering data on the size and maturity of the organization. Packages containing the appropriate implementation methodology, products at that maturity level and, consequently, IT governance processes and requirements to that level of maturity.

KEYWORDS

Business Intelligence Implementation, Business Intelligence Maturity, Information Technology

RESUMEN

El propósito de esta investigación es proporcionar una base para elegir el enfoque para implementar sistemas de inteligencia de negocios basados en la madurez de la organización. Esta investigación

1 Certified international business consultant (CMC) and he has more than 20 years of practical experience in the fields of management, IT, strategy making, business intelligence and IT project and program management. This article is based on his PhD dissertation on IT Management. ORCID: <https://orcid.org/0000-0001-7503-9813>. Email: arash.ghashami@gmail.com

2 Artificial intelligence and machine learning researcher and instructor. He was finished his PhD on Artificial Neural Networks (ANN) in Brunel University in 1996 in UK. He was instructor and the deputy of researches Tehran University of Oil and also in Science and Research branch, Islamic Azad University. He wrote lots of reference books in Persian and had many experiences on business consultancy in Iranian enterprises. Dr. Mahmood Alborzi was born in Iran. He graduated from Tehran University in Operating Researches (PhD) in 1992, and MBA from Harvard University in 1974, and General Engineering degree from Oil University of Iran in 1965. He is the corresponding author of this article. ORCID: <https://orcid.org/0000-0001-6619-992X>. Email: mahmood_alborzi@yahoo.com

3 Fulltime professor in Science and Research branch, Islamic Azad University. He is graduated of Industrial Engineering at all levels of Bachelor in 1992, MSc in 1995 and PhD in 2005 from Tarbiat Modarres University.

ORCID: <https://orcid.org/0000-0002-4602-2710> Email: farzad1348@yahoo.com

4 Professor of Management and systems in Science and Research branch, Islamic Azad University. He finished his PhD in Industrial Management in 2004. He is a fulltime professor and a business consultant for Iranian enterprises. He is also reviewer in some journal like International Journal of Information, Security and System Management and International Journal of Productivity and Performance Management. ORCID: <https://orcid.org/0000-0002-2535-4521>. Email: radfar@gmail.com

Arash Ghashami · Mahmood Alborzi · Farzad Movahedi Sobhani · Reza Radfar

A Model for Implementation of Intelligent Business Solutions on the Basis of the Level of BI Maturity: An Iranian experience

no solo recomienda considerar el nivel de madurez de la inteligencia de negocios a momento de planear la implementación, sino también el uso de instrumentos de política pública de tecnologías de la información (TI) para aumentar el nivel del uso eficiente de dichos sistemas. En esta investigación, al analizar el tema por expertos en el método Delphi Fuzzy, estas ideas han sido revisadas y verificadas en casi 109 organizaciones que respondieron a los cuestionarios. El resultado de esta investigación es un motor de inferencia difusa que sugiere el mejor paquete de ejecución requerido, al ingresar datos sobre el tamaño y la madurez de la organización. Los paquetes que contienen la metodología de implementación adecuada, los productos en ese nivel de madurez y, en consecuencia, los procesos y requisitos de gobierno de TI a ese nivel de madurez.

PALABRAS CLAVE

Implementación de inteligencia de negocios, madurez de la inteligencia de negocios, tecnologías de la información

INTRODUCTION

Presenting a model in order to select the most appropriate method for implementing intelligent business solutions in organizations with different dimensions and maturity is the basic idea in this research. Basically, business intelligence can only be valuable when properly employed by organizations. There is a relationship between the optimal use of business intelligence, the performance and features of organizations. better access to data has no effect on a company's performance, though the quality of using data by the company has a direct effect on their performance.

Whatever are the features of intelligent business solutions in the organization, they should be tailored to the organization's readiness in employing the solutions. The research hopes to increase the positive effects of employing the intelligent business solutions in the organization and reduce the failure of such projects in line with increasing the proportionality of selecting the methods for implementing intelligent business solutions through conceptualizing and presenting a fuzzy model between the organization's characteristics and the expected benefits of intelligent business solutions.

Presenting a model in order to select the best method for implementing intelligent business projects in organizations tailored to the maturity and readiness of those organizations constitutes the main idea in this research. The present research comes in two quite distinct, sequential sections. The former deals with presenting a model to select the implementation method of intelligent business systems based on the organizational maturity, and the latter tests the model and presents the test results.

This is an applied research in terms of purpose and is considered a field research in terms of situation. It is a retrospective study in terms of time and is based on the past data of the organizations surveyed and it is a survey (contextual) research in terms of research method.

The model is proposed by investigating the problems and implementation issues of the projects for the deployment of intelligent business systems in the companies in the country, and developing idea of how to prevent or solve these problems and

the output model, includes 5 different implementation packages, proposed and designed per 5 levels of intelligent business maturity.

