Spring 3-19-2013

The Relevance Of Specific CSFs For Stakeholders During ERP Implementation: An Empirical Study From Oman

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THE RELEVANCE OF SPECIFIC CSFs FOR STAKEHOLDERS DURING ERP IMPLEMENTATION: AN EMPIRICAL STUDY FROM OMAN

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Abstract

The success of ERP systems implementation is affected by the extent to which stakeholders have been prepared for the project activities and its outcomes. Stakeholders' preparation needs change as the ERP implementation lifecycle progresses and varies across stakeholder groups. Therefore a dynamic model is needed for such preparation. However such a model needs to reflect the relevance of different CSFs to different stakeholder groups at different stages of the ERP implementation life-cycle. This study examines empirical evidence from a survey conducted in Omani organisations to determine what these individual CSFs are and how they are distributed across the ERP implementation life-cycle for different stakeholder groups. The CSFs included in the survey were derived from a structured review of literature. Purposive sampling was used to select respondents representing different ERP stakeholders groups; all respondents had both experience and knowledge of ERP implementations. The survey data are analysed and the distribution of relevant CSFs across the ERP lifecycle for the different stakeholder groups are presented.

Keywords: ERP implementation, dynamic model, CSFs, stakeholders, stages of implementation, Oman.

1. Introduction

Over the last two decades there has been significant research investigating the critical success factors (CSFs) that impact on ERP implementations; for instance the development of a taxonomy of CSFs (Al-Mashari, Al-Mudimigh, & Zairi, 2003), investigation of the relationships between CSFs (Akkermans & Van Helden, 2002), and a compilation and analysis of CSFs found in the literature (Finney & Corbett, 2007). Such work provides a foundation for practitioners to use in preparing their organisations for ERP implementations. However, much of the literature assumes that CSFs are distributed uniformly across the ERP implementation lifecycle and that they are equally important all project stakeholders. However, there is a small, but growing, set of literature from authors such as (Esteves, 2004; Khullar & Ala, 2011; Law,

Chen, & Wu, 2010; Markus & Tanis, 2000; Nour & Mouakket, 2011; Somers & Nelson, 2004) that considers these factors in a more nuanced manner. That is, investigating the distribution of CSFs across stages of the implementation phase and understanding their relevance to selected groups of project stakeholders. This paper reports on an empirical study that sought to identify the critical success factors that affect stakeholders in Oman at each stage of an ERP implementation. This was a precursor to the development of a dynamic model aimed at supporting organisations in preparing their stakeholders for each stage: and assessing their readiness thereafter.

The initial list of potential CSFs were defined based upon literature review is outlined in section 2. In section 3 we explain the research approach taken to gather empirical data from experienced ERP stakeholders in Oman. This survey-based study examined the perceptions of experienced ERP stakeholders regarding the relative importance of a wide range of CSFs across the stages of ERP implementations. In section 4 we present and discuss the findings which evaluate the extent to which different stakeholder groups are affected by different CSFs across the stages of ERP implementation. We conclude in section 5 by considering the implications arising from this study, including its strengths and limitations, and we end by identifying opportunities for further work.

2. Literature review

A number of studies have identified the positive impact of using CSFs to improve ERP success, for instance (Al-Mashari et al., 2003; Brown & Vessey, 2003; Finney & Corbett, 2007; Ngai, Law, & Wat, 2008; Ram & Pattinson, 2009). Two main approaches have been adopted by researchers to identify precisely what these CSFs are: contextual empirical studies and (meta) analyses of existing work; for this study both types of literature were analysed to identify candidate CSFs.

2.1 Identifying CSFs in ERP Implementation

To develop a comprehensive list of CSFs to use within the empirical study the authors developed a structured approach for analysing ERP papers returned by bibliographical searches. Each paper was analysed to determine: the CSFs; the stakeholders involved; the stages that were considered; the main findings; study limitations. For the 38

empirical papers and two academic theses that were analysed additional data were also collected on: study location; organisation(s) type; research instruments used. For the six papers that reported meta analyses additional data were collected on the resources that they had used.

Eight empirical studies were conducted in USA, eight in Taiwan, with a wide range of single country studies, including three from the Middle East (El Sawah, Tharwat, & Rasmy, 2008; Maguire, Ojiako, & Said, 2010; Mouakket, 2010). Different research techniques were used to collect the data (CSFs): single case study (Amoako-Gyampah & Salam, 2004; Razmi, Sangari, & Ghodsi, 2009); questionnaires (El Sawah et al., 2008; Wang & Chen, 2006); interviews (El Sawah et al., 2008; Yu, 2005). Moreover, there was variation in the number of CSFs identified or used: varying from two (Jang, Lin, & Pan, 2009) to 20 (Esteves, 2004). The main purpose of the literature review was to identify CSFs that were potentially influential in ERP implementations and thereafter to evaluate these in an empirical study to determine which were of most significance. From the analysis of the literature a set of 61 CSFs was derived: the full mapping of these against the literature is available in (Al-Hinai, 2012), Table 1 itemises the CSFs along with their frequency of occurrence in the reviewed literature. It is important to note that this frequency of occurrence does not indicate CSF importance. For example, "effective communication between stakeholders" and "top management support" appeared in the 46 analysed articles 26 and 25 times respectively and factors that influence end users such as "Adequate quality training for end users on ERP" and "Involvement of end users" are also among the highest cited CSFs. However, these frequencies may be a reflection on the number of studies that concentrated on end users' preparation, acceptance and use of the ERP solutions rather than their intrinsic importance.

