J. Inf. Technol. Appl. Manag. 24(1): 45~61, March 2017
https://doi.org/10.21219/jitam.2017.24.1.045

ISSN 1598-6284 (Print)
ISSN 2508-1209 (Online)

Are Critical Success Factors of BI Systems Really Unique?

Sung Kun Kim* · Jin Yong Kim**

Abstract

Business intelligence has been attracting much attention these days. Despite such popularity of BI systems, it is widely known that about a half of BI system projects have failed. To grasp why many BI projects end in failure and what factors would make BI projects less failure-prone, a number of BI studies were made to produce a variety of CSFs. However, there is a paucity of information on whether these CSFs are distinctive from those of typical information systems. By identifying how BI CSFs differ from CSFs of typical information systems, we would be able to explain why most BI projects are more likely to be failure. It is believed that a corrective measure about CSFs will lead to more success in future BI projects. In addition, though there have been a number of similar types of BI systems such as decision support systems and executive information systems in existence, there was no study to determine whether there is ever a discrimination between CSFs of BI systems and the similarly-titled systems. This study is to answer these questions using a literature review analysis. The findings of our study are expected to be helpful in a successful implementation of BI systems.

Keywords : Business Intelligence, Critical Success Factors, Decision Support Systems, Executive Information Systems, Data Warehousing, Data Mining

Received : 2017. 02. 13.   Revised : 2017. 03. 31.   Final Acceptance : 2017. 03. 31.

※ This research was supported by the Chung-Ang University Research Scholarship Grants in 2016.

* Corresponding Author, Professor of information systems at Business School of Chung-Ang University, 84 Heukseok-ro, Dongjak-gu, Seoul, 06974 Korea, Tel : +82-2-820-5133, Fax : +82-2-815-7001, e-mail : sungkun@gmail.com

** Research Associate at Business School of Chung-Ang University, e-mail : wlsyong90@gmail.com

1. Introduction

Business Intelligence (BI) system is an information system that enables users to obtain a variety of insightful business information through the application of analytic techniques [Davenport et al., 2010; Olszak, 2014; Popovic et al., 2014]. To make decisions more intelligently and much faster, many firms have attempted to develop and deploy it [Bloomberg Businessweek, 2011].

Despite its prevalence, it is not as productive as it is thought to be. Many BI projects are reported to end in failure and a number of BI systems deployed are left unused [Chaudhuri, 2004; Howson, 2008; Isik et al., 2013; Schick et al., 2011; Watson and Wixom, 2007]. Furthermore, Clavier et al. [2014] pointed out the uncertainty about the return on BI investment.

To identify key areas where things must go right for an endeavor to become successful, a critical success factor approach had been proposed by Rockart [Rockart, 1978]. Since its first use in defining information needs of chief executives [Rockart, 1978], it has been used extensively in a variety of problem domains, especially project-style undertakings such as strategic planning [Leidecker and Bruno, 1984] and software development [Fortune and White, 2006; Nasir and Sahibuddin, 2011; Tarhini et al., 2015].

To increase the chance of BI success, a number of researchers have studied to identify a set of critical success factors for BI projects [Yeoh and Koronios, 2010; Gonzales, 2011; Grublješič and Jaklič, 2015]. Factors identified in their studies include management support, well-established BI business case, and high quality of data, etc.

One major problem with CSF studies is that a set of CSFs identified in one study may be different from those of the other, depending upon research method or study domain [Fortune and White, 2006]. This problem makes it difficult for us to reach common ground in BI CSFs. In some domains such as enterprise resource planning [Ngai et al., 2008] and software projects [Fortune and White, 2006; Nasir and Sahibuddin, 2011] a follow-up and systematic review study was made on results of individual CSF studies in order to reach a common set of CSFs. However, we have not yet found such a systematic review study in BI domain.

Other types of information systems analogous to BI system have been in existence. For instance, these are decision support systems, executive information systems, or data warehousing system. A research question arising from this issue is whether there exists any difference between CSFs of a type of BI and those of the other types of BI. Two research questions of our study are 1) Whether BI CSFs are different from those of typical information systems? 2) Whether there is a meaningful difference between CSFs of BI and those of other BI-like systems.

In order to achieve these goals, we focus on establishing a framework for cross-checking results of different CSF studies and, based upon this framework, comparatively evaluating results of CSF studies in software project, BI systems, and other BI-like systems, through literature review analysis.

2. Literature Review

2.1 Business Intelligence and Related Systems

In a technology field, the conceptualizing of an artifact may be unusually difficult. It is because the continuing advance of new technologies or the abrupt disappearance of some falling-behind technologies occurs very often. These words fitly apply to the field of business intelligence. Business intelligence has gone through the ups and downs of many related technologies or artifacts, such as decision support system, executive information system, data warehousing, data mining, etc.

