

ERP Life Cycle Implementation, Management and Support: Implications for Practice and Research

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Abstract

This paper reports on exploratory, descriptive and comparative analyses of client-centred major issues, from the perspectives of individuals who have been directly and substantively involved with SAP Financials in five closely related government agencies. A three-round, non-anonymous, Delphi-type, open-survey was adopted using personalised email with attached survey instruments. To support the interpretation of study findings, a series of interviews and domain experts' workshops were conducted during and after the Delphi survey rounds. Implications for practice and research are discussed. The study also makes interesting methodological observations, suggesting pitfalls and possible improvements when employing a Delphi-type survey approach in similar or more traditional IS key issues studies.

1. Introduction

Organizations worldwide, whether public or private, are moving away from developing Information Systems (IS) in-house and are instead implementing Enterprise Resource Planning (ERP) systems and other packaged software [2, 26, 37]. ERP has been referred to as a business operating system that enables better resource planning and improved delivery of value-added products and services to customers. ERP systems have, in recent years, begun to revolutionise best practice business processes and functions. They automate core corporate activities such as manufacturing and the management of financial, and human resources and the supply chain, while eliminating complex, expensive links between systems and business functions that were performed across legacy systems [4, 16, 29, 40].

Despite warnings in the literature, many organizations apparently continue to underestimate the issues and problems often encountered throughout the ERP life cycle, as evidenced by suggestions that: (1) more than 40% of large software projects fail, (2) 90% of ERP implementations end up late or over budget, and (3) 67%

of enterprise application initiatives could be considered negative or unsuccessful [e.g., 34, 11, 5].

ERP life cycle-wide management and support are ongoing concerns rather than a destination. The pre-implementation, implementation and post-implementation stages continue throughout the lifetime of the ERP as it evolves with the organization [9]. Unlike the traditional view of operational IS that describes a system life cycle in terms of development, implementation, and maintenance, examination of ERP implementations is revealing that their life cycle involves major iterations. Following initial implementation there are subsequent revisions, re-implementations and upgrades that transcend what is normally considered system maintenance. As the number of organizations implementing ERP increases and ERP applications within organizations proliferate [3, 10, 22, 41], improved understanding of ERP life cycle implementation, management and support issues is required so that development, management, and training resources can be allocated effectively [16]. A better understanding of ERP life cycle issues will also help direct the ERP research agenda.

Although ERP sales in 2000 declined for the main vendors (e.g., SAP, Baan, ORACLE, JD Edwards, Peoplesoft) due to post-Y2K curtailment in IT/IS activity and to saturation of large organizations, the outlook through to 2004 is for compound annual growth of 11.4% for license, maintenance, and related service revenue associated with enterprise resource management applications [26]. This sustained interest in implementing and realising the benefits of ERP systems, and the consequent life cycle issues, provide the rationale for this study (this need is further outlined in [14, 15, 16, 17]).

This study began with the proposition that for those who implement, manage and support ERP systems, there are benefits in knowing the major ERP life cycle issues and the relative importance of these issues. There are two general categories of research question investigated in this research. First, this study is interested in the identification and explication of the relative importance of ERP life cycle issues and the association of relationships among certain demographic groupings. Within this category the

study then examines questions related to the major issues themselves. The second category discusses questions related to the research methodology. Here the study is interested in developing an approach that rationally supports the information elicitation technique used to achieve a better outcome (an improved understanding of ERP life cycle issues).

This study noted that numerous previous studies of IS issues had been conducted for the benefit of private sector organisations, but little study had been done of IS issues within public sector organisations. Nor had there been previous studies directed specifically at issues relating to ERP implementation. Accordingly, a modified Delphi-type survey together with a series of interviews and domain experts' workshops were conducted to establish and define the major issues and related sub-issues that were confirmed as relevant to the stakeholder groups involved in the study. Ultimately, while findings are expected to be particularly valuable to organisations implementing ERP and more particularly to the organisations involved in the study, an improved understanding of ERP life cycle issues should also benefit other packaged systems and the range of consulting firms' and software vendors' services, as well as IS research at large.

In summary, the study's aims were to: (1) present a set of major ERP life cycle implementation, management and support issues of relevance to stakeholder groups, (2) compare the responses across stakeholder groups so that they would benefit from an understanding of the issues identified, and (3) develop a well-documented, repeatable methodology and related instruments to ascertain the significance of these major issues.

