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Bambang Purwoko Kusumo Bintoro Togar Mangihut Simatupang Utomo Sarjono Putro Pri Hermawan

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Actors' interaction in the ERP implementation literature

Bambang Purwoko Kusumo Bintoro
*School of Business and Management, Bandung Institute of Technology,
Bandung, Indonesia, and Bakrie University, Jakarta, Indonesia, and*
Togar Mangihut Simatupang, Utomo Sarjono Putro and
Pri Hermawan
*School of Business and Management, Bandung Institute of Technology,
Bandung, Indonesia*

Abstract

Purpose – The purpose of this paper is to identify the existence of studies, by exploring the current literatures, on interaction among actors in Enterprise Resource Planning (ERP) implementation.

Design/methodology/approach – A new classification framework is offered, along with the two dimensions of ERP implementation: determinants and outcomes, to provide four types of research classes. Hundreds of articles were searched by using keywords from journal data bases. The selected articles were grouped based on the new classification of ERP implementation, followed by an in-depth analysis by using the Context, Intervention, Mechanism, Outcomes logic and the system of systems methodologies (SOSM) framework.

Findings – The interactions among actors in ERP implementation have been overlooked, although there is almost always disagreements, misperceptions, and conflicts. Managing the interactions among actors is considered important because common failures in ERP implementation are often caused by mismanaged interactions among the key actors. Unfortunately, the existing research has so far shown a small effort to study how the actors' interactions are managed.

Research limitations/implications – One key limitation of this research is that the number of actor-related articles is lesser than the factor-related articles. Further research should be conducted to explain how to manage the interactions among the actors in each stage of ERP implementation.

Practical implications – A guidance to prepare the entire organization prior to the ERP implementation to seriously consider the typical conflict among actors on each stage of ERP implementation and its causal factors and how to resolve them.

Social implications – The importance of understanding typical conflict among actors, its causal factors, and how to resolve them can be extended to other projects or social phenomenon.

Originality/value – This proposed framework is new to the ERP literature and serves to identify and expand further research on actors' interactions to improve the success of ERP implementation. This is the first research to identify the interactions among actors in ERP implementation by using a clearly structured methodological approach, which is conducted by critically reviewing the ERP implementation literature.

Keywords Critical review, ERP (Enterprise Resource Planning), Actor's interaction,
ERP implementation, Key success factor, Key success actor

Paper type Literature review

1. Introduction

Enterprise Resource Planning (ERP) is a system that automates and integrates separate, autonomous business functions and silo-centric infrastructures across an enterprise

which, is intended to improve operational efficiency and provide real-time information to the top management for strategic decision making. ERP system is composed of several modules, such as human resources, sales, finance, and production, which can be customized up to a certain limit to the specific needs of an organization. In reality, implementation of ERP is not exclusively for customizing a business process embedded within an organizational system so that the business process suits to the organization. It is proved to be a challenging task because of both critical socio-technical and technical factors found during ERP implementation (Shah *et al.*, 2011).

ERP implementation can be regarded as a journey which consists of five different stages or phases. They are design, implementation, stabilization, continuous improvement, and transformation (Ross and Vitale, 2000). Françoise *et al.* (2009) argued that the scope of an ERP project is huge and involves as many uncertainties as there are benefits expected from this system. Managing the changes in a large ERP system is exceptionally complex, which requires a wide variety of knowledge (business, technology, human, organization), skills (managerial, political, project management), and the ability to handle practical situations (Kraemmergaard and Rose, 2002).

Since their introduction in the early 1990s, ERP systems and their complicated implementations have given rise to numerous publications. Vast amount of literature regarding the critical success factors (CSFs) of ERP implementation has been written. Holland and Light (1999) developed a framework that grouped the CSFs of ERP implementation process into strategic and tactical factors. Research conducted by Akkermans and van Helden (2002) confirmed the top ten of the list of CSFs that could adequately explain both the successful and failed ERP implementation projects being studied. Muscatello (2002) conducted an exploratory study on ERP implementation and concluded that there were 26 factors that contributed to the likelihood of successful ERP implementation. Finney and Corbett (2007) published a compilation about the analysis of CSFs of ERP implementation, which was based on the content and data bases of the 70 prominent MIS journals, which discussed nine strategic CSFs and 17 tactical CSFs. Françoise *et al.* (2009) proposed 13 ACSFs (actions CSFs) derived from a literature review on critical factors in implementing ERP systems. Moohebat *et al.* (2011) conducted a literature review on the evaluation of ERP implementation using five CSFs.

On the other hand, failed ERP implementation still happens, as annually announced by International Data Group (IDG), a leading media technology, event organizing, and research company in the world. These contradictive conditions led to an interesting question as to why the failure rate remains high if the CSFs had already been identified in prior studies. According to Žabjek *et al.* (2009), Snider *et al.* (2009), and Françoise *et al.* (2009), the high failure rate was still one of the motivating factors and a lively topic to study the CSFs of ERP implementation. Esteves de Sousa (2004) argued that although CSFs were quite well studied, except for their operationalization, a need to understand the different actors, such as steering committee, project members, consultants, vendors in an ERP implementation project was still needed. Moreover, Finney and Corbett (2007) on their literature review also concluded that the most significant finding was the lack of research that focussed on the identification of CSFs from the perspectives of key actors. This is in-line with the statement of Denyer and Tranfield (2009) that it was not enough only to know the importance of user interaction or involvement without ascertaining why or how, in what form, and in what circumstances the interaction among actors occurs.

Therefore, this paper attempts to find the studies that are focussed on actor interaction analysis as well as on how the interaction is managed in each stage of ERP implementation. If such studies do not exist, then this paper will propose a further

study that is focussed on the exploration of the types of conflicts arising in the interaction among actors in each stage of ERP implementation, their causal factors, and the best methods to resolve the conflicts.

This paper is organized as follows. In Section 1, the background and formulation of the problem is introduced. Section 2 contains a literature review of the previously related studies on the actor interaction analysis. Section 3 explains the research method. Section 4 contains the steps to conduct the article analysis. Section 5 discusses the findings of the article analysis. Finally, Section 6 concludes this paper and provides inputs for further research.

2. Literature review

Through successful implementation of ERP systems, organizations can reap a lot of benefits, but a project can also be disastrous for the organizations that fail to manage the implementation process. The articles focussed on stakeholders (or users) of ERP implementation are still limited, not as many as the articles on critical factors of ERP implementation. Moreover, the number of articles on stakeholder acceptance is more than user resistance, possibly due to its positivist nature. This is similar with the articles on critical factors of ERP implementation, where the number of articles on success factors is more than the articles on failure factors.

