An Investigation Study on Business Intelligence Success

Mostafa GhelichKhani

Abstract—Among the most important research fields, when deciding on the implementation and deployment of information systems in organizations, is study of Success Model and identify critical success factors (CSF) of information systems. Any information system has its own special model and factors of success while the success of operating information systems has been well-researched; our understanding of how of relevance between the dimensions of BI with each other and that how they can affect use of BI, is limited. This report aims to introduce and provide a framework for business intelligence success, and it has been enjoyed of the results of the Delphi group to identify critical contextual success factors of business intelligence (CCSF), Yeoh & Koronios model of BI Success whose know success as a result of interoperability of four groups of Infrastructure, Process, Organization and technology, the university proposed model of business intelligence success... that is based on the literature of information systems and organizational maturity, quality of information, culture on analytical decision-making and how the use of information in decision-making is introduced as various aspects of business intelligence systems, and organizational model of business intelligence maturity provided in ... Mentioned models, defined the information quality (IQ) as the degree of data availability and correctness of organizational information and have considered it as the main criterion to determine the maturity of BI and they have perceived the business intelligence success as how use of information in business processes and impact of use of business intelligence systems information on business processes and thus the Commercial added-value (Value) for organization.

Index Terms—Investigation, Business, Success.

1 INTRODUCTION

TODAY, business executives, do not consider success in applying information technology only of transfer rate and amount of information exchanged, rather, their criterion is the value added to the enterprise data, in other words, the process of converting raw data into useful information is more important to corporate; a business intelligence system by providing the ability to faster access to information, enabling a more interactive FAQ, more information compatibility, information integration and information management (modifying and organizing information) lead to increase the value of information in the information value chain of organization. Different definitions of business intelligence are proposed, but like most multi-faceted and complex concepts, there are no universally agreed upon definition. Business intelligence have been defined as the ability of a business to plan, predict, problem solving, abstract thinking, training, creativity, learning, shaping the decision-making process, make effective decisions and, ultimately, the power to achieve organizational goals which are including processes, technologies, tools, applications, data, databases, dashboards, scoring cards, and data analysis systems. [2] Now a large share of corporate capital is spending to develop of business intelligence systems. However, the use of business intelligence, despite the potential facilities has been associated with confusion and disorder. Official statistics show high failure rate of BI projects. Gartner Group warned in its report that more than half of the companies active in the field of Business Intelligence have experienced at least one failure in the projects of BI [1]; these failures, had have heavy financial losses for employers and the consumer organizations are faced with many problems, these failures have occurred for several reasons, one of the main reasons for it, is that the organizations are not familiar with critical success factors (CSF), Success Models and necessary preconditions for the successful use of BI in organizations. This report aims to introduce and develop a framework for success including critical success factors, success models and enterprise BI maturity levels and for this used of the Delphi Group Research results in Fourth International Conference on System Sciences, University of Hawaii, two proposed models of BI success and organizational maturity model presented at the Fourth International Conference on systems Sciences. These studies were based on information systems literature and organizational maturity, information quality, culture on analytical decision-making and how to use of information in decision-making are proposed as different aspects of business intelligence systems and considering the interoperability of above mentioned aspects offer a framework for moving towards business intelligence success in organizations.

2 THE GOALS AND APPLICATIONS OF THE SUBJECT

Among the most important research areas when deciding to use information systems in organizations, is identifying critical success factors and impact of IS on the business value of organizations [2]. Due to different aspect and complexity of business intelligence, applying these models, methods and tools in the early stages of assessing the readiness of organizations to deploy business intelligence systems, lead to control and better manage of business intelligence implementation projects. Using these results, organization can identify the fac-

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tors that make break or success of investment and use of success factors as a measure for correct implementing of plan and, make ensure of the correct path and compliance prerequisite, and guarantee its investment return.