First, experts were interviewed to confirm the initial assumptions of the research, during which the main assumptions were confirmed. In the second step, the data collection regarding the elements of the research model was conducted as desk study and the data on various maturity models, implementation methodologies and governance frameworks were identified and integrated and were proportionated and tailored to the research. Third, the governmental implementation model, which is the main purpose of the research is initially designed and presented, and reviewed and modified by the experts. Fourth, to test the model validity, the developed questionnaires were sent to a number of banks and financial and credit institutions, subsidiary companies and payment service companies as well as manufacturing, service and government companies. After testing the validity and reliability of the questionnaire, the characteristics of organizations questionnaires were sent to the experts and their comments about the maturity and the proper executive package were asked. Fifth, the data obtained from companies and institutions, along with the opinions and comments of experts on those institutions were investigated by MATLAB software, and the data of 80% of these companies and institutions were inferred and fuzzy rules were extracted, and the results were tested in the remaining 20% companies and institutions. The results of the model test were investigated with mean square error (MSE), root mean square error (RMSE), mean absolute percentage error (MAPE), and regression coefficient R². Eventually, in the sixth step, considering the indices mentioned, the fuzzy method was measured by other conventional methods in order to identify the best package for each maturity level, the results of which are presented in the following.

LITERATURE REVIEW

A large body of materials has been presented considering the problems and issues of the implementation of intelligent business solutions in organizations. Based on the research literature, multiple studies were conducted on the causes of the problems and implementation issues of these types of projects, which generally include issues, namely, strategic issues, problems with project or program management, problems with system quality and security, issues of infrastructure and suppliers, issues related to employee and how information and data are used in the organization, and eventually financial issues. The following Table categorizes and combines the problems that were identified and collected in the implementation of intelligent business solutions in previous studies, which were repeated in different research with different meanings and interpretations. The following Table indicates the summary of issues.

Table 1. the summary of BI implementation Issues

#	Item	Ref's.
1	Lack of Strategic Approach to BI Implementation	(Rouhani and Rabiee Savoji Spring 2016), (Nazari Salari, Khadivar and Abdolvand Summer 2016), (Aghae, Aghaei and Aghaei Spring 2016), (Rahmanimanesh, et al. Winter 2018), (Abbaspour Spring 2017), (Rouhani and Zare Ravasan Autumn 2013)
2	Project Management Problems	(Rouhani and Rabiee Savoji Spring 2016). (Aghae, Aghaei and Aghaei Spring 2016)
3	Quality and Security of Systems	(Aghae, Aghaei and Aghaei Spring 2016), (Abbaspour Spring 2017), (Alinezhad and Hakimian Spring 2003), (Rahmanimanesh, et al. Winter 2018)
4	Infrastructure Problems	(Rouhani and Rabiee Savoji Spring 2016), (Nazari Salari, Khadivar and Abdolvand Summer 2016), (Abbaspour Spring 2017)
5	Suppliers Issues	(Rouhani and Rabiee Savoji Spring 2016), (Abbaspour Spring 2017)
6	Training problems	(Nazari Salari, Khadivar and Abdolvand Summer 2016), (Abbaspour Spring 2017)
7	HR Problems	(Rouhani and Rabiee Savoji Spring 2016), (Aghae, Aghaei and Aghaei Spring 2016), (Nazari Salari, Khadivar and Abdolvand Summer 2016), (Rahmanimanesh, et al. Winter 2018), (Abbaspour Spring 2017)
8	The Problems with Data, Information, Decision Making Style and Inference in Organizations	(Rouhani and Rabiee Savoji Spring 2016), (Aghae, Aghaei and Aghaei Spring 2016), (Nazari Salari, Khadivar and Abdolvand Summer 2016), (Rouhani and Zare Ravasan Autumn 2013)
9	Organization Structure Problems	(Rouhani and Rabiee Savoji Spring 2016), (Nazari Salari, Khadivar and Abdolvand Summer 2016), (Rahmanimanesh, et al. Winter 2018)
10	ROI Issues	(Rouhani and Rabiee Savoji Spring 2016), (Abbaspour Spring 2017), (Nazari Salari, Khadivar and Abdolvand Summer 2016)

The problems that were repeatedly mentioned in various sources indicate the fundamental issues of the implementation of these projects in the country. In line with solving these problems, the present research presented and tested a model based on the intelligent business maturity.

Using strategies that enhance the success of the development, acceptance, and comprehension of intelligent business systems in the organization is the main idea behind this research. The main idea and initiative in this research is firstly the application of executive packages tailored to the maturity of intelligent business in the organization, and secondly, using IT governance levers in the process of developing intelligent business systems in the organization. In studying the research

literature, in other articles, the significance of these two solutions is mentioned which is presented and summarized in the following Table.