1.1 Research method and design

The chosen research methodology was a Delphi-type, three round, non-anonymous, open survey using personalised email with attached survey instruments. Chang and Gable [6] critique the Delphi method in the context of IS key issues studies and its application within the context of the current study. The use of the Delphi method with its advantages and inherent methodological issues led to the development of a set of coding methods and synthesis procedures, which aimed to achieve the research objectives. This also aided explanation beyond that achievable from basic descriptive and comparative statistical analyses. The strengths and weaknesses of potential coding methods and synthesis procedures are discussed in Chang et al [7]. Qualitative data analysis techniques [18, 19, 25, 30, 38, 45, 49] also served as a guide to coding and synthesis (e.g. how to deal with a large amount of non-numerical, unstructured and rich data; how to ensure that when synthesized, those issues accurately reflect the respondents' concerns) that confront

Delphi method researchers. Figure 1 outlines particular data collection and analytical phases of the research design.

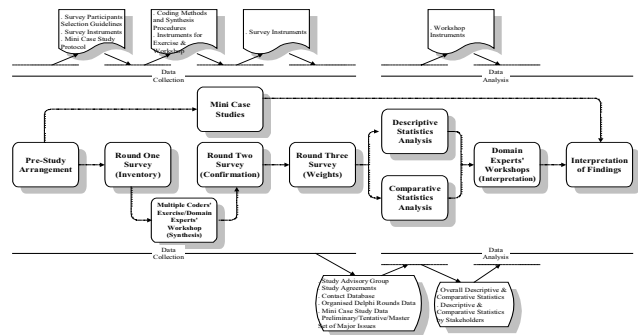


Figure 1 Data collection and analytical phases of the research design

Accordingly, the following methodological approach was adopted: (1) Use the modified Delphi-type survey rounds to “inventory”, “confirm”, and “weight” data from two different survey samples who have had substantial involvement with the SAP Financials: consulting firm personnel (as implementation partner) and client organisation personnel (the agencies). (2) Use the coding methods and synthesis procedures developed for: distilling a tentative set of major issues from the individual raw issues using an open coding approach; examining and attempting to understand the interrelationships between the tentative set of major issues; combining and mapping the researchers' results into a coherent preliminary set of major issues; seeking confirmation of the resulting preliminary set of major issues with agencies' representatives and survey respondents; and finalising a master set of major issues relevant to further survey participants. (3) Conduct a series of interviews and domain experts' workshops to establish a collection of the client organisations' specific profiles and to develop understanding of salient differentiating characteristics of these client organisations (i.e. organisational nature / background, major services / roles / responsibilities of the agency, history/initiatives of the financial management system, overview of agencies' SAP project) to enhance the study outcomes and to facilitate interpretation and triangulation.

1.2 Study population

Individuals from the implementation partner, a “big 5” Consulting Firm, and five closely related government client agencies were pre-identified and contacted for study participation. To qualify for study participation, they were required to possess substantial involvement

with SAP Financials: at any level, in any role, in any phase of the life cycle, with any of the modules implemented. Employing formal “Survey Participants’ Selection Guidelines,” and through interviews of senior sponsors in each agency, 117 individuals were identified and included in the contact database. Note that the term “client” herein refers to employees of the agencies, who are “clients” of both the ERP vendor and the implementation partner. Owing to the full support of the government agencies in this study and to the assistance of key contacts in each organization, the 117 contacts selected approximate the ‘population’ of knowledgeable individuals (rather than a “sample”).

2. Summary of main findings

Following the administration of the Delphi survey rounds and the coding methods and synthesis procedures, a master set of major issues from M-1 to M-10 with sub-issues from S-1 to S-38 sub-issues categories (Appendix A) was rationally synthesised and logically structured. Essentially, 274 issues were identified from the “inventory” survey round, or 4.5 issues per respondent on average. Although results indicate that respondents have been involved across all phases of the life cycle (i.e. planning, design and build, testing, implementation and installation, knowledge management, and up-and-running) and all modules (i.e. general ledger, accounts receivable, accounts payable, fixed assets, controlling, materials management, project management and others), the study results also portray a relatively recent picture of individuals’ involvement with the SAP Financials. This is a result of several factors including: (1) the relatively recent prevalence of ERP, (2) the relatively brief history of ERP within the five government agencies, and (3) the dearth of ERP expertise at the time of the study sometimes resulting in relatively junior staff of the implementation partner being promoted as “experts”. Figure 2 shows the incidence of the initial 274 issues from the sixty-one respondents across the ten major-issue categories.