Accordingly, how BI is conceptualized differs from one researcher to another. Arnott and Pervan [2008] understood all applications aiming to support or improve managerial decision-making as decision support system (DSS) and therefore viewed BI as a sub-field of DSS. Their major DSS sub-fields are personal decision support system (PDSS), group support system (GSS), negotiation support system (NSS), intelligent decision support system (IDSS), knowledge management-based decision support system(KMDSS), data warehousing, enterprise reporting and analysis system. They viewed that BI belongs to the last category, enterprise reporting and analysis system, along with executive information systems and corporate performance management systems.

A similar standpoint was made by Power [2001] who proposed 5 generic types of DSS : communication-driven, data-driven, document-driven, knowledge-driven, and model-driven. He viewed that business intelligence, executive information systems, and data warehousing and analysis systems all fall under the data-driven DSS.

On the contrary, some researchers pointed out that terms like DSS and EIS are virtually disappearing and instead BI should be the accepted term for analytical and strategic information systems [Petrini and Pozzebon, 2009; Watson, 2009]. Petrini and Pozzebon [2009] ascribed the declining popularity of EIS or DSS to a lot of manual work needed to transform original data source into information insightful to executives or specific decision makers. Similarly, Watson [2009] emphasized that "business intelligence" became more widely used in not only industry but also academia since Gartner analyst Howard Dresner first coined the BI term to describe all decision support applications in 1989 when the software industry was mired in DSS or EIS jargons.

In our opinion this dilemma of terminology was caused by an excessive expansion of a concept. For instance, Arnott and Pervan [2008] defined DSS as an information system to support decision processes. In fact, supporting decision processes can be made through a number of approaches or a variety of constantly evolving technologies. It is our understanding that, once we are based upon each term's intrinsic characteristics, we will be able to compare these confusing terms a little more effectively.

So <Table 1> shows a result of the comparison among DSS, EIS, and BI. A conventional DSS is for a few, at most, decision-makers. And, it is most likely that the DSS employs features of decision-making models but, to a much less extent, features of extracting insightful information by massaging a bunch of raw data. One

〈Table 1〉 A comparison of DSS, EIS, and BI

	A conventional DSS	EIS	BI system
User	specific decision-maker	board of executive managers	the entire staff demanding business insights
Amount of information to handle	small	medium	large
Use of analysis models	most likely	not essential; likely to use basic financial models	not essential; likely to use specific models in a given domain
Dependence with other systems or IT infra	small	medium	large

may also say that as the DSS is close to a stand-alone type of system it has less dependence on, or less relationship with other existing systems.

In comparison, EIS and BI system are more information-focused. The only difference between these two is a matter of degrees, such as the number of users, data handling requirements, and dependence with other systems. In a word, BI system is more enterprise-level than EIS.

There exist two additional terms frequently cited in these systems : data warehousing and data mining. Data warehouse is a technology or a component of BI system used for reporting and data analysis [Dedić and Stanier, 2016]. On some occasions, the term 'data warehousing' is used as a system or project in itself [Wixom and Watson, 2001; Shin, 2003]. In our understanding, the latter denotes a system or development project exploiting a set of data warehouse-related technologies.

Similarly, data mining is used also as a technique [Chen et al., 2012] or a system that chiefly employs data mining techniques [Brossette et al., 2000]. In this paper, these two terms are used for either purpose, depending on the context.

2.2 Critical Success Factors of Information Systems

Critical success factor approach is a method to identify key elements that must be in existence or go right for an organization or project to achieve its goal. Since Rockart [1978]'s first use in the definition of information needs of chief executives, the CSF approach has been used extensively in MIS field in order to inquire about key factors in system development project. Virtually all different types of information systems have been subjects of this inquiry. Pinto and Mantel [1990], Fortune and White [2006], and Nasir and Sahibuddin [2011] employed the CSF approach to identify key factors for software projects. Key factors regarding ERP projects were identified by a number of researchers including Holland and Light [1999], Al-Mashari et al. [2003], and Ngai et al. [2008]. In addition, the CSF approach was also applied to BI-related systems, such as DSS [Finlay and Forghani, 1998], EIS [Poon and Wagner, 2001], BI [Yeoh and Koronios, 2010], and Data Warehousing [Watson and Haley, 1997].

Such a wide variety of CSF studies, however, has led to an issue of interpretation about CSFs

[Fortune and White, 2006]. As each CSF study was made on different samples or dissimilar research settings, some CSF studies, of course, have generated different set of factors [Wateridge, 1995; Ngai et al., 2008]. Moreover, key factors may differ on different project size [Nasir and Sahibuddin, 2011] or different country or geographical area [Nasir and Sahibuddin, 2011; Ngai et al., 2008]. Besides, such a difference may have been caused by obscurity [Fortune and White, 2006] or granularity in factor definitions. For instance, a particular factor in one study might be semantically similar, though not identical, to a factor or a sub-factor of some factor in another study.