Klaus and Blanton (2010) stated that stakeholder's resistance, which is defined as "the behavioral expression of a stakeholder's opposition to a system implementation during the implementation," was an important issue in the implementation of enterprise systems (ES). According to Warne (1997), although stakeholder's resistance was generally viewed as a negative characteristic of implementation, it was still beneficial since it became a problem that had to be addressed. A conflict is always related to resistance, and the resistance itself is a form of conflict avoidance. Warne (1997) stated that the types of conflict in IS project, including in ERP, were grouped into developer-developer conflict, developer-user conflict, and user-user conflict and the extent to which each conflict type took, e.g., major, significant, or minor.

There were no previously related studies which explained what are the cause of resistance and commitment of the stakeholders, what type of conflicts exist, how the conflicts arose from the interaction among actors and resolved in each stage of ERP implementation every stage of ERP implementation project (initiation/planning, development, and deployment/go live).

3. Research method

The primary purpose of this research is to find out the actor's interaction, including how to manage the interaction among them, which contribute to the outcome of ERP implementation. In the first stage, the research begins by characterizing ERP implementation based on two key dimensions: the outcomes and determinants. The outcomes of ERP implementation are related to success and failure ERP adoption. The determinants are related to factors and actors of ERP implementation. The two dimensions are able to capture the existing literature status on both the actors and factors that determine the results of ERP implementation.

3.1 Defining the outcomes (success or failure) of ERP implementation
Outcome is defined as the result of an experiment or any other situation involving uncertainty. Uncertainty and risk are inherent in a project, and ERP implementation is

no exception. However, the definition of success and failure is not simple and clear cut. According to Markus and Tanis (2000), the success (or failure) of ESs is not a monolithic concept, but multidimensional and relative. It is relative to the time at which it is assessed and to the organization's unique goals for a system. To accommodate the success of multidimensionality and relativity of ESs, from adopting an organization's perspective, Markus and Tanis (2000) defined a standard for an optimal success. The standard referred to the best outcomes that the organization could achieve with ESs, given its business situation, which was measured against its project portfolio, early operation, and metrics' longer-term business results. Fortune and Peters (2005) defined success as "the system achieved what was intended of it; it was operational at the time and cost that were planned; the project team and the users are pleased with the result and they continue to be satisfied afterwards."

Al-Mashari *et al.* (2003), in their taxonomy of critical factors of ERP implementation, defined ERP success by correspondence success, e.g., IT matched the planned objectives; process success, e.g., the project was completed in time and within the budget; interaction success, e.g., the users' attitudes toward IT were positive; and expectation success, e.g., the system matched users' expectations. In summary, an ERP implementation project can be regarded as a successful one if the project can be finished on time and within the budget; the users are satisfied because their expectations are met; the systems are able to perform the functionalities as expected; and the business performance or operational efficiency experiences an increase.

Yeo (2002) offered four types of IS failures:

(1) correspondence failure is mainly because the design objectives created at the first place do not correspond with the system evaluation;

(2) process failure is when the project runs overtime, when the project is overbudget, or when there is no workable system at all;

(3) interaction failure is when the system fails to improve the business performance or the operation efficiency, the users are unsatisfied with how the system works, or there are other problems faced by the users; and

(4) expectation failure is when the stakeholders' requirements, expectations, or values are not met due to the inability of the system.

Aloini *et al.* (2007) in their study on the risk management of ERP implementation classified the failure of an ERP project as the mirror of the ERP success factors that belong to the category of Al-Mashari *et al.* (2003). Summarizing those statements, failure can be defined as a condition when an ERP implementation project cannot be finished on time, it experiences a budget overrun, users are unsatisfied because their expectations are not met, the systems cannot perform the expected functionalities, and there is no increase in business performance or in operational efficiency.

3.2 Determinants (factors and actors) of ERP implementation

Determinants are the causal elements or factors that have the power or quality for deciding or influencing the condition of, in this case, successful or failed ERP implementation. Macy and Willer (2002) reviewed an approach that models interactions among adaptive agents (actors) as an alternative to model interactions among variables (factors). Thus, besides factors which are elements or causes that actively contribute to a condition, an accomplishment, or a result; it is also important to consider the actors or persons who actively involve or participate in producing a result or a certain condition.

In addition, it is Eisenhardt and Zbaraki (1992, p. 18), in Esteves de Sousa (2004), who mentioned the needs to consider the actors in CSF method for the first time before Markus and Tanis (2000) defined the existence of stakeholders in each stage of ERP implementation.

The original concept of success factors can be traced back to 1961, where Daniel (1961) first discussed "success factors" in management literature. Anthony *et al.* (1972) went a step further by emphasizing the need to tailor CSF to both a company's particular strategic objectives and its particular managers. Another CSF definition proposed by Hofer and Schendel (1978) as "the variables which management can influence through its decisions that can significantly affect the overall competitive positions of the various firms in an industry." Combining the perspective of both Daniel (1961) and Anthony *et al.* (1972), Rockart (1979) defined CSF as the few key areas where "things must go right" for the business to flourish. Later on, Rockart and Bullen (1981) broadens their view toward the word "CSFs," where they begun to take place with other basic terms concerned with the management of an organization. Furthermore, Boynton and Zmud (1984) defined CSFs as the vital constructs that must go well to ensure success for manager or organization. Saraph *et al.* (1989) defined the CSFs as "the critical areas of managerial planning and action that must be practiced in order to achieve the effectiveness." Another more recent definition was proposed by Caralli (2004), where CSFs are defined in the context of an effort that must be undertaken with regards to ensure that it is successful. Esteves de Sousa (2004) argued that the difference between success criteria and CSFs was an important distinction. However, Chuen (2010) stated that some CSFs, which were identified in prior research, were critical aspects which should not be regarded as CSFs because they were not sufficient conditions. Chuen (2010) proposed five CSFs, such as top management support, effective project management, consultants support, perceived usefulness, and self-efficacy. These five CSFs are in-line with Rockart's (1979) definition of CSFs, in which it is regarded as the few key areas, and not as the long list of success factors as presented in some previous studies. Recently, Neuert and van der Vorst (2014) stated that CSF are elements that are vital for a strategy to be successful.

Wong *et al.* (2005) on the other hand, examined and discussed 14 critical failure factors (CFFs) and suggested that the role of consultants, effective project control and monitoring, and making use of business process reengineering matches both the business processes and the ERP function, which were important in ERP implementation. Thus, it can be defined that CSFs are the key or critical elements or causes that actively contribute and have the power or quality of deciding or influencing the success of ERP implementation. Subsequently, the CFFs were the key (critical) elements or the causes that actively contribute to the failure of ERP implementation.