Table 2. the solutions in previous researches

The Solutions	Ref's.
BI Maturity as a predecessor of BI systems implementation	(Elbashir, Collier and Davern 2008), (Clavier, Lotriet and van Loggerenberg 2012), (Cosic, Shanks and Maynard 2012), (Lahrmann, et al. 2011), (Jiang, et al. 2004), (Popovič, et al. 2012), (RANJAN 2009), (Rajterič 2010), (Raber, Wortmann and Winter 2013), (Sledgianowski and Luftman 2005), (Saghafi and Fasanghari 8-2010), (Mehrabi, Mahmoudi and Alihosseyni Spring 2016), (Bakhshandeh and Rahmati Spring 2016), (Manian, Mosakhani and Zare Mirakabad Summer 2013), (Khadivar and Abasi Autumn 2016), (Taghva and Hajizadeh 2010), (Dastranj Mamaghani and Akhavan 7-2011), (Rezaeemanesh, Mohammadnabi and Mohammadnabi 2012)
BI/IT Governance as a predecessor of BI systems implementation	(Wixon and Watson 2001), (van der Raadt 2010), (Ribbers, Peterson and Parker 2002), (Sambamurthy and Zmud 1999), (Wu, Straub and Liang June 2015), (Peterson 2004), (Wixon and Watson 2001), (van der Raadt 2010), (Ribbers, Peterson and Parker 2002), (Sambamurthy and Zmud 1999), (Wu, Straub and Liang June 2015), (Peterson 2004), (Tabatabaei and Chaharsooghi 12-2016), (Hashemi, et al. Autumn 2017), (Hasanzadeh, Namdarian and Elahi spring 2012), (Hossein Ronaghi and Mahmoudi Autumn 2015), (Raeis Safari, Ghazanfari and Fathiyan 1-2009), (Ghazanfari, Fathiyan and Raeis Safari Spring 2011), (Toghyani, Rajabzadeh and Anvari Rostamy Summer 2016), (Azar, et al. Spring 2015), (Raeesi Vanani and Ganjalikhan Hakemi Spring 2015)

Considering the previous research, it seems that attention to maturity, as well as increased governance of information technology or business intelligence, could be potential solutions to improve the implementation of intelligent business systems within the organization.

In order to provide a proper model, while defining the *pre-assumptions*, it is necessary to limit the scope of applications and the use of intelligent business systems to narrow the target population and allow for sampling to test the model.

The first *pre-assumption* is the paradigm used in intelligent business by the organization. The definitions provided for business intelligence can be categorized into three main metaphorical paradigms. The first paradigm; BI as an architecture of monitoring and management of business processes. The second one is BI as a set of technical artifacts and the third one is BI as a strategic system for decision making. The target paradigm in this research is the third one; BI as a strategic system.

The second *pre-assumption* is based on the development of intelligent business systems in the organization. The researcher believes in the distinction between different types of development and launch of systems, who is inspired by the theorization of Burns and Stalker. This distinction means that there are two main

practices in developing intelligent business systems: the first is the organic strategy, which means endogenous development, based on creativity, innovation, often with no integrated, local, and coherent architecture with the tasks of units and individuals, and implemented by individuals within the organization, taking place by the promoting levers of education, innovation and entrepreneurship. The second approach is the mechanical approach in the development, which is contrary to the organic approach and the development enjoys a consistent and integrated architecture, methodology and organizational determination to develop an intelligent business system in an organization based on the project plan, investigation of contractors and external suppliers and precise calculations of critical success factors and key performance indices. (Burns and Stalker 2012)

However, because the research intends to achieve a road map appropriate to the status of the organization by describing these dimensions in the implementation of intelligent business solutions in an organization, and also the implementation of the requirements and procedures of IT governance take place primarily to increase the mechanical levels of the organization, therefore, in the present research, organizations that develop their intelligent business development in an organic way basically are out of the scope of this research, and only the focus and attention of research is on the mechanical methods of development.

The present research activated in two main sections: first, the construction of the model and, second testing it. In order to develop the model, the model mentioned will be presented based on the general principles and pre-assumptions in the previous section. To this aim, primarily, one of the intelligent organization maturity models must be selected as the base model, and then methodologies tailored to each maturity layer are identified and, subsequently, the processes and methods within the IT governance frameworks are identified and discussed for each maturity layer. Eventually, five executive packages are proposed for five layers of intelligent business maturity and are approved by experts and presented for testing.

In investigating the maturity models, these models are compared and the final model is selected.

In such comparison, the CMMI model is selected by the experts which have the most proportionality in application in the research.

Following the selection of the basic model in measuring the intelligent maturity in organizations, according to the researcher's resource or mapping, the constructs and the intelligent business tools and tools in each maturity layers were mapped. This mapping on 5 CMMI maturity layers enables us to describe each of the constructs on each level of intelligent business maturity levels.

The same study was also conducted on common executive methodologies in implementing intelligent business projects, which means that we can measure and compare different methodologies based on the degree of intelligent business maturity and achieve to the most appropriate methodology at each maturity level. In library studies, a relationship was found between project size and project duration

as well as a relationship between maturity level and project management method and implementation methodology previously stated by the US Data Warehouse. (TDWI Team 2010) Based on the above findings, the proposed methodology is proposed for each project size.

