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A Critique of the Delphi Method in the Context of IS Key Issues Studies

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Abstract

Over the past two decades, IS researchers have used variants of the Delphi Method (DM) to identify and rank key issues in the IS field. Although DM is popular, the implications of key DM design decisions are not well understood, including decisions about who should be surveyed; the use of anonymity; open-ended or structured questions; the number of rounds; and how to synthesize a summary list of issues. Through review of past DM-type IS Key Issues studies, and through "methodological action research" into an ongoing DM-type study of major ERP lifecycle issues in the Queensland Government, the methodological study presented herein aims to: (1) highlight strengths and limitations of DM; (2) identify important contingencies that should influence DM design or its variation; (3) highlight possible design limitations of past IS Key Issues studies employing DM; (4) present a comprehensive and detailed example of the application of DM; and (5) evolve the best possible DM-type design for the ongoing ERP Major Issues study.

Keywords: Delphi Method, Key IS Issues Studies, ERP

1. Introduction

A derivative of the Delphi method (Dalkey and Helmer, 1963; Dalkey, 1969) has been used extensively in Information Systems (IS) research to identify and determine the relative importance of key issues for IS management, education and research. By reviewing previous Delphi-type key IS issues studies and through methodological action research into an ongoing reference study of ERP lifecycle support issues in the Queensland Government, this paper presents advantages and inherent issues associated with the use of the Delphi Method (DM). The reference study is relevant to the objectives of this paper only insofar as it contributes to a better understanding of DM. Specific objectives of the paper are to: (1) highlight strengths and limitations of DM; (2) identify important contingencies that should influence DM design or its variation; (3) highlight possible design limitations of past IS Key Issues studies employing DM; (4) present a comprehensive and detailed example of the application of DM; and (5) evolve the best possible DM-type design for the ongoing ERP Major Issues study.

The paper proceeds in four sections. First, background literature on DM advantages and inherent issues, and on previous DM studies of key IS issues, are reviewed. Second, the reference study design is described in terms of the research context, the research object and the motivation for using DM. Third, the DM-type methodology employed in the reference study is presented in detail. Finally, the findings of this paper are summarized.

2. Literature Review

1.1 The Delphi Method

In the 1950s, Dalkey and his associates at the Rand Corporation developed DM (Dalkey and Helmer, 1963). The method seeks iterative feedback from a group of experts and is particularly useful for aggregating the judgements of dispersed individuals in order to improve the quality of decision-making (Bass, 1983). It is a technique for the systematic solicitation and collation of judgments on a particular topic through a set of carefully designed sequential questionnaires interspersed with summarized information and feedback of opinions derived from earlier responses (Delbecq, Van de Ven and Gustafson, 1986). DM has gained considerable recognition and is used in a wide range of fields, including recreation and tourism development, energy development, land use planning, marketing, education, economic, social, and community development (Bardecki, 1984; Mann and Miller, 1985), as well as in information systems.

The steps to be followed in general DM are: (1) select “experts” in the area - the participants are required to have had substantial involvement or experience in the investigation area; (2) contact the selected experts via survey instruments or other appropriate media - seeking opinions or issues of interest; (3) compute the average rate and range of answers of the respondents; (4) contact the selected experts again, provide the consensus and range of answers then ask if they wish to revise their answers in light of this information; and (5) compute the average rate and range of the respondents' revised answers. Repeat steps 4-5 if more rounds are needed.

DM can: (1) be used to help identify problems, set goals and priorities and determine problem solutions; (2) be used to clarify positions and delineate differences among diverse reference groups; and (3) provide exchange of more current scientific or technical information than a literature search by drawing upon the current knowledge of experts (Dalkey and Helmer, 1963; Delbecq, Van de Ven and Gustafson, 1986). DM also aims to achieve several general objectives: (1) to determine or develop a range of possible program alternatives; (2) to explore or expose underlying assumptions or information leading to different judgments; (3) to correlate informed judgments on a topic spanning a wide range of disciplines; and (4) to educate the respondent group as to the diverse and interrelated aspects of the topic (Dalkey, 1969).