CSF	**Occ.**	**CSF**	**Occ.**
Effective communication procedures between stakeholders	26	Empowerment	6
Top management support	25	Top management involvement	6
Adequate quality training for end users on ERP	22	Monitoring & control	6
Effective project management methodology	19	Clear project scope	6
Appointment & availability of competent project teams	19	Alignment between business & IT strategies	5
Clear organisational strategy	18	Organisation structure	5
Effective change management	18	Clear roles & responsibilities	5

CSF	Occ.	CSF	Occ.
Involvement of end users	17	Motivation	5
Effective business process re-engineering	16	Performance measurement	5
Technical & functional training for project teams & key users	15	ERP easy to learn	5
Top management commitment	14	Consultant's experience with ERP consultation in similar scope	5
Clear ERP goals, objectives	13	Collaboration & trust between stakeholders	5
ERP ease of use	12	Effective conflict management	4
Education & awareness programs for all ERP stakeholders	10	Implementer's domain knowledge & experience	4
ERP usefulness	10	Implementer's experience with ERP implementation in similar scope	4
Organisational culture (norms, values & beliefs)	9	Top management leadership	4
Clear ERP implementation strategy	9	Project manager's skills & competence	4
Consultant's domain knowledge & experience	9	Organisation encouragement of continuous learning	3
Teams members' skills & competence	9	Effective risk management	3
End users' attitudes	9	Appointment & availability of competent key users	3
Effective management of expectations	8	Availability of qualified implementation team	3
ERP provides required functionality	8	Top management beliefs on ERP	3
Previous organisation's experience with complex IS	8	Social influence	3
Availability of reliable IT infrastructure	8	The fit between ERP functionality & organisation's functionality	2
Appointment of consultant	8	Vendor reputation	2
Clear IT strategy	7	Key users' business knowledge	2
Appointment & availability of competent project manager	7	End users' functional knowledge	2
ERP output quality	7	Users' beliefs on ERP	2
Vendor collaboration	7	Availability of reliable data networks	1
Clear business processes	6	Project manager's beliefs on ERP	1
		Project teams' beliefs on ERP	1

Table 1: 61 ERP CSFs Detected From Literature (With Their Number Of Occurrences).

2.2 Stakeholders in ERP Implementation

In addition to identifying the potential CSFs it was importance to identify the representative stakeholders of an ERP implementation: since such projects involving a range of stakeholders (Boonstra, 2006; Esteves, 2004; Finney & Corbett, 2007; Gable, Sedera, & Chan, 2003). We use McLoughlin's definition to determine who such stakeholders are, that is "… *those who share a particular set of understandings and meanings concerning the development of a* given technology .... *Each group will be*

identifiable through the different views they have (about) the artefact, or even whether it is a desirable technology at all. They will thus each perceive different problems and potential solutions to them". (McLoughlin, 1999). This reflects the existence of a variety of ERP stakeholders who must be considered and prepared for any such project. Moreover, more than a decade ago, (Davenport, 2000) suggested a rational approach for implementing ERP was to consider it as having two parts: preparing people and preparing the technical system. Preparing people involves creating the appropriate structure for the specific roles, considering their training, and familiarising them with the new business processes. (Akkermans & Van Helden, 2002) argued that the presence and attitudes of stakeholders are the root causes for the success or failure of an implementation. Studies of ERP critical success factors such as (Al-Mashari et al., 2003; Brown & Vessey, 2003; Burns, Turnispeed, & Riggs, 1991; Davenport, 2000; Esteves & Pastor, 2000; Holland & Light, 1999; Nah, Lau, & Kaung, 2001; Soja, 2006) have identified a range of relevant stakeholders, as a consequence of their focus on how factors affect different groups. The key stakeholders, used within this study emerge as: top management; project manager; project teams; key users; and end users.

2.3 The Stages of ERP Implementation

An ERP implementation is increasingly identified as having a lifecycle, but to date there is not standardisation on what these life-cycle stages are. Therefore, after analysing the literature (Al Hinai, Edwards, & LHumphries, 2013) a decision was taken to adopt the first four stages (initiation; adoption; adaptation; acceptance) of a long-established IS implementation life-cycle (Kwon & Zmud, 1987) and add one further stage "use" to represent the point at which from which an ERP system is in operational use.

2.4 Summary

From literature it is possible to identify candidate CSFs for ERP implementations. However, their importance to different stakeholder groups is unclear as is their distribution across the ERP implementation life-cycle stages. The empirical study presented in the following sections seeks to determine whether the relevance of CSFs varies across stakeholder groups, and secondly whether for individual stakeholder groups there is variation in the relevance of CSFs across the life-cycle stages.

3. Empirical Research Procedure

A survey instrument was designed to gather responses from a wide range of individuals who had experienced ERP implementation and provided representation of all our different stakeholder groups. The rationale for using a survey was that this would enable large scale data gathering to evaluate the candidate CSFs for relevance and importance based on respondents' knowledge and experience. The survey was conducted in Oman as it was part of a larger scale research project based in Omani organisations.

