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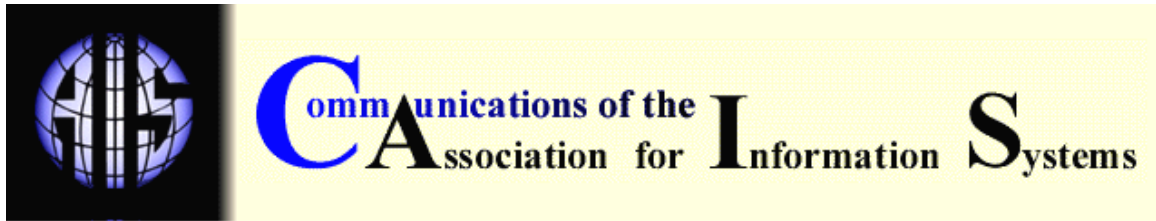
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INVESTIGATING INFORMATION SYSTEMS WITH POSITIVIST CASE STUDY RESEARCH

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ABSTRACT

This paper offers a rigorous step-by-step methodology for developing theories and contains specific and detailed guidelines for IS researchers to follow in carrying out positivist case studies. The methodology is largely inspired by the work of Yin [2003], Eisenhardt [1989], Miles and Huberman [1994] and several others who are strong proponents of and have wide experience in this research approach. It also relies on previous key contributions to the positivist case research method in IS [Benbasat et al., 1987; Lee, 1989; Dubé and Paré, 2003]. We illustrate how this methodology can be applied in our field to help find new perspectives and empirical insights. In addition, the desired qualities associated with several of the proposed concepts and the techniques and tools included in the methodology are presented. We believe that the two detailed case studies presented in this paper represent highly rigorous, yet different applications of the positivist case research method and, hence, we strongly encourage IS researchers to follow their respective approaches.

Keywords: case study research, positivism, methodology, rigor

I. INTRODUCTION

For at least two decades acceptance of case study research has been increasing in the information systems (IS) discipline [Benbasat et al., 1987; Lee, 1989; Orlikowski and Baroudi, 1991; Alavi and Carlson, 1992; Yin, 1993; Markus, 1997; Klein and Myers, 1999]. Although numerous definitions of case studies exist, Yin [2003] defines the scope of a case study as

“an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 13).

Case research is therefore useful

- when a phenomenon is broad and complex,
- where the existing body of knowledge is insufficient to permit the posing of causal questions,
- when a holistic, in-depth investigation is needed, and

- when a phenomenon cannot be studied outside the context in which it occurs [Bonoma, 1985, Benbasat et al., 1987; Feagin et al., 1991; Yin, 2003].

Clearly, the case study methodology is particularly well-suited to IS research. As stressed by Benbasat et al. [1987], the object of our discipline is the study of information systems in organizations, and interest shifted to organizational rather than technical issues. Furthermore, several researchers demonstrated that IT is neutral and that any system cannot be separated from the context in which it is implemented and deployed [Markus and Robey, 1988; Orlikowski, 1992]. Asked to give one reason to account for the popularity of the case method in IS, one Harvard professor noted that

“whereas traditional MIS systems were simply a subfunction of an organization, the newer MISs could potentially lead to the restructuring of the entire organization, with the firm in its entirety becoming an MIS” [Yin 1993: p.44].

We agree that only the case method could capture such dynamic, changing conditions. Up to now, case studies were used to study IS phenomena, particularly in system development and implementation [e.g., Markus, 1983; Leonard-Barton, 1988; Keil, 1995; Robey and Newman, 1996; Paré and Elam, 1997; Sarker and Lee, 2000]. However increasingly, they are also being used to explore a variety of IT management issues [e.g., Cross et al., 1997; Brown, 1999; Sambamurthy and Zmud, 1999] and the impacts of IT on organizations and markets [e.g., Palvia et al., 1992; Caron et al., 1994; Barrett and Walsham, 1999].

A few IS researchers formulated a set of methodological principles for case studies that are consistent with the conventions of positivism. One of the earliest contributions was that of Benbasat et al. [1987] who clarified the nature of the case research method and explained why it might be used in the IS field. They surveyed the case study literature in IS and offered general suggestions for improvements. They recommended that case researchers should provide clearer descriptions of where their topics fit into the knowledge building process, detail the case selection criteria, and provide detailed information about the data collection process. Another key contribution was made by Lee [1989] who provided an overview of and responded to the methodological problems involved in the study of a single case. He also summarized what a scientific methodology for IS case studies does, and does not, involve. Lee [1989] demonstrates how to make controlled observations and deductions as well as how to allow for replicability and generalizability with the use of a single case.