DM offers several advantages. By avoiding face-to-face confrontation amongst the participants, pressure to conform to group opinion and possible dominance of the group by certain personalities are eliminated (Dalkey and Helmer, 1963). Respondents sometimes revise their initial opinions on an issue in the light of other expert responses. Thus, DM can be effective for developing consensus among experts in the solution of a complex problem. Respondents may benefit from learning about additional issues or dimensions of the problem, which they may have overlooked in earlier responses. Written questionnaires may permit respondents to adapt their participation to busy schedules, take as much time as necessary for thoughtful responses, and work in their own home or office with access to any necessary reference materials.

Although there appears to be agreement among researchers and practitioners on DM advantages, considerable variance is possible in DM design and implementation. In particular, variations among researchers and practitioners in the administration of DM revolve around the following issues: (1) what respondent group should be targeted; (2) what alternative mechanisms are available for that communication; (3) should the respondent group members be anonymous; (4) should open-ended or structured questions be used to obtain information from the respondent group; (5) what

procedures are to be used to synthesize a summary list of issues; (6) how many items should be carried over to subsequent surveys; and (7) how much iteration of questionnaires and feedback reports is needed (Linstone and Turoff, 1975; Delbecq, Van de Ven and Gustafson, 1986).

1.2 Past Delphi-Type Key IS Issues Studies

During the past thirty years IT/IS has played an influential role in business organizations. The overall importance, and in particular, the rapidly changing character of information systems, demands ongoing assessment of major issues in the IS field. Many prior studies of the relative importance of IS issues have been published. The first of these studies, and several since, were completed in the United States with the cooperation of SIM, the Society of Information Management (Dickson and Nechis, 1984; Brancheau and Wetherbe, 1987; Deans, Karwan, Goslar and Toyne, 1991; Niederman, Brancheau and Wetherbe, 1991; Watson and Brancheau, 1991; Brancheau, Janz and Wetherbe, 1996; Watson, Kelly, Galliers and Brancheau, 1997).

Watson and Brancheau (1991) recommend that using the Delphi method is appropriate for comparing and contrasting current findings with those of earlier studies, and contributes to a cumulative IS management discipline. Nonetheless, identifying and prioritizing IS issues critical to respondents (for example, account managers, quality control managers, project managers, project consultants, IT/IS executives/managers, and business managers) has been undertaken in many countries, and many different research methodologies have been used making comparison of findings across studies difficult, if not suspect.

DM has been used to evaluate strengths and weaknesses of IS relative to developmental planning, and to identify key issues and problems in IS management. The identification and prioritization of key issues in IS management that are critical to US-based IS managers, was the focus of a study by Dickson and Nechis (1984), who used a revised Delphi method. A similar approach for investigating critical information systems management issues was used in subsequent studies (that is, Brancheau and Wetherbe, 1987; Niederman, Brancheau and Wetherbe, 1991; and Brancheau, Janz and Wetherbe, 1996 in the USA; in Australia Watson 1989 and Pervan, 1993; Dexter, Janson, Kiudorf and Laast-Laas, 1993 in Estonia; and Dekleve and Zupancic, 1996 in Slovenia), to investigate critical information systems management issues. Similarities among these major IS studies include the following: (1) a sample list of issues is provided (2) a heterogeneous respondent group is surveyed; (3) 3-4 consensus rounds are applied; (4) a 10-point item scale is used; (5) reasonable consensus is achieved; and (6) a final list of 20-30 issues is summarized. Important methodological features of these DM type prior studies are summarized in Table 1.