3.1 Participants

The survey respondents represent different groups of stakeholders from a variety of Omani organisations. All respondents worked within organisations that had completed their ERP implementation. Purposive sampling (Oates, 2006) was used in that respondents who were approached to complete the survey fulfilled the criteria of both belonging to an identified stakeholder group (senior managers; project managers; team members; key users; end users) and having experienced an ERP implementation. Moreover their organisations belonged to a range of organisation types to ensure the breadth of ERP deployments were considered: for instance, service industries, utilities, manufacturing, government and healthcare. The respondents who provided usable data represented all stakeholder groups: senior managers (8); project managers (11); team members (9); key users (5); end users (5).

3.2 Survey design

The main aim of the survey was to assess how important the respondents perceived each CSF success factor to be for their stakeholder group, within each life-cycle stage. The structured analysis of the reported literature generated a set of 61 CSFs for ERP implementations. These findings were triangulated against emergent empirical data from a series of interviews held with ERP practitioners in Oman: this study is not reported further here but the detail is available in (Al-Hinai, 2012). This identified a further five potential CSFs to add to the list: *availability of standards, policies and procedures; availability of IT technical policies; local presence of implementer; national economy;* and *global economy*. This set of 66 CSFs was used in the survey. A structured questionnaire format was considered to be the most appropriate research

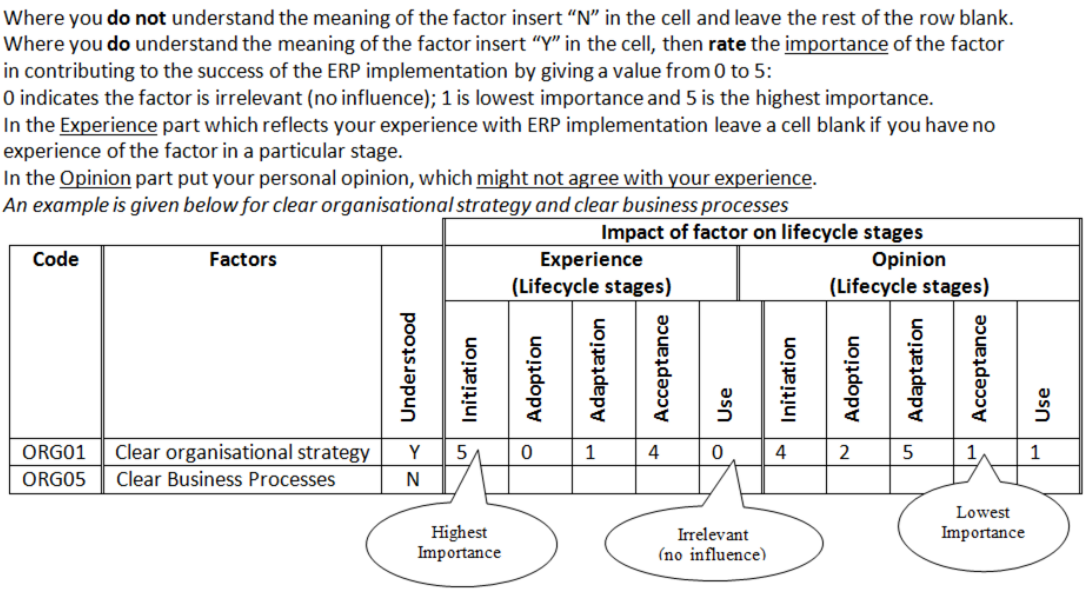
instrument to use given that such a large number of CSFs were to be evaluated by each ERP stakeholder respondent across the five defined stages. However, constructing an effective and comprehensible questionnaire required careful design and testing before its distribution to potential participants. Four design decisions were made regarding the CSFs:

- To aid respondents' comprehension the 66 CSFs were categorised into five groups: external (11 factors); human and social (12 factors); managerial (21 factors); organisational (12 factors); technical (10 factors).
- Data were to be collected from respondents about their experience of those CSFs that they understood. That is, they were asked to rate how important each CSF had been in contributing to success in each stage of the ERP projects that they had been involved in.
- Data were to be collected from respondents on their opinion of those CSFs that they understood. That is, they were asked to rate how important they believed each CSF would be in contributing to success in each stage.
- Likert scales were to be used to collect the data sets. The scale used was 0 (irrelevant) then 1 to 5 (lowest to highest importance).

The questions and the structure of the questionnaire were reviewed several times by the authors, ERP practitioners in Omani organisations, and ERP implementation consultants, before piloting with sample set of stakeholders. The aim was to reduce the complexity of the questionnaire as far as possible to enable the full range of stakeholder groups to respond. The pilot survey feedback indicated non-discriminatory assessment by the respondents (with scores of 5 being given to most CSFs in each stage) the authors felt, based on their experience and the literature that had been analysed, this was unlikely to be true reflection of the CSFs. Therefore, the information provided with the final survey was enhanced to remove any ambiguities and provided detailed guidance on how to provide valid responses: contact information was also included so respondents could clarify matters directly. In addition, the first author held a workshop with potential respondents to explain the nature and purpose of the questionnaire. To encourage respondents to respond candidly they were assured of the confidentiality of the survey data and the option to respond anonymously. The value of this modification was seen in the acquired data which reflected a more nuanced assessment of the CSFs by respondents.