For this reason, some researchers have attempted to compare and synthesize the CSFs that were identified under different studies. Fortune and White [2006] and Nasir and Sahibuddin [2011] examined CSFs for software projects while Nah et al. [2001] and Ngai et al. [2008] reviewed CSF studies based on ERP projects. All of these studies have employed a systematic literature review method.

An evaluation on these CSF-synthesizing studies was made as shown in <Table 2>. Each study was evaluated in terms of project types, number of works covered, use of synthesizing scheme, and factors synthesized. It should be noted that only Fortune and White [2006]'s study has employed a synthesizing scheme for CSFs. As the synthesizing scheme, they used the Formal System Model (FSM). The FSM enables us, by representing most core systems concepts of a 'purposeful entity', to understand more systematically how the entity should work to be successful [Bignell and Fortune, 1984]. Bignell and Fortune [1984] claimed that the FSM can be used to overcome difficulties in interpretation of factors found in various studies [Fortune and Peters, 1990].

3. A Scheme for Synthesizing Success Factors

The more the project success factor studies are made, the less chance there appears to be a consensus of opinion among researchers on these factors [Wateridge, 1995; Fortune and White, 2006]. This problem has led to the debut of CSF synthesizing studies, the ultimate objective of which was to construct a list of common CSFs. What is important in this effort is that a scheme is needed to cross-match the factors that were produced separately. Bignell and Fortune [1984]'s Formal Systems Model is a good example [Fortune and Peters, 1990; Fortune and White, 2006].

We here propose a general framework for synthesizing the individually generated critical

〈Table 2〉 Evaluation of the CSF-Synthesizing Studies

Study	Object	# of works	Synthesizing Scheme	Results
Nah et al. [2001]	ERP	10	x	11 factors
Ngai et al. [2008]	ERP	48	▲(used Nah et al.'s result)	18 factors
Fortune and White [2006]	Software project	63	0	27 factors
Nasir et al. [2011]	Software project	43	x	26 factors

success factors. The framework is largely built on the Social Capital Theory, which makes much of relationships among network members as a key resource for social action [Adler and Kwon, 2002].

Nahapiet and Ghoshal [1998] understood that differences in performance between firms may accrue from differences in their ability to create and exploit social capital. They also suggested that firms may utilize three different dimensions of social capital: structural, relational, and cognitive. The structural dimension of social capital refers to the overall relationship pattern of network as a whole, while the relational dimension represents the pattern of personal relationships among network members. And, resource providing shared representation, interpretations, and systems of meaning among the parties can be signified as the cognitive dimension.

Their insight that, in order to make a firm successful, management should reinforce an organizational capability to manage social capital was applied in IT management by Peppard [2007]. He understood that delivering value through IT is mainly knowledge-based practice. Furthermore, he ascribed an organization's incapability to generate business value from IT investment to contemporary IT management practice that is symbolized as an island-like IT function. That is, although much part of the knowledge in IT management is located in non-IT functions, the IT department does not have an access or authority over this knowledge. To overcome the limits, he suggested that an organization-wide knowledge integration be made. Moreover, he presented, as examples, a set of organizational initiatives in each of the three domains of social capital.

The issue of system development is perhaps a little different from the normal IT management. Because the development of a system nearly always demands referring to a set of business or technical blueprints, we suggest that another dimension of knowledge or social capital be needed for managing a system development project. Such blueprints are usually named as architecture or enterprise architecture, which is defined as "the organizing logic for key business processes and IT capabilities (resources) reflecting the firm's operating model" [Ross et al., 2006].

Therefore, key factors for system development project can be organized in four dimension : structural, relational, cognitive, and architectural. Furthermore, to cross-check CSFs, we propose a framework in which 13 key factors were identified, each belonging to one of the four dimensions.

Before taking that further, we have attempted to check the feasibility of this framework. It was assumed that an application test be taken to ensure if this framework may classify distinctively a particular set of CSFs. For this purpose, Ngai et al. [2008]'s study was selected because it is the latest ERP CSF synthesizing study and its result was regarded as vastly comprehensive. Among their 18 CSFs, two ('national culture' and 'country-related function requirement') were excluded from our consideration because these two were meaningful only to the study dealing with a possibility of regional or national difference, which is not applicable to our study.

<Table 3> shows the result of cross-check-

〈Table 3〉 Cross-Checking of the Framework with ERP CSFs

The Synthesizing Framework		Ngai et al. [2008] CSF
Structural	Joint project team	ERP teamwork and composition
	Project leading by users	Project champion
	IT governance (Top Management/Steering Comm.)	Top management support
Relational	Effective communication	Communication
	Joint (business-IT) performance management.	Monitoring and evaluation of performance
	Collaboration with external stakeholders	ERP vendor
Cognitive	Users' skills and competence	Organizational characteristics
	Educational programs	Change management culture and program
	Organizational change culture	Change management culture and program
Architectural	Data/information	Data management
	Systems/IT infra	Appropriate business and IT legacy systems
	Project management & development methodology	- ERP strategy and implementation methodology - Project management - Software development, testing, and troubleshooting
	Business goals & process	- Business plan/vision/goals/justification - Business process reengineering - Fit between ERP and business/process

ing between the synthesizing framework and Ngai et al.'s list of CSFs for ERP. Be noted that these two sets of CSFs are matched one-to-one in the majority of cases. In this respect, our synthesizing framework was regarded as solid enough to be used for CSF cross-checking.