More recently, Dubé and Paré [2003] sought to determine the extent to which the IS field advanced in its operational use of the case study method. Specifically, they investigated the level of methodological rigor in positivist IS case research conducted over the past decade. To fulfill this objective, they identified and coded 183 case articles from seven major IS journals. A total of 53 evaluation attributes or criteria, which cover the areas of case design, data collection and data analysis, were considered by the authors. Such listing of attributes, garnered from the works of leading case research methodologists, provides a framework that is intended to be helpful to IS researchers and to journal reviewers and editors.

As a result of contributions like these, case study research is now accepted as a valid research strategy within the IS research community. We posit that applying a well-defined methodology along the lines described in this paper will help to position case studies even more in the mainstream of IS research. While previous contributions [Benbasat et al., 1987; Lee, 1989; Dubé and Paré, 2003] proposed general principles and guidelines for conducting IS positivist case research (macro perspective), this paper offers a step-by-step methodology together with a set of key concepts, techniques, and tools on *how* to conduct good-quality positivist case research (micro perspective). To refine further our understanding of the methodological basis upon which to conduct rigorous positivist case studies in our field, the present article:

1. describes a detailed scientific approach for positivist case study research;

2. describes the optimal qualities associated with several of the proposed concepts, techniques, and tools;
3. illustrates these same concepts, techniques and tools with extensive material from two IS positivist case studies; and
4. provides insights into the many choices that researchers must make when adopting this methodology for exploratory purpose.

Using the proposed methodology as a foundation, our intent is to provide an up to date and detailed practical guide for researchers, reviewers, editors and practitioners wishing to conduct, evaluate, justify, understand, or even sponsor positivist case research in IS studies. The implications of this methodology on IS research are also discussed throughout the paper.

To present and illustrate a scientific methodology for conducting positivist IS case research, it is necessary to summarize briefly the basic assumptions underlying this philosophical stance. Lincoln and Guba [1985], Orlikowski and Baroudi [1991], and Devers [1999], argue that the adoption of a positivist perspective is accompanied by a broad commitment to the idea that the social sciences should emulate the natural sciences [Lee, 1989]. Ontologically, positivist research assumes

“an objective physical and social world that exists independent of humans, and whose nature can be relatively unproblematically apprehended, characterized, and measured” [Orlikowski and Baroudi, 1991: p.9].

For instance, IT departments in organizations are understood to have a structure and reality beyond the actions of their members. The focus of positivist research consists of “discovering” the objective reality by crafting measures that will detect those dimensions of reality that interest the researcher. Understanding phenomena in positivist research is thus primarily a problem of modeling and measurement [Orlikowski and Baroudi, 1991]. Epistemologically, positivist studies are premised on the existence of a priori fixed relationships within phenomena capable of being identified and tested via hypothetic-deductive logic and analysis. The causal relationships, that are the basis for generalized knowledge, can predict patterns of behavior across situations. Furthermore, positivist researchers believe that scientific inquiry is “value-free” and, hence, see themselves as impartial observers who can evaluate or predict actions or processes objectively.

Keeping in spirit with this set of beliefs, a positivist case study is likely to be conducted with the ideas of establishing appropriate measures (qualitative and/or quantitative) for the constructs being studied; establishing or testing causal relationships; determining the domain to which the study's findings can be generalized; and demonstrating that the inquiry is value-free. The criteria for judging the quality of such positivist studies, compared to interpretive and critical case studies, are related to the traditional validity and reliability tests used in the natural sciences [Yin, 2003].

THE SCOPE OF THIS STUDY

Just as case research can be positivist, interpretive, or critical [Myers, 1997], positivist case study research can be descriptive, exploratory, or explanatory. Each of these three approaches can be either single or multiple-case studies [Yin, 2003]. The scope of this paper is confined to exploratory (theory building) case research. We do not consider explanatory (theory testing) case research nor other, valuable, types of case research such as evaluative case studies or case studies limited to quantitative evidence [Yin, 2003].

An exploratory case study, whether based on single or multiple cases, is aimed at defining questions, constructs, propositions, or hypotheses to be the object of a subsequent empirical study [Yin, 1993]. Keil [1995] provides a brilliant example of a longitudinal, single-case, exploratory study. His research is concerned with one pattern of system failure that is observed but seldom studied, namely, projects that seem to “take a life of their own,” continuing to absorb valuable resources without ever reaching their objectives. Usually, these projects are abandoned

or significantly redirected, but the sunk cost of funding them can represent a tremendous waste of human and financial resources. In that study, escalation refers to a

“continued commitment in the face of negative information about prior resource allocations coupled with uncertainty surrounding the likelihood of goal attainment”
[Brockner, 1992].

In terms of contribution to both practice and research, Keil's study offers a new perspective on software project management that holds the promise of improving our ability to successfully manage IT projects. More specifically, the author demonstrates that it is necessary to look beyond the traditional explanations of poor project management and to consider possible psychological, social, and organizational factors that may promote project escalation.