3 Issues and Problems Relating to the Subject Matter

Many studies have been done in the area of information systems success, including their most commonly used model is McLean and DeLone model of IS success model. Any information system has its own specific model and factors of success. Compared with the operating system, BIS success is usually difficult to assess since BISs, are enterprise-wide systems where further profit, are long-term and indirect and difficult to measure. A team of researchers of business intelligence such as Watson and Waxium believe that the information system models are public and for successful implementation of business intelligence making specific models of this domain is required. According to these two researchers, yet comprehensive research has not been done on various aspects affecting business intelligence, required resource, business value and its impact on company’s success and we need to do more extensive research in this area, Koronios, from others in the field, has suggested to create a framework of critical success factors including critical success factors and dimensions of the various elements involved in the successful use of business intelligence. Koronios believes running and implementation of BI is not as easily and structured as IT-based systems such as event processing systems. Application systems such as TPS have many frameworks for evaluating success that BI lacks it [3].

4 Solutions Provided with the References

As was discussed in the previous sections, yet comprehensive research has not been done on various affecting aspects on business intelligence and we need to do more extensive research in this area. In response to this problem, in this section the critical factors for successful implementation of business intelligence has been investigated and then in the second part two proposed model are presented for BI success projects. These studies were based on information systems literature and organizational maturity, information quality, culture on analytical decision-making and how to use of information in decision-making are proposed as different aspects of business intelligence systems and considering the interoperability of above mentioned aspects offer a framework for moving towards business intelligence success in organizations.

5 Part One) Introduction the Critical Success Factors of Delphi Group

A lot of research has been done on identifying critical success factors of business intelligence. But Delphi group has studied factors according to their context, in three dimensions of relevance and importance of the factor in BI success, variability of the factor and controllability by the project manager of business intelligence [1]. More precisely, current studies do not focus only on the importance of the relevance of factor in the business intelligence success but also deals with two important issues in the management, i.e., uncertainty of factors due to the dynamic changes in the organization and actual controllability of critical factors by BI project manager [1]. Delphi Group has conducted these studies in two stages, in the first part of studies, using an expert staff, has identified a list of critical success factors, by their relevance index with BI success which are shown in Table 3 [1]. These factors not only are different in the amount and manner of relevance with business intelligence, but also there are different in dynamic range and controllability. For example if we classify in terms of controllability of the project manager, market dynamics is located outside the organization, literate people and style of management is located in the organization, technical capabilities of IT staff and up-to-date tools in the IT department and strategy of business intelligence are located in BI- Steering Committee. In the next step Delphi Group is assessed these factors (Table 3) from two dimensions of variability and controllability through survey of BI professionals.

At this stage, the respondents have been asked to show their views by scoring any variable at 5-point Likert scale includes relevance (1: Important barely 5: very important), variability (1: never varies; 5: continuously variable), and controllability (1: uncontrollable 5: Well-controlled). The survey results are shown in six clusters in Table 4 [1].

<table>
<thead>
<tr>
<th>Table 1</th>
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<tbody>
<tr>
<td><strong>List of Underlying Critical Success Factors (CCSF)</strong></td>
</tr>
<tr>
<td>Factor</td>
</tr>
<tr>
<td>Business Model</td>
</tr>
<tr>
<td>Company’s Strategy</td>
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<tr>
<td>Data Sources</td>
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<tr>
<td>Factor</td>
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<tr>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>The degree of competition</td>
</tr>
<tr>
<td>Distribution channels</td>
</tr>
<tr>
<td>Financial status</td>
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<tr>
<td>Heterogeneous of IT infrastructure</td>
</tr>
<tr>
<td>Industry</td>
</tr>
<tr>
<td>The role of informal communication in organization</td>
</tr>
<tr>
<td>IT Budget</td>
</tr>
<tr>
<td>IT impact on firm strategy</td>
</tr>
<tr>
<td>Terms and Conditions</td>
</tr>
<tr>
<td>IT literate of staff</td>
</tr>
<tr>
<td>Place of IT department</td>
</tr>
<tr>
<td>Market dynamics</td>
</tr>
<tr>
<td>Management style</td>
</tr>
<tr>
<td>Size of organization</td>
</tr>
<tr>
<td>Organizational structure</td>
</tr>
<tr>
<td>Ownership structure</td>
</tr>
<tr>
<td>The degree of mechanization of business processes in the organization</td>
</tr>
<tr>
<td>Frequency of product innovation</td>
</tr>
<tr>
<td>Product range</td>
</tr>
<tr>
<td>The complexity of competitors’ BI technology</td>
</tr>
</tbody>
</table>
In the next step Delphi Group is assessed these factors (Table 1) from two dimensions of variability and controllability through survey of BI professionals.