3.3 A new framework of ERP implementations articles
In order to conduct a holistic article analysis, a new framework is developed by synthesizing the outcomes and determinants of ERP implementation that results in the categorization of four types of combinations as follows:

(1) CSFs are the articles which explain the key or critical elements or causes that actively contribute to and have the power or quality of deciding or influencing the success of ERP implementation.

(2) CFFs are the articles which clarify the key or critical elements or causes that actively contribute to the failure of ERP implementation.

(3) CSAs (critical success actors) are the articles which elaborate the participants or persons or key players who actively take part in the success of ERP implementation.

(4) CFAs (critical failure actors), are the articles which discuss the participants or persons or key players who actively involved in the failure of ERP implementation.

The next step is to select the articles on ERP implementation, which contained well-known information systems, from journals, as the first round searching, by using ProQuest and from Emerald Insight data bases, as the second round one, by using the following seven search keywords: ERP implementation, factors ERP implementation, CSFs ERP implementation, CFFs ERP implementation, actors ERP implementation, critical success actors ERP implementation, and critical failure actors ERP implementation. The selected articles were then classified into the Outcomes and Determinants matrix.

Based on the new article classification framework, an in-depth analysis using Context, Intervention, Mechanism, Outcomes (CIMO) logic (Denyer *et al.*, 2008) on ERP governance was conducted to confirm the findings. The CIMO logic is a combination of Problem-in-Context, Intervention, Outcome Producing Generative Mechanisms, and Outcome.

Another analysis was conducted using the framework of System of Systems Methodologies (SOSM) developed by Flood and Jackson (1991) based on the problems and actors of ERP implementation. Finally, a conclusion is drawn upon the findings of the article analysis, and further research directions are outlined based on the identified research gaps.

Figure 1 shows the theoretical model of article analysis mentioned above.

4. Findings
4.1 Articles selection results
The following are the first round results obtained by using the above-mentioned search keywords. The results from ProQuest are as follows. There are 5,845 articles from kw1 = keywords 1 "ERP implementation," 4,756 articles from kw2 = keywords 2 "factors ERP implementation," 2,836 articles from kw3 = keywords 3 "critical success factors ERP implementation," 1,944 articles from, kw4 = keywords 4 "critical failure factors ERP implementation;" 1,031 articles from kw5 = keywords 5 "actors ERP implementation," 661 articles from kw6 = keywords 6 "critical success actors ERP implementation," and 488 articles from kw7 = keywords 7 "critical failure actors ERP implementation." The article searching was limited to 200 articles because of the inconsistency of the results with the keywords beyond 200 articles. There were articles which always appear in kw1, kw2, kw3, and kw4 for factor and in kw5, kw6, and kw7 for actor.

The results obtained from Emerald Insight database by using the same search terms or keywords are as follows. There were 1,130 articles from kw1 = keywords 1 "ERP
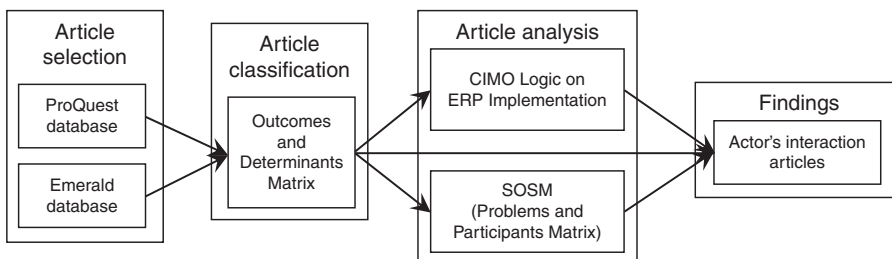
Figure 1.
Theoretical model of
article analysis

implementation," 1,005 articles from kw2 = keywords 2 "factors ERP implementation," 767 articles from kw3 = keywords 3 "critical success factors ERP implementation," 446 articles from kw4 = keywords 4 "critical failure factors ERP implementation," 250 articles from kw5 = keywords 5 "actors ERP implementation," 180 articles from kw6 = keywords 6 "critical success actors ERP implementation," and 116 articles from kw7 = keywords 7 "critical failure actors ERP implementation." The article searching was also limited to 200 articles, because of, once again, the inconsistency of the results with the keywords beyond 200 articles. Similar to the results obtained from ProQuest selection, there were articles which always appear in kw1, kw2, kw3, and kw4 for factor and in kw5, kw6, and kw7 for actor in Emerald Insight selection.

4.2 Articles selection analysis

By combining the results from the first and second screening, the final result consisted of 108 articles: 99 for factor articles and nine for actor articles. In total, 78 out of the 108 selected articles were obtained from well-known journals as presented in Table I. Moreover, 81 out of the 108 selected articles were published in 2007 (six articles), 2008 (14 articles), 2009 (19 articles), 2010 (18 articles), 2011 (12 articles), 2012 (four articles), 2013 (seven articles), and 2014 (one article). According to Huang (2010), researchers paid more attention to human factor than technical factors in ERP implementation because ERP software becomes more mature and needs less attention on technical parts. His research found that more articles after 2003 put end-user's training or involvement as a CSF. This is in-line with Kumar *et al.* (2003) statement that implementation challenges relate more too behavioral and management issues than to technical difficulties.

The fact that there were articles which always appear in kw1, kw2, kw3, and kw4 for factor and in kw5, kw6, and kw7 for actor from ProQuest as well as Emerald Insight selection proved that there were two categories: factor articles and actor articles. The number of actor articles was significantly smaller than the factor articles. This condition indicated that the number of research on the actors of ERP implementation was still limited, while the number of research on the factors of ERP implementation already reached a saturated level.

The classification of 108 articles into each cell was indicated from the title of the articles, or if the title did not explicitly mention the word CSF, further indication was obtained from either the abstract of the articles or within the reading articles. From 108 articles, 80 articles were classified into the CSFs cell, 19 articles into the CFFs cell, seven articles into the CSAs cell, and two articles into the CFAs cell. The initial classification of the articles is presented in Figure 2.

Business Process Management Journal	20
Industrial Management and Data Systems	15
Journal of Enterprise Information Management	14
European Journal of Information Systems	7
Journal of Manufacturing Technology Management	6
Information Technology and People	4
European Journal of Operational Research	3
International Journal of Business and Management	3
International Journal of Enterprise Information Systems	3
International Journal of Operations and Production Management	3

Table I.
Journals of the
selected articles

Although the initial classification has already been obtained, there were 80 articles on CSF and 19 articles on CFF which could not provide the answers to the main factors contributing to the root causes of both the successful and the failed ERP implementation. Similar condition happened to seven articles on CSA and two articles on CFA, which were not able to show the main actors who were involved in either the successful or failed ERP implementation. Thus, another way to conduct a more in-depth analysis to those articles is needed.