4. Literature Analysis Methodology

The aim of our study is to answer the question of whether there is any difference in CSFs not just between BI systems and typical information systems but also between generally known BI systems and other BI-like systems such as DSS and EIS. In this section, we present our literature analysis methodology.

First, we need to locate BI CSF literature. As our analysis requires the literature for a variety of BI-like systems, we include all of these terms in our literature search. A comprehensive search was made on Web of Science. The keywords was shaped like "(BI or DSS or EIS or DW or DM) and (Success Factor)." Their full names as well as their acronyms were used at the same time. After eliminating publications that are other than academic journal articles and were evaluated as 'non-CSF study' from authors' review of their abstract, we have located 14 journal articles including 3 for BI, 2 for DSS, 4 for EIS, 3 for DW, and 2 for DM, which were shown in <Table 4>.

Next, we need to identify CSF studies for typical information systems as a comparison target. Because there exist a slew of articles in this area, we decided to use a list of CSFs that had been already synthesized before. Two synthesizing studies for software projects were found such as Fortune and White [2006] and Nasir and Sahibuddin [2011]. Of the two, Nasir and Sahibuddin [2011] is a later one and, to produce

〈Table 4〉 The List of BI CSF Studies

	area	Title	Author	Year	Journal
1	BI	Success Factors for Business Intelligence and Data Warehousing Maturity and Competitive Advantage	Gonzales	2014	International Journal of Information Management
2	BI	Business Intelligence Acceptance : The Prominence of Organizational Factors	Grubljesic and Jaklic	2011	BUSINESS INTELLIGENCE JOURNAL
3	BI	Critical Success Factors for Business Intelligence Systems	Yeoh and Koronios	2010	Journal of Computer Information Systems
4	DM	Critical Success Factors for Implementing CRM Using Data Mining	Ranjan and Bhatnagar	2008	Journal of Knowledge Management Practice
5	DM	Consolidation of Success Factors in Data Mining Projects	Sim	2014	GSTF Journal on Computing
6	DSS	Factors Influencing Success and Failure of Health Informatics Systems-A Pilot Delphi Study	Brender et al.	1998	Decision Support Systems
7	DSS	A Classification of Success Factors For Decision Support Systems	Finlay and Forghani	2013	Decision Support Systems
8	DW	An Empirical Investigation of the Factors Affecting Data Warehousing Success	Wixom and Watson	2001	MIS Quarterly
9	DW	Data Warehousing : A Framework and Survey of Current Practices	Watson and Haley	1997	Journal of Management Information Systems
10	DW	Critical Success Factors for Data Warehousing : A Classic Answer to A Modern Question	Kimpel and Morris	2013	Issues in Information Systems
11	EIS	Key Antecedents of Executive Information System Success : A Path Analytic Approach	Bajwa et al.	2010	European Journal of Scientific Research
12	EIS	EIS Success : Keys and Difficulties in Major Companies	Salmeron	2001	Decision Support Systems
13	EIS	Critical Success Factors Revisited : Success and Failure Cases of Information Systems for Senior Executives	Poon and Wagner	2015	Information Systems Management
14	EIS	The Keys to Executive Information System Success	Rainer and Watson	2012	International Journal of Enterprise Information Systems

a list of most common CSFs, further cross-checked their results with those of Fortune and White [2006]. In this study the list of CSFs in Nasir and Sahibuddin [2011] was selected as a standard of comparison.

5. Results and Practical Implications

A set of CSFs for software projects were made by a number of scholars. Recently, Nasir and Sahibuddin [2011] compared 43 articles from the years 1990 to 2010 and, as the result, compiled 26 critical successful factors. They further cross-checked with the result of another synthesizing study by Fortune and White [2006] to finalize a set of common factors in both studies. <Table 5> shows this list.

To make a comparison among different sets of CSFs, we take 'a presence check' approach by which we only determine if a category in one list is present in the other list. With this approach, level of intensity or frequency is disregarded.