Eventually, it is necessary to complete the processes and procedures for the governance of information technology requirements on maturity levels mapped in order to complete the implementation packages to provide the necessary recommendations in the development of intelligent business systems in each implementation package.

The COBIT, ITIL, ValIT, RiskIT, and ISMS governance frameworks were investigated. Not all processes and procedures of these requirements will be used in the development of intelligent business systems. Thus, it is necessary to select only the desired process among the processes and methods considering the problems identified in the studying the research literature. In order to select the methods and processes of governance requirements investigated, and the processes involved in the executive steps, the proposed models were added to each of the maturity levels and proposed packages, which are not mentioned in the article due to the breadth of the Tables, and in the beginning maturity layer, two processes of one ValIT and the other of RiskIT were briefly added. In the managed maturity layer, 4 processes of ITIL and 6 processes of COBIT and a process of ValIT were added. In the defined maturity layer, 13 processes of ITIL, a process of RiskIT and two processes of ValIT to the implementation package were added. In the quantified maturity layer, 4 processes of ITIL, 10 processes of COBIT and one process of the ValIT process were added, and eventually, in the optimization maturity layer an ITIL process, a process of ValIT, and a process of RiskIT were added to the executive package.

Considering the information presented in this section, the designed packages including methodology, governance processes, implementation guidance, and permitted implementation tools were developed at each maturity level. In this section of the research, five executive packages were developed for five maturity layers. Now, this model should be tested, this test is done with a fuzzy method in terms of the research method.

METHODOLOGY

The intended statistical population in the present research comprised the companies that satisfactorily use the intelligent business systems, and that are satisfied with the function and application of their intelligent business systems, and at least realized part of their expected goals in developing intelligent business systems, i.e. the target population in this research is the companies in which attempts are made to use intelligent business systems and have a kind of enjoyment and satisfaction with the implementation of these systems during the research.

Such definition does not guess the total population of the sample, obviously there should be no statistics of these types of companies, therefore the number of these

companies cannot be guessed in the country. Thus, due to the lack of statistics or databases from companies that implement and use successful intelligent business projects, the sampling strategy is selected through the combination of both “targeted sampling” and “network sampling.”

In a purposeful sampling, the researcher tries to select the desired sample through the judgment, personal and expert judgment, and thought-out effort which is as representative of the population as possible. In such sampling, which is known as the dominant method in grounded theory, samples are selected in a way that contribute to the creation of the theory, and is used in situations where determining the whole population under study is impossible or costly, or when sampling should be made from specific cases. Both conditions are met in the present study, however, it should be noted that in this method sampling is biased and cannot represent the population. In the network method, a member of the social network introduces another member and that member introduces another member which leads to the chained and network sample size selection. The steps for theory development are as follows.

RESULT

A fuzzy Delphi method has been considered by the researchers to test this research in investigating the research literature, which seems adequate for this study considering the nature of the present research. The Fuzzy Delphi method was introduced since 1980 by Kauffman and Gupta. In this method, the experts are provided with the linguistic variables. (Cheng and Lin 2002) Numeric values of linguistic variables are also expressed in the form of fuzzy numbers. Then, in each step, the fuzzy average of each question is calculated and compared with the average of the previous step. Also, in another study conducted by Akhavan et al., which is more similar to the present thesis, the surveyed method and expert survey was used with fuzzy Delphi technique. (Akhavan, Philsoophian and Karimi Gavareshki Winter 2017)

Testing the model developed in the organizations studied with the rule-based fuzzy inference system method is *Takagi-Sugeno* in this thesis. (L. Zadeh 1975) In this research, all types of data required include training data, evaluation data and test data. (Shafia, Manian and Raeesi Vanani Spring 2013) The data was collected using questionnaire and the opinion of experts. The fuzzy Delphi method is based on the views and opinions of the experts, which follows all the principles and rules of the Delphi method. (Ludwig and Starr 2005)

Factors such as sample size and executive power of the group determine the number of experts, and the number of experts is considered appropriate between 10-20 people. (Skulmoski, G., J, F. T. Hartman and j. Krahn 2007)

Two distinct questionnaires were sent to the companies to conduct the test. First, the questionnaire of systems used by intelligent business and the circumstances of the utilizing organization, which was a researcher made questionnaire based on

compulsory multiple choice. The validity of these questionnaires was tested by the experts and the method of face, content and construct validity. Testing the reliability was only possible through test-retest which was measured by repeated sampling of a sample questionnaire. However, the second questionnaire, which was the maturity rate of organization questionnaire, was a formal and highly valid CMMI organization questionnaire that was tested by a group of experts in terms of validity, however, their reliability was investigated by Cronbach's alpha coefficient to measure reliability.

The experts in this study included 15 intelligent information and business activists who were selected based on the research's previous acquaintance and each investigated at least three samples and provided their comments. In this section, considering the education level, four out of fifteen experts had a Ph.D. degree, one had an undergraduate degree, and the remaining ten had a master's degree. In terms of the field of study, one person completed his studies in electrical and electronic engineering, one in system management, two in industry and system engineering, two in executive management, three in the management of information technology and six in computer engineering- software. The team of experts in this research is rated among the teams with appropriate conditions in terms of the work experience and the empirical background. The possibility of deviation in the votes of these experts is negligible.