4.3 In-depth article analysis using CIMO logic

Denyer *et al.* (2008) stated that the publication of organization and management research had grown exponentially, but their scientific basis was traditionally regarded as highly fragmented. Pawson (2006) in Denyer *et al.* (2008) stated that realist synthesis could accommodate research evidence from a range of study types because the realist's goal was to understand how interventions or systems work in various types of contexts. Denyer *et al.* (2008) introduced the design propositions which were based on the so-called "CIMO logic," involving a combination of a problematic Context. The design propositions suggested a certain intervention type to produce, through specified generative Mechanisms, the intended Outcome(s). This is in accordance with Pawson (2006) in Denyer and Tranfield (2009), who stated that a realist's approach required a reviewer to determine the context, mechanism, and outcome configurations through comparing and contrasting interventions in different contexts. Moreover, Denyer and Tranfield (2009) also stated that in social science fields, such as organization and management studies, only knowing what worked was not enough. Ascertaining why or how and in what circumstances a relation occurred was required.

This CIMO logic is adopted into a simple contingent contextual framework, where the context in which ERP implementation is required, can be identified in:

(1) the globalization, which happens due to the growth of e-commerce in this borderless world, since it requires the accuracy and assurance of the information presented in a financial statement and the rapid delivery or response time of the goods that are ordered. In this context, ERP plays an important role to support those requirements;

(2) the structural changes of an organization, because the company that wishes to implement an ERP system should reengineer its business reengineering process while the nature of ERP package can only be customized up to a certain limit; and

(3) the uncertainty (unpredictability) and risk, because the high investment to implement an ERP system is required, but there is no guarantee for the project success, direct improvement, and business performance.

In order to achieve the intended outcomes of ERP implementation while considering the above-mentioned contextual factors, the mechanism, through which the intervention produces the intended outcomes, has to be defined. Inspired by the governance in ERP

|		ERP Implementation Outcomes	
		Success	Failure
ERP implementation determinants	Factors	80 articles	19 articles
	Actors	7 articles	2 articles

Figure 2.
The initial classification of articles on ERP implementation

implementation system, which was proposed by Fitz-Gerald and Carol (2003), consisted of organizational governance, project governance, and IT governance, the intended interventions should consist of organizational related (an increase in business performance or operational efficiency), project related (finished on time and within the budget), and IT related (able to deliver the expected system of functionalities and to satisfy the users by fulfilling their requirements). As previously mentioned, there are only two outcomes of ERP implementation, i.e. the success and failure. While the four measures toward either the successful or failed ERP implementation are project completion time, project expenditure, user's expectations or performing system of functionalities, and impact to the business performance or operational efficiency. The relationships among contextual factors, interventions, and outcomes are presented in Figure 3.

The derivation of mechanisms was made by relating the contextual factors, intended interventions, and outcomes of ERP implementation. Connecting the accuracy and assurance of the information from the globalization context with the successful ERP implementation as the intended outcome requires an excellent data quality, data conversion, and data integrity from the legacy systems which fall under the mechanism of standardize specification in the project-related intervention. Business reengineering, as a consequence of structural changes of the organization context, requires an organizational-related intervention using such mechanisms as redesign business processes, commitment to change, top management support, and interdepartmental cooperation. Uncertainty (unpredictability) and risk context, which are inherent in every project, including in ERP implementation, will require a minimal customization, realistic and adequate budget, and balanced team and best people under the project-related intervention.

Table II shows the summary of the relationships among contextual factors, interventions, and outcomes, while the details are presented in Tables III and IV.

The results of the articles classification using CIMO logic in Table II are in line with the design propositions offered by Denyer *et al.* (2008). The CIMO analysis shows that the dominant context is uncertainty and risk on both CSF and CFF articles, but there are no dominant contexts on both CSA and CFA articles. The order of dominant mechanisms in CSF articles are: organizational-related intervention, project-related intervention, and IT-related intervention. While in CFF articles, the rank of dominant mechanisms are: project-related intervention, organizational related, and IT related. Moreover, the rank of dominant outcomes in CSF articles are: the impact to business
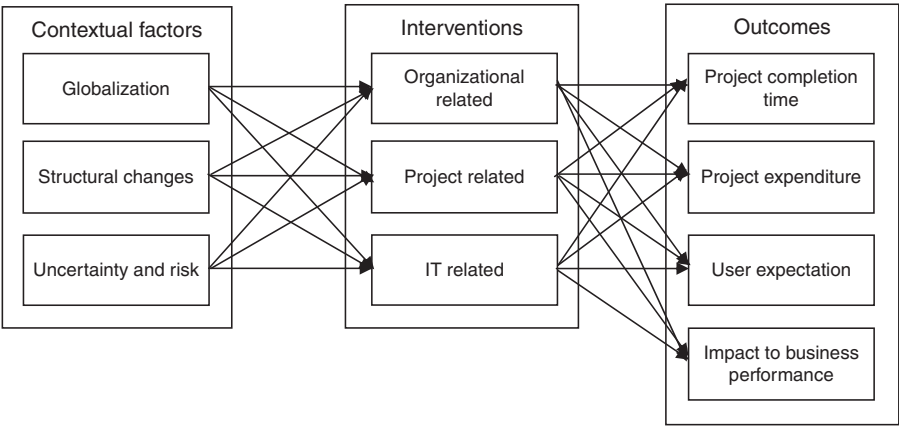
Figure 3.
Relationships among contextual factors, interventions and outcomes

	CSF (80 articles)	CFF (19 articles)	CSA (7 articles)	CFA (2 articles)
Context				
Globalization	4	3	0	0
Structural changes	4	6	1	0
Uncertainty and risk	12	13	0	0
Interventions				
Organizational related				
Top management support	54	9	3	0
Commitment to change	45	10	2	2
Redesign business process	58	18	5	2
Interdepartmental cooperation	44	4	3	0
IT related				
Adequate infrastucture	35	11	2	2
Qualified consultant	42	8	4	1
Partner relationship	31	8	2	0
Project related				
Minimal customization	32	8	1	1
Realistic and adequate budget	18	10	2	0
Standardized specifications	38	15	5	2
Balanced team and best people	49	13	3	0
Outcomes				
Project completion time	23	2	0	0
Project expenditure	20	1	0	0
User satisfaction	19	8	0	2
Impact to business performance	30	9	3	0

Table II.
Article analysis
using CIMO logic

performance, project completion time, project expenditure, and the ability to fulfill user expectation. The order of dominant outcomes in CFF articles are: the impact to business performance and the ability to fulfill user expectation. However, the dominant intervention and outcomes in CSA and CFA articles cannot be determined because of the limited number of or very few articles on CSA, and CFA.