〈Table 5〉 A Final List of CSFs Compiled through Nasir and Sahibuddin [2011]'s Study

Number	Factor	Number	Factor
1	Clear objectives and goals	10	Up-to-date progress reporting
2	Realistic schedule	11	Effective monitoring and control
3	Effective project management skills/methodologies	12	Adequate resources
4	Support from top management	13	Good leadership
5	User/client involvement	14	Risk management
6	Effective communication/feedback	15	Complexity, project size, duration, number of organizations involved
7	Skilled and sufficient staffs	16	Effective change and configuration management
8	Familiarity with technology/development methodology	17	Good performance by vendors/contractors/ consultants
9	Appropriate development processes/methodologies	18	End-user literacy, knowledge and skills to use the system

〈Table 6〉 A Comparison of BI CSFs with IS CSFs

The Synthesizing Framework	area	BI			DM		DSS		DW			EIS				IS
	No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Structural	Joint project team		*	*					*	*	*	*			*	*
	Project leading by users	*		*										*	*	*
	IT governance (Top Management/Steering Comm.)	*	*	*	*		*	*	*	*		*	*	*	*	*
Relational	Effective communication			*	*	*		*			*	*	*		*	*
	Joint (business-IT) performance management.	*			*	*	*	*		*	*	*		*	*	*
	Collaboration with external stakeholders			*		*	*	*				*				*
Cognitive	Users' skills and competence		*		*		*	*	*				*	*		*
	Educational programs		*	*			*	*		*		*				
	Organizational change culture		*				*							*	*	*
Architectural	Data/information	*	*	*	*	*		*		*	*		*	*	*	
	Systems/IT infra	*	*	*	*	*		*		*	*		*	*	*	
	Project management and development methodology	*	*	*	*		*	*	*	*	*		*	*	*	*
	Business goals & process			*	*			*		*		*	*	*	*	*

Main part of our analysis is shown in <Table 6>. The leftmost two columns corresponds to our synthesizing framework while on the right-hand side are the result of 14 BI and BI-like studies shown. The rightmost column indicates the result of a presence check with the final list of CSFs for software projects.

First, we review critical success factors of BI projects in a broad sense. We found that 'IT governance structure', 'Project management & development methodology', 'Data/information', 'Systems/IT infra', and 'Joint performance management' are the five most critical success factors for business intelligence projects. In comparison, 'Project leading by user', 'Organizational change culture', 'Collaboration with external stakeholders', and 'Educational programs' are factors of less importance. What 'Project leading by user' and 'Organizational change culture' were identified as the least important CSFs was a quite surprise. These two factors seem to be closely related with 'business-oriented approach.' Watson and Wixom [2007] identified, through an analysis of most successful BI cases, a set of facilitating conditions for BI success, including 'Senior management believes in and drives the use of BI', and 'The use of information and analytics is part of the organization's culture.' The present lower success rate of BI projects (at most 50% success rate) may result from the absence of business-oriented approach requiring user-driven project initiation and change management [Schiff, 2014]. It may be understood that most of current BI projects were chiefly initiated not by users but by technical experts. Unless there is a change in this approach, the BI project would continue to undergo a hardship.

In terms of knowledge areas, we can find out that factors belonging to cognitive area are currently evaluated as that of less importance. From this result we may interpret that in most of current BI projects cognitive factors such as user competence, education, organizational change culture was less focused while technical features or functionalities were emphasized. As many scholars emphasized the importance of BI capabilities [Isik et al., 2013; Foshay et al., 2015], future BI projects ought to place more stress on capability building programs.

Second, BI CSFs are compared to those of general software projects. We found that, with BI systems, 'data/information' and 'Systems/IT infra' was counted as more important than typical information systems. It is quite understandable because BI systems need to gather and transform data from a variety of data sources and, in this process, most probably need to connect with other information systems. A point of interest is the less importance of 'Collaboration with external stakeholders' factor. Whereas a considerable number of information system are bespoke software and are often developed by outside software developers or systems integrators, many of BI systems often tend to be implemented on BI tools. Determining which BI tools to buy is not easy [Sherman, 2015]. An even bigger problem is that firms are "rushing into purchasing BI tools without defining the business problems you are trying to solve" [Schiff, 2014]. Therefore, you should, from now on, be able to have a good relationship with and consult more frequently with external stakeholders including BI tool vendors. In other words, future BI projects should be initiated by user organizations, not by vendors, and user organizations ought to be wise enough to communicate with various stakeholders and to tell the difference between technical possibilities and needs/requirements.

Third, it is now to identify if there is any difference in CSFs between BI systems and other BI-like systems. When it comes to a difference with DSS, BI projects regard 'Data/information', 'Systems/IT infra", 'Joint project team', and

'Project leading by users' factors more importantly than a conventional DSS. The deviation may come from DSS characteristics such as more stand-alone type and less user- driven endeavor. And, greater importance was placed on 'Joint performance management' in DSS. It could be the case that, as most of DSS users are high-level decision makers or managers, they, by the roots', seem to be more results oriented. More emphasis on 'Collaboration with external stakeholders' in DSS probably had to do with an almost indispensable use of decision models. In the process of model building or interpretation of model outcomes, one may need lots of outside experts' support or advice in a given domain.

Comparing to EIS CSFs, EIS projects are placing more emphasis on 'Joint performance management' and 'Effective communication'. The former can be explained identically with more goal-oriented users, as mentioned earlier in DSS. A plausible reason for the latter is that, as executives tend to be pressed for time and a heavy schedule, they may be less impatient with ineffective communication. In this sense, an effective communication would have been one of key success factors.

