



## Research on using ANP to establish a performance assessment model for business intelligence systems

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### ABSTRACT

In order to compete in the rigorous environment, the electronization has enabled business to deploy business intelligence (BI) systems for the purpose of decision-making. However, to avoid the ineffective experiences during the deployment, it is important to clarify the impact factors of a BI system and find out a suitable assessment method to evaluate the performance of BI systems. In this paper, an analytic network process (ANP) based assessment model was constructed to assess the effectiveness of BI systems. Furthermore, an expert questionnaire was used to filter out useful performance matrices, used as the sub-criteria of the ANP model. Finally, a real case was analyzed using the constructed ANP-based effectiveness assessment model for Business Intelligence systems. The results indicate that the most critical factors that impact the effectiveness of a BI system are: output information accuracy, conformity to the requirements, and support of organizational efficiency. Utilizing this model to assess the BI performance of the studied case, it reveals that 24% improvement in effectiveness has been reached, which consists with the perception of the management level. Therefore, this effectiveness assessment model can be used to evaluate the performances of a BI system. It can also provide performance indices and improvement directions for BI users and vendors, respectively, for the total succession in system effectiveness and satisfaction.

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### 1. Introduction

Traditional enterprises may normally face issues such as the overflow of data, the lack of information, the lack of knowledge and insufficiency of reports. Therefore, in order to make prompt decision within the shortest period of time possible to keep pace with the situation, high levels of management commonly make decisions based on their experiences, leading to the ever-increasing risk of decision failure while lowering the value of the decision itself. As worldwide competition is maturing, past decision-making modes can no longer satisfy the requirements of enterprises for decision efficiency and benefits; enterprises must make good use of electronic tools to quickly extract useful information from huge volume of data by providing the skills of fast decision-making (Rakar & Jovan, 2004). The way to promote the electronization solutions from the operational level to the decision making level is a topic enterprises cannot avoid in the face of the next wave of electronization. The information system applied within the enterprises should be able to demonstrate the data or information with

accuracy and in real-time, in order to expedite the speed of processing and decision-making. Existing electronization software package can provide a set of complete solutions for the operation and management processes of enterprises. However, the effects of the implementation of electronization tools vary that the probability of failure is higher than that of the success (Ward, Hemingway, & Daniel, 2005). Therefore, defining the performance of information tool and laying down related assessment criteria is an important issue that has to be tackled for the deployment of electronization.

Business intelligence (BI) is the tool used by enterprises to collect, manage and analyze structural and non-structural data and information by taking advantage of modern information technology (IT). It utilizes a substantial amount of collected data during the daily operational processes, and transforms the data into information and knowledge to avoid the supposition and ignorance of the enterprises (Wang, 2005). Under the speed-oriented operation mode, in order to improve management effects and performance, BI will surely become the tool enterprises would like to actively deploy as well as the solution that can bring enterprises competitive edge. However, current BI application is still at its fledging stage and most of the enterprises fall short of sufficient understanding

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towards BI (Wang, 2005); currently, research on conducting performance evaluation for the implementation of BI system is scarce, not to mention the analysis of on-line performance. Beside that, managers usually have to measure all the pros and cons to achieve a balance in assessing the performances of BI/IT systems. Different end users and IT people adopt different performance measurement criteria. Therefore, it is a significant issue to implement across-the-board considerations to incorporate different viewpoints and perspectives from manifold experts in BI development and usage into the choice for assessing BI performance effectiveness.

In order to lower the failure risk after implementation, it is necessary to conduct in-depth discussion for the aforementioned issue. Therefore, this research starts by analyzing BI benefits, takes advantage of analytic network process (ANP) to discuss BI effectiveness and related performance assessment indications. The results thus provide enterprises that are interested in deploying BI systems with a consistent and effective assessment model for future BI implementation while serving as a direction of future improvement and enhancement for BI software suppliers and consulting companies.

The remainder of this paper is organized as follows. Section 2 presents the related studies regarding to this research. Then, the research theory and method is presented in Section 3. Section 4 demonstrates the proposed architecture for assessing the performance of BI systems. An empirical research and related analysis is illustrated in Section 5. Then a case study on a global supplier of computer peripherals is described in Section 6, and the summary and conclusions are drawn finally.

## 2. Information systems

With the demands for information technology, application software and enterprise information tactics constantly are enhanced and expanded. The deployment of SCM, ERP, CRM systems, etc. has become mature, and the growth of business intelligence information system will become a new direction for enterprises' electrification construction (Chung, Lee, & Pearn, 2005).