Table 1. The Comparison of Delphi-Type Major IS Issues Studies

Researchers	Respondents	Number of Rounds	Method of Prioritizing	Starting Set of Issues	Final number of Issues	Number of Respondents	Response Rate
Dickson et al 1984.	American SIM members	4 rounds,	ranking	No	19	52, 102, 62, 54	Not reported
Brancheau and Wetherbe 1987	American SIM members	3 rounds,	ranking	Yes	20	90, 54, 68	50%, 62%, 76%
Watson 1989	Australian IS executives	3 rounds,	10 point scale	Yes	36	52, 55, 48	26%, 28%, 24%
Niederman et al. 1991	American SIM members	3 rounds,	10 point scale	Yes	25	114, 126, 104	47%, 52%, 49%
Pervan 1993	Australian IS	3 rounds,	10 point	Yes	27	88, 97, 88	29%, 32%,

	managers		scale				29%
Dexter et al. 1993	Estonian IS professionals	3 rounds,	10 point scale	No	30	10, 24, 24	35%, 85%, 85%
Dekleve and Zupancic 1996	Slovenian IS managers	4 rounds,	10 point scale	No	26	105, 163, 129, 148	32%, 49%, 69%, 80%
Brancheau et al. 1996	American SIM members	3 rounds,	10 point scale	Yes	20	78, 87, 83	36%, 40%, 38%

3. The Reference Study

In order to further explore DM, a recent reference study involving the method was analyzed in a reflective action research mode. It is noted that all research, and in particular doctoral research, should involve a degree of methodological action research. The doctoral thesis should reflect both the design and its rationale. Strengths and limitations of the design and design variations due to contingencies discovered pre-design, during design and during data collection and analysis should be discussed. A traditional “pure scientist” might abhor variations in design driven by the data, but in many circumstances this is entirely appropriate (for example, follow-up interviews; testing for sample bias; longitudinal repetition of a survey to increase validity; and even variation in the model in light of strong new evidence).

1.3 Aims of the Reference Study

The reference study is a research project currently underway in the Information Systems Management Research Center (ISMRC), Queensland University of Technology (QUT), Australia. The study seeks to understand major client-centered ERP lifecycle support issues from the perspectives of individuals who have had substantial involvement with the ERP. As the number of organizations implementing ERP increases and its applications within organizations proliferate, better understanding of these client-centered issues is needed. Software vendors, consulting firms and user organizations must make difficult judgements in relation to implementing, managing and supporting the ERP across its lifecycle, in order that ERP research, management and educational resources can be allocated effectively.

The reference study has several aims: to identify, quantify and determine the relative importance of client-centered major ERP lifecycle issues from the perspectives of the key players; to compare and contrast these key players’ perceptions; to compare perceptions across other demographic groupings (roles, agencies and types of involvement); to develop a well documented, repeatable methodology and related tools for the conduct of major issues studies; and to contribute to the understanding of methodological issues related to "major issues" studies. Finally, by inventorying, rationalizing, weighting and analyzing the issues, this study aims to provide a framework or strategy that suggests a better approach to ERP lifecycle implementation, management and support.

1.4 The Research Context

Implementing ERP is, for many organizations, their largest ever project, entailing considerable potential benefits and risks. ERP implementation, management and support is an ongoing journey rather than a destination. Figure 1 shows the pre-implementation, implementation, and post implementation stages and their associated phases, which are repeated across the lifecycle of the ERP as it evolves with the organization (Dailey 1998).