The final questionnaire had a three part structure: the first collected demographic data including the extent of the respondents' ERP experience (this was used as an inclusion/exclusion criterion). The second section gathered data about the activities that stakeholders practice during each stage of ERP implementation. The final, main,

section evaluated the 66 CSFs and their relevance at the different stages of the ERP lifecycle. Figure 1 gives an example of the guidelines that were provided to aid respondents in completing the survey, for example: where a respondent did not understood a CSF term then he/she was instructed to ignore the row relating to it in each stage. Our rationale was that if the respondent did not understand the factor then any subsequent assessment of it would be invalid.



Where you **do not** understand the meaning of the factor insert "N" in the cell and leave the rest of the row blank.
Where you **do** understand the meaning of the factor insert "Y" in the cell, then **rate** the importance of the factor in contributing to the success of the ERP implementation by giving a value from 0 to 5:
0 indicates the factor is irrelevant (no influence); 1 is lowest importance and 5 is the highest importance.
In the Experience part which reflects your experience with ERP implementation leave a cell blank if you have no experience of the factor in a particular stage.
In the Opinion part put your personal opinion, which might not agree with your experience.
An example is given below for clear organisational strategy and clear business processes

Code	Factors	Understood	Impact of factor on lifecycle stages: Experience (Lifecycle stages) Initiation	Adoption	Adaptation	Acceptance	Use	Opinion (Lifecycle stages) Initiation	Adoption	Adaptation	Acceptance	Use
ORG01	Clear organisational strategy	Y	5	0	1	4	0	4	2	5	1	1
ORG05	Clear Business Processes	N										

Figure 1: Example of guideline and CSF assessment row

3.3 Data collection procedure

The questionnaires were distributed in hard copy and by email to practitioners in 19 organisations who had implemented ERP (from 11 different industries). Nine organisations were selected by the first author (based on personal networking). The other ten organisations were contacted based on information provided by an ERP consultant. All selected organisations had completed their ERP implementation. The response target was 95 (equating to one respondent from each stakeholder group from each organisation). Only 43 stakeholders responded to the survey, however, they represented all stakeholder groups, which was important for this purposive sample.

3.4 Data analysis and decisions

Each respondent provided two data sets about the CSFs: one relating to experience and one relating to opinion (as shown in Figure 1). The experience data set reflects the respondents' encounters with the individual CSFs in practice (this was not linked to

project success). In contrast, the opinion data set reflected respondents' informed assessment of the relevance of the CSFs based on their past knowledge and experience. Therefore, the opinion data were used to examine whether, and to what extent, the importance of CSFs varied over the implementation life-cycle. It was observed that the individual respondents' data sets differed which indicated that respondents did not simply reproduce their experience responses in their opinion entries. From the 43 surveys that were returned 38 were accepted for inclusion in the data analysis: of these eight were from senior managers, 11 from project managers, nine from team members, five from key users and five from end users. The following three criteria were used to determine inclusion:

- the respondent must have been part of an ERP implementation for at least the last three stages (adaptation; acceptance; use);
- their ERP implementation had reached the use stage (had "gone live");
- all CSFs in the survey must have been evaluated for all stages, unless the respondent explicitly identified that he/she did not understand the term or did not have experience of a specific stage.

The first two criteria reflected the need to gather data from experienced stakeholders who could provide informed responses. The third criterion was used to ensure that all respondents considered the full range of factors in the stages for which they had experience, and did not simply respond to those they most readily identified with.

Since there were small numbers of respondents within each group of stakeholders (especially key users and end users) it would have been inappropriate to use statistical approaches such as Anova or chi-square; therefore data were analysed using means "M" (and their associated standard deviation "SD" and standard errors "SE"). An algorithm was developed to determine, for each factor, whether it was of influence in a stage for a stakeholder group. This algorithm has three decision conditions all of which must be met for a factor to be included.

- Condition 1: $M \geq 4.00$. The maximum value was 5 therefore setting the cut-off point at 4 ensured that factors had been rated highly by most stakeholder respondents.
- Condition 2: $M - SD \geq 3.00$. This avoided taking into consideration factors with highly scattered responses.
- Condition 3: $M - 2SE \geq 3.00$. This ensured that the lower interval, for the confidence level above 95%, had a mean of 3 or above which could indicate reliability.

4. Findings and Discussion

4.1 Distribution of Categories of Factors Among Stakeholders

The result of the data analysis was to determine which CSFs were deemed to be relevant to each stakeholder group in each ERP implementation stage. The data did confirm our expectation that these distributions would vary. Figure 2 illustrates this by presenting the numbers of relevant CSFs (by category) for each stakeholder across the stages. Overall the managerial CSFs and human and social CSFs are those that affect the preparedness of all stakeholders, whereas technical and external CSFs have only limited impact which varies with stakeholder group.