The selected samples were selected sufficiently from the banking and electronics industries to avoid bias and deviation in the research results of these industries. Although the other selected organizations are not sufficient samples of the entire country's companies, in terms of the type of industry or size of the business, according to the experts in the field of intelligent business system development, almost the most important organizations that use strategic intelligent business systems in the country have been surveyed in this research, however, in general only in the banking and electronic industries the results and lack of model bias can be confirmed.

A number of 109 institutions and firms were studied. Considering the number of samples per industry, the following diagram illustrates that 38 banks and financial and credit institutions approved by the central bank were analyzed, which indicates lack of bias in the results obtained in the banking sector of the country. Also, 13 payment service providers were investigated, which indicates a lack of bias in this sector and the generalizability of the results to the entire industry.

Among the samples, 29% belong to the public sector and 71% to the private sector. Such combination is not significant by itself, however, if the research results are accepted, then it can be argued that there is no specific bias in this case and the results obtained can be generalized in all public and private sectors. However, it is noteworthy in this section that the existence of 24 samples out of the 109 samples investigated in this study on the list is known as IMI 100 the Industrial Management Organization, which listed the top 100 companies in 2017, meaning that approximately one-quarter of the top 100 companies in the country were investigated in this study. Moreover, 13

sample investigated in this study are listed on the top 20 IMI100, which can indicate the research results among companies successful and prominent in the country.

The organizational maturity questionnaires, where answers to the questions take place at different levels through the language variables, were sent to the organizations and their validity and reliability were evaluated after completion of the study. The validity of the study was evaluated through face, content and construct validity by experts, and reliability was calculated by Cronbach's alpha. Considering the calculation results, the questionnaire is quite trustworthy.

Figure1. Test Results

Case Processing Summary				Reliability Statistics	
		N	%	Cronbach's Alpha	N of Items
Cases	Valid	101	92.7	.931	36
	Excluded ^a	8	7.3		
	Total	109	100.0		

a. Listwise deletion based on all variables in the procedure

Then, we asked for the opinion of experts for each company, meaning that the first questionnaire on the extend and method of using the company of the intelligent business systems which was completed and sent were investigated by experts, and each company was provided by two types of points, first, the level of maturity intended by the expert, and second, the similarity of the executive method to the designed packages. Each company was also investigated by three experts.

The information completed in the organizational questionnaire and the scores provided by the experts, altogether were analyzed using MATLAB software. Eighty percent of samples were considered for training and 20% of them were considered for testing. Data were tested by fuzzy method and error indices were calculated.

In the fuzzy method, once as single variable for each organizational maturity variable and the executive package calculations were conducted, and once as bivariate the studies were conducted and error indices were calculated. Also, in order to identify the desired radius, the study was conducted in every 10 radius and the radius 0.01 is known as the best radius.

Table 3. Fuzzy bivariate results including execution package and maturity level

Radius	R2	MAE	MAPE	RMSE	MSE
0.01	0.811026	0.209037	0.120757	0.17375	0.030189
0.11	0.766654	0.27814	0.130385	0.207823	0.043191
0.21	0.768412	0.275906	0.129912	0.207106	0.042893
0.31	0.771069	0.273283	0.129484	0.205904	0.042397
0.41	0.767995	0.268668	0.130666	0.204973	0.042014
0.51	0.777452	0.257935	0.130485	0.200509	0.040204
0.61	0.773722	0.257462	0.135603	0.198102	0.039245
0.71	0.762957	0.265648	0.139947	0.197612	0.03905
0.81	0.773706	0.246286	0.135938	0.19444	0.037807
0.91	0.761877	0.251785	0.141521	0.195172	0.038092

Based on the results, the best prediction is made by the radius 0.01. Based on error indices and if the criterion is considered the regression index, the best performance is obtained in the radius 0.01. It seems that the decision-making model of the quality of implementing projects of intelligent business works correctly based on the maturity degree.

However, for more certainty, the data are compared with other methods, including:

1. A bivariate fuzzy method (described in the previous table)
2. Fuzzy hybrid method and genetic metaheuristic algorithm
3. Fuzzy hybrid method and PSO metaheuristic algorithm
4. Dual output neural network method
5. Hybrid neural network and genetic metaheuristic algorithm
6. Hybrid neural network and PSO metaheuristic algorithm

The results of studies and comparisons are as follows:

Table 4. Fuzzy bivariate results including execution package and maturity level

Method	R2	MAE	MAPE	RMSE	MSE
Fuzzy Method (R:0.01)	0.811026	0.209037	0.120757	0.17375	0.030189
Fuzzy & Genetics Algorithm	0.8817	0.055193	0.11198	0.13289	0.01766
Fuzzy & PSO Algorithm	0.14214	0.21825	0.39687	0.27814	0.077361
Neural Network (30 Neurons)	0.63205	0.1398	340.37	0.2559	0.06552
Neural Network & Genetics Algorithm	0.16	0.32624	0.46883	0.40912	0.16738
Neural Network & PSO Algorithm	0.07	0.28225	0.47116	0.360	0.1298

