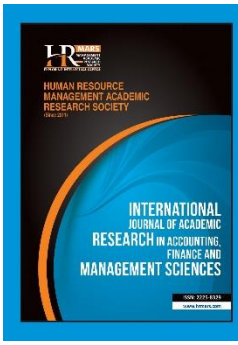

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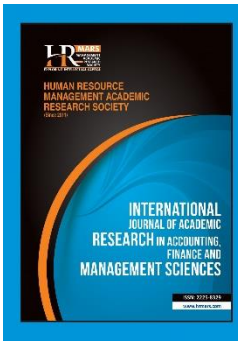
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A Study of the Influencing Technological and Technical Factors Successful Implementation of Business Intelligence System in Internet Service Providers Companies

Nazanin Khojasteh[1], Reza Ansari[2], Hosein Rezaee Dolat Abadi[3]

[1]Commercial Management Islamic Azad University Najaf abad, Isfahan, Iran, [2,3]University of Isfahan, Isfahan, Iran

Email: n.khojasteh@gmail.com, rezaansar@yahoo.com, Ho.rezaie@gmail.com

Abstract

The present research has been done to consider the technological and technical factors affected on the implementation of business intelligence system in Shuttle Company which presents Internet services. The type of this research is from descriptive-quantitative one. In order to determine the technological and technical factors, the literature of the subject has been considered and the effective factors have been extracted through the studying of Shuttle Company. These factors were classified based on experts' ideas and distributed in the form of questionnaire. The descriptive statistics were used to analyze the descriptive data and analytic factor analysis was done by means of SPSS and LISREL software for the purpose of determining the factors validity (ranges of research) and examining the hypotheses. At the end, all of the components of technological and technical factors were confirmed as effective factors on the implementation of business intelligence system. These components include Extensible technical framework (hardware and software), System and data quality, Appropriate technology/tools, Integration between Business intelligence systems with other systems.

Keywords: Critical Success Factors, Technological and Technical Factors, Business Intelligence System, Factor Analysis

Introduction

New technologies are progressing with a so a break-neck speed, that societies, in general, and market, in particular, with an indescribable haste look for ways to guarantee their survival in this chaotic and unstable situation. Organizations should accept that their philosophy of life has changed and existence no longer means permanent benefit status; they must seek competition and its instruments since nowadays too few companies work in the traditional way, away from the new rules of the game. So to keep up with the competitors, or to move a step further than them with high skill and difficulties, they should master the new

rules of game so that some day they may be able to make a new regulation. So mastering the new technologies, such as business intelligence, becomes crucial and inevitable (Maes and Gutman, 1999).

In other words, business intelligence is a vast aspect of functions and technologies to collect the data and knowledge required for creating inquiry for analyzing business to make intelligent and minute commercial decisions. Data turns into knowledge through entering business intelligence system and being analyzed. Then this knowledge is analyzed and analytical conclusions are drawn (Olszak and Ziemba, 2012).

Literature Review

Modern business intelligence systems complexity and adaptability means that their successful performance needs referring to methods with strong foundation and proved scientific theories. It seems that "Critical Success Factors" theory is a good foundation to express factors that must be followed for implementing systems (Olszak and Ziemba, 2012).

Rockart (1979) provides one of the most common definitions through using opinions Daniel and Anthony (1961); Dearden and Vancil (1972). His definition is: "Critical Success Factors are a limited number of satisfying factors that guarantee successful competitive operation for the organization". The author insists on factors and actions that must be constantly and cautiously managed for company's survival (Vodaplli, 2009). Regarding business intelligence systems, Critical Success Factors can be defined as a combination of tasks and approaches that must be considered to make sure of business intelligence success (Olszak and Ziemba, 2012).

Yeoh (2008) identifies four categories for implementing business intelligence which are technical, processing, organizational and environmental factors. Technical factors are: instruments, systems, ultra-systems, business intelligence development, and business intelligence architecture and also data quality. Processing factors are: the project, project management, skills and users. Organizational factors are: organization's short term and long term goals, organization and management issues. And environmental factors that are in relation to environment.

Wixom and Watson (2001) categorize these factors in three groups that are organizational factors, technical factors and project-related factors. They measured both implementing and success of business intelligence system.