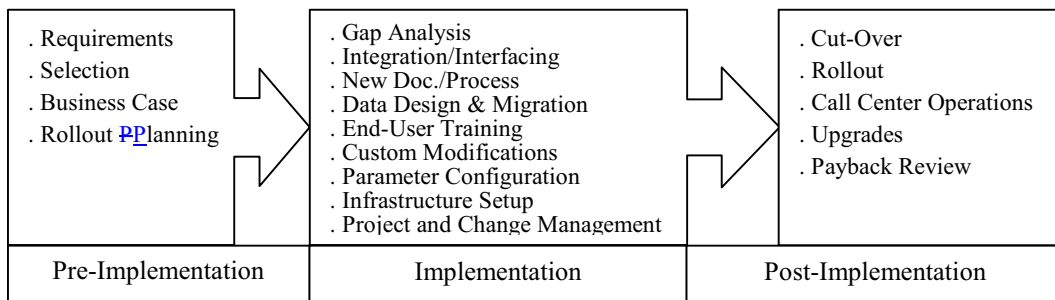


Figure 1. The Stages of ERP lifecycle

However, many organizations underestimate the issues and problems of implementing, managing and supporting the ERP lifecycle. As with many other technologies, organizations typically exhibit a significant time gap between implementation and the realization of benefits (Lu and Guimaraes, 1988). Effective management of the new technology is needed to ensure maximum benefit to the organization. Although the technology for ERP has been available for several years, its full potential is still being realized. While ERP is growing in popularity and potential, there appears to be insufficient insight into the major issues involved in implementing, managing and supporting the repeating stages of the ERP lifecycle.

1.5 Why the Delphi Method?

The reference study seeks to learn from individuals who have had substantial involvement with the ERP lifecycle at all levels and in all roles within Queensland Government. The study intends to systematically identify and rigorously analyze responses to the research question: “What do you consider have been the major issues in implementing, managing and/or supporting the SAP Financials in [your agency]?” Owing to a relatively small amount of mostly practitioner and some academic literature, which exists in the area of major issues with ERP lifecycle support, the research strategy conducted in this reference study can be described as exploratory, descriptive, and comparative. A two-round, non-anonymous and open survey was distributed by personalized email.

This DM type approach is particularly appropriate for the reference study. First, questionnaires are used to solicit expert opinion. This means that the respondents can be geographically remote. Second, thought respondents are known to the researchers, confidentiality and anonymity amongst respondents is ensured, thus dominant individuals are unable to overly influence the results. Third, because respondents are known to the study team, the researchers are able to group respondents based on various demographics and follow up ambiguous and missing details. Fourth, an email-out is inexpensive and can be completed in a short time. Fifth, an open-ended survey allows respondents to fully express and delineate their views. Sixth, a two-round questionnaire enables information feedback, thereby stimulating reflection, movement toward a certain level of consensus or difference, and a greater depth of insight emerges. Seventh, the DM findings allow statistical summarization and comparison to demonstrate group consensus or differentiation. Finally, because many previous studies investigating IS issues have employed DM, comparing and contrasting findings with those of earlier studies is possible, and contributes to the cumulative information systems discipline. Thus, DM is deemed an appropriate method, since a major goal of this reference study is to systematically identify, analyze and determine the relative importance of major ERP lifecycle issues.

1.6 The Reference Study Design

Figure 2 depicts the overall reference study design, which includes six major phases: (1) Define Strategy & Context; (2) Review Literature; (3) Conduct Data Collection; (4) Perform Data Analysis; (5) Interpret Findings; and (6) Suggest Future Research Opportunities. In the diagram, the rectangles represent processes or phases of the research framework. Other symbols represent input/output information flows.