The CFF articles seems to pay more attention on how to avoid the failed ERP implementation, and this explains why CFF articles put uncertainty and risk as the dominant context and project related as the dominant intervention. On the other hand, although CSF articles also put on uncertainty and risk as the dominant context, but organizational related is the first rank on the dominant intervention. In other words, CFF articles are focussing on the tactical or technical aspects, while CSF articles concentrate more on the strategic aspects. It is also important to note that further investigation on all articles revealed that user interaction was implicitly discussed on the organizational-related intervention under the interdepartmental cooperation, commitment to change and redesign business process mechanisms. This supports the conclusion that articles on user interaction are unavailable.

4.4 Article analysis using the SOSM framework
The use of CIMO logic for the in-depth article analysis mentioned in the previous section still cannot show the actor interaction in each stage of ERP implementation. Therefore, another in-depth analysis method is needed to explore the actor interaction and its situation. This led to the decision of using SOSM framework, which was

CSF	Akkermans and van Helden (2002)	Albalata and Al-Mudimigh (2011)	Ali and Xie (2012)	Al Mashari et al. (2003)	Al-Mudimigh et al. (2001)	Annamalai and Ramayah (2013)	Capaldo and Rippa (2009)	Carton et al. (2008)	Chan et al. (2009)	Chuang and Shaw (2008)	Dawson and Owens (2008)	Dey et al. (2010)	Dezdar and Ainin (2009)	Dezdar and Ainin (2011)	Doom et al. (2010)	Ehie and Madsen (2005)	El Sawah et al. (2008)	Elbanna (2007)	Esteves (2009)	Federici (2009)	Finney and Corbett (2007)	Finney (2011)	Francois et al. (2009)	Ful et al. (2007)	Gargeya and Brady (2005)	Gosain et al. (2005)	Hakkinen and Hilmola (2008)	Hasan et al. (2011)	Ho et al. (2004)	Holland et al. (1999)	Hsu and Minder (2004)	Huang (2010)	Hitedo (2008)	Hitedo and Nahar (2009)	Jeng and Dunk (2013)	Jiang et al. (2009)	Kale et al. (2010)	Koh et al. (2006)	Kumar et al. (2003)	Lee et al. (2010)	Li (2012)	Lin and Rohm (2009)	Longinidis and Gotzamani (2009)	Kemp and Low (2008)	Madimsu et al. (2012)	Maguire et al. (2009)
CONTEXT																																									✓					
Globalization																									✓																					
Structural changes																										✓		✓						✓												
Uncertainty and risk																				✓			✓			✓							✓			✓		✓								✓
INTERVENTIONS																																														
Organizational related																																														
Top management support	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓			✓	✓	✓		✓				✓	✓		✓	✓				✓		✓	✓				✓		
Commitment to change	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓				✓	✓	✓		✓				✓	✓		✓					✓	✓	✓	✓		✓		✓		
Redesign business process	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓		✓				✓	✓	✓				✓			✓		✓						✓	✓			✓				✓
Interdepartmental cooperation	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				✓							✓		✓			✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
IT related																																														
Adequate infrastructure	✓		✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓	✓				✓		✓		✓			✓	✓				✓	✓			✓	✓	✓	✓	✓	✓			✓	✓
Qualified consultant	✓		✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓	✓			✓	✓	✓	✓			✓			✓					✓			✓	✓	✓	✓	✓	✓		✓	✓	✓
Partner relationship	✓		✓	✓		✓	✓					✓	✓		✓		✓				✓				✓				✓				✓	✓				✓	✓			✓			✓	
Project related																																														
Minimal customization	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓		✓		✓		✓		✓		✓		✓			✓	✓	✓				✓			✓	✓	✓	✓	✓	✓		✓		✓
Realistic and adequate budget	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓												✓	✓	✓	✓	✓			✓		
Standardized specifications	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				✓		✓		✓		✓										✓	✓	✓	✓			✓		✓	✓
Balanced team and best people	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓									✓	✓	✓							
OUTCOMES																																✓															
Project completion time		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓		✓			✓							
Project expenditure		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓		✓		✓	✓	✓												✓							
User satisfaction		✓		✓	✓	✓						✓	✓	✓	✓								✓		✓	✓	✓	✓					✓	✓		✓							✓			
Impact to business performance		✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓		✓			✓	✓		✓				✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓					✓		

Table III.
The results of the CIMO logic for CSF

CSF	Mandal and Gunasekaran (2003)	Mehrjerdi (2010)	Moohebat et al. (2010)	Moohebat et al. (2011)	Muscatello and Chen (2008)	Muscatello et al. (2003)	Nah and Delgado (2006)	Neuert and van der Vorst (2014)	Ngai et al. (2008)	Norton et al. (2013)	Noudoostbeni et al. (2010)	Okrent and Vokurka (2004)	Saini et al. (2013)	Saatçioğlu (2013)	Schniederjans and Yadav (2013)	Shaul and Tauber (2012)	Silveira et al. 2013	Skok and Legge (2012)	Snider et al. (2009)	Subramoniam et al. 2009	Tsai et al. (2011)	Umble et al. (2003)	Upadhyay et al. (2010)	Upadhyay and Dan (2009)	Upadhyay et al. (2011)	Velcu (2007)	Wenrich and Ahmad (2009)	Wickramasinghe and Gunawardena (2010)	Willis and Chiasson (2007)	Woo (2007)	Yeh and OuYang (2010)	Yu (2005)	Zabjek et al. (2009)	Zhang et al. (2005)
CONTEXT																																		
Globalization		V																		V													V	
Structural changes																																	V	
Uncertainty and risk												V								V	V				V			V						
INTERVENTIONS																																		
Organizational related																																		
Top management support	V		V	V	V	V	V	V	V	V	V		V	V	V	V		V	V	V		V	V	V			V	V		V		V	V	V
Commitment to change	V		V	V	V	V	V	V	V	V	V		V	V	V	V		V	V	V		V	V	V			V	V				V	V	V
Redesign business process	V		V	V		V	V	V	V	V	V		V	V	V	V	V	V	V			V	V	V	V	V	V	V	V	V	V	V	V	V
Interdepartmental cooperation			V										V					V				V	V	V	V			V						
IT related																																		
Adequate infrastucture	V		V	V	V	V	V	V	V	V	V		V	V	V	V		V	V	V	V	V	V	V	V		V					V	V	V
Qualified consultant			V	V					V	V			V	V	V	V		V	V			V	V	V	V								V	V
Partner relationship	V		V	V			V	V	V	V			V					V					V	V	V									V
Project related																																		
Minimal customization	V									V			V		V	V				V			V				V							V
Realistic and adequate budget			V	V				V	V	V			V		V	V				V			V	V	V									
Standardized specifications	V				V			V	V	V			V		V							V	V	V	V									
Balanced team and best people	V	V	V	V			V	V	V	V	V		V		V	V			V		V	V	V	V	V		V	V				V	V	V
OUTCOMES																																		
Project completion time	V		V	V									V	V												V		V						
Project expenditure	V		V	V	V	V							V	V													V	V						
User satisfaction						V							V	V														V	V	V			V	V
Impact to business performance	V												V	V			V												V	V		V	V	V

Note: V is equivalent with check marks

Table III.