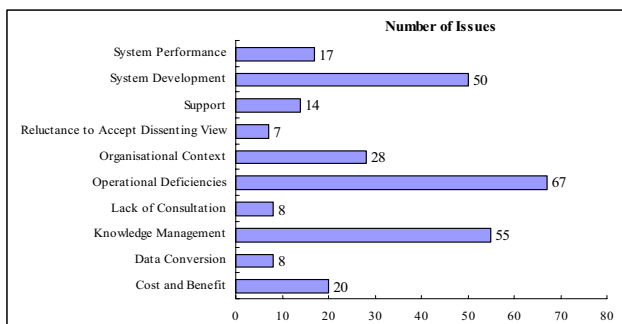


Figure 2 Issue counts for the 10 major-issues categories

During the “weights” round survey, respondents were asked to rate the importance of each of the thirty-eight sub-issue categories across the six life cycle phases on a scale from 1 to 10; 1 indicating the sub-issue category was not important, 10 indicating the category was of primary concern. Based on the valid responses to each of the thirty-eight sub-issue categories across the life cycle phases, it is noted that the majority of participants have responded to the Up-and-Running phase while other phases have received a fairly even distribution of responses. This suggests not only relatively high concern regarding the post-implementation phase (Up-and-Running) during which the “weights” round survey was conducted, but also that the ongoing management and support of the system remain a challenge beyond “go live”. Figure 3 shows the number of respondents by life cycle phase for each of the thirty-eight sub-issues.

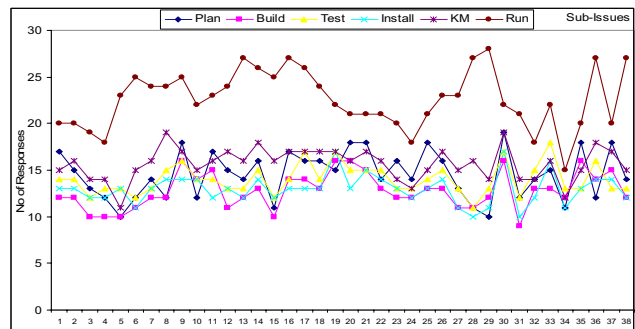


Figure 3 Distribution of rating responses by life cycle and sub-issue categories

In comparing the issues cited most overall based on round 1 counts, and the issues ranked highest based on round 3 weights, it was observed that **Operational Deficiencies** related issues ranked highest based on number of citations in the round-one survey. Yet, this major issue category dropped to fifth place based on the round-three weights. This suggests that these issues were prominent in many respondents’ consciousness during round-one, yet subsequently when listed alongside other sub-issues in the round-three instrument were felt by respondents to be somewhat less important than the initial relative incidence of citations implied. Note that frequency of citation was known from the outset to be a considerably cruder indicator of issue importance than weights. Respondents may feel that something is an issue, while at the same time universally believing it to be a relatively lesser issue. Another factor possibly resulting in changing views on the **Operational Deficiencies** related issues, may be an awareness that the system is improving over time, as many concerns are resolved by a growing acquaintance with the system.

Regardless, with a mean score of 5.62, the **Operational Deficiencies** issues are marginally above the

scale mid-point (5.5), suggesting that they, at a minimum, are perceived to be moderately important issues. Even **System Performance** issues, with a mean score of 4.28, more than a full point below the scale mid-point and ranked as the least important major issue category (10th) based on weights, should not be considered irrelevant. These are issues cited by multiple respondents in round one, and considered moderately important in round three.