Ariyachandra and Watson (2006), analyzing CSFs for BI implementation, take into account two key dimensions: process performance (i.e., how well the process of a BI system implementation went), and infrastructure performance (i.e. the quality of the system and the standard of output). Process performance can be assessed in terms of time-schedule and budgetary considerations. Whereas infrastructure performance is connected with the quality of system and information as well as this system use.

In this research we will study technical and technological factors influencing successful implementing of business intelligence system as a Critical Success Factors.

In researches done in different years in the field of key factors influencing business intelligence system, technical and technological factors are defined in various manners.

Vodapalli (2009) in a research in Copenhagen University titled "Critical Success Factors in implementing business intelligence system" identifies technical and technological factors influencing successful implementing of business intelligence system as Robust and extensible framework, Data quality and management issues, Appropriate technology/tools, Integrated BI applications, Performance considerations. Olszak and Ziemba (2012) did a research titled

"Critical Success Factors for implementing business intelligence systems in small and medium Enterprises on the example of Upper Silesia, Pland" and deep case study in 200 Silesia companies in Poland and identified technical and technological factors influencing business intelligence system implementing as Integration between BI systems and other systems (e.g. ERP), Data quality, BI flexibility and responsiveness on user's requirements, Appropriate technology/tools, "User friendly" (usability) BI system.

Yeoh and Koronios (2010) in a research titled "Critical Success Factors for business intelligence systems" and by Delphi method tried to identify effective factors. They identify technical and technological factors as Business-driven, stable and flexible technical framework, Sustainable data quality and integrity.

Research Structures

Extensible technical framework (hardware and software):

Many experts have stated, based upon strategic and extensible technical framework, that back-ends/fixed resources are important in implementing business intelligence system. A reliable back-end is important for justifying that data updates work for extracting, transferring, and loading phases in operational situations (Chen, 2007).

Technical framework of business intelligence system must be capable for matching scalability and extensibility requirements. With a strategic view in system design, scaling system framework can include more data resources, characteristics, and dimensional positions in reality-based analysis, and combine external data of sellers, contractors, legislatures, and industry foundations (Watson et al, 2004). Then long term solution for meeting business needs can be found. In this article, studying the attitudes of Eckerson (2005), Howson (2006) and Imhoff (2004), we studied the three markers below, as the markers of this component: sustaining the required data about customers and suppliers in an electronic database, categorizing customers' and suppliers' information, using a reliable data source in the company.

System and data quality

If the business intelligence system is applied successfully, data quality especially in source systems matters. Usually many related issues in the back-end systems are not detected until collection and search in the business intelligence system. So data quality in resources affects reports management quality that will influence the results of decisions (Watson et al, 2004).

It is important for the business intelligence team to evaluate resource's systems stability and flexibility before the business intelligence projects start. Otherwise, after implementing the system, changes expenses based on time and money will be of importance. In this article, studying the attitudes of Markarian (2007), Veset (2005), Wixom and Watson (2001) and Yeoh and koronios (2010), we studied the five markers below as the markers of this opponent: being up-to-date, accuracy, data precision and completeness, data comprehensiveness and interpretability, efficient and effective distribution of data all over the company, high quality of company system, company system's extensibility and flexibility for making custom-built systems.

Appropriate technology/tools

Business intelligence system prepares organizational data in a way that the organizational knowledge can be easily filtered through them and turned into useful

knowledge for the organization. Those involved in business intelligence processes use different technologies, software programs and instruments to collect, save, analyze, and creating access to the data. These instruments help in managing business operation and also help people make a better decision using correct, accessible, and related data, given to them in the proper time. Some of these instruments are data warehouses, databases, decision back-end etc. (Ranjan, 2009). In this article, studying attitudes of Zeng (2006), Ranjan (2008), Ranjan (2009), Howson (2006), de Henry (2009), Yeoh (2000), we studied the thirteen markers below as the markers of this component: company's access to high speed internet, company's access to wireless connections, company's access to intranet and extranet, employees' access to e-mail, using security levels to protect the information, limiting the access for legal users, public software programs ease of use, the level of in-use software programs being up-to-date, company's website, website quality and ease of browsing the pages and use, sufficient information about the company on the website, regular website updating, website's English language backup.