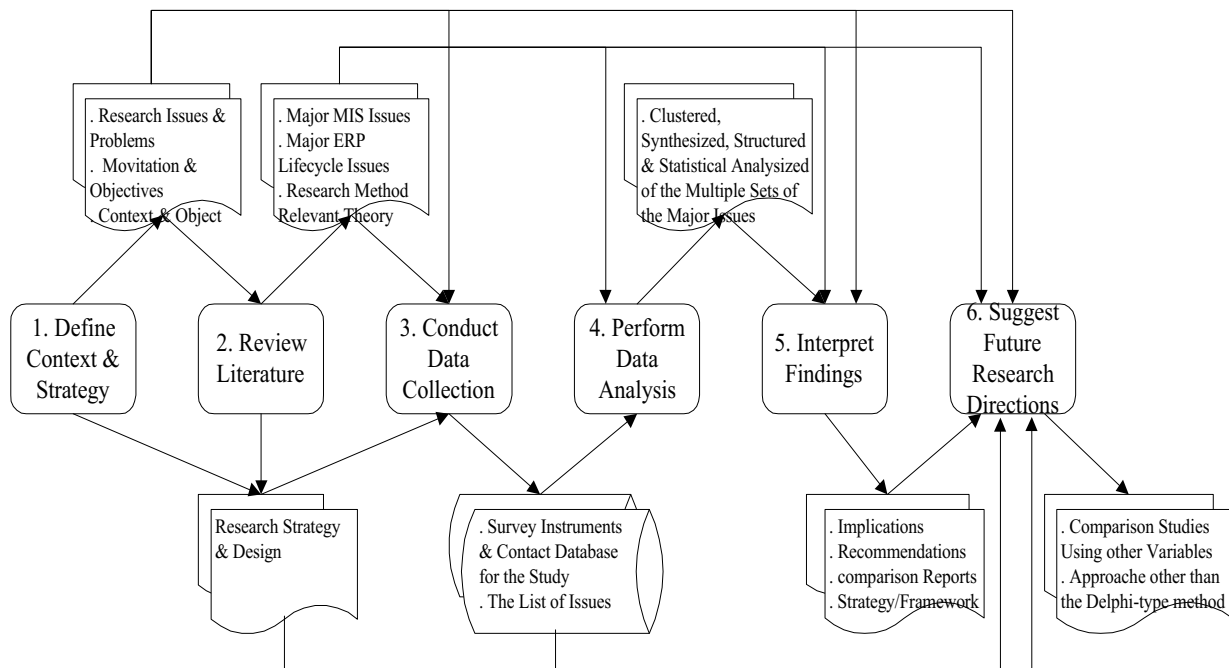


Figure 2. The Overall Reference Study Design

1.7 The Delphi Design

A research design is an operational plan generated from a research methodology. The research methodology provides a more detailed description of the approach taken in carrying out the research, such as characteristics of data, data collection instruments and the data collection process (Gable, 1994). The following design is offered as one potentially useful methodology for organizing Delphi-generated data for similar economic development and extension studies. A comprehensive methodology will assist the researcher to design the instrument broadly enough that responses are encouraged on all topics or issues that are considered workable to a successful study. Most importantly, the Delphi process should identify specific activities by which the key players can capitalize on their advantages and seek to eliminate or overcome obstacles, to better manage and support clients' ERP.

This study suggested a selected group of five government agencies as a logical place to start in piloting the first DM round. Subsequently, the study will be extended to all other government agencies. The approach consists of three sub-phases: (1) pre-study arrangement; (2) a pilot study at five government agencies; and (3) an extension study to include all government agencies. The following sub-sections address particular sub-phases of this application of the DM approach within the context of the reference study.

1.7.1 Pre-Study Arrangement

In most Delphi approaches, two different groups of people will carry out the processes: the researchers - the working group who will evaluate and utilize the outcomes of the Delphi approach; and the participants (for example, software vendors, consulting firms, and client organizations) whose judgments are being sought. In this study, a third advisory group of individuals within the government agencies (nominees from each agency) was identified; these senior individuals have been closely involved with SAP Financials in the Queensland Government. They assisted the researchers to compile a list of knowledgeable individuals in each department/agency who were then sent the survey instrument. The advisory group also assisted the researchers in following up missing or ambiguous details and non-respondents.

1.7.2 The Pilot Study at Five Government Agencies

The study was piloted in five agencies that implemented SAP Financials as a group. Appendix A illustrates the details of the pilot study design. Each of the eight main stages depicted is discussed in the following sub-sections.