In order to conclude, it should be noted that the model tested was confirmed and the fuzzy method enjoys the necessary efficiency for modeling. Consequently, it is argued that the implementation of intelligent business systems, methodologies used, and intelligent business constructs in any organization should be compatible with the maturity level of its intelligent business, also using the required IT governance processes and methods during the implementation of intelligent business projects added to the success of these projects, and these processes and methods are related to the level of intelligent business maturity of organizations. The above results can be certainly proved in the banking and e-payment industries and, in the opinion of the experts, these relationships can be investigated in the number one organizations of the country.

CONCLUSION

There are two reasons beyond unwelcoming intelligent business solutions in organizations. First, the application of these solutions and, in brief, data-based decision-making in the organization requires intelligent business maturity, and if any organization has not reached the intended maturity level, it cannot accurately use the intended tool. Second, even if the organization enjoys sufficient maturity to use intelligent organizational tools, but the organization lack sufficient power to dominate the application in the organization, staff and managers continue to ignore using the reproductions of intelligent business systems of the organization in the process of adopting basic decisions.

Considering the findings of the present research, the roots of the general acceptance of intelligent business applications in the organization are, first, adapting the intelligent business construct and related applications to the degree of organizational maturity in its use, and second, the presence of the necessary driving force in the organization for the business intelligence governance. This research also plays the role of the idea of a mutual relationship in this application, i.e. the existence of an intelligent business maturity leads to the general acceptance of its applications. Similarly, the governance of the intelligent business tools in the organization leads to the increase of the maturity of the intelligent business.

By and large, applying IT governance processes and methods relies on thinking about some arrangements in the organization, which will result in the correct use of the information and IT infrastructure in the organization, in the case of intelligent business solutions, also the application of methods and processes of IT governance is used to consolidate the use of this tool in the organization, as in strategic intelligent business applications, this application does not go beyond decision-making based on organizational data. If the IT governance processes and methods are institutionalized in the organization, a kind of requirement to change in the decision-making process in the organization is created based on the data and information processed in intelligent business systems, and the well-known organizational decisions will find a kind of technical attachment that will be required with the decision in the decision-making automation system in the organization.

If the requirements of IT governance are considered when developing intelligent business applications in an organization, the result is that in practice, a mechanism and decision-making process is produced during the production of systems alongside the original systems. Meaning that the outputs of intelligent business systems are organizationally and formally used in the organization, and the information processing chain, which were produced up to the dashboard level and multiple reports, but ignored by the users, is suddenly considered, and this chain continues with decision-making automation. To this aim, developing intelligent business systems together with the requirements of the governance together allow the organization to consider its mechanism and automation and plan it.

REFERENCES

- Abbaspour , Ghanbar . "Prioritizing Information Technology (IT) Enablers in Service Organizations by Fuzzy Multiple Criteria Decision Making (F-M.C.D.M)." *BI Management Studies* Volume 5, Issue 18, (Spring 2017): Page 169-193.
- Aghae , Reza , Milad Aghaei, and Asghar Aghaei. "Identification and Interpretation of Key Factors Affecting on Management Information Systems." *BI Management Studies* Volume 4, Issue 15, (Spring 2016): Page 125-148.
- Akhavan, Peyman, Maryam Philsoophian, and Mohammad Hossein Karimi Gavareshki. "Developing a knowledge management strategy model based on maturity level: A Fuzzy Delphi approach." *Iranian Journal of Information Processing and Management* Volume 32, Issue 2 (Winter 2017): 397-420.
- Alinezhad, Alireza, and Ramin Hakimian. "Performance Evaluation of Information Technology (IT) Industries using a hybrid approach of SERVQUAL, DEA and FMCDM Case Study: System Group Co." *BI Management Studies* Volume 1, Issue 3 (Spring 2003): Page 19-46.
- Azar, Adel, Mohammad Sangi, Mohammad Mahdi Izadkhan, and Ali Anvari. "Synergy Management Model of the Holding by Fuzzy Approach; The Role of Information Technology in its Implementation." *Journal of Information Technology Management* Volume 7, Issue 1 (Spring 2015): Page 1-22.
- Bakhshandeh, Somayeh , and Mohamad Hosein Rahmati. "The Investigation of Alignment of Business Intelligence capabilities and components in Conjunction with Creating Business Intelligence Benefits (case: SMEs of Tehran)." *the Journal of Information Technology Management* Volume 8, Issue 1 (Spring 2016): Page 27-46.
- Burns, Tom, and G.M Stalker. *Sociology of Organization: Structures and Relationships*. Edited by Mary Godwyn, & Jody Hoffer Gittel. London: SAGE, 2012.
- Cheng, C, and Y Lin. "Evaluating the best main battle tank using fuzzy decision theory with linguistic criteria evaluation. ." *European Journal of Operational Research* 1421 (2002): 174-186.