A second example of an exploratory positivist case study is offered by Paré and Elam [1997]¹ who examined the implementation process, use and consequences of three clinical information systems at a large tertiary care teaching hospital. The IT implementation stream of research consists primarily of studies, often referred to as “factor studies,” which try to identify factors believed to be relevant to IT implementation success. Even though these studies contributed substantially to our understanding of IT implementation, the authors posit that we know very little about how and why the factors included in these models interact and work together to produce success or failure. The ultimate intent of that study was to broaden and strengthen our understanding of the implementation of IS by researching the dynamic nature of the implementation process. In terms of contribution, the set of research propositions developed in that study defined a preliminary set of laws of interaction which characterizes the dynamic nature of the implementation process. Table 1 synthesizes the basic descriptors of Keil's and Paré and Elam's studies.

Table 1. Summary of Keil's and Paré and Elam's Case Studies

	Keil [1995]	Paré and Elam [1997]
Case design	Single	Multiple
Research objective(s)	To determine whether the escalation phenomenon could be observed and if so, to identify the reasons why it occurs	To provide a deeper understanding of the dynamics of the system implementation process
Research Site(s)	The identity of the company and of its industry have been disguised to provide anonymity	Three distinct organizational units at a large tertiary care teaching hospital
Theoretical Focus	IT project escalation predictors	Teleology theory of change process
Key Findings	Escalation is promoted by a combination of project, psychological, social and organizational factors	A series of research propositions reflecting the dynamic nature of the implementation process

More detailed information from the two empirical case studies introduced above will be provided throughout the manuscript to illustrate and demonstrate how the various concepts, techniques and tools associated with the proposed methodology can be applied in IS research. These

¹ The authors provide a practical demonstration of how the approach proposed by Eisenhardt can be used in studying IT implementation. This paper illustrates it with extensive material taken from a published IT implementation case study (Paré et al., 1996; Paré et al., 1997; Paré and Elam, 1998; Paré, 2002).

studies were considered because they exemplify most of the suggested concepts and techniques, even though some are better exemplified than others and they represent a wide variety of case research designs (single versus multiple case; literal versus theoretical replication; qualitative versus quantitative data collection methods) as well as a diversity of sampling strategies and data analysis techniques. In short, the two cases were selected primarily because of their high level of methodological rigor.

II. DESCRIPTION OF THE METHODOLOGY AND ILLUSTRATIONS

The step-by-step scientific methodology proposed here is largely inspired by the work of Yin [2003], Eisenhardt [1989], Miles and Huberman [1994] and several others [e.g., Stake, 1995; Devers, 1999; Crabtree and Miller, 2000; Patton, 2002] who are strong proponents of and possess extensive experience in this research approach and qualitative methods in general. It also relies on previous key contributions of the case research method in IS [Benbasat et al., 1987; Lee, 1989; Dubé and Paré, 2003]. As shown in Figure 1, our methodology follows the recommendations of Yin [2003] and involves four distinct stages.

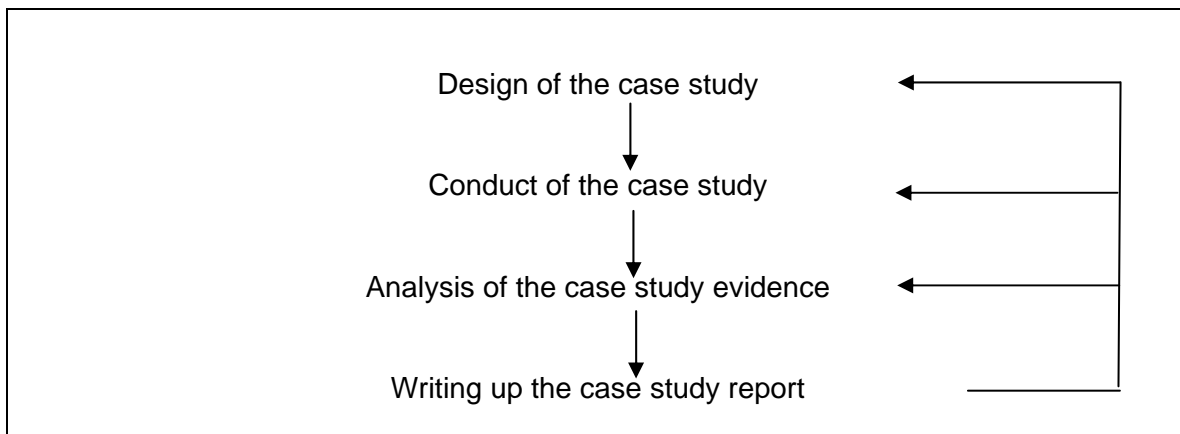


Figure 1. Scientific Approach for Conducting Positivist Case Study Research

STAGE 1: DESIGN OF THE CASE STUDY

Five issues are of great importance in getting started, namely,

- the initial definition of research questions,
- the *a priori* specification of constructs or theory,
- the definition of the unit of analysis,
- the selection and number of cases, and
- the use of a case study protocol.