- **Draft First Round Survey Instrument**

This is the key to the Delphi-type process. If respondents do not understand the initial question that is the focus of the study, they may answer inappropriately, ambiguously or become frustrated with the questionnaire and lose interest. The researchers should clarify exactly what information is desired, and how the information will be used. Reflections which may help the researchers in question formulation are: (1) why are the researchers interested in this study? (2) what do the researchers need to know that they do not know? and (3) how will results from the Delphi-type study influence data analysis, comparison and interpretation once the study is completed?

- **Draft Participant Selection Guidelines**

Who should constitute the respondent sample in a Delphi-type study and how many individuals should be included in the participant panel are selection issues that need to be clarified in any survey. It is anticipated that all participants in all levels are required to have had substantial involvement with SAP Financials in the study organization.

- **Build Pilot Study Contact Database**

The study design requires the involvement of a senior staff member within each agency who has been closely involved with SAP Financials. This senior staff member, with a set of selection guidelines, will compile a list of knowledgeable individuals in their agency to be surveyed. The senior staff member will also assist in following up missing or ambiguous details and non-respondents.

- **Pilot-Test the First Round Survey Instrument**

The modification of the first round open-ended questionnaire was made by the researchers at this step. Several participants were invited to test and comment on the survey instrument and appropriate revisions were made.

- **Administer Pilot List-Building Survey**

At this stage of the study, questionnaires were sent to and returned by respondents. Participants were invited to identify and briefly describe five to ten issues in response to the investigative question. The first round result should yield a rich and detailed set of data. Two major tasks of the researchers were to distribute the first round instrument by email and to record individual responses.

- **Categorize Participants' Involvement**

The study was not anonymous thus the researchers could group respondents based on various demographic data. Some of the data were available prior to the survey (e.g., name, title, contact details) while more data could be compiled subsequent to the survey, since the survey instrument asks about phases, modules, and level of respondent involvement.

- **Confirm the Categorization with Advisory Group Members**

Three major tasks were involved during this step. They were to schedule the confirmation meeting with the senior staff at five agencies; to hold the confirmation meeting with the senior staff members; and to confirm the categorization of individuals' involvement for further data analysis.

- **Finalize the Guidelines for Building Extension Study Contact Database**

This document contains guidelines for selecting staff to be included in the first round survey contact list. The guidelines should direct the selection of the appropriate type and number of individuals to include in the contact list as well as suggesting a sample table for compiling the contact list details. The guidelines aim to include individuals who have had substantial involvement with SAP Financials at all levels (for example, strategic, technical and operational users) and in all phases of the SAP Financials lifecycle (for example, Plan, Design & Build, Testing, Implement, Knowledge Management, and Up-and-Running); who have been involved with the modules implemented (for example, general ledger, accounts receivable/payable, fixed assets); who have had various roles (for example, project management, change management, development, configuration, internal audit); and who have worked in the organization as a representative of either the client organization, an implementation partner or the vendor.

1.7.3 The Extension Study to Include All Government Agencies

Appendix B illustrates the detailed levels of the extension study design. Each of the nine stages depicted in the Appendix B is discussed in the following sub-sections.

- **Finalize First Round Survey Instrument**

The instrument was developed through the processes of revising, testing and finalizing in order to assist the participants in an appropriate response to the survey. The questionnaire includes (1) Introduction and Background; (2) Purpose of the Survey; (3) Conduct of the Survey; (4) Who Should Complete the Questionnaire; (5)

Confidentiality; (6) General Instructions for Completing and Returning the Questionnaire; (7) Individuals' Involvement; and (8) the Major Issues.

In addition, it is crucial that the introduction/invitation letter is well prepared. The covering letter includes the following elements: thanking the individual for participating, explaining why his or her help is needed, explaining how the results of the Delphi-type will be utilized, providing instructions and a response date, and addressing confidentiality of the individuals' data.

- **Expand the Contact Database to Include All QG Agencies**

Three tasks were involved during this step. They were to schedule extension study meeting with the senior staff member within each additional agency; hold extension study meetings with the senior staff members; and establish an extension study contact database.