- Clavier, Pamela R., Hugo H. Lotriet, and Johan J. van Loggerenberg. "Business Intelligence Challenges in the Context of Goods- and Service-Dominant Logic." 45th Hawaii International Conference on System Sciences. Hawaii: IEEE, 2012.
- Cosic, Ranko, Graeme Shanks, and Sean Maynard. "Towards a Business Analytics Capability Maturity Model." 23rd Australasian Conference on Information Systems. Geelong, 2012.
- Dastranj Mamaghani, Nasrin, and Peyman Akhavan. "Investigating Organizational Readiness of Implementation by Considering Knowledge Management Effective Success Factors." Iranian Journal of Information Processing and Management 26, Issue 3 (7-2011): 493-517.
- Elbashir, Mohamed Z., Philip A. Collier, and Michael J. Davern. "Measuring the effects of business intelligence systems: The relationship between business process and organizational performance." International Journal of Accounting Information Systems, 2008: 135-153.
- Ghazanfari, Mahdi, Mohammad Fathiyan, and Mojtaba Raeis Safari. "Measuring of information technology governance maturity in Iranian financial services industry Comparison between state & private bank sectors using the COBIT4.1 framework." Journal of Information Technology Management Volume 3, Issue 6 (Spring 2011): Page: 63-88.
- Hasanzadeh, Alireza, Leila Namdarian, and Shaban Elahi. "A model for service-oriented architecture (SOA) governance maturity." Iranian Journal of Information Processing and Management Volume 27, Issue 3 (spring 2012): 681-697.
- Hashemi, Seyyed Ali Akbari, Hasan Alvedari, Mohammad Reza Daraei, and Rohollah Razini. "A Model for the Assessment of Organizational Dashboard Development Using Business Intelligence Logic in Organizations." Bi Management Studies Volume 6, Issue 21 (Autumn 2017): Page 93-130.
- Hosseini Ronaghi, Mohammad, and Jafar Mahmoudi. "The relationship between corporate governance and IT governance in public organizations." Journal of Information Technology Management Volume 7, Issue 3 (Autumn 2015): Page 615-634.
- Jiang, James J., Gary Klein, Hsin-Ginn Hwang, Jack Huang, and Shin-Yuan Hung. "An exploration of the relationship between software development process maturity and project performance." Information & Management 41 (2004): pp: 279-288.
- Khadivar, Ameneh, and Fatemeh Abasi. "KM Maturity assessment in 300 top Iranian company." Modern Researches in Decision Making Volume 1, Issue 3 (Autumn 2016): Page 23-42.
- L. Zadeh, A. "The concept of a linguistic variable and its application to approximate reasoning." Information Sciences 8 (1975): 199-249.

- Lahrmann, Gerrit, Frederik Marx, Robert Winter, and Felix Wortmann. "Business Intelligence Maturity: Development and Evaluation of a Theoretical Model." Proceedings of the 44th Hawaii International Conference on System Sciences. Hawaii: IEEE, 2011.
- Ludwig, L, and S Starr. "Library as place: results of a Delphi study." Journal of the Medical Library Association 933 (2005): 315-327.
- Manian, Amir, Mosakhani Mosakhani, and Ali Zare Mirakabad. "Assessing the Maturity Level of Organization in Strategic Alignment between IT and Business (Multi-cut Case Studies: Barid, Caspian and Sepehr)." Journal of Information Technology Management Volume 5, Issue 2 (Summer 2013): Page 171-186.
- Mehrabi, Ali, Edris Mahmoudi, and Reza Alihosseyni. "Business Intelligence Maturity Assessment Using a New Hybrid Model." BI Management Studies Volume 4, Issue 15 (Spring 2016): Page 65-96.
- Nazari Salari, Leila, Ameneh Khadivar, and Neda Abdolvand. "A model for analyzing the barriers of using Business Intelligence (BI) in the tourism industry of Iran, a mixed method approach." Modern Researches in Decision Making Volume 1, Issue 1 (Summer 2016,): Page 79-102.
- Peterson, Ryan. "CRAFTING INFORMATION TECHNOLOGY GOVERNANCE." Information Systems Management, 2004: pp: 7-22.
- Popovič, Aleš, Ray Hackney, Pedro Simões Coelho, and Jurij Jaklič. "Towards business intelligence systems success: Effects of maturity and culture on analytical decision making." Decision Support Systems Vol. 54 (2012): pp: 729-739.
- Raber, D, F Wortmann, and R Winter. "Towards the Measurement of Business Intelligence Maturity." ECIS, 2013.
- Raeesi Vanani, Iman, and Fatemeh Ganjalikhan Hakemi. "Designing an Adaptive Neuro-Fuzzy Inference System for Evaluating the Business Intelligence System Implementation in Software Industry." Journal of Information Technology Management Volume 7, Issue 1 (Spring 2015): Page 85-104.
- Raeis Safari, M., M. Ghazanfari, and M. Fathiyan. "COBIT A Suitable Framework for Measuring IT Governance in Organizations." Iranian Communication and Information Technology Volume 1, Issue 1 And 2 (1-2009): 55-65.
- Rahmanimanesh, Mohammad, Mohsen Shafiei Nikabadi, Fatemeh Pourkarim, and Golafrooz Davoodifar. "Using Fuzzy Flowsort Inference System to Rank the Factors Leading to among Iranian Enterprises." Journal of Information Technology Management Volume 9, Issue 4 (Winter 2018): Page 787-808.
- Rajterič, Irena Hribar. "OVERVIEW OF BUSINESS INTELLIGENCE MATURITY MODELS." Management Vol. 15, Issue 1 (2010): pp. 47-67.