	CFF																				CSA						CFA	
	Allen (2008)	Al Mashari and Al-Mudimigh (2003)	Hawari and heeks (2010)	Lowe et al. (2008)	Lyytinen et al. (2009)	Maheshwari et al. (2010)	Momoh et al. (2010)	Pan et al. (2011)	Peng et al. (2009)	Peng et al. (2009)	Poba-Nzaou et al. (2008)	Salmeron et al. (2012)	Sammon et al. (2005)	Huang et al. (2004)	Shirouyehzad et al. (2011)	Sternad et al. (2006)	Venugopal et al. (2011)	Wei et al. (2005)	Xue et al. (2005)	Helo et al. (2008)	Lim et al. (2005)	Matende et al. (2013)	Metrejan and Stocks (2004)	Palanisamy et al. (2010)	Somers et al. (2004)	Soja (2008)	Klaus et al. (2010)	Meissonier et al. (2010)
CONTEXT																												
Globalization		V					V	V													V							
Structural changes	V	V		V	V		V											V		V								
Uncertainty and risk		V	V	V			V	V	V	V	V	V	V	V				V										
INTERVENTIONS																												
Organizational related																												
Top management support		V		V		V	V	V	V						V	V	V				V				V	V		
Commitment to change	V	V		V		V					V			V	V	V	V	V		V					V		V	V
Redesign business process		V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V			V	V	V	V	V
Interdepartmental cooperation	V	V												V		V				V					V	V		
IT related																												
Adequate infrastucture		V	V			V	V	V	V	V	V	V	V			V		V		V					V		V	V
Qualified consultant		V		V	V		V	V	V	V			V					V		V		V	V	V				V
Partner relationship					V		V	V	V	V	V	V				V			V						V	V		
Project related																												
Minimal customization		V				V					V	V	V		V	V	V			V					V			V
Realistic and adequate budget		V				V	V	V	V	V	V			V			V	V	V				V					
Standardized specifications		V	V	V		V	V	V	V	V	V	V	V	V	V	V	V		V	V		V		V	V	V	V	V
Balanced team and best people		V		V	V		V	V	V	V	V		V	V	V		V	V	V					V				
OUTCOMES																												
Project completion time						V											V											
Project expenditure						V																						
User satisfaction		V	V			V		V			V	V		V			V										V	V
Impact to business performance		V	V		V		V	V	V		V	V		V					V	V						V		

Note: V is equivalent with check marks

Table IV.
The results of the CIMO logic for CFF, CSA, and CFA

introduced by Flood and Jackson (1991). SOSM was found useful to group problem contexts according to two dimensions: systems (problems) and participants. Systems (problems) dimension consists of simple and complex, while participants dimension consists of unitary, pluralist, and coercive. The combination of the systems and the participants dimensions results in six possible SOSM cells: simple unitary, simple pluralist, simple coercive, complex unitary, complex pluralist, and complex coercive.

To determine which one of the 108 articles belongs to each cell of the SOSM, each article was classified according to the criteria of each SOSM cell after a thorough reading of the objective and the methodology were conducted. Following are the criteria:

- Simple unitary – it applies to the articles that discuss a certain objective and hard system approach, it is assumed that the participants share values and beliefs, and the systems can be quantitatively modeled.

- Simple pluralist –it is similar to the characteristics of Simple unitary, except for the fact that its articles show different perceptions among participants although their basic interests are compatible. A disagreement can take place. And if the

participants involved in decision making, then compromises or agreements can be reached (compromise approach).

- Simple coercive – it is the same as simple unitary, except for the fact that its articles show few interests in common among the participants. Compromise is not possible, and decisions are taken on the basis of who has the most power (coercive approach).

- Complex unitary, complex pluralist, and complex coercive are basically similar with simple unitary, simple pluralist, and simple coercive respectively, except for the fact that their articles discuss a large number of subsystems involved, and such systems adapt and evolve over time as they are affected by the turbulent environments where they exist although the participants have similar values, beliefs, and interests.

Flood and Jackson (1991) suggested that we should be careful in defining simple and complex systems. For example, an aircraft, due to its having many parts and interrelations, might be mistakenly considered as a complex system. The fact is that aircraft falls into the category of a simple system. It is because aircraft technologies are operated according to well-defined laws of behavior, not evolutionary laws of behavior. Similar condition applies to ERP, where the number of people involved as well as the number of ERP software modules to be customized, easily assumed as a complex system. Actually, there is a limit of customization that can be implemented in an ERP software, and consequently the user should follow to the world class business process embedded in it. Table V shows the summary of articles mapping under the SOSM framework using the above-mentioned criteria, while the details are presented in Table VI.

The results of articles analysis using SOSM approach indicate that most of the articles fall into both the simple unitary and simple pluralist category and the rational stream due to certain characteristics, such as common knowledge and complete information. In other words, because it follows hard systems engineering approaches, which assume a given objective or objectives and with hard technological systems, there is usually little disagreement. On the other hand, failed ERP implementation, which is often caused by the interactions, should be classified into either complex pluralist or complex coercive category because in many business situations - especially those involving IT such as ERP - the objectives are not clear cut.

Different people in an organization may have different objectives for the same organizational system. Since businesses are human activity systems, there is almost always a disagreement, involving intuition, emotion, misperceptions, and conflicts. This phenomenon characterizes an irrational stream. Different perceptions, the business process changes in ERP implementation, may lead to the pluralist if a solution is needed to resolve disagreements or the coercive category if certain actors coerce others to accept the decision. Therefore, there is a chance to study how to manage the interaction among the actors in the ERP implementation.