- **Administer List-Building Survey to All QG Agencies**

At this stage of the study, questionnaires were sent to and returned by respondents. The first round results profile a rich and meaningful set of major issues. Two tasks of the researchers at this stage were to distribute the first round instrument by email to all QG agencies; and to record individuals' responses properly.

- **Draft Second Round Survey Instrument**

It is important that each item in the second round questionnaire accurately convey the meaning which respondents have attempted to communicate by means of their first round return. This implies a pretest of the second round questionnaire, just as there needs to be a pretest of the first round instrument. Pretests can be accomplished by a pilot test prior to mailing the questionnaires, with a sample of respondents who are not part of the formal respondent panel.

The potential benefits of the second round survey, if the Delphi-type method is conducted properly, are that areas of disagreement are identified, areas of agreement are identified, items requiring clarification are identified and discussed, so that an early understanding of priorities emerges.

- **Codify and Rationalize the Issues**

At this stage of the study, the first round questionnaires were sent to and returned by respondents. An analysis of the data should result in a summary list of issues identified and comments made. The summary list should be short enough for all respondents to easily review, criticize, support, or oppose in the further individual-weights survey. The list-building survey resulting from the pilot study and extension study should yield a rich and detailed set of issues. The tasks of the working group at this stage are to (1) codify the collected raw data, (2) convert each raw data into a master set of issues, and (3) use the resulting information to formulate the subsequent second round survey questionnaire.

- **Confirm Sets of Issues with Members of Study Advisory Group**

Three major tasks were involved with senior staff members in each agency during this step in order to confirm the sets of master issues for the second round survey. They include (1) schedule the confirmation meeting with the members of study advisory group; (2) hold the confirmation meeting; and (3) confirm the sets of master issues further second survey.

- **Transform Individuals' Responses into the Master Issues**

At this stage, the relationship between individuals' responses and the master set of issues were established. These relationships show how individuals' responses are being included in the multiple sets of master issues.

- **Finalize Second Round Survey Instrument**

The instrument was developed through the processes of revising, testing and finalizing in order to assist the participants to appropriately correspond to the second round survey. This instrument includes (1) introduction and background; (2) purpose of the survey; (3) conduct of the survey; (4) who should complete the questionnaire; (5) confidentiality; (6) general instructions for completing and returning the second round survey; (7) confirmation of individuals' involvement; and (8) weighting of the major issues.

- **Conduct the Individual-Weight Survey**

Respondents were asked to confirm their nature of involvement according to the categorization that the researchers have applied. They then are invited to rate each of the 20 issues on a 10-point scale where a 10 represents the highest priority issue and a 1 indicates the lowest priority issue. The respondents are also offered the opportunity to change the wording of any issue or modify the rationale. Further, space is provided at the end of the form to write in additional issues and their rationale. Two major tasks of the researchers at this stage are to distribute the second round instrument by email to all QG agencies and to record individuals' second round survey responses properly.

4. Summary

The Delphi method has been subjected to scrutiny and criticism at various times since the 1950's. The literature, while not extensive, contains specific guidelines for researchers to follow in carrying out the Delphi approach. The paper has identified several advantages and inherent issues of the Delphi method highlighted by past studies. The previous Delphi type key IS management issues studies were also examined. A reference study, designed to enhance understanding of major ERP lifecycle issues, which involved the Delphi method, was described. This paper has also presented a detailed example for conducting the Delphi method in the context of IS key issues studies, which will enhance the reliability and validity of the investigation.

The appropriateness of the Delphi method to IS key issues studies and a better understanding of client-centered major issues in relation to the ERP lifecycle is very considerable. Yet, because the detailed characteristics of the design of the process can have important effects on the nature of the outcomes, it will be important to not just tailor the Delphi method to the investigated problems but also to address the research design issues concurrently. It is believed that the Delphi design presented in this paper answers some of the criticisms of past Delphi type IS research.