At this stage, the respondents have been asked to show their views by scoring any variable at 5-point Likert scale includes relevance (1: Important barely 5: very important), variability (1: never varies; 5: continuously variable), and controllability (1: uncontrollable 5: Well-controlled). The survey results are shown in six clusters in Table (2).

### TABLE 2

<table>
<thead>
<tr>
<th>Cluster I (R+/V+/C*)</th>
<th>Cluster II (R+/V+/*C+)</th>
<th>Cluster III (R+/V*/C+)</th>
<th>Cluster IV (R+/V+/C+)</th>
<th>Cluster V (R*/V+/*C+)</th>
<th>Cluster VI (R*/V-/*C+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management support or development</td>
<td>Completeness and being up-to-date</td>
<td>IT Infrastructure</td>
<td>IT Budget</td>
<td>Company’s Strategy</td>
<td>Financial status</td>
</tr>
<tr>
<td>R: Relevance and importance</td>
<td>+High, +Medium, -Low</td>
<td>V: Variability</td>
<td>C: Controllability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 6 ANALYSIS OF RESULTS

Clusters are arranged primarily in terms of their relevance and importance to the success of business intelligence and secondly in terms of variability. To better understand the concept of simultaneously look from three-dimension to a factor we consider the factor of senior management support. According to the results, the factor of senior management support is important not only for BI applications in the organization, but also with a moderate degree project manager can control it and simultaneously, it is in a high degree of variability over time. This situation represents a very important critical factor that needs to constant attention of BI Project Manager. If management support, for example, from weak to strong falls, BI manager would see the most important critical success factor at risk, and other factors such as IT budgets may also be affected.

Using this logic, other clusters can be interpreted similarly.

For example, in cluster 6 rated factors (relevance, controllability, and low variability) include factors that due to uncontrollable by the project manager and low variability need to less attention of the project manager. Clusters II, IV and V are in particular interest of business intelligence project manager. For example, cluster II, factors include areas with a high degree of relevance (corporate strategy, product range, financial and market dynamics) that indicates the level of business intelligence support of organization business objectives. Each factor in cluster II in business intelligence success having high relevance is in a low degree of variability and controllability by project manager. The important point that is the purpose of this research is that in this case, even if BI project manager can have little impact on these factors, (according to their importance), will have a huge impact on the success of a business intelligence project [1].

### 7 PART TWO) INTRODUCTION OF BUSINESS
INTELLIGENCE SUCCESS MODELS

Many studies have been done in the field of information systems success, including the most widely used, is DeLone and McLean’s multi-dimensional model of information systems success. This model focuses the concept of applying (Use) and effectiveness (Impact) as a main indicator of success of information systems that these concepts are affected directly from the concept of quality (system quality, information and services). The model emphasizes on understanding the relevance between different dimensions of success, but ultimately is the value (net profit) of outcome success variable of this model.

Researchers are considered the level of application and usability of information systems as criteria to determine the level of projects success. This means that the system how much is accepted by the users, and whether users can meet their needs by taking advantage of it? Some models have used of efficient concepts and variables in IS models. These models know an information system beyond technology and consider it as combining of Strategy, the process and infrastructure and seek to maximize the use, based on cooperation of social system includes staff, methodologies of capability and corporate experience and technical systems consists of technical tools and infrastructure [4].