In an attempt to understand areas of consensus and disagreement between the stakeholder groups, besides reviewing ranks of the sub-issue and major issue categories based on weights, this study compared the weights and ranks across the stakeholder groups (i.e. Strategic versus Operational within Agencies, and Agency versus Agency). A comparison of strategic and operational respondents across the agencies revealed that most of the top priority issues for these two groups were rated similarly, although the ordering on some issues was slightly different for the two groups. Analysis of variance shows that only the **Reluctance to Accept Dissenting View** related issue *organisation appears unable or unwilling to be responsive to requests for changes in the system to resolve operational problems (S-27)* showed a significant difference between the two groups. Operational respondents rated this sub-issue higher (mean = 5.60 yielding a rank of 24) than strategic respondents (mean = 3.17, rank = 37). The difference in ranks suggests that common problems raised by operational respondents may not have been adequately addressed by the organisation, and that satisfactory solutions may not have been reached during discussions outlining common problem scenarios.

Regardless, for neither group was this sub-issue category ranked among the top-ten sub-issue categories. Furthermore, although strategic respondents may be expected to be more concerned about management-oriented issues, while operational respondents focused on operations-oriented issues, it was found that there is broad consensus between these two groups, with only this one significant difference identified. Difference across the sub-issues as discussed above, are presented in Figure 4.

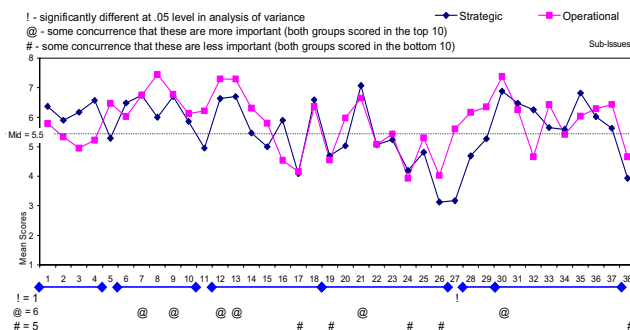


Figure 4 Personnel mean scores on 38 sub-issues

The study were aimed to identify and explicate the major issues and related sub-issues through methods (i.e., Delphi survey rounds, coding methods and synthesis procedures, interviews and domain experts' workshops) to distil those initial responses into a final set of major issues and related sub-issues. Despite attempts to map the initial data to several existing frameworks failing to provide a satisfactory level of discrimination between substantive issues, the bottom-up data driven open coding method and synthesis procedures have resulted in a meaningful set of ten major issues categories with 38 sub-issues.

Several modifications have been made to adapt the conventional Delphi method including the following: (1) use of a range of criteria and contact for participants selection, (2) use of open-survey to inventory as many issues as possible, (3) use of coding and synthesising procedures to summarise a set of major issues, (4) use of multiple feedback activities for collection and analysing of judgements, and (5) use of sub-populations of respondents rather than a single population to understand the judgements and concerns at multiple levels.

After the study findings had been collected and compared, additional domain experts' workshops were conducted to further validate the study results. While the results of these workshops do not have any statistical significance, they contributed to the effort in at least two ways: firstly, issues highlighted in the final set of ten major issues categories and related set of thirty-eight sub-issues were in fact experienced by the individuals who have had substantial involvement with the ERP life cycle implementation, management and support. Secondly, these workshops added a real operating perspective to those findings; for example, highlighting some of the difficulties that the agencies were experiencing while trying to implement the SAP Financials service, and some intended actions on the issues for further life cycle-wide management and support of the system.

By repeatedly exposing the major issues to the individuals who have had substantial involvement with the SAP Financials system and comparing these issues across the stakeholder groups, the study has confirmed that interactive involvement with study participants (research team, survey respondents and agency representatives) is essential to fulfilling the study objectives.

3. Implications of the study

The following sections describe the implications of the research results for ERP user organisations, consulting firms and software vendors, and IS research.

3.1 Implications for user organisations

The first observation was that issues associated with the ERP life cycle are a multi-faceted phenomenon of immense complexity, which defy any simple solution. Recent research suggests that a lack of ERP product knowledge has been a major concern for many organisations [12, 33]. The study findings also support the complexity of ERP systems, where respondents revealed that it is difficult to obtain fully qualified experts who can advise to an organisation holistically in every single ERP module. While there appear to be experts on individual modules, what seems to be lacking is an informed overview of the system, which enormously impacts on the ability to use the system efficiently and effectively. Other issues identified also reflect the consequences of insufficient ERP knowledge. This is why many organisations use external consultants to assist with the implementation process. Consultants may have more experience in specific industries, comprehensive knowledge about certain modules including their strengths and weaknesses, and thus may be better able to suggest which will work best for a given organisation; however, hiring and managing the consulting firm and its employees is another challenge [12, 36, 46]. As stated in this study, shared knowledge among project team members was a concern throughout.