A comparison of BI CSFs with DM and DW CSFs is followed. We begin with DM. We found out that less emphasis was placed on all the factors in structural area. It indicates that DM projects appear to be less business-oriented and rather technique-focused. A point of interest is that 'Educational programs' factor was evaluated as that of less importance. It could be the case that, as most of data mining algorithms or techniques are very much complicated, it is almost impossible for the ordinary layman to grasp the essence of how the system really works even though a certain amount of training or education is offered. That is, education may not be a good help in DM projects. As for DW, DW has many similarities with BI, except in the case that 'Project leading by users' was less emphasized. In those days most DW projects were triggered by an emergence of the then new technology such as ETL or OLAP. So, it was quite a matter of course that BI project was all initiated by technical side, not business side.

6. Summary and Future Study

In the business world are many types of information systems in existence. The larger issue is that on some occasions, owing to the ebb and flow of new technology, a particular type gained popularity and suddenly disappeared from our view. Systems like BI is that kind. Currently the term DSS is not much used and the EIS term is seldom used. DW and DM are no longer used as a term of information system and are used just as a term of technique or technology.

Such rise and fall of information systems has sparked some scholarly interest. Whether is a set of CSFs for BI systems similar to that of the other types? Whether is there a meaningful difference between BI CSFs and those of BI-like systems, the terms of which are no longer widely used? In order to answer these questions, this study has attempted a literature analysis on CSF studies. For this purpose, we first proposed a general framework for synthesizing the individually generated critical success factors and then conducted a presence check analysis on the existing CSF studies.

From a review of BI CSF studies, we identified that 'Organizational change culture', 'Collaboration with external stakeholders', and 'Educational programs' were treated less importantly. That is deemed as the absence of business-oriented approach and perhaps accounts for the lower success rate of present BI projects.

A comparison against CSFs of general software projects showed that 'data/information' and 'Systems/IT infra' was counted as more important than typical information systems. This may have stemmed from characteristics of BI systems in which a connection with other systems is an indispensable feature in order to elicit business insights from a variety of data sources. On the other hand, we have understood that the less importance of 'Collaboration with external stakeholders' indicates firms currently not having a good relationship with BI tool vendors and therefore not affording to consult them on many matters.

And, EIS and DSS projects put more emphasis on factors that are much related to goal-oriented users like executives or high-level decision makers. A comparison against DM and DW indicated that most of these projects were initiated by people of technical side and therefore business-oriented or organization-wide factors were taken less importantly.

Results of this study are believed to make a contribution in theoretical as well as practical angle. Practically speaking, first, we provided BI practitioners with some helpful hints such as which critical factors to be paid more attention to from now on. Whereas most of existing BI CSF studies just highlighted the set of CSFs found through their own investigation, with no consideration of results of other studies, we were able to construct a common list of critical success factors. In this way, we hope that BI practitioners do not just conform to results of former studies but will be able to understand true characteristics of BI systems and thus discern a number of critical success factors, existent or to be discovered newly. For a theoretical standpoint, the general framework for synthesizing CSFs can be used to contrast a variety of individually conducted CSF studies each other. We believe that this way we would be able to construct a common body of knowledge (CBK) about critical success factors of IS.

For future work, we need to devise, for a CSF comparative study, a more elaborated analysis method other than a presence check. Further, we hope we will be able to come up with a building block for CBK of IS CSFs. This work is believed to relate strongly with the components of organization-wide knowledge for IT-initiatives which was the basis of the general synthesizing framework in this study.

References

[1] Adler, P. and Kwon, S., "Social capital : Prospects for a new concept", *Academy of Management Review*, Vol. 27, No. 1, 2002, pp. 17-40.

[2] Al-Mashari, M., Al-Mudimigh, A., and Zairi, M., "Enterprise resource planning : A taxonomy of critical factors", *European Journal of Operational Research*, Vol. 146, No. 2,

2003, pp. 352-364.

[3] Arnott, D. and Pervan, G., "Eight key issues for the decision support systems discipline", *Decision Support Systems*, Vol. 44, No. 3, 2008, pp. 657-672.

[4] Bajwa, D., Rai, A., and Brennan, I., "Key antecedents of executive information system success : a path analytic approach", *Decision Support Systems*, Vol. 22, No. 1, 1998, pp. 31-43.

[5] Bignell, V. and Fortune, J., *Understanding Systems Failure*, Manchester University Press, 1984.

[6] Bloomberg Businessweek, B., The Current State of Business Analytics : Where Do We Go from Here?, *Bloomberg Businessweek Research Services (http://www.sas.com/resources/asset/busanalyticsstudy_wp_08232011.pdf),* 2011.

[7] Brender, J., Ammenwerth, E., Nykänen, P., and Talmon, J., "Factors influencing success and failure of health informatics systems : A Pilot Delphi Study", *Methods Inf Med*, Vol. 45, No. 1, 2006, pp. 125-36.