Any information system has its own special model and factors to success, but compared to the operating system, assess the success of the BIS is usually more difficult, since BISs are enterprise-wide systems that return on investment in it, is long-term and indirect and it is difficult to measure. Business Intelligence Systems (BIS) are technological solutions that provide data integration and analysis capabilities for stakeholders in different organizational levels and can provide valuable information for decision-making. Waxium and Watson believe that still comprehensive research has not been done on various aspects affecting business intelligence, required resource, business value and the level of its affect on company's success and we need further research in this area and Koronios proposed to create a framework of critical success factors including critical success factors and various dimensions and elements involved in the successful use of business intelligence. Following Yeoh & Koronios model of success, proposed model of BI systems success… has been introduced.

<table>
<thead>
<tr>
<th>Operating IS</th>
<th>BIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structuring of processes</td>
<td>Higher</td>
</tr>
<tr>
<td>Set area of information needs</td>
<td>processes</td>
</tr>
<tr>
<td>Methods of determining the information needs</td>
<td>Well-structured</td>
</tr>
<tr>
<td>The data sources used</td>
<td>More than process itself</td>
</tr>
<tr>
<td>The level of liberty in use</td>
<td>Lower</td>
</tr>
<tr>
<td>IS focus</td>
<td>Application and process-oriented</td>
</tr>
<tr>
<td>Major issues in Data Quality</td>
<td>The quality and accuracy of data acquisition</td>
</tr>
<tr>
<td>Level of integration of IS</td>
<td>Process</td>
</tr>
<tr>
<td>Level of required reliability in IS</td>
<td>Higher</td>
</tr>
</tbody>
</table>

**TABLE: DIFFERENCE BETWEEN OPERATIONAL SYSTEMS AND BUSINESS INTELLIGENCE**

1) The proposed model of success

As mentioned, each information system has its own success models and success criteria, depending on the systems are different. Due to this problem, designers of proposed model, have been adjusted general model of information systems success so that to reflect the characteristics of the BIS. Particular attention of this group is on data quality, use of information in business processes and effectiveness of using BI systems information in business processes and thus creating business value for the organization. Quality of information is the focal point of this model, and it means the degree of availability of information and the correctness of information used in organizations.

This study thus provides new insights about BIS success and identify BIS key factor in the successful implementation of projects in the model through attention to BIS detail and inclusion of various parts of IQ (Information Quality) and culture on analytical decision-making.

1-1) Different aspects of the proposed model

Discussed model in line with conducting research on success, introduced the five dimensions affecting business intelligence, and consider business intelligence success as a result of mutual communication and interactions between these five dimensions [2] the dimensions are:

1) Maturity of Business Intelligence Systems
2) The quality of information content and their integrity
3) The quality of information availability
4) How to use of information in business processes
5) Culture on analytical decision-making and the ability of
analytical decision-making

In following of paper these dimensions are examined and measures are being taken to determine the status of the organization.

A) Maturity of Business Intelligence

Determination the level of expectation and utilization of BI interests in an organization with regard to the organization's BI maturity level is characterized in BI. Maturity has been defined as a yardstick for measuring organization's ability to achieve predetermined objectives, another definition knows maturity implying of the rate of completeness, perfectness and readiness. One of the concepts that can generally support various elements, components and concepts of business intelligence is capability maturity model that has been experienced in software engineering; the purpose of this model is to identify the strengths and weaknesses of the organization and support them to determine current status (As Is) and the requirements for enhancing organizational capabilities (To Be) in the field of business intelligence.

In the models studied, organization's information quality (IQ) is considered as a benchmark to determine the maturity of business intelligence [2] and other aspects of the model somehow influenced or have a role in its promoting. Quality of information is defined with regard to three concepts of the quality of information content, and the quality of availability and integration of information. These mentioned concepts have some criteria which are listed in the following in separate:

A) Criteria for information integration: being formulated of data retention policies, information systems concentration, uniformity in the use of tools and/or less diversity of instruments

B) Criteria of information contents quality: data compatibility, non-redundant information, update information, compatibility of basic concepts and definitions across all units of the organization, a standard definition for original data of specification, understandable of information to the audience, simplicity and non-errorless of information