Each of these issues will be examined in turn.

Definition of Research Questions

Defining the research questions is one of the most important steps to be taken in a research study [Yin, 2003]. A definition of one or more related research questions, in at least broad terms, is as important in building theory from case studies as it is in hypothesis-testing research. Yet, it is interesting that little concrete attention has been paid to this activity and less to criteria for knowing that one asked a good, and potentially great, question. In their recent survey of positivist

case research in IS, Dubé and Paré [2003] found that only 42% of all case study articles in their database specified clear research questions.

The general question posed by Keil

“Why are troubled projects allowed to continue for so long before they are ultimately abandoned or brought under control?” (p.421)

possesses all of these qualities. This question is in line with the main objective of the study which consists of understanding why the escalation phenomenon occurs and how it can be avoided. Given that IT project escalation was seldom studied prior to this research, three specific questions were actually posed by the investigator:

- “Does escalation occur in actual IT projects?”,
- “What are the factors that seem to promote escalation?”, and
- “What is the course of events that can break a cycle of escalation?”

Yin [2003] explains that the case study research strategy is most likely to be appropriate for “how” and “why” research questions because they deal with operational links needing to be traced over time, rather than mere frequencies or incidence. When “what” questions are exploratory in nature, such as in Keil’s study, it is justifiable to adopt an exploratory case research strategy [Yin, 2003].

As mentioned previously, the ultimate objective pursued by Paré and Elam was to broaden and strengthen our understanding of IT implementation by studying the dynamic nature of the implementation process. In pursuit of this aim, two interrelated research questions were stated:

“What are the laws of interaction which characterize the dynamic nature of IT implementation?” and

“How do contextual conditions and implementation tactics interact and work together to ensure project success?”.

These research questions provided a well-defined focus to the study and permitted the researchers to specify the kind of data (i.e., project context, implementation strategies, and project success) to be gathered. Again, both of these questions are appropriate in an exploratory case study context [Yin, 2003].

Generally speaking, the amount of time spent setting the question is proportional to the quality and relevance of the question. The desired qualities of research questions in case research are presented in Figure 2. Although it is not a formal criterion for evaluating case research, we counsel prospective IS researchers to choose a question and area that they are fundamentally interested in, as the research process usually takes months to complete. The two empirical studies presented here represent good cases in point.

- | |
|---|
| <ul style="list-style-type: none"> • Clear • Simple • Obvious • Intriguing • Feasible within the time and resources available • Socially important • Timely • Scientifically relevant |
|---|

Figure 2. Desired Qualities of Case Research Questions

Prior Theorizing

With respect to the issue of using existing theoretical constructs to guide theory-building research, two different approaches may be taken [Anderson and Aydin, 1994]. In the first, the researcher works within an explicit conceptual framework which

“consists of a selection of concepts and relations among them, grouped so as to enable its users to easily see the major concepts simultaneously in their relations to one another” [Kochen, 1985: p.93].

Therefore, a conceptual framework becomes a “researcher's first cut at making some explicit theoretical statements” [Miles and Huberman, 1994: p.91]. In the second approach, the researcher tries not to be constrained by prior theory and instead sees the development of relevant theory, hypotheses, and concepts as a purpose of the project. Both approaches were combined in each of the two exploratory studies examined in this article.

Using the research questions as a guide, Paré and Elam developed a conceptual framework that grouped constructs related to the contextual conditions surrounding most implementation situations, the tactics and strategies aimed at launching the project, managing the development of the new system and preparing organizational members for the new computer application, and the different criteria commonly adopted to evaluate system success. Eisenhardt [1989] suggests that theory-building research must begin as close as possible to the ideal of no theory under consideration and no hypotheses to test since preordained theoretical perspectives may bias and limit the findings. However, as stressed by Eisenhardt, it is quite impossible to achieve the ideal of a clean theoretical slate. Hence, although Paré and Elam followed Eisenhardt's suggestion in terms of not identifying specific relationships between the constructs identified in their conceptual framework, they found it necessary to make use of a process meta-theory called the teleological view [Van de Ven and Poole, 1995]. Following Mohr [1982], Paré and Elam believe process explanations become more meaningful when situated within a broader or higher level of process theory. Specifically, the teleological view of process theory shaped their study of IT implementation in a few important ways. For instance, by adopting a teleological view of the change process, a theory of IT implementation cannot specify what trajectory implementation will follow. At best, researchers can rely on norms of rationality to prescribe certain paths. Consequently, Paré and Elam focused their research efforts on understanding how courses of action were selected, developing process explanations related to the movement toward attaining a desired end state, and assessing the role of human perception in making progress toward goal achievement. The adoption of the teleological process meta-theory was of great help in focusing research efforts at the outset of the project since it provided the frame through which the IT implementation process could be observed and identified the key events of interest out of numerous ones that were occurring.