- RANJAN, JAYANTHI. "BUSINESS INTELLIGENCE: CONCEPTS, COMPONENTS, TECHNIQUES AND BENEFITS." *Journal of Theoretical and Applied Information Technology*, 2009: pp: 60-70.
- Rezaeemanesh, Behrooz, Sina Mohammadnabi, and Saviz Mohammadnabi. "Knowledge Management Application in Measurement of Organizational Maturity." *Iranian Journal of Information and Management* 27, Issue 4 (2012): 985-1009.
- Ribbers, Pieter M. A., Ryan R. Peterson, and Marilyn M. Parker. "Designing Information Technology Governance Processes: Diagnosing Contemporary Practices and Competing Theories." 35th Hawaii International Conference on System Sciences. Hawaii: IEEE, 2002.
- Rouhani, Saeed, and Sogol Rabiee Savoji. "An Assessment Model for the Success of Business Intelligence Tools." *BI Management Studies* Volume 4, Issue 15 (Spring 2016): Page 29-64.
- Rouhani, Saeed, and Ahad Zare Ravasan. "A Model for Assessing Business Intelligence level of Enterprise Systems." *BI Management Studies* Volume 1, Issue 2 (Autumn 2013): Page 105-121.
- Saghafi, Fatemeh, and Mehdi Fasanghari. "Comprehensive Interactive Maturity Model for Mobile government." *Iranian Communication and Information Technology* Volume 2, Issue 3 And 4 (8-2010): 27-40.
- Sambamurthy, V., and Robert W. Zmud. "ARRANGEMENTS FOR INFORMATION TECHNOLOGY GOVERNANCE A THEORY OF MULTIPLE CONTINGENCIES." *MIS Quarterly* Vol. 23, No. 2 (1999): pp: 261-290.
- Shafia, Mohammad Ali, Amir Manian, and Iman Raeesi Vanani. "Designing a Fuzzy Inference System for Predicting the Implementation Success of ERP Solution." *Journal of Information Technology Management* Volume 5, Issue 1, (Spring 2013): Page 98-106.
- Skulmoski, G., J. F. T. Hartman, and j. Krahn. "The Delphi Method for Graduate Research." *Journal of Information Technology Education* 6 (2007): 1-21.
- Sledgianowski, D, and J Luftman. "IT-Business Strategic Alignment Maturity: A Case Study." *Journal of Cases on Information Technology*, 72 (2005): pp102-120.
- Tabatabaei, Seyyed ahmad, and Seyed Kamal Chaharsooghi. "Proposing a model for IT services-based assessment approach, based on IT Governance Model." *Iranian Communication and Information Technology* Volume 7, Issue 23 And 24 (12-2016): 53-62.
- Taghva, Mohmmad Reza, and Payman Hajizadeh. "Measuring the Maturity of IT and Business Strategies Alignment in Organization: Case Study of SAIPA-Yadak Company." *Journal of Information Science and Technology* Volume 25, Issue 3 (2010): 481-504.
- TDWI Team. *BI Project Management*. 2010.

- Toghyani, Alireza, Ali Rajabzadeh, and Aliasghar Anvari Rostamy. "Designing of Decision-Making Model in Uncertainty Conditions." *Modern Researches in Decision Making* Volume 1, Issue 1 (Summer 2016): Page 189-216.
- van der Raadt, B. "The relation between EA effectiveness and stakeholder satisfaction." *Journal of Systems and Software* 83 (2010): pp.1954-1969.
- Wixon, B, and H Watson. "An emprical investigation of the factor affecting data warehousing success." *MIS Quarterly* 25 (2001): pp: 17-41.
- Wu, Shelly Ping-Ju, Detmar W. Straub, and Ting-Peng Liang. "HOW INFORMATION TECHNOLOGY GOVERNANCE MECHANISMS AND STRATEGIC ALIGNMENT INFLUENCE ORGANIZATIONAL PERFORMANCE: INSIGHTS FROM A MATCHED SURVEY OF BUSINESS AND IT MANAGERS." *MIS Quarterly* Vol. 39 (June 2015): pp. 497-518.