C) Availability of quality criteria for data: specification of access levels, control of information security and privacy, perfect availability, detachment and delays

B) How to use of information of BI systems in business process

Proper application of high-quality and analytical information has direct impact to improve the performance of business process, management of business processes, management of organization’s supply chain, and thus to improve organization’s decision-making and increase the efficiency of the organization. In the literature of information systems the use of information have been defined as the use of applications for collecting, storing, accessing and analyzing data to help users make the right decision. However, elements such as Use Of incentives, Use Of frequency, Use Of volume, the number of users and the number of different criteria of backup systems for decision-making, are other aspects of the use of information. In higher quality of information, use of information will have great benefit to the organization and will lead to better implementation of the processes of organization [2].

To measure the correctness of use of information in business processes the following criteria are defined:

- Availability of information of organization's business processes
- Identification of weaknesses and problems in business processes
- Innovation in defining and implementing the business processes
- Fast response to process problems
- Reduce the risk of process implementation
- Reduce the cost of processes implementation and to provide services
- More accurate determination of the distance of standard processes

C) Culture on analytical decision-making

Although organizations act to establish and implement of decision support systems in order to improve decision-making and anticipate, but there are other things that organizations are usually unaware of that including that how the information generated by the decision support information systems are used and who uses them. In fact, for the correct use of information only use of information systems, information management, data sharing, and data integration is insufficient and the rational approach need to be exist to decision-making in organizations.

In organizations which there is not an approach to take decisions, the information generated by BISs is used as a case in analysis, in a more progressive organizations information are used in operational levels by senior management; in older and more mature organization, use of information and decision making is done by the scholars and analysts specializing in Business Intelligence. Models of rational decision-making are employed in large organizations and when taking strategic decisions but middle managers and small organizations do not show willing to use these models [2].

In addition to models of rational decision-making, decision-makers must have the ability to apply advanced decision-making tools; various decision-making tools are shown in Table.

<table>
<thead>
<tr>
<th>Level</th>
<th>Resource and tools of decision-makers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Using manually generated reports</td>
</tr>
<tr>
<td>1</td>
<td>Received case reports</td>
</tr>
<tr>
<td>2</td>
<td>OLAP online processing processes</td>
</tr>
<tr>
<td>3</td>
<td>Analytical tools capable of analyzing and answering the questions of What if</td>
</tr>
<tr>
<td>4</td>
<td>Data mining results</td>
</tr>
<tr>
<td>5</td>
<td>Dashboards that demonstrate key indicators of the process performance</td>
</tr>
</tbody>
</table>

D) A summary of the assumptions of the model:

Hypothesis 1: The maturity of business intelligence is measured based on data quality.

Hypothesis 2: Data quality means faster data availability and quality of information content.

Hypothesis 3: Role of the quality of information content is higher.
Hypothesis 4: Quality of information content and quality of data availability has a direct role in use of information.

Hypothesis 5: In use of information the role of quality of information content is higher than information availability.

Hypothesis 6: Presence of culture and rational decision-making in organizations has a positive impact on more effective use of information content in improvement of organization’s business process.

Hypothesis 7: Presence of culture and rational decision-making in organizations has a positive impact on more effective use of available information in improvement of organization’s business process.

3) Yeoh & Koronios model of BI success framework

According to Yeoh & Koronios running and implementation of business intelligence is not as easily and structured as IT-based systems such as event processing systems. Applied systems such as TPS have many success assessment frameworks which business intelligence lacks of it. Yeoh & Koronios to fill this gap attempt to create a model for business intelligence success and called it framework or infrastructure of business intelligence success. The two researchers by combining data quality, system quality, and use of information were created a group called business intelligence performance infrastructure. In the following of research in addition to noted group, other dimensions and elements such as project management and budgeting issues, cost view, time-scheduling, business intelligence alignment with organizational goals and visions document and ... were added which finally researchers divided involved factors and issues into four general categories [3], synchronization of the four groups knew organization as prerequisite for successful implementation of business intelligence success. These groups included:
- Group organization: consists of senior manager support measures, presence of commercial sponsorship and supporters, organizational clear vision, a strategy is established based on organization’s business case
- Group Process: The process of finding-team, project management, used methodologies, changing requirements
- Group Technology: Include data management, technical infrastructure including networks and ...
- Group BI performance infrastructure: Information quality, system quality, use of quality, budgeting, time-scheduling.