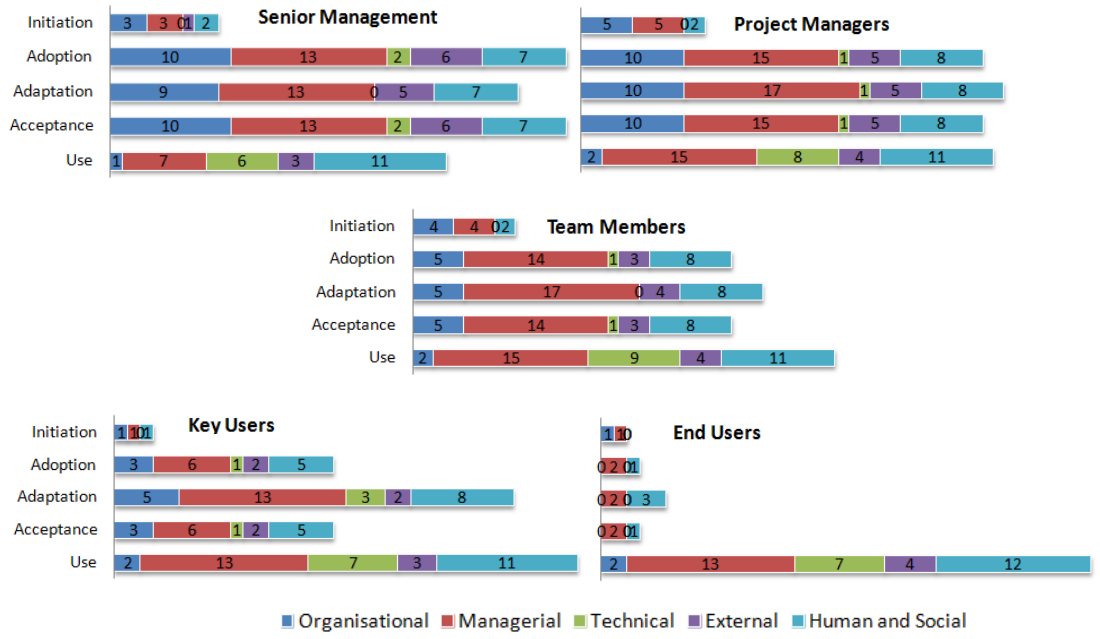


Figure 2: Importance of CSFs (by category) for Each Stakeholder Across the Stages

The following subsections look in more detail at the CSFs and identify their relevance to the different stakeholders in each of the life-cycle stages.

4.2 Initiation Stage.

This stage is concerned with the decision from top management to implement the ERP solution based on analysis of the business case. Therefore it no be expected that there is much work to be done by stakeholders' groups at this stage. The technical factors are not likely to influence the preparation of stakeholders at this stage and this is confirmed by the data. The data also identified only one relevant external factor *national economy* and this solely influences senior managers, whose decisions to proceed with an ERP system may well be affected by the state of the economy. In

contrast, *top management leadership* influences four groups; senior management, project managers, team members and key users. Other related managerial factors (*support, commitment and involvement*) influence stakeholders who provide the support and participate in the management of the implementation: senior management, project managers and team members. The organisational factor c*lear organisational strategy* influences only senior managers and the project manager. *Effective communication* is required to prepare all groups but, surprisingly did not emerge as relevant to senior management. It is also noticeable that in this stage many more factors influence the management stakeholders groups (six to eight CSFs) than the users (two for key users and one for end users). Table 2 identifies the relevant factors.

Code	Factor	SM	PM	TM	KU	EU
ORG01	Clear organisational strategy	X	X			
MGM01	Top management support	X	X	X		
MGM02	Top management commitment	X	X	X		
MGM03	Top management involvement	X	X	X		
MGM04	Assignment and availability of competent project manager		X			
MGM08	Effective communication procedures between stakeholders		X	X	X	X
EXT10	National economy	X				
HUM01	Top management leadership (e.g. cooperative, consultative)	X	X	X	X	
HUM02	Top management beliefs on ERP	X	X	X		
No of factors per stakeholder group		**7**	**8**	**6**	**2**	**1**

Table 2: Relevant CSFs in the Initiation Stage

4.3 The Adoption Stage.

The objective of this stage is the selection of the ERP solution that most appropriately meets the organisation's requirements. The stage involves many stakeholder activities such as: appointment of consultants; requirements analysis (which involves business, technical, training and support requirements); documentation of the as-is business processes; development of the to-be business processes; re-engineering the business processes and starting the change management programme; production of the request for proposal (RFP); evaluation of the tenders; selection of the ERP solution. Given the extent of activity in the stage is it not surprising that many more CSFs are found to be relevant to many of the stakeholders. The data analysis identified 44 factors; however, only three influenced all five groups; *top management support*, *effective communication procedures between stakeholders* and *top management leadership*. In

particular it is worth noting that *effective communication procedures between stakeholders* is relevant to all groups including senior management in contrast to the initiation stage where *effective communication* was not determined to be relevant to this group: this change between stages may reflect the increased level of activity and interaction between stakeholders in this stage. Among the 44 relevant CSFs in this stage there are three that influence the preparation of only one of the five groups. For example (as for the initiation stage) *national economy* influences only senior managers, *availability of standards, policies and procedures* influences the project manager alone, whilst the factor *assignment and availability of competent key users* influences the key users. All other factors influence two, three or four groups. At this stage it noticeable that senior managers and project manager are those most influenced by preparation factors (38 and 40 factors respectively). In contrast, end users are influenced only by the three common factors of this stage. Table 3 identifies the relevant factors.