[8] Brossette, S., Sprague, A., Jones, W., and Moser, S., "A data mining system for infection control surveillance", *Methods Archive*, Vol. 39, No. 4, 2000, pp. 303-310.

[9] Chaudhuri, S., Dayal, U., and Narasayya, V., "An overview of business intelligence technology", *Communications of the ACM*, Vol. 54, No. 8, 2011, pp. 88-98.

[10] Chen, H., Chiang, R., and Storey, V., "Business intelligence and analytics : From big data to big impact", *MIS Quarterly*, Vol. 36, No. 4, 2012, pp. 1165-1188.

[11] Clavier, P., Lotriet, H., and Van Loggerenberg, J., "A first step towards service-dominant logic as a new approach to overcome challenges in business intelligence", *South African Journal of Economic and Management Sciences*, Vol. 17, No. 2, 2014, pp. 1-12.

[12] Davenport, T., Harris, J., and Morison, R., *Analytics at work : Smarter decisions, better results*. Harvard Business Press, 2010.

[13] Dedić, N. and Stanier, C., "An evaluation of the challenges of multilingualism in data warehouse development", 18th International Conference on Enterprise Information System, 2016.

[14] Finlay, P. and Forghani, M., "A classification of success factors for decision support systems", *The Journal of Strategic Information Systems*, Vol. 7, No. 1, 1998, pp. 53-70.

[15] Fortune, J. and Peters, G., "The formal system paradigm for studying failures", *Technology Analysis and Strategic Management*, Vol. 2, No. 4, 1990, pp. 383-390.

[16] Fortune, J. and White, D., "Framing of project critical success factors by a systems model", *International Journal of Project Management*, Vol. 24, No. 1, 2006, pp. 53-65.

[17] Foshay, N., Yeoh, W., Boo, Y., Ong, K., and Mattie, D., "A comprehensive diagnostic framework for evaluating business intelligence and analytics effectiveness", *Australasian Journal of Information Systems*, Vol. 19, 2015, pp. S37-S54.

[18] Gonzales, M., "Success factors for business intelligence and data warehousing maturity and competitive advantage", *Business Intelligence Journal*, Vol. 16, No. 1, 2011, pp. 22-

29.

[19] Grublješič, T. and Jaklič, J., "Business intelligence acceptance : The prominence of organizational factors", *Information Systems Management*, Vol. 32, No. 4, 2015, pp. 299-315.

[20] Holland, C. and Light, B., "A critical success factors model for ERP implementation", *IEEE Software*, Vol. 16, No. 3, 1999, pp. 30-36.

[21] Howson, C., *Successful business intelligence : Secrets to making BI a killer application,* New York : McGraw-Hill, 2008.

[22] Isik, O., Jones, M., and Sidorova, A., "Business intelligence success : The roles of BI capabilities and decision environments", *Information and Management*, Vol. 50, No. 1, 2013, pp. 13-23.

[23] Kimpel, J. and Morris, R., "Critical success factors for data warehousing : A classic answer to a modern question", *Issues in Information Systems*, Vol. 14, No. 1, 2013, pp. 376-384.

[24] Leidecker, J. and Bruno, A., "Identifying and using critical success factors", *Long Range Planning*, Vol. 17, No. 1, 1984, pp. 23-32.

[25] Nah, F., Lau, J. and Kuang, J., "Critical factors for successful implementation of enterprise systems", *Business Process Management Journal*, Vol. 7, No. 3, 2001, pp. 285-296.

[26] Nahapiet, J. and Ghoshal, S., "Social capital, intellectual capital, and the organizational advantage", *Academy of Management Review*, Vol. 23, No. 2, 1998, pp. 242-266.

[27] Nasir, M. and Sahibuddin, S., "Critical success factors for software projects : A comparative study", *Scientific Research and Essays*, Vol. 6, No. 10, 2011, pp. 2174-2186.

[28] Ngai, E., Law, C., and Wat, F., "Examining the critical success factors in the adoption of enterprise resource planning", *Computers in Industry*, Vol. 59, No. 6, 2008, pp. 548-564.

[29] Nour, M. and Mouakket, S., "A classification framework of critical success factors for ERP systems implementation : A multi-stakeholder perspective", *International Journal of Enterprise Information Systems,* Vol. 7, No. 1, 2011, pp. 56-71.

[30] Olbrich, S., Poppelbuß, J., and Niehaves, B., "Critical contextual success factors for business intelligence : A Delphi study on their relevance, variability, and controllability", System Science (HICSS), 2012 45th Hawaii International Conference (4148-4157), 2012.

[31] Olszak, C., "Dynamic business intelligence and analytical capabilities in organizations", Proceedings of the e-skills for knowledge production and innovation Conference, 2014.

[32] Peppard, J., "The conundrum of IT management", *European Journal of Information Systems*, Vol. 16, No. 4, 2007, pp. 336-345.