### 2.1. Business intelligence

Starting from the use of initial data storage devices, enterprises have continued innovating and creating new system modes, in a pursuit of higher operation efficiency. After the development of relational database, the development of business intelligence is then underway. Currently, there are multiple software suppliers and specialty consulting companies conducting even more logic planning and enhancement for the function and applicability of BI systems, e.g. tools assisting enterprises in decision-making such as data warehouse and real-time analysis. Hence, commercial logic thinking is still being innovated and developed and through such processes, systematic enterprise operation mode is expected to be created to enhance the competitive edge of enterprises.

The application of business intelligence is the process through which enterprises take advantages of modern information technology to collect, manage and analyze structural or non-structural data. In order words, through the extraction, integration and analysis of data, technology and commercial processing procedures in the decision-making are supported (Wang, 2005). Problems and a huge amount of data of enterprises are input into data mining systems for data analysis so that decision makers can obtain useful information promptly for making correct judgment; that is, in regard to enterprise operating contents, abilities of fast understanding and deducing are provided, and thus enhancing the quality of decision-making and improving performance and expediting processing speed (Back, 2002). Business intelligence is an analysis mechanism by which automated decision-making regarding busi-

ness status, sales analysis, customer demand, product preference, etc. is provided for enterprises through large database system analysis as well as mathematical, statistical, artificial intelligence, data mining and on-line analysis processing (OLAP) (Berson & Smith, 1997; Thomsen, 2002). Eckerson Wayne (2005) held that BI must be able to provide the following tools: production reporting tools, end-user query and reporting tools, on-line analysis processing, dashboard/scorecard tools, data mining tools, planning and modeling tools.

BI is not only a tool reflecting issues, but also the management of transferring internal messages in the enterprise environment (Eckerson Wayne, 2005). Therefore, apart from substantial IT support, sound and proper planning abilities are needed when constructing BI working environment, for example, ensuring the delivery and implementation of BI projects; ability of acquiring standardized data elements and changing process to ensure the quality of data acquired, integrating all strategic objectives within the organization, and designing strategic map and transmitting important corporate value. Therefore, BI covers a wide range of tools and broad scope, and among the commonly mentioned important applications are data warehouse, data mining, OLAP, decision support system (DSS), balance scorecard (BSC), etc. All in all, the purpose of BI is to provide users with the best possible assistance in the process of decision-making. Apart from delivering the right information to right person during the right time (Back, 2002; Eckerson Wayne, 2005), at the BI planning, implementing and go-live stages, enterprise operation contents and business objectives must be understood in order to properly plan related performance measurement indices and ensure the correctness and validity of the information provided by BI.

### 2.2. Performance measurement indices of information system

Effectively assessing the efficiency of an information system is the key element in the successful implementation of the system. Assessing the performances of an information system means if the information system can be accepted by users, and if users' work-related needs can be met and the objective at the initial implementation can be achieved. As to how to assess the efficiency of information system, roughly it can be classified into the assessment of system satisfaction and the assessment of effectiveness. Among the assessments of system satisfaction are contents correctness (Doll & Torzadeh, 1988; Ives, Olson, & Baroudi, 1983), resilience of the format (Doll & Torzadeh, 1988), easiness of the operation (Doll & Torzadeh, 1988; Tan & Lo, 1990), real-time nature (Doll & Torzadeh, 1988), integrity of the output (Doll & Torzadeh, 1988), credibility of the output (Ives et al., 1983), integration and safety of the system (Tan & Lo, 1990). Wildemann (1987) indicated that the success of the information system should be considered from both aspects of the success of project management and the efficiency of software execution at the time of system implementation. If a business intelligence system can be successfully implemented, it can play its due role in four aspects, namely, assisting in understanding business status, measuring organization performance, improving stakeholder relationship, and creating profitable opportunities (Wang, 2005).

To prevent inefficiency of an information system after the introduction from appearing again, assessing the effectiveness of a BI system is an important issue and must be carefully planned. It can serve as the criteria for BI system selection and implementation. However, current research has not yet pointed out the effectiveness and its assessment methods after BI system actually goes online. Therefore, through literature discussion, this research summed up 40 criteria of evaluating information system performances. Proper key criteria are then picked out through experts' questionnaires as the major basis for constructing BI

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