In his paper, Keil shows that escalation is a complex process and that it may be necessary to look beyond traditional explanations of poor project management and consider other factors that may promote such a phenomenon. From a review of the literature, the author adopted an existing taxonomy [Staw and Ross, 1987] as a conceptual basis. The taxonomy groups these predictors into four categories: project factors, psychological factors, social factors, and organizational factors. As stressed by Eisenhardt [1989], although early identification of possible constructs or factors allows them to be explicitly measured in interviews, it is equally important to recognize that the identification of constructs is tentative in theory-building research. Both Keil and Paré and Elam found this to be true as new factors were found during data collection that needed to be added to their respective analysis.

Unit of Analysis

The third component of a case design is related to the fundamental problem of defining what the “case” is [Yin, 2003]. “What is my case?” is one of the questions most frequently posed by case researchers. Without a tentative answer, case researchers will not know how to limit the

boundaries of their study. A case can be defined as an “integrated system” bounded by time and place [Stake, 1995]. As an example, a user of an information system is a working combination of cognitive, psychological, cultural, attitudinal, and other forces. Similarly, the information system being deployed and used is a working combination of ergonomic, technical, and performance (e.g., response time) characteristics. In our field, a case may not only be a particular technology or system (e.g., geographic information system) or a potential user or group of users, but also an IT governance or management strategy (e.g., outsourcing), an IT position (e.g., CIO), an organization or a network of organizations, or a decision (e.g., adoption of an emerging technology at the organizational level), to name just a few possible areas of study.

Miles and Huberman [1994] claim that the case is the unit of analysis but they also recognize that the “case” might not be monolithic and might include “subcases” embedded within it. Yin [2003] concurs that a single case may involve more than one unit of analysis. This situation occurs when, within a single case, attention is also given to a subunit or subunits. For example, Leidner and Jarvenpaa [1993] conducted a multiple-case study to explore how computer technology is used in the university classroom and how computer-based teaching methods differ from traditional teaching methods in terms of class interaction and in-class learning. The primary unit of analysis in this study was a course and an embedded unit of analysis was the students in each course. Another example is provided by Guha et al. [1997] who chose an embedded case design to investigate the broad and complex phenomenon of business process change (BPC). The embedded design implied the use of multiple units of analysis:

1. the firm;
2. the BPC team; and
3. the BPC project.

The specification of the unit of analysis is key. If we want to understand how the case study relates to a broader body of knowledge. This specification is even more important with explanatory and exploratory case studies since, as Markus [1989] noted, the practical significance of the findings for the theory rests on the study of the appropriate unit of analysis. In an exploratory case study, a clear definition of the unit of analysis helps define the boundaries of a theory, which in turn set the limitations in applying the theory.

As another general guide, the definition of the unit of analysis must be related to the way the initial research questions are defined and the generalizations desired at the project's completion [Yin, 2003]. If research questions do not lead to the favoring of one unit of analysis over another, they may be either too vague or too numerous. The unit of analysis and the research questions in both case studies considered here are clearly and directly associated. Indeed, the unit of analysis in Keil's and Paré and Elam's studies was the IT implementation project. Finally, given that researchers might be interested in comparing their findings with previous research, literature also can become a guide for defining the cases and the unit of analysis. Figure 3 summarizes some useful insights and concepts for specifying the unit of analysis in case research.

- | |
|---|
| <ul style="list-style-type: none">• Each unit of analysis must be as specific as possible• Each case should be a bounded system• Each unit must be related to the initial research question(s)• Literature must be used as input |
|---|

Figure 3. Useful Insights and Concepts for Specifying the Unit of Analysis

Number and Selection of Cases

A central issue in case research design is the decision to include one or more cases in the research project. A frequent criticism of case study research is that its dependence on a single case renders it incapable of providing a generalizable conclusion. Case study research is not sampling research [Lee, 1989; Yin, 2003] and a single case can be sufficient to disconfirm an existing theory if its predictions do not hold [Markus, 1989]. Selection of cases represents another important but difficult aspect of case study research [Yin, 2003; Lee, 1989; Benbasat et al., 1987; Eisenhardt, 1989]. Selecting a single case or multiple ones must be done so as to maximize what can be learned, in the period of time available for the study.

A single case design is appropriate when it represents a unique, revelatory, or critical case in testing a well-formulated theory [Yin 2003]. Keil mentions that one of the reasons for choosing the particular project he studied was that the history of the CONFIG system was well documented and could be studied by reviewing a variety of historical material. Since IT project escalation is not a phenomenon easily accessible from a research standpoint, CONFIG could therefore be considered a perfect example of a revelatory case in IS.