5. Discussion
The result of initial classification on ERP implementation articles confirms the saturation level of factors' articles, while actor's articles are less studied.The CSFs mentioned by Holland and Light (1999), Akkermans and van Helden (2002), Muscatello (2002), Finney and Corbett (2007), Françoise *et al.* (2009), Chuen (2010), and Moohebat *et al.* (2011) in their studies showed many similarities, and some articles showed the list

of CFFs as the mirror of CSFs. Although various research methods were used to produce those CSFs, the mechanisms derived using CIMO logic can explains very well the origins of them. In the future, the studies on actors should be more emphasized than the factors on ERP implementation.

It is important to note Finney and Corbett (2007) recommendation that there was a need to conduct more in-depth research into the concept of change management in ERP implementation. Unfortunately, many CSF articles only mentions the importance of change management without further explaining it, for example, when and how to conduct a proper change management. Managing changes during ERP implementation means managing interaction among actors involved in each stage of ERP interaction. Schniederjans and Yadav (2013) believes that ERP implementation success can be negatively impacted by a culture resistant to change and a lack of trust within the ERP community, including the vendor, consultant and ERP implementing organization, as well as trust with the system itself.

Finney and Corbett (2007) also mentioned the need to study the stakeholders (or the actors) in ERP implementation. Somers and Nelson (2004) have analyzed who are the key players, the so called stakeholders, and what are their roles in ERP implementation. Earlier, Skok and Legge (2002) define the company selecting, implementing and using ERP system as "a social activity system which consists of a variety of stakeholders." Further, Skok and Legge (2002) illustrated the complexity of the relationships among the stakeholders and possible conflict points in the interaction between them.

Somers and Nelson (2004) list top management, project champion, steering committee, implementation consultants, and project team as the most important players in ERP implementation. However, Kumar *et al.* (2003) argue that users were not currently listed as key players by Somers and Nelson (2004), and it is paradoxal since the key players representing the company that implements an ERP system are to be users after the implementation. According to Matende and Ogao (2013), literature review conducted by Moon (2007) mentioned that one of the most cited CSFs in the ERP implementation is user participation and involvement. However, this is only presented in form of user education and training in order to fully use the implemented system.

Akkermans and van Helden (2002) in their study stated that two CSFs, such as interdepartmental collaboration and interdepartmental communication, served as the core of CSFs. Both reinforced each other or used system dynamics terms, and they are called core reinforcing loop (Akkermans and van Helden, 2002). This statement confirms that, under the SOSM framework, most of the analyzed articles on ERP implementation belong to the simple unitary and simple pluralist category. In the future, more and more studies should be directed to prove whether ERP implementation belongs to complex pluralist or complex coercive category.

Annamalai and Ramayah (2013) cited Sternad and Bobek (2006) statement that interdepartmental communication should cover the rationale for the ERP implementation,

| | | Participants | |
	Unitary	Pluralist	Coercive
Problems			
Simple	92	16	–
Complex	–	–	–

No.	Author	Simple	Complex	Unitary	Pluralist	Coercive
1	Akkermans and van Helden (2002)	V		V		
2	Alballaa and Al-Mudimigh (2011)	V		V		
3	Allen (2008)	V			V	
4	Ali and Xie (2012)	V		V		
5	Al Mashari et al. (2003)	V		V		
6	Al Mashari and AI-Mudimigh (2003)	V		V		
7	Al-Mudimigh et al. (2001)	V		V		
8	Capaldo and Rippa (2009)	V		V		
9	Carton et al. (2008)	V		V		
10	Chan et al. (2009)	V			V	
11	Annamalai and Ramayah (2013)	V		V		
12	Chuang and Shaw (2008)	V		V		
13	Dawson and Owens (2008)	V		V		
14	Dey et al. (2010)	V		V		
15	Dezdar and Ainin (2009)	V		V		
16	Dezdar and Ainin (2011)	V		V		
17	Doom et al. (2010)	V		V		
18	Ehie and Madsen (2005)					
19	El Sawah et al. (2008)	V		V		
20	Elbanna (2007)	V			V	
21	Esteves (2009)	V		V		
22	Federici (2009)	V			V	
23	Finney and Corbett (2007)	V		V		
24	Finney (2011)	V			V	
25	Françoise et al. (2009)	V		V		
26	Fuß et al. (2007)	V		V		
27	Gargeya and Brady (2005)	V		V		
28	Gosain et al. (2005)	V		V		
29	Häkkinen and Hilmola (2008)	V			V	
30	Hasan et al. (2011)	V		V		
31	Hawari and Heeks (2010)	V			V	
32	Helo et al. (2008)	V			V	
33	Ho et al. (2004)	V			V	
34	Holland and Light (1999)	V		V		
35	Hsu and Minder (2004)	V		V		
36	Huang (2010)	V		V		
37	Ifinedo (2008)	V		V		
38	Ifinedo and Nahar (2009)	V		V		
39	Jeng and Dunk (2013)	V		V		
40	Jang et al. (2009)	V		V		
41	Kale et al. (2010)	V		V		
42	Kemp and Low (2008)	Simple		V		
43	Klaus and Blanton (2010)	V			V	
44	Koh et al. (2006)	V		V		
45	Kumar et al. (2003)	V		V		
46	Lee et al. (2010)	V		V		
47	Li (2011)	V		V		
48	Lim et al. (2005)	V			V	

(continued)

Table VI.
The results of the
SOSM framework

No.	Author	Simple	Complex	Unitary	Pluralist	Coercive
49	Lin and Rohm (2009)	V			V	
50	Longinidis and Gotzamani (2009)	V		V		
51	Lowe and Locke (2008)	V		V		
52	Lyytinen et al. (2009)	V			V	
53	Maditinos et al. (2012)	V		V		
54	Maguire et al. (2010)	V		V		
55	Maheshwari et al. (2010)	V		V		
56	Mandal and Gunasekaran (2003)	V		V		
57	Mehrjerdi (2010)	V		V		
58	Meissonier and Houzé (2010)	V			V	
59	Matende and Ogao (2013)	V		V		
60	Metrejean and Stocks (2011)	V		V		
61	Moohebat et al. (2010)	V		V		
62	Moohebat et al. (2011)	V		V		
63	Momoh et al. (2010)	V		V		
64	Muscatello and Chen (2008)					
65	Muscatello et al. (2003)	V		V		
66	Nah and Delgado (2006)	V		V		
67	Neuert and van der Vorst (2014)	V		V		
68	Ngai et al. (2008)	V		V		
69	Norton et al. (2013)	V		V		
70	Noudoostbeni et al. (2010)	V		V		
71	Okrent and Vokurka (2004)	V		V		
72	Palanisamy et al. (2010)	V		V		
73	Pan et al. (2011)	V		V		
74	Peng and Nunes (2009a)	V		V		
75	Peng and Nunes (2009b)	V		V		
76	Poba-Nzaou et al. (2008)	V		V		
77	Saini et al. (2013)	V		V		
78	Saatçioglu (2009)	V		V		
79	Salmeron and Lopez (2012)	V		V		
80	Sammon and Adam (2005)	V		V		
81	Schniederjans and Yadav (2013)	V		V		
82	Shaul and Tauber (2012)	V		V		
83	Huang et al. (2004)	V		V		
84	Shirouyehzad et al. (2011)	V		V		
85	Silveira et al. (2013)	V		V		
86	Skok and Legge (2002)	V		V		
87	Somers and Nelson (2004)	V		V		
88	Snider et al. (2009)	V		V		
89	Soja (2008)	V		V		
90	Sternad and Bobek (2006)	V		V		
91	Subramoniam et al. (2009)	V		V		
92	Tsai et al. (2011)	V		V		
93	Umble et al. (2003)	V		V		
94	Upadhyay et al. (2010)	V		V		
95	Upadhyay and Dan (2009)	V		V		
96	Upadhyay et al. (2011)	V		V		