Code	**Factor**	**SM**	**PM**	**TM**	**KU**	**EU**
ORG01	Clear organisational strategy	X	X	X	X	
ORG02	Clear IT strategy	X	X			
ORG03	Alignment of business and IT strategies	X	X			
ORG04	Clear ERP goals and objectives	X	X	X	X	
ORG05	Clear business processes	X	X	X		
ORG06	Organisation structure	X	X	X		
ORG07	Clear roles and responsibilities	X	X	X	X	
ORG08	Organisational culture (norms, values and beliefs)	X				
ORG09	Availability of standards, policies and procedures		X			
ORG10	Empowerment	X	X			
ORG11	Motivation	X	X			
MGM01	Top management support	X	X	X	X	X
MGM02	Top management commitment	X	X	X	X	
MGM03	Top management involvement	X	X	X		
MGM04	Assignment and availability of competent project manager	X	X	X	X	
MGM05	Clear ERP implementation strategy		X	X		
MGM06	Clear project scope	X	X	X		
MGM07	Effective project management methodology	X	X	X		
MGM08	Effective communication procedures between stakeholders	X	X	X	X	X
MGM09	Effective business process re-engineering	X	X	X		
MGM10	Effective change management	X	X	X		
MGM11	Effective management of expectations	X	X	X		
MGM12	Effective risk Management	X	X	X		
MGM13	Effective conflict management	X				
MGM14	Assignment and availability of competent project teams		X	X	X	
MGM15	Assignment and availability of competent key users				X	
MGM17	Education and awareness programmes for all ERP	X	X	X		

Code	Factor	SM	PM	TM	KU	EU
	stakeholders					
MGM20	Monitoring and Control		X			
TECH03	ERP Provide required functionality	X	X	X		
TECH06	ERP usefulness	X			X	
EXT01	Appointment of consultant	X	X			
EXT02	Consultant's domain knowledge and experience	X	X	X	X	
EXT03	Consultant's experience with ERP consultation in similar scope	X	X	X	X	
EXT06	Vendor reputation	X	X	X		
EXT07	Vendor collaboration	X	X			
EXT10	National economy	X				
HUM01	Top management leadership (e.g. cooperative, consultative)	X	X	X	X	X
HUM02	Top management beliefs on ERP	X	X	X	X	
HUM03	Project manager skills and competence	X	X	X		
HUM04	Project manager's beliefs on ERP	X	X	X	X	
HUM05	Teams members skills and competence	X	X	X		
HUM06	Project teams' beliefs on ERP	X	X	X		
HUM07	Key users business process knowledge		X	X	X	
HUM12	Collaboration and trust between stakeholders	X	X	X	X	
No of factors per stakeholder group		**38**	**40**	**29**	**17**	**3**

Table 3: Relevant CSFs in the Adoption Stage

4.4 The Adaptation Stage

The adaptation stage focuses on re-engineering the current business processes, producing the new business processes blueprint and making the ERP operable for the organisation. This stage's activities are typically carried out by organisational stakeholders, the consultant, and the implementer (the vendor might also be involved). The major activities of the stage include: confirming the 'to-be' business processes and producing the blueprint; configuring and/or customising the solution; implementing business process re-engineering and change management programmes. There is increased involvement of project teams and key users in the adaptation stage. Indeed team members and key users play a major role in the configuration and customisation of the system at this stage by providing guidelines for the implementer about business processes and the workflows. This is reflected in the CSFs that influence stakeholders groups (a total of 48) with a more balanced distribution of these factors across senior management, project managers, team members and key user: although the influence on end users remains limited with only five factors influencing them. Table 4 identifies the relevant factors.

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Code	Factor	SM	PM	TM	KU	EU
ORG01	Clear organisational strategy	X	X	X	X	
ORG02	Clear IT strategy	X	X			
ORG03	Alignment of business and IT strategies	X	X			
ORG04	Clear ERP goals and objectives	X	X	X	X	
ORG05	Clear business processes	X	X	X	X	
ORG06	Organisation structure	X	X	X	X	
ORG07	Clear roles and responsibilities	X	X	X	X	
ORG09	Availability of standards, policies and procedures		X			
ORG10	Empowerment	X	X			
ORG11	Motivation	X	X			
MGM01	Top management support	X	X	X	X	X
MGM02	Top management commitment	X	X	X	X	
MGM03	Top management involvement	X	X	X		
MGM04	Assignment and availability of competent project manager	X	X	X	X	
MGM05	Clear ERP implementation strategy		X	X	X	
MGM06	Clear project scope	X	X	X	X	
MGM07	Effective project management methodology	X	X	X	X	
MGM08	Effective communication procedures between stakeholders	X	X	X	X	X
MGM09	Effective business process re-engineering	X	X	X	X	
MGM10	Effective change management	X	X	X	X	
MGM11	Effective management of expectations	X	X	X		
MGM12	Effective risk management	X	X	X		
MGM13	Effective conflict management	X		X		
MGM14	Assignment and availability of competent project teams	X	X	X	X	
MGM15	Assignment and availability of competent key users				X	
MGM17	Education and awareness programmes for all ERP stakeholders		X	X	X	
MGM18	Technical and functional training for project teams and key users		X	X	X	
MGM20	Monitoring and control		X	X		
MGM21	Performance measurement		X			
TECH01	ERP ease of use				X	
TECH02	ERP easy to learn				X	
TECH03	ERP provide required functionality		X			
TECH06	ERP usefulness				X	
EXT02	Consultant's domain knowledge and experience	X		X		
EXT03	Consultant's experience with ERP consultation in similar scope	X	X	X		
EXT04	Implementer's domain knowledge and experience	X	X		X	
EXT05	Implementer's experience with ERP implementation in similar scope	X	X	X	X	
EXT07	Vendor collaboration	X	X	X		
EXT08	Availability of qualified implementation team		X			
HUM01	Top management leadership (e.g. cooperative, consultative, etc)	X	X	X	X	X
HUM02	Top management beliefs on ERP	X	X	X	X	X
HUM03	Project manager skills and competence	X	X	X	X	