Integration between Business intelligence systems with other systems:

The main goal of a business intelligence system is uniting data stores for advance analysis to improve decision-making process (Yeoh et al, 2008). In this article, studying attitudes of Knightsbridge (2006); Olszak and Ziemba (2012), we studied the two markers below as the markers of this component: the level of company's key processes automation, the level of harmony among units involved in company's processes.

Conceptual Model and Research Hypotheses

Research visionary frame is a conceptual model based on theory relationships among a number of factors identified as important for the research issue. Visionary frame speaks of internal links among variables that ultimately play a role in the present situation's dynamism, under study (Sakaran, 1386). Through review of literature markers of technological and technical factors of each component were determined and presented in previous part. Review of literature can prepare a suitable frame for modeling, but to affirm the context asking experts' attitudes is a proper approach (Yin, 2003). In this research also, to affirm the context of Iranian companies especially those related to IT, asking experts' attitudes was considered a good way to improve literature findings. The conceptual model according to literature findings and experts' attitudes is suggested in the figure below.

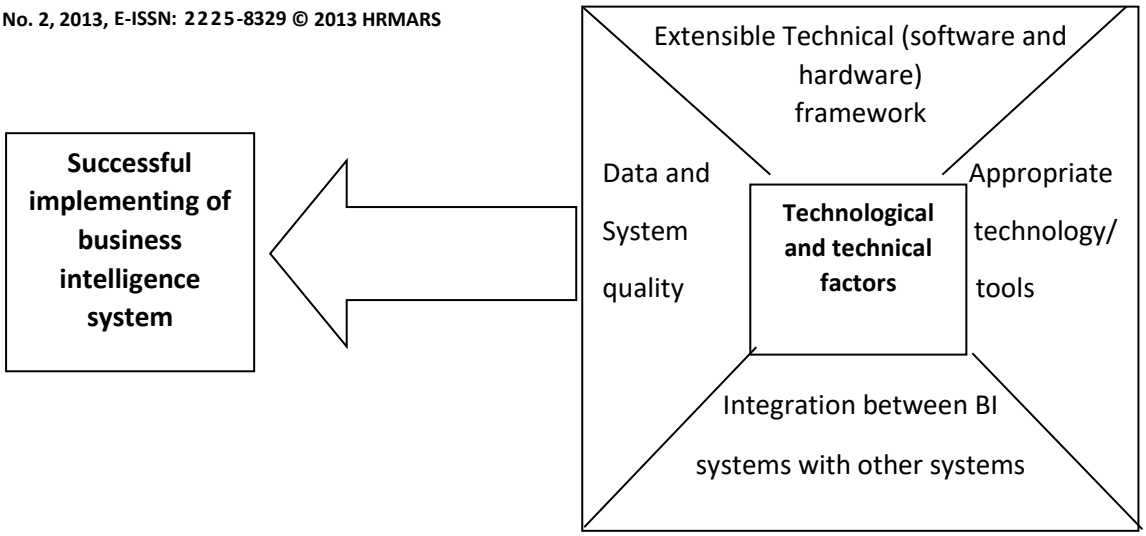

Figure 1. Research conceptual model

Research Hypotheses

H1- studying the relationship between technological and technical factors and successful implementing of business intelligence system

H1-1 studying the relationship between extensible technical framework (software and hardware) and successful implementing of business intelligence system

H1-2 studying the relationship between data and system quality and successful implementing of business intelligence system

H1-3 studying the relationship between appropriate technology/tools and successful implementing of business intelligence system

H1-4 studying the relationship between Integration between business intelligence systems with other systems and successful implementing of business intelligence system

Research Methodology

The goal of this research is analyzing technological and technical factors to successfully implement business intelligence system. So the present research is functional from the goal aspect and descriptive-survey. To collect the research literature available Persian and English articles and books were used. Data collection instrument was questionnaire. This questionnaire was first given to 10 experts and then with the corrections based on experts opinions applied, the final questionnaire was designed with five-choice Likert scale, including variables related to organizational factors to implement business intelligence system successfully, and contains 29 questions (23 questions on the hypotheses and 6 demographic questions) and was administered among the responders. The research population was built up of Shuttle Company managers and employees.