The issues perceived are not entirely negative – there are stakeholders who learn from the issues experienced by others. The central aim of issue assessment is to understand the causes and effects of issues identified, and how stakeholders might organise their actions around these. For example, lack of user training and failure to completely understand how ERP change business processes, frequently appear to be responsible for difficulties associated with the ERP implementation [4, 8, 48]. Organisations in the current study are realising the need for improved training, not only in the system, but also in the new job function. The government agencies have already taken action, soon after “go-live” (e.g. making a large investment in staff training and ongoing support of the ERP system), to minimise reliance on external contractors and to build in-house expertise. A performance planning and development program within the agencies (which looks at staff training over time) was implemented in response to the issues identified in this area. With Knowledge Management related issues both heavily cited and highly weighted across the life cycle-wide implementation, management and support of the ERP system, it is believed that dedicated resources for knowledge management are critical to realising the benefits associated with an ERP package [21, 39].

Implementing an ERP system also involves re-engineering existing business processes to meet the best business process standard [12, 33]. However, the costs and benefits of aligning with an ERP model could be very high because it is difficult to gain agreement to accept the

new process from all who are affected. Furthermore, some existing business processes are so specific to the agency (agencies) that they need to be preserved or appropriate steps taken to customise them. This can be counter-productive in the long run and can negatively affect the viability of the organisation and interests of all stakeholders. If the effects are too radical, ERP implementation can critically disrupt the organisational environment. In such a case, it is important that any ERP initiative has strong political support from key stakeholder groups, and evidence of gains for each group. Unfortunately, many reported IS issues have been caused by insufficient support [24, 44].

A further implication of the study is the increased pressure on user organisations to integrate the system they purchased into their business environment. Since so many systems are being developed by so many vendors, and many standards are either emerging or evolving along with the systems, or do not yet exist, each new system demands extensive integration into the existing system’s mix. The results indicated that the client should undertake a requirements analysis, at a broader organisational level, to identify discrepancies between particular ERP systems and user needs prior to making a commitment to a particular system. As ERP systems cross over functional and departmental boundaries, the cooperation and involvement of all involved appears to be critical [39]. Willcocks and Sykes [48] suggest that ERP benefits cannot be realised without strong coordination of effort and goals across business and IT personnel. Other researchers also suggest that “configuration” should only be requested when essential, or when the competitive advantage derived from using non-standard processing can be clearly demonstrated [1, 24, 27, 36]. However, differences in business orientation, organisation size, and related requirements may argue for unique processes. It is clear from the study findings that many felt important detrimental compromises had been made to achieve the level of standardisation sought.

It is therefore very unlikely that any ERP implementation can simply be asserted to be a success or a failure. Such claims usually hide all effects of ERP life cycle-wide implementation, management and support, and fail to appreciate the rich variety of stakeholders’ expectations of the system. Lyytinen and Hirschheim [30, p.263] state that information systems failure has been defined as “*the inability of an IS to meet a specific stakeholder group’s expectations.*” Research from Ginzberg [20] also suggests that successfully consulting and managing user requirements is directly proportional to successful systems implementation. An organisation’s requirements may exceed the capabilities of the system or may be too simple to need one. ERP systems often fail to meet requirements despite positive contributions to the organisation if the system is “oversold” by the vendor.

Careful deliberations on success measurement and management of requirements throughout all stages of the ERP life cycle are important success factors [24].

While many in the IS business consider project management an oxymoron, its importance in ERP projects is well documented, and numerous methodologies and management tools exist. Project management activities span the life of the project from initiation of the project to its closing [24, 43]. The contingency approach to project management suggests that project planning and control is a function of the project's characteristics such as project size, experiences with the technology, and project structure. The vast combination of hardware and software and the myriad organisational, human and political issues make many ERP projects huge and inherently complex, requiring new project management skills [41]. Proper management of scope is critical to avoid schedule and cost overruns and necessitates having a plan and sticking to it. A project scope that is too broad or ambitious can cause severe problems. Customisation increases the scope of an ERP project and adds time and cost to an implementation. Therefore, clear goals and objectives that are specific and operational, and indicate the general directions of the project, were prerequisites in an ERP implementation.