When adopting a multiple-case design, a question many researchers encounter is related to the number of cases deemed necessary or sufficient for their study. The number of replications is basically a matter of discretionary and judgmental choice; it depends upon the certainty a researcher wants to have about the multiple-case results [Yin, 2003]. Ideally, researchers should stop adding cases when theoretical saturation is reached [Eisenhardt, 1989]. Theoretical saturation is the point at which incremental learning is minimal because the researchers are observing phenomena seen before [Glaser and Strauss, 1967]. In practice, however, theoretical saturation often combines with pragmatic considerations to dictate when case collection ends. In fact, it is not uncommon for researchers to plan the number of cases in advance.

In its simplest form, a multiple-case design would consider two or more cases that are believed to be literal replications. Selection of such cases requires prior knowledge of the outcomes, with the multiple-case inquiry focusing on how and why the outcomes might have occurred and hoping for literal replications of these conditions from case to case. Such replication logic was adopted by Paré and Elam [1997] who studied the successful implementation of a similar technology in three distinct organizational units at Jackson Memorial Hospital. More complex multiple-case designs would result from the number and types of theoretical replications researchers might want to cover. Multiple-case rationales also can derive from the prior theorizing of different types of conditions and the desire to have subgroups of cases covering each type [Yin, 2003]. For instance, Sabherwal and Tsoumpas [1993] conducted four case studies in order to examine any differences that may exist between large and small firms with regard to the development process of strategic information systems. Designs like these are more complicated because the study should still have at least two individual cases within each of the subgroups, so that the theoretical replications across subgroups are complemented by literal replications within each group.

In a multiple-case design, the selection of cases should follow a literal replication logic (conditions of the case lead to predicting the same results) or a theoretical replication logic (conditions of the case lead to predicting contrasting results) [Yin, 2003]. As reported in Dubé and Paré [2003], two studies on business process reengineering illustrate the proper use of these strategies. On the one hand, Stoddard and Jarvenpaa [1995] adopted a theoretical replication approach to study the tactics of three organizations' reengineering initiatives which varied in terms of the expected change outcomes. On the other hand, Broadbent, Weill, and St Clair [1999] used a literal replication strategy in an exploratory case analysis of four firms from two industries to understand how IT contributes to success in implementing reengineering. The aim was to demonstrate that the phenomena were not industry-specific.

To summarize, Table 2 presents a typology of purposeful case sampling strategies adapted from the work of Patton [2002]. We believe some of these strategies deserve emphasis because they

are typical of or critical for good qualitative inquiry in the IS field. The categories in Table 2 are not mutually exclusive and, hence, several sampling strategies can be adopted in a single study.

Critical Case Sampling

In critical case sampling the researcher looks for sources of data that are particularly information rich or enlightening. This sampling strategy

“permits logical generalization and maximum application of information to other cases because if it’s true of this one case it’s likely to be true of all other [similar] cases” [Patton, 1990: p.82].

Table 2. Case Sampling Strategies (Adapted from [Patton, 2002])

CASE SAMPLING STRATEGY	PURPOSE
Critical case	Permits logical generalization and maximum application of information to other cases.
Theory-based	Finding examples of a theoretical construct and thereby elaborate and examine it.
Confirming and disconfirming cases	Elaborate initial analysis, seeking exceptions, looking for variations.
Extreme or deviant case	Learning from highly unusual manifestations of the phenomenon of interest.
Typical case	Illustrate or highlight what is typical, normal, average.
Intensity	Information-rich cases that manifest the phenomenon intensely, but not extremely.
Criterion	All cases that meet some criterion; useful for quality assurance.
Convenience	Saves time, money and effort, but at expense of information and credibility.

Adapted from Patton [2002]

In other words the researcher is looking for the particularly good story that illuminates the questions under study. An example of critical case study aimed at theory building is offered by Mukhopadhyay, Kekre, and Kalathur [1995] who estimate the dollar benefits of improved information exchanges between Chrysler Corporation and its suppliers that resulted from using EDI for a ten-year period.

Theory Based Sampling

Theory-based sampling occurs when sampling for information in a focused manner, based on a priori theory that is being evaluated and/or modeled. In a hypothetical study, a researcher may wonder about the relationship between trust and virtual team success. She would therefore specifically gather interview data that might confirm or disconfirm the presence of such relationship and characterize its form. In this sense, confirming and disconfirming cases are sampling strategies in which data is sought that will support or challenge the investigator’s understanding of the topic of study. Patton [1990] calls this a process of “elaborating and deepening initial analysis, seeking exceptions, testing variation” (p.183).

Extreme or Deviant Case Sampling

The extreme or deviant case sampling strategy involves selecting one or more cases that are information rich because they are unusual or special in some way, such as outstanding successes or notable failures. In the IS field, Montealegre [1997] studied an extreme case, an agro-industrial organization within a less-developed country, to analyze the interaction between IT and the social/organizational setting in which it is being implemented. A Guatemalan firm was chosen since this country presents the greatest dependence of subordinates on bosses (power distance), the most intolerance to ambiguity, and the highest degree of collectivism among 53 less-developed nations.