Shuttle Company

Shuttle companies group is the biggest active group in internet access services and e-communication methods in the country. Shuttle companies group's main and leading actions are:

- ADSL2+ high speed internet services;
- Providing and implementing access and aggregation networks for communicational companies and big organizations;

- Proprietary bandwidth services (wireless and copper-cable based);
- And other electronic and internet services by this company.

Presently Shuttle's human force consists of more than 800 university graduates of different fields of study, giving service to customers in company's different parts.

Using Cochran formula sample had approximately 180 members and the questionnaire was administered among them. To estimate questionnaire validity there are many ways. In this research we used content and construct validity. Reliability is also a technical feature of measuring instruments that shows how much the measuring instrument provides the same result in the same situation. In this research reliability is estimated by Cronbach's alpha. So using the data acquired through questionnaires and by the statistical software program, SPSS, the rate of reliability was estimated using Cronbach's alpha. Cronbach's coefficient alpha was calculated 0.88 for technical framework (software and hardware), 0.83 for data and system quality, 0.87 for appropriate technology/tools, and 0.80 for Integration between business intelligence with other systems. These numbers show that the questionnaire used is reliable. Descriptive data were analyzed through descriptive statistics, and analytical factor analysis was used to estimate elements (research structures) validity and test the research hypotheses, using SPSS and LISREL software programs.

Results of Demographic Data Analysis

Results of demographic data analysis consist of the information below:

Table 1. Demographic findings

Instruments	Quantity	Frequency	Frequency percentile
Sex	*Female*	120	66.7
	Male	60	33.3
Organizational position	*Manager*	1	0.6
	Expert	157	87.2
	Other	22	12.2
Educational level	*Diploma or AA*	36	20
	BA	132	73.3
	MS	11	6.1
	PhD	1	0.6
Job experience	*Below 5 years*	137	76.1
	5 to 10 years	37	20.6
	10 to 15 years	3	1.7
	15 to 20 years	1	0.6
	Above 20 years	2	1.1
IT familiarity	*Perfect*	26	14.4
	Good	88	48.9
	Average	60	33.3
	Weak	6	3.3

Research Structures Measurement Models

To study the conceptual model and factor structure test, level 2 factor analyses was used. Results of these analyses were done by LISREL 8.5 software program. Also, to examine instruments' construct reliability and model fitting, level 1 factor analysis using LISREL

software program was considered. In confirmatory factor analysis one must bear in mind that there is no optimum test for examining fitting's goodness. Though different kinds of tests, called generally fitting indexes, are constantly being compared, developed and completed, there is no agreement over even one optimum test (Houman, 1384). Normally a number of indexes are used to test model fitting, but for confirming a model, usually 3 to 5 indexes suffice (Ghazi, 1381). In this research for examining fitting's goodness AGFI, GFI, CFI, NFI, RMSEA indexes are used.

RMSEA index is the root mean square error of approximation. Low values of this index shows good fitting of the model, meaning that this index is equal to or below 0.05 for good models (0.05 to 1.00 is counted as almost good) (Azar and Momeni, 1388).

AGFI (Adjusted Goodness of Fit Index) and GFI (Goodness-of-Fit index) are the proportion of squares sum stated by the model to the total squares sum of the assessed Matrix in the population. This index is similar to correlation coefficient. Both are variables between 0 and 1. The more they approach 1, the higher model fitting goodness with observed data will be (Delavar, 1383). NFI, also called Bentler-Bunnet, suggests values equal to or bigger than 0.9 compared to zero model, as goodness index for model fitting, whereas some researchers use 0.80 as the cutting point (Zanjirchi and Olfat, 189; Mehregan et al, 1387). CFI index is similar to NFI and based on conventions values above 0.90 are acceptable and show model fitting $\frac{x^2}{df}$, as x^2 modified, is an adaptation proportion index and its modification with population size. This test's value is better to be below 3, too. Now results of analyses by LISREL on each research structure id presented (Kalantari, 1388).