Because no simple approach will avoid issues arising, more emphasis on understanding contextual features of ERP (and organisation) is necessary. Stakeholders should focus on those critical issues in the ERP that will have adverse effects on their interests. ERP life cycle issues should be studied as dynamic processes that can be shaped by stakeholders' action. This action depends on available interpretations and "mappings" of the situation, i.e. how and in which light stakeholders make sense of the situation. The main concern is the content and scope of the "mapping" or "understanding" process – these are the conceptual means by which stakeholders inquire and reflect on ERP. Consequently, these study findings should be of benefit to the stakeholders in their involvement with life cycle-wide ERP implementation, management and support.

Another condition for preventing ERP life cycle issues is to establish organisational arrangements that help to channel stakeholders' involvement during the different stages of implementation, to allow them to meet one another. Here, more open, democratic, and participatory arrangements seem to be necessary. Organising a consortium is a possible means of developing a direct link. Setting realistic expectations facilitates corporate planning for missing functionality and consideration of alternatives. Generally, a deeper understanding and sharing of experience together with an open style of communication would benefit not only project team members, but also user organisations. It is also imperative for organisations to establish the goals, and educate and

communicate their goals and long-term perspectives, to win support of all members of the organisation affected by the changes [32, 43]. A negative consequence of this may be a slower development pace, but the reward is higher fulfilment of expectations, reduced resistance, and more informed, diversely qualified and competent ERP users. Therefore, it is important for organisations to be aware of certain critical issues before, during and after implementing any ERP systems. Careful consideration of these issues, and prior planning to minimise their effects across all stages of implementation will ensure a smooth rollout and realisation of full benefits of the ERP solution.

3.2 Implications for consulting firms and ERP software vendors

The first observation, based on the issues identified in this study, is that because the ERP market has expanded so quickly, there also has been a shortage of competent consultants during the time of implementation. Finding the right people and retaining them throughout implementation was a major challenge to the agencies. While ERP implementation demands multiple skill-sets, consultants with specific industry knowledge and skills at the time of the study were few in number. It is believed that to support an ERP system properly the consultants need skilled personnel across at least three dimensions. Firstly, consultants must be skilled in ERP itself, and these skills alone are hard to find. Secondly, consultants must be familiar with the technology (i.e. they need to understand computing technology and what it can do for the business). Finally, consultants must acquire an understanding of the business practices. It is believed to be very difficult and costly, to recruit people with a range of skills across these three dimensions. Furthermore, within a government environment, consultants have to know all of the specific operating constraints of the legislation, the financial management practice regulation (e.g. what the chart of accounts contains, the coding, the different configurations) that are related to the government environment. The success or failure of the project depends on how well the consulting firms and software vendors meet these challenges.

It is realistic to suppose that user organisations do not fully understand an ERP system during implementation, because it may be the first experience of this system for the client. This was why the implementation services from the consulting firm were introduced for the project in the first place, and the user organisation anticipated knowledge transfer to them during the project. Although organisations use consultants as an implementation partner to help during the implementation process, it is also important that knowledge is transferred from the consultant to internal employees who will be the long-term users of the new system [11]. As highlighted by the

study's findings on Knowledge Management, shared knowledge among project team members is a factor that needs to be resolved to fulfil the client organisations' anticipations. Software vendors and consulting firms working in the role of implementation partners need to work closely with the client in comparing the ERP system to client needs. After jointly identifying discrepancies, the three parties should estimate the extent of modifications necessary and their duration as well as costs.

Furthermore, consulting firms and software vendors must be prepared to offer substantial timely ongoing support for the client across the various stages of the ERP life cycle. Findings from several of the survey responses suggest the importance of such support (e.g. extended technical assistance, emergency maintenance, updates and special user training). Support was a major source of conflict between customers and the vendor. Without proper support, life cycle-wide implementation, management and support of the system can be derailed. The need for continual support beyond implementation must be given sufficient consideration from the initial stages of planning [12, 29, 33]. While the consulting firms and software vendors may want to evaluate the capabilities of the client, and recommend special training or consulting assistance to prepare for ERP implementation, the implementation partners may want to calculate and include the cost of sufficient consulting help for each client organisation in its bid.