Code	Factor	SM	PM	TM	KU	EU
HUM04	Project manager's beliefs on ERP	X	X	X	X	
HUM05	Teams members skills and competence	X	X	X	X	
HUM06	Project teams' beliefs on ERP	X	X	X	X	
HUM07	Key users business process knowledge		X	X	X	
HUM09	Users' beliefs on ERP					X
HUM12	Collaboration and trust between stakeholders	X	X	X	X	
No of factors per stakeholder group		**34**	**41**	**34**	**31**	**5**

Table 4: Relevant CSFs in the Adaptation Stage

4.5 Acceptance Stage.

The objective of this stage is to confirm that the ERP solution satisfies the organisation's requirements and can be operationally implemented. During this stage, the stakeholders need to carry out various tests to ensure that the system is providing the agreed functionality. The implementer is responsible for dealing with any bugs that appear during testing and might be required to carry out more configuration and customisation until the system is accepted. The data show a noticeable increase in relevant factors (increasing from 48 in the adaptation stage to 58). In particular there is a rise in the number that influences team members, key users and end users: from 34, 31 and 5 in the adaptation stage to 44, 50 and 30 here. This is consistent with the types of activities undertaken in the stage, such as testing which directly includes both team members and users. In contrast the number of factors influencing the project manager remain constant (41) and those influencing senior managers drops from 34 to 26. Table 5 identifies these factors.

Code	Factor	SM	PM	TM	KU	EU
ORG01	Clear organisational strategy	X	X	X	X	
ORG02	Clear IT strategy	X	X			
ORG03	Alignment of business and IT strategies	X	X			
ORG04	Clear ERP goals and objectives	X	X	X	X	X
ORG05	Clear business processes		X	X	X	X
ORG06	Organisation structure	X	X	X	X	X
ORG07	Clear roles and responsibilities	X	X	X	X	X
ORG09	Availability of standards, policies and procedures				X	
ORG10	Empowerment		X		X	
ORG11	Motivation	X	X		X	
ORG12	Organisation encouragement of continuous learning				X	
MGM01	Top management support	X	X	X	X	X
MGM02	Top management commitment	X	X	X	X	X
MGM03	Top management involvement		X	X		
MGM04	Assignment and availability of competent project manager	X	X	X	X	X
MGM05	Clear ERP implementation strategy	X	X	X	X	
MGM06	Clear project scope	X	X	X	X	X

Code	Factor	SM	PM	TM	KU	EU
MGM07	Effective project management methodology	X	X	X	X	X
MGM08	Effective communication procedures between stakeholders	X	X	X	X	X
MGM09	Effective business process re-engineering				X	
MGM10	Effective change management	X	X	X	X	X
MGM11	Effective management of expectations			X	X	
MGM12	Effective risk management		X	X	X	
MGM13	Effective conflict management			X	X	
MGM14	Assignment and availability of competent project teams	X	X	X	X	
MGM15	Assignment and availability of competent key users		X	X	X	X
MGM16	Involvement of end users					X
MGM18	Technical and functional training for project teams and key users		X	X	X	
MGM20	Monitoring and Control		X	X	X	
MGM21	Performance measurement	X	X	X	X	X
TECH01	ERP ease of use				X	
TECH02	ERP easy to learn				X	
TECH03	ERP provide required functionality		X	X	X	
TECH04	The fit between ERP functionality and organisation's functionality			X	X	
TECH05	ERP output quality		X		X	X
TECH06	ERP usefulness			X	X	X
TECH07	Previous organisation's experience with complex IS			X		
TECH08	Availability of reliable IT infrastructure				X	
TECH09	Availability of reliable data networks				X	
EXT02	Consultant's domain knowledge and experience			X		
EXT03	Consultant's experience with ERP consultation in similar scope		X	X	X	
EXT04	Implementer's domain knowledge and experience	X	X	X	X	X
EXT05	Implementer's experience with ERP implementation in similar scope	X	X	X	X	X
EXT07	Vendor collaboration		X	X	X	
EXT08	Availability of qualified implementation team		X	X	X	X
EXT09	Local presence of the implementer			X	X	
HUM01	Top management leadership (e.g. cooperative, consultative)	X	X	X	X	X
HUM02	Top management beliefs on ERP	X	X	X	X	X
HUM03	Project manager skills and competence	X	X	X	X	X
HUM04	Project manager's beliefs on ERP	X	X	X	X	X
HUM05	Teams members skills and competence	X	X	X	X	
HUM06	Project teams' beliefs on ERP	X	X	X	X	X
HUM07	Key users business process knowledge		X	X	X	X
HUM08	End users functional knowledge			X		X
HUM09	Users' beliefs on ERP		X	X	X	X
HUM10	End users' attitudes		X	X	X	X
HUM11	Social Influence (e.g. friendship, supervision, power, etc)					X
HUM12	Collaboration and trust between stakeholders	X	X	X	X	X
No of factors per stakeholder group		**26**	**41**	**44**	**50**	**30**