3-1) Relevance of Model groups

In this model, prior to implementation of business intelligence projects is done, business orientation process and technology of business intelligence projects are determined by collaboration and alignment of organization groups. In the next step, the elements of Group BI performance infrastructure are used to increase the efficiency and effectiveness of projects implementation and finally, the organization take advantage of benefits resulted of implementing business intelligence. The model is dynamic and results are used as the input of business orientation determination stage. These stages are shown in Figure ...

3-2) Deficiencies in the model:

The main problem with the above model, was lack of necessary indicators and benchmarks and/or generality and ambiguous of benchmarks for various groups participating in the business intelligence success. Complementary studies [4] have been carried out in this context that indicates the more specific and tangible indicators and benchmarks for groups which have been provided in the following:

Indicators of organization-dimension:
- The level of senior manager support, presence of business sponsors and supporters
- A clear organizational vision, presence of strategy which is
established based on organization's business case (cost view)
- Having a comprehensive BI strategy that focus on organization and processes such as technology and tools
- Having a steering committee of business intelligence in the organization and being updated of BI strategies on a regular basis
- Develop business intelligence solutions based on specific standardized BI processes
- Compiled method to estimate the costs and profit of generating business intelligence
- Leading and steering business intelligence under IT

Group process:
- Production and development of business intelligence is done in the form of a project
- Agile methodologies are used to produce and develop the BI solutions
- Centralized management of business intelligence applications
- Presence of processes of requirements change, project management
- Central operations of BI software applications are based on ITIL
- Policies and standards of management are defined
- Production methods, tools, processes and supporting applications are defined as formally and standard

Group technology:
- Use of updated tools
- There is a standard definition for the original data
- Integrated repository of integrated data
- Reports from various sources using cubes of organizational centralized data-repository

Group BI performance infrastructure:
- Production and development of business intelligence based on value such business documents (profitability)
- There would be a central and effective supporter and bailsmen
- Measurement the level of use of Business Intelligence by middle managers
- Business Intelligence will be used by specialist analysts
- Dynamic management of data quality (Quality)
- Define and document roles involved in data quality management
- Measuring the financial performance of BI-related activities
- The customer is satisfied of efficiency
- There is a standard definition for the original data
- High availability: no deficit and separation, defined storage policies and to cover detachments in a short time.

8 REVIEW AND COMPARISON OF METHODS AND CONCLUSIONS

This paper aims to introduce and develop a framework for BI Success, is used the results of Delphi group research to identify Critical Contextual Success Factors (CCSF). Yeoh & Koronios Model of success in BI which know the successful as a result of interoperability of four groups of infrastructure, process, organization and technology; BI Success Model that has been proposed by the University is based on IS literature, and organizational maturity, information quality, culture on analytical decision-making and how to use of information in decision-making are as different aspects of the business intelligence systems and is used of BI organizational maturity model presented in ..., this paper is examined the identification critical success factors derived from the Delphi Group Research framework, proposed BI systems success models and Yeoh & Koronios Model in order to present a framework for business intelligence success.

These studies were based on information systems literature and organizational maturity, information quality, culture on analytical decision-making and how to use of the information in decision-making have been proposed as various aspects of business intelligence systems and taking into account the interactions of the above dimensions suggest the models to move towards business intelligence success in the organization. BI critical success factors were examined according to three dimensions of relevance, variability and controllability. The proposed model can be used as a framework for assessing of organizational maturity and level of readiness used by organizations.

Mentioned models, defined the information quality (IQ) as the degree of data availability and correctness of information and considered it as the main criterion for determining the maturity of BI and perceived the BI success as how to use of information in business processes and impact of use of information of BI systems on business processes and thus business added-value (Value) for organization.

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