Finally, consulting firm, software vendor and client partnerships are vitally important to successful ERP projects. Research has shown that a better relationship between the implementation partner and user organisation is positively associated with packaged software implementation success [28]. The relationship between the user organisation and software vendor and implementation partner should be strategic in nature with the ERP provider, thereby enhancing an organisation's competitiveness and efficiency. Both software vendors and consultants can seek to increase the size of the ERP market through reduced costs and increased benefits to clients. Furthermore, software vendors and their implementation partners need to be more attuned to the issues identified to become better positioned to further support clients throughout the ERP life cycle.

3.3 Implications for IS research

This study contributes to the area of IS research in the following particular ways: (1) It examines ERP implementation from the perspectives of individuals, unlike most existing studies taking a top-down or managerial approach. This could act as a beginning of understanding ERP implementation from the stakeholders' point of view. (2) The research applies a new methodological approach towards understanding

ERP implementation. Previously the Delphi method has not been used in ERP studies; such an approach, if applied appropriately, could enable future researchers to better unearth some of the embedded issues related to ERP implementation from a different point of view. (3) The sources of evidence are collected and analysed triangularly from: survey rounds, domain experts' workshops, interviews and literature.

Several research implications emerge from this study, both of an empirical and theoretical nature. In particular, the research implications deal with overcoming some of the weaknesses of studying IS key issues in the past. Following, four needs are identified and discussed. These are: attention to stakeholder concerns, understanding of the nature of IS issues, clarification of reasons for IS issues, and the use of appropriate research methods. Some lessons are learned, some suggestions are also offered regarding the direction of future research.

This study stresses the importance of identifying those stakeholders who perceive the issues associated with ERP systems. In contrast, past IS key issues studies have not been very detailed in addressing whom the issue has influenced. For example, past key IS issues studies were generalised to concern all stakeholder groups (based on senior personnel's views). Clearly, there is a need for studies on how various stakeholder groups are affected by their experiences with the ERP life cycle-wide implementation, management and support. More extensive statistical surveys, in which stakeholders' concerns are sufficiently observed, are virtually non-existent.

This study implies a clear understanding of the types of issues met by a particular stakeholder group. Unfortunately, past studies have not been very detailed in exploring how IS issues have been identified. IS researchers often suggest too general and/or vague descriptions of issues' histories. Therefore, study in this area has been characterised by the lack of a more comprehensive taxonomy of IS issues. This study suggests that such taxonomy could ease the comparison of research results, help to generalise research findings, and to focus research resources on a more informed basis. Some initial steps in this direction have been taken in this study.

The study suggests that a more detailed understanding of the environment in which stakeholders act is required for clarifying why issues are raised. This would provide a more exact and comprehensive account of the environment of key issues. Again, prior IS key issues studies are too superficial on this subject. It is almost impossible to classify the empirical research in terms of which reasons and issue types are covered by different studies.

The Delphi technique represents a methodology for organising and prioritising the collective judgement of a

group, through iterative surveying of that group. The initial procedure is to prepare, distribute, and synthesise a series of issues for evaluation. Participants receive feedback in the form of their own previous responses and data describing the entire group. This enables participants to reaffirm original opinions, modify previous and add new issues to the list. This study suggests extending the analysis of key issues in life cycle-wide implementation, management and support of ERP systems by using an open coding approach in which coding categories were developed from the data themselves. The method of synthesising the results from multiple coding rounds was then described and summarised. This approach is believed to provide greater insight into the concerns of stakeholders rather than the traditional rating method used by most recent key issues studies.

4. Conclusions

Results from this study support assertions that there are substantial research opportunities in the ERP research area. This study represents early work in an area that has been, to a large extent, ignored. It was necessary to perform this broad study to uncover specific areas of concern from which to direct more detailed studies. Five potential future research activities are suggested: (1) More extensive case studies; (2) More extensive statistical analysis; (3) More theoretical work on taxonomies; (4) More theoretical work on issue framework and (5) More studies on how to use frameworks prescriptively.