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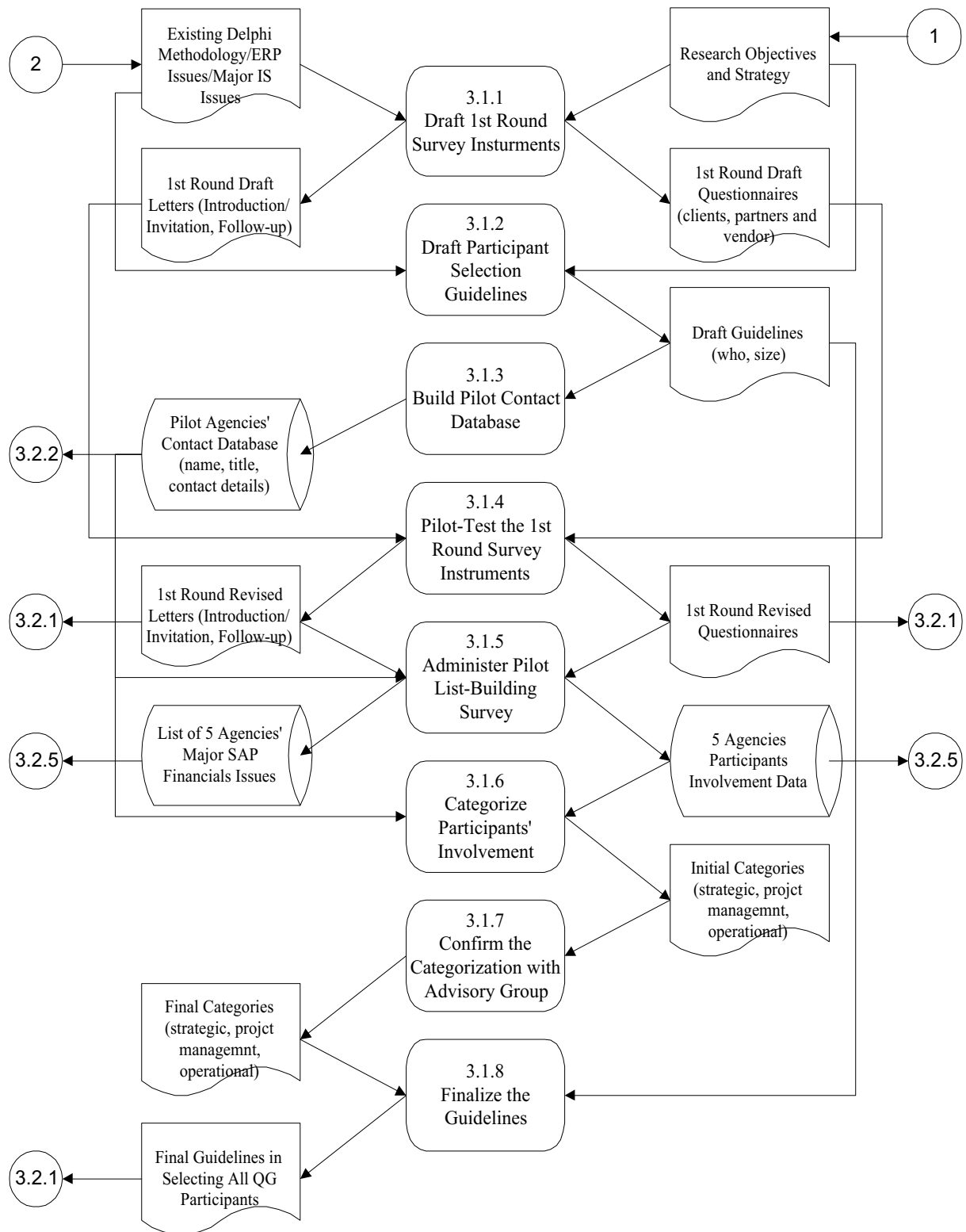
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Appendix A – The Pilot Study



Appendix B - The Extension Study