Typical Case Sampling

Extreme cases are in sharp contrast with the typical case sampling strategy where the site is specifically selected because it is not in any major way atypical, extreme, deviant or intensely unusual.

Intensity Sampling

For its part, intensity sampling involves the same logic as extreme case sampling but with less emphasis on the extremes. An intensity sample consists of information-rich cases that manifest the phenomenon of interest intensely (but not extremely). Extreme or deviant cases may be so unusual as to distort the manifestation of the phenomenon of interest. In short, using the logic of intensity sampling, one seeks excellent or rich examples of the phenomenon of interest, but not highly unusual cases.

Criterion Sampling

The logic of criterion sampling is to review and study cases that meet some predetermined criterion of importance. This strategy can add an important qualitative component to a quantitative analysis of an information system. All cases in the data system that exhibit certain pre-determined criterion characteristics are routinely identified for in-depth, qualitative analysis. Criterion sampling also can be used to identify cases from standardized questionnaires for in-depth follow-up; for example, all respondents to a survey who report having experienced computer anxiety. This strategy can only be used where respondents willingly supplied contact information.

Sampling by Convenience

Lastly, in the strategy of sampling by convenience, the researcher does what is fast and convenient. Patton [2002] states that this strategy is probably the most common sampling strategy, and the least desirable. Too often, case study investigators think that because the sample size they can study will be too small to permit generalizations, it does not matter how cases are picked. Therefore, they might as well pick ones that are easy to access and inexpensive to study. We concur with Patton [2002] that while convenience and cost are real considerations, they should be the last factors to be taken into account after deliberating strategically on how to obtain the most information of greatest utility from the limited number of cases to be sampled.

Use of a Case Study Protocol

Reliability should be considered an important issue in positivist case research [Yin, 2003]. The goal of reliability is to minimize the errors and biases in a study. The general way to achieve reliability is to conduct the research so that another investigator could repeat the procedures and arrive at the same conclusions. One prerequisite for allowing other investigators to repeat an earlier case study is the need to document the procedures followed in the earlier case. Yin [2003] proposes to create a case study protocol to increase reliability.

A case study protocol contains more than the interview or survey instruments, it should also contain procedures and general rules that should be followed in using the instruments and it must be created prior to the data collection phase. It is essential in a multiple-case study, and desirable in a single-case study. A protocol is not a questionnaire (posing questions to interviewees) but represents the investigator's own agenda in pursuing the line of inquiry for the case study. In other words, the "respondent" for the case study protocol is the investigator, addressing research questions and following a line of inquiry by having collected data and triangulated a variety of evidence [Yin, 1999]. As shown in Figure 4, a typical case protocol should contain four components.

1. An overview of the case study project (objectives, issues, topics being investigated)
2. Field procedures (credentials and access to sites, sources of information)
3. Interview guides and/or survey instruments
4. A guide for case study report (outline, format for the narrative)

Figure 4. Main Components of a Case Study Protocol

1. The overview should communicate to the reader the general topic of inquiry and the purpose of the case study. This key information is often provided in the introduction section of most scientific papers, as in the two illustrative studies considered here.

2. Field procedures mostly involve data collection issues and must be properly designed. The investigator does not control the data collection environment [Yin, 2003] as in other research strategies; hence procedures become all the more important. Gaining access to the subject organization, having sufficient resources while in the field, clearly scheduling data collection activities, and providing for unanticipated events, must all be planned for. In the past, field procedures were poorly documented in IS case research, making external reviewers suspicious of the reliability of the case study. Recently, however, researchers found new ways of providing key information regarding field procedures. For example, Keil presents a schematic diagram of the research design, showing the chronology of the CONFIG project, along with separate timelines indicating when various types of data were generated or collected in relation to the history of the project.

3. The third component of the case protocol is the interview guides that contain the specific issues to be discussed with the respondents, and questions to be kept in mind during each interview. In both illustrative studies, interview guides were developed and were used during each interview. In most case studies, the specific list of questions depends on several factors such as the individual's position in the organization and his/her affiliation with the project.

4. Finally, the guide for the case study report is generally missing from most case study plans [Yin, 2003]. It is essential to plan this report as the case develops. This should facilitate the collection of relevant data, in an appropriate format, and will reduce the possibility that a return visit to the site will be necessary [Yin, 2003]. It is also important to have the final version of the case report reviewed, not just by peers, but also by the participants and informants in the case [Yin, 2003]. This procedure has been identified as a way of corroborating the essential facts and evidence presented in the case report [Schatzman and Strauss, 1973]. This practice was followed by Paré and Elam as well as by Keil.