This study represents the first attempt to empirically identify and explicate the issues and important concerns for individuals substantially involved with the SAP Financials system within government agencies. A well-documented and repeatable methodology was also developed to fulfil the study aims. This is the first such study to suggest future research directions and focus in this area.

Following the methodology developed in this study, conclusions may be divided into those related to the methodology used and those related to the issues themselves. For methodology, this research has found that the actual step-by-step processes for generating a relevant set of major IS issues from diverse survey responses has not been adequately reported, and the data is non-numeric, generally unstructured, and often particularly rich in various perceptions. The three-round Delphi-type open survey, together with a series of interviews and domain experts' workshops have served as a guide to better understand and facilitate the comparison of the study's results. The methodology has proved to be an alternative approach for coping with this type of study in the context of key IS issues.

Following the administration of qualitative and quantitative data collection and analysis (the processes of

identifying, rationalising, determining and comparing issues), a final set of ten major issues categories with thirty-eight related sub-issue categories was obtained. A detailed discussion of these issues was presented. Although the findings in some discussions may apply only to the situation at the time of the study, the insights from the study findings should interest and benefit the ERP life cycle implementation, management and support stakeholder groups.

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Appendix A master set of major and sub-issue categories

M-1: Cost/benefit

- S-1: Complexity (and therefore cost) of SAP far exceeds the requirements of some agencies
- S-2: Complexity of SAP drives costs beyond reasonable limits
- S-3: Costs of SAP exceed those of QGFMS without commensurate benefit
- S-4: SAP implementation benefits do not justify costs

M-2: Data conversion

- S-5: Errors were found in data converted from former QGFMS

M-3: Knowledge management

- S-6: Difficult to retain people with SAP skills due to market pressure to leave
- S-7: Insufficient resources and effort put into developing in-house knowledge
- S-8: Training provided was inadequate and did not cover the diversity of circumstances encountered in normal daily operations
- S-9: Shared knowledge among project team members was a problem - agency staff did not understand SAP and implementation personnel did not understand agency requirements
- S-10: System documentation is inadequate, particularly with respect to system design and controls

M-4: Lack of consultation

- S-11: Lack of consultation with operational level users meant that operation requirements were not met

M-5: Operational deficiencies

- S-12: Developing reports is difficult in SAP
- S-13: Not all required reports were available at implementation time
- S-14: Operational deficiencies that impact the accuracy and efficiency of operations and the ease of use of the system
- S-15: Persistent minor errors and operational issues have not been rectified
- S-16: SAP is not sufficiently integrated with other systems
- S-17: SAP lacks some functionality of QGFMS
- S-18: Security is difficult to maintain in SAP resulting in some users being granted too much access and others not having access to data they need

M-6: Organisational context

- S-19: Differences in work ethic among project personnel
- S-20: Diversity of government systems makes integration difficult
- S-21: Implementation across multiple agencies led to sub-optimisation of the system configuration
- S-22: Lack of leadership at senior levels
- S-23: Lack of ownership/responsibility by agency personnel at the project level
- S-24: Political issues had a negative impact on the project
- S-25: Poor communication between agencies
- S-26: Timing of implementation was inappropriate because of change underway in the public sector

M-7: Reluctance to accept dissenting view

- S-27: Organisation appears unable or unwilling to be responsive to requests for changes in the system to resolve operational problems

M-8: Support

- S-28: Ongoing support for the SAP system is inadequate
- S-29: Support personnel are inadequately trained

M-9: System development

- S-30: Complexity of SAP means few, if any, people understand SAP beyond a single module, making overall design decisions very difficult
- S-31: Frequency of SAP upgrades places a large burden on system maintenance
- S-32: Frequency with which requirements changed caused problems for developers
- S-33: Inadequate system testing left many errors in the implemented system
- S-34: Issues that arose during, or result from, the development phase of the SAP system
- S-35: Requested system functionality was sacrificed in order to meet implementation deadlines
- S-36: The project team was disbanded when the system was handed over despite many issues remaining unresolved
- S-37: Too little effort was put into redesigning the underlying business processes, resulting in a system that represented a "technology swap" that failed to capture many of the benefits of SAP

M-10: System performance

- S-38: System performance is inadequate to meet operational requirements