Table 2. Results of model fitting indexes values

Research structure / Index / model fitting	/dfx^2	CFI	NFI	AGFI	GFI	RMSEA
Extensible technical framework (software and hardware)	0	1	1	1	1	0
Data and system quality	2.07	0.99	0.98	0.93	0.98	0.077
Appropriate technology/tools	1.81	0.96	0.92	0.87	0.92	0.067
Integration between Business intelligence systems with other systems	0	1	1	1	1	0

According to results of table 2, markers and elements of business intelligence system in the designed model are proper markers and elements, since model fitting indexes in level 2 confirmatory factor analyses were all proper and showed model fitting. Proportion of Chi-square to degree of freedom is 1.54 and below the rated level. RMSEA is also 0.055 and at an acceptable rate. Other fitting indexes such as: AGFI, GFI, IFI, CFI, NFI are near 1 and counted as proper indexes of model fitting.

Also according to t-values factor loads from model presentation (above 1.96), all research hypotheses were confirmed. The conclusion of testing the research hypotheses is briefly presented in the table below:

Table 3. Summary of testing the research hypotheses conclusion

Hypothesis	t-value	confirmation	Rejection
H1- technological and technical factors have a meaningful relationship with implementation of business intelligence system	8.24		
H1-1: extensible technical framework (software and hardware) has a meaningful relationship with successful implementation of business intelligence system	8.79		
H1-2: quality of data and procedural factors system and business have a meaningful relationship with successful implementation of business intelligence system	8.78		
H1-3: Appropriate technology/ tools has a meaningful relationship with successful implementation of business intelligence system	8.49		
H1-4:Integration between business intelligence systems with other systems has a meaningful relationship with successful implementation of business intelligence system	6.70		

Factors Ranking

Using Freedman test factors examined are classified separately, the conclusion of which you can see in the table below:

Table 4. Technical and technological factors ranking using Freedman test

Technical and technological factors components	Rank mean
Extensible technical framework (software and hardware)	2.89
Data and system quality	2.18
Appropriate technology/ tools	2.71
Integration between Business intelligence systems with other systems	2.22

According to the conclusions extensible technical framework (software and hardware) ranked the first, proper technology/instruments ranked the second, Business intelligence systems unity with other systems third and Data and system quality was placed fourth.

Discussion and Conclusions

This research shows that technological and technical factors influencing successful implementation of business intelligence system have four components, which are extensible technical framework (software and hardware), data and system quality, appropriate technology/tools and Integration between business intelligence systems with other systems.

Taking into account the confirmation of the first hypothesis and the minor ones related to it, showing the relationship of technological and technical factors and successful implementation of business intelligence system, it is suggested that managers of Shuttle Company pay the required attention to these factors, since it is one of the most important factors of successful implementation of business intelligence systems.

Based on hypothesis 1-1 it is suggested that for successful implementation of business intelligence systems, extensible hardware and software programs be used, since with a strategic and long term look toward these systems and using extensible technical frameworks a long term solution can be found for meeting business needs. Flexibility and open architecture of these systems makes their easy development possible. This issue is of great importance when new informational needs are created or the amount of the information to be processed increases remarkably.

Based on hypothesis 1-2 we can say that as the quality of the company's systems' and the current information increases, better reports can be made and submitted to the managers to be used in their decisions. Quality of decision-making, strategic scheduling and unstructured decisions will improve by accurate and on time data collection.

As it is apparent in hypothesis 1-3, using proper and up-to-date technologies and instruments can improve the successful implementation of business intelligence systems. Business intelligence systems should be based upon new technologies so that we can use them more confidently.

And also according to hypothesis 1-4 we can suggest that for successful implementation of business intelligence systems, it is better for these systems to be in harmony with other company systems, like organization resources scheduling system, exchange systems, customer contact systems etc. to improve information current and decision-making process.

References

Anthony, R. N., Dearden, J., & Vancil, R. F. (1972). *Management control systems.* Homewood: Irwin.

Ariyachandra, T., & Watson, H. (2006). Which data warehouse architecture is most successful. *Business Intelligence Journal*, 11(1), 14-23.

Azar, A., & Momeni, M. (1388). Statistics and Application in management. Tehran: SAMT Publications.