[33] Petrini, M. and Pozzebon, M., "Managing sustainability with the support of business intelligence : Integrating socio-environmental indicators and organisational context", *The Journal of Strategic Information Systems*, Vol. 18, No. 4, 2009, pp. 178-191.

[34] Pinto, J. and Mantel, S., "The causes of project failure", *IEEE Transactions on Engineering Management*, Vol. 37, No. 4, 1990,

pp. 269-276.

[35] Poon, P. and Wagner, C., "Critical success factors revisited : success and failure cases of information systems for senior executives", *Decision Support Systems*, Vol. 30, No. 4, 2001, pp. 393-418.

[36] Popovic, A., Hackney, R., Coelho, P., and Jaklič, J., "How information-sharing values influence the use of information systems : An investigation in the business intelligence systems context", *The Journal of Strategic Information Systems*, Vol. 23, No. 4, 2014, pp. 270-283.

[37] Power, D., "Supporting decision-makers: An expanded framework", Proceedings Informing Science Conference, 2001, pp. 431-436.

[38] Rainer Jr, R. and Watson, H., "The keys to executive information system success", *Journal of Management Information Systems*, Vol. 12, No. 2, 1995, pp. 83-98.

[39] Ranjan, J. and Bhatnagar, V., "Critical success factors for implementing CRM using data mining", *Journal of Knowledge Management Practice*, Vol. 9, No. 3, 2008.

[40] Rockart, J., "Chief executives define their own data needs", *Harvard Business Review*, Vol. 57, No. 2, 1978, pp. 81-93.

[41] Ross, J., Weill, P., and Robertson, D., *Enterprise architecture as strategy: Creating a foundation for business execution*, Harvard Business Press, 2006.

[42] Salmeron, J., "EIS success: keys and difficulties in major companies", *Technovation*, Vol. 23, No. 1, 2003, pp. 35-38.

[43] Schick, A., Frolick, M., and Ariyachandra, T., "Competing with BI and analytics at monster worldwide", 44th Hawaii International Conference on System Sciences, 2011.

[44] Schiff, J., "9 Common BI Software Mistakes (and How to Avoid Them)", CIO, 2014. http://www.cio.com/article/2464167/business-intelligence/9-common-bi-software-mistakes-and-how-to-avoid-them.html.

[45] Sherman, R., "Comparing BI analytics tools from the leading vendors", http://searchbusinessanalytics.techtarget.com/feature/Comparing-BI-analytics-tools-from-the-leading-vendors, 2015.

[46] Shin, B., "An exploratory investigation of system success factors in data warehousing", *Journal of the Association for Information Systems*, Vol. 4, No. 1, 2003, pp. 141-168.

[47] Sim, J., "Consolidation of Success Factors in Data Mining Projects", *GSTF Journal on Computing*, Vol. 4, No. 1, 2014, p. 66.

[48] Tarhini, A., Ammar, H., and Tarhini, T., "Analysis of the critical success factors for enterprise resource planning implementation from stakeholders' perspective : A systematic review", *International Business Research*, Vol. 8, No. 4, 2015, pp. 25-40.

[49] Wateridge, J., "IT projects : a basis for success", *International Journal of Project Management*, Vol. 13, No. 3, 1995, pp. 169-172.

[50] Watson, H., "Tutorial : business intelligence-past, present, and future", *Communications of the Association for Information Systems*, Vol. 25, No. 1, 2009, 487-510.

[51] Watson, H. and Haley, B., "Data warehousing : A framework and survey of current

practices", *Journal of Data Warehousing*, Vol. 2, No. 1, 1997, pp. 10-17.

[52] Watson, H. and Wixom, B., "Enterprise agility and mature BI capabilities", *Business Intelligence Journal*, Vol. 12, No. 3, 2007, pp. 4-6.

[53] Weill, P. and Ross, J., *IT governance : How top performers manage IT decision rights for superior results*, Harvard Business Press, 2004.

[54] Wixom, B. and Watson, H., "An empirical investigation of the factors affecting data warehousing success", *MIS Quarterly*, Vol. 25, No. 1, 2001, pp. 17-41.

[55] Yeoh, W. and Koronios, A., "Critical success factors for business intelligence systems", *Journal of Computer Information Systems*, Vol. 50, No. 3, 2010, pp. 23-32.

저자소개

Sung Kun Kim

Sung K. Kim is a professor of information systems at Business School of Chung-Ang University. He received his Ph.D. in Information Systems from Stern Business School of New York University. He has been actively involved in advisory roles on Korea's national ICT planning & governance as well as major IT projects in public and private organizations. He has published a number of articles on research journals including Sustainability, Expert Systems with Applications, Asia Pacific Journal of Information Systems, Information Systems Review, and Journal of IT Applications & Management. His current research interests include BI & Big Data, Enterprise Architecture, and technology adoption.

Jin-Young Kim

Jin-Young Kim is a Research Associate at the Business School of Chung-Ang University while pursuing a Master degree in information systems. His research interest includes Business Intelligence and Big Data, Software Engineering, and Knowledge Management.