Table VI.

(*continued*)

No.	Author	Simple	Complex	Unitary	Pluralist	Coercive
97	Velcu (2007)	V		V		
98	Venugopal and Rao (2011)	V		V		
99	Wei *et al.* (2005)	V		V		
100	Wenrich and Ahmad (2009)	V		V		
101	Wickramasinghe and Gunawardena (2010)	V		V		
102	Willis and Chiasson (2007)	V			V	
103	Woo (2007)	V		V		
104	Xue *et al.* (2005)	V		V		
105	Yeh and OuYang (2010)	V			V	
106	Yu (2005)	V		V		
107	Žabjek *et al.* (2009)	V		V		
108	Zhang *et al.* (2005)	V		V		

Note: V is equivalent with check marks

Table VI.

details of the business process management, demonstration of applicable software modules, briefings of change management strategies and tactics, and establishment of contact points. Annamalai and Ramayah (2013) also stated that interdepartmental cooperation is essential for creating an understanding, an approval of the implementation and sharing information between the project team and communicating to the whole organization, the results and the goals in each implementation stage.

Based on the result of CIMO analysis, the interdepartmental cooperation implicitly includes user interaction mechanism. If the term interdepartmental cooperation is replaced with actors interaction, no articles will appear. Further investigation to the selected articles revealed that there was no further explanation on user interaction, which confirms that actually there are no articles on actor interaction.

Moreover, the analyzed articles under the SOSM framework indicated that most of the ERP implementation articles follows the rational stream or hard systems engineering approach. This is because of the allowable customization limit of ERP application software, that the category "little or very few user interactions" was made. There were no articles on ERP implementation which fell under the complex pluralist or complex coercive category, as one of the characteristics of ERP implementation.

6. Conclusions
ERP implementation is an important topic that is receiving considerable attention both from academics and practitioners. Much of the prior literatures on ERP implementation focussed on the factors that contribute to successes and failures in practices. This study has attempted to consider the actors during ERP implementation in order to understand the practices of ERP. To accomplish this, a new classification of ERP implementation was developed with the supporting literature that demonstrated the importance of elements of the framework. After collecting and selecting the relevant articles, the analysis of the articles was conducted and the results showed that there were four elements of the framework that were able to show the important aspects of ERP implementation. The results also provided evidence that the identification of the main actors and their roles, interactions, decisions, and impacts to ERP implementation were overlooked by previous research. The general findings can be categorized into five points. First, the articles on ERP implementation studied more on critical success and failure factors but very few on critical

success and failure actors. Second, almost all of the articles used CFFs as the mirror of CSFs, which explain why there were fewer articles on CFFs than CSFs. Third, the result of CIMO analysis on CSFs and CFFs articles also confirmed that the mechanisms to carry out the interventions were similar with the list of widely known CSFs of ERP implementation. Fourth, there was no further elaboration on CSAs and CFAs articles which mention user interaction as a determinant on ERP implementation. Fifth, the result of further analysis using SOSM approach showed that all of the articles fall within the category of simple problems/situations with unitary and pluralist participants.

It was also found that interaction and conflicts among actors affected the success of ERP implementation, and sometimes their decisions were made by using a coercive approach. In other words, the real situation of ERP implementation cannot be approached only through hard systems engineering or rational stream. Therefore, future studies are needed to explore and explain the interaction among actors in every stage of ERP implementation project (initiation/planning, development and deployment/go live) and how to manage the conflict that may arise. It is expected that failed ERP implementation can be avoided by understanding the typical conflicts and dilemmas resulted from interaction in each stage of ERP implementation.

In a broader scope, new initiatives which require radical changes, such as in economic, commercial, public policy or else, special attention should be given to actors' interaction instead of interaction among factors (variables). As stated by Macy and Willer (2002), the interactions among agents (actors) can generate familiar but difficult to interpret or understand global patterns, such as the diffusion of information, emergence of norms, coordination of conventions, or participation in collective action.

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About the authors
Bambang Purwoko Kusumo Bintoro is a PhD Candidate of Doctor of Science in Management study program at the School of Business and Management in the Bandung Institute of Technology, Indonesia. He earned a Master of Business Administration from the University of Southern California, Los Angeles. His research interests include enterprise resource planning implementation and drama theoretic analysis on decision making and negotiation. Bambang Purwoko Kusumo Bintoro is the corresponding author and can be contacted at: pungky@sbm-itb.ac.id

Togar Mangihut Simatupang is a Professor of Operations and Supply Chain Management. He holds a PhD Degree from the Massey University in New Zealand. He has extensively published in logistics and supply chain management journals. He has been attributed Highly Commended Award by Emerald Literati Network for his research in supply chain management. His current research and teaching interests focus primarily on supply chain collaboration, operations management, and value chain management.

Dr Utomo Sarjono Putro is a Professor of Decision Making and Negotiation. He holds a PhD Degree from the Department of Value and Decision Science, Tokyo Institute of Technology,

Japan. He has extensively published in systems analysis and modeling journals. His current research and teaching interests focus primarily on systems approach in decision making, negotiation, service sciences, and agent-based modeling.

Dr Pri Hermawan is a Professor of Decision Making and Negotiation. He holds a PhD Degree from the Department of Value and Decision Science, Tokyo Institute of Technology, Japan. He has extensively published in drama theoretic and social simulation journals. His current research and teaching interests focus primarily on soft computing for social simulation and systems science-based approach to decision making and negotiation.

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