Table 5: Relevant CSFs in the Acceptance Stage

4.6 Use Stage.

In the use stage, the system becomes operational. The main activities of the use stage are: installing the solution in the live environment; providing access to the users; using the system; providing the post implementation support. The data show a slight reduction in relevant CSFs to 54 (from 58 in the acceptance stage); however, 29 of these influence all stakeholders. Moreover, there is more balance in the number of factors influencing each group. There is more agreement between the stakeholders on the importance of the technical factors as five of the top ten factors that influence all stakeholders are technical factors, and another influences four groups. There is also agreement between different groups of stakeholders about the importance of end users' competence, beliefs and attitudes at this stage. This is logical at this stage since a range of stakeholders is likely to use the system in addition to the end users; for example, senior managers for decision-making and authorising financial commitments. Table 6 identifies the relevant factors.

Code	Factor	SM	PM	TM	KU	EU
ORG01	Clear organisational strategy	X	X	X	X	X
ORG02	Clear IT strategy	X	X			
ORG03	Alignment of business and IT strategies	X	X			
ORG04	Clear ERP goals and objectives		X	X	X	X
ORG05	Clear business processes	X	X	X	X	X
ORG06	Organisation structure	X	X	X	X	X
ORG07	Clear roles and responsibilities		X		X	X
ORG09	Availability of standards, policies and procedures					X
ORG10	Empowerment				X	
ORG11	Motivation	X	X	X	X	X
ORG12	Organisation encouragement of continuous learning		X	X	X	X
MGM01	Top management support	X	X	X	X	X
MGM02	Top management commitment	X	X	X	X	X
MGM03	Top management involvement		X			X
MGM04	Assignment and availability of competent project manager	X	X	X	X	X
MGM05	Clear ERP implementation strategy		X	X	X	X
MGM06	Clear project scope	X	X	X	X	X
MGM07	Effective project management methodology	X	X	X	X	X
MGM08	Effective communication procedures between stakeholders	X	X	X	X	X
MGM10	Effective change management		X	X		X
MGM12	Effective risk management		X	X		
MGM14	Assignment and availability of competent project teams		X	X	X	X
MGM15	Assignment and availability of competent key users		X	X	X	X
MGM16	Involvement of end users		X	X	X	X
MGM19	Adequate and quality training of end users			X	X	X
MGM20	Monitoring and Control		X	X	X	
MGM21	Performance measurement	X	X	X	X	

Code	Factor	SM	PM	TM	KU	EU
TECH01	ERP ease of use	X	X	X	X	X
TECH02	ERP easy to learn	X	X	X	X	X
TECH03	ERP provide required functionality	X	X	X	X	X
TECH04	The fit between ERP functionality and organisation's functionality			X	X	
TECH05	ERP output quality	X	X	X	X	X
TECH06	ERP usefulness	X	X	X		X
TECH07	Previous organisation's experience with complex IS			X		
TECH08	Availability of reliable IT infrastructure		X	X	X	X
TECH09	Availability of reliable data networks	X	X	X	X	X
TECH10	Availability of IT technical policies		X			
EXT04	Implementer's domain knowledge and experience	X	X	X	X	X
EXT05	Implementer's experience with ERP implementation in similar scope	X	X	X	X	X
EXT07	Vendor collaboration		X			
EXT08	Availability of qualified implementation team	X	X	X	X	X
EXT09	Local presence of the implementer			X		X
HUM01	Top management leadership (e.g. cooperative, consultative)	X	X	X	X	X
HUM02	Top management beliefs on ERP	X	X	X	X	X
HUM03	Project manager skills and competence	X	X	X	X	X
HUM04	Project manager's beliefs on ERP	X	X	X	X	X
HUM05	Teams members skills and competence	X	X	X	X	X
HUM06	Project teams' beliefs on ERP	X	X	X	X	X
HUM07	Key users business process knowledge	X	X	X	X	X
HUM08	End users functional knowledge	X	X	X	X	X
HUM09	Users' beliefs on ERP	X	X	X	X	X
HUM10	End users' attitudes	X	X	X	X	X
HUM11	Social Influence (e.g. friendship, supervision, power)					X
HUM12	Collaboration and trust between stakeholders	X	X	X	X	X
No of factors per stakeholder group		**33**	**47**	**45**	**42**	**44**

Table 6: Relevant CSFs in the Use Stage

5. Conclusion

The data presented here highlight the need for researchers and practitioners to consider the dynamic nature of CSFs carefully in their work. The study provided confirmation that many of the factors discussed in the literature are indeed important, but their relevance varies with time (life-cycle stages), and across stakeholders. It is fundamental to understand this distribution in order to develop a framework model to support the preparation of stakeholders for ERP implementation, and in order to assess their readiness. However, there are limitations with the study, most significantly the limited number of key users and end users who provided data. The robustness of the study and its results would be greatly enhanced by re-implementation across a larger base of respondents representing more fully each

stakeholder group. Furthermore, it would be interesting to replicate the study over an international set of respondents to increase the understanding and confidence about the relevance of specific CSFs to stakeholders approaching particular ERP implementation stages.

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