Chen, S. Y., & Liu, X. (2007). Data mining from 1994 to 2004: An application oriented review. *International journal of Business intelligence and Data mining*, 1(1), 4-11.

deHenry, F. (2009). Accessing BI Readiness, FMT Systems Inc. Retrieved from http://www.slideshare.net/buttonback/bi-readiness-by-fmt

Delavar, A. (1383). Theoretical and Scientific Research. Tehran: Roshd Publications.

Eckerson, W. (2005). The Keys to Enterprise Business Intelligence: Critical Success Factor, Business Objects. *A Data Warehouse Institute*, 4(1), 1-15.

Ghazi, M. (1381). The process of formulating, implementing and interpreting the output end, for a Liserel Model. *Yearbook of Research and Evaluation in Social and Behavioral Sciences*, 21(4), 81-125.

Houman, H. (1384). Structural Equation Modeling with Liserel. Tehran: SAMT Publications.

Howson, C. (2006). The Seven Pillars of BI Success. Retrieved from *http*://intelligententerprise informationweek.com/showArticle.jhtml;jsessionid=4U1PP2ZX5QBP3QE1GHPCKH4ATMY32JVN?articleID=192300046

Imhoff, C. (2004). Business Intelligence-Five Factor for Success. Retrieved from http://www.b-eye-network.com/print/252

Kalantari, K. (1388). Structural Equation Modeling in Social Research – Economic. Tehran: Farhange Saba Publications.

Ksbridge, K. (2006). Getting Smart about BI: Best Practices Deliver Real Value. *Business Week Research Services*.

Leidecker, J., & Bruno, A. (1987). CSF Analysis and the Strategy Development Process. *Strategic Planning and Management handbook*, 333-351.

Maes, P., Guttman, R., & Moukas, A. (1999). Agents that Buy and Sell. *Communications of ACM*, 24(3), 81-91.

Markarian, J. (2007). Critical Success Factors deploying pervasive BI. Informatica, Teradata, Microstrategy.

Mehregan, M., Asgharizadeh, A., & Safari, H. (1387). Model designed to assess the competitiveness at the firm level using Structured Equation Modeling Case Study: National Petrochemical Company of Iran. *Quarterly Journal of Commerce,* 46(2), 1-36.

Olszak, C. M., & Ziemba, E. (2007). Approach to Building and Implementing Business Intelligence systems. *Interdisciplinary Journal of Information, Knowledge, Management,* 2(1), 135-148.

Olszak, C. M., & 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, Knowledge, Management*, 7(2), 129-150.

Rockart, J. (1979). Chief executives define their own information needs. *Harvard Business Review*, *March/April*, 81-92.

Vesset, D. (2005). *Bridging the IT and Business Needs Gap: Keys to Successful Business Intelligence Deployment.* IDC.

Vodapalli, N. (2009). Critical Success Factors of BI Implementation. Master's Thesis Report, IT University of Copenhagen.

Williams, S., & Williams, N. (2004). The business value of Business Intelligence. *Business Intelligence Journal*, 8(3), 3-6.

Williams, S., & Williams, N. (2006). The profit impact of Business Intelligence. Morgan Kaufmann, San Francisco C.A. Implementation. Master's Thesis Report, IT University of Copenhagen.

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

Yeoh, W., & Kronios, A. (2010). Critical Success Factors for Business Intelligence Systems. *Journal of Computer Information Systems*, 23-32.

Yeoh, W. (2008). Critical Success Factor for Implementation of Business Intelligence Systems in engineering Asset Management Organizations. *International Journal of Enterprise Information Systems*, 4(3), 9-94.

Yin, R. (2003). Case Study Research-Design and Methods (3thed). Thousand Oaks, California: Sage Publications.

Zanjirchi, S., & Olfat, L. (1389). IT's role in achieving agility in electronics companies in Iran. *Journal of Science and Technology Policy,* 3(1), 22-44.

Zeng, L., Xu, L., Shi, Z., Wang, M., & Wu, W. (2006). Techniques, process and enterprise solutions of business intelligence. *IEEE Conference of Systems, Man, and Cybernetics*, Taipei, Taiwan, 6.