STAGE 2: CONDUCT OF THE CASE STUDY

Data Collection Methods

Case study research typically combines multiple data collection methods. Collecting different types of data by different methods from different sources produces a wider scope of coverage and may result in a fuller picture of the phenomena under study than would be achieved otherwise [Bonoma, 1985]. Yin [2003] identifies six sources of qualitative evidence in case research: documentation, archival records, interviews, direct observation, participant observation, physical artifacts. In fact, the more all of these techniques are used in the same study, the stronger the case study evidence will be [Yin, 1999].

Table 3 enumerates the main types of evidence and their strengths and weaknesses. Documents can be letters, memoranda, agendas, administrative documents, newspaper articles, or any document that is germane to the investigation. For example, Keil consulted several documents including design-team minutes, cost/benefit analyses, and internal reports concerning barriers to. Similarly, all documents relevant to Paré and Elam's study, including organizational charts, annual reports, special reports and/or administrative documents, newsletters and other internal publications, user manuals and/or training material, and software vendor's marketing kits, were collected and analyzed. Archival documents can be service documents, organizational records, lists of names, survey data, and other such records [Yin, 2003]. The investigator must be careful in evaluating the accuracy of the records before using them. In one of their three cases, Paré and Elam read a series of three scientific papers which were recently published by two of the key actors involved in the IT implementation process. These archival records presented the results of a post-audit evaluation effort which took place before, during and after an anticipated four-day system failure. As another example, Keil was given access to historical system usage reports.

Table 3. Sources of Evidence in Case Research: Strengths and Weaknesses

SOURCE OF EVIDENCE	STRENGTHS	WEAKNESSES
Documentation	Stable—can be reviewed repeatedly Unobtrusive—not created as a result of the case study Exact—contains exact names, references, and details of an event Broad coverage—long span of time, many events, and many settings	Retrievability—can be low Biased selectivity, if collection is incomplete Reporting bias—reflects (unknown) bias of author Access—may be deliberately blocked
Archival records	[same as above for documentation] precise and quantitative	[same as above for documentation] accessibility due to privacy concerns
Interviews	Targeted—focuses directly on case study topic Insightful—provides perceived causal inferences	Bias due to poorly constructed questions Response bias Inaccuracies due to poor recall Reflexivity—interviewee gives what interviewer wants to hear
Direct observations	Reality—covers events in real time Contextual—covers context of event	Time consuming Selectivity—unless broad coverage Reflexivity—event may proceed differently because it is being observed
Participant observation	[same as above for direct observations] insightful into interpersonal behavior and motives	[same as above for direct observations] bias due to investigator's manipulation of events
Physical artifacts	insightful into cultural features insightful into technical operations	selectivity availability

Adapted from Yin [2003]

Primary Data Collection Method: Interviews

Case data are primarily collected through interviews. As stressed by Kaplan and Maxwell [1994], the primary goal of interviews is to elicit the respondent's views and experiences in his or her own terms, rather than to collect data that are simply a choice among pre-established response categories. As expected, interview data were collected in both illustrative studies. Keil conducted 197 face-to-face and phone interviews with 111 individuals over an 11-month period while Paré and Elam conducted a total of 95 interviews over a period of six months. For reliability purposes, Keil also provided an indication of the number of interviewees by job function.

Common questions about doing interviews are who to interview and how many interviews to conduct. The optimal sampling strategy in case research is complex. Fundamentally, the choice of the unit of analysis and the overall purpose of the case study project should guide sampling decisions. The studies by Keil and Paré and Elam are good cases in point. Another good example of this principle is offered by Stoddard and Jarvenpaa [1995] who adopted a multiple-case design to explore how and why different change management tactics were used in reengineering initiatives. Those initiatives, which could be one project or a set of interrelated projects, were the unit of analysis.

In selecting interviewees, case researchers must ensure that the sampling strategy is consistent with the purpose of the inquiry. To help IS researchers make informed decisions, Table 4 shows some of the most common informants sampling strategies suggested by Patton [2002].

Maximum Variation Sampling. Occurs when an investigator seeks to obtain the broadest range of information and perspectives on the subject of study. Guba and Lincoln [1989] claim this strategy is preferred for qualitative inquiry. By looking for this broad range of perspectives, the case researcher is purposefully challenging her preconceived (and developing) understanding of the phenomenon under study. Presumably, the maximum variation strategy was adopted by both Keil and Paré and Elam.

Table 4. Sampling Strategies for Selecting Informants

INFORMANT SAMPLING STRATEGY	PURPOSE
Maximum variation	Documents diverse variations and identifies important common patterns.
Homogeneous	Focuses, reduces, simplifies; facilitates group interviewing.
Snowball or chain	Identifies cases of interest from people who know people who know what cases are information-rich.
Purposeful	Select information-rich cases strategically and purposefully; selected type and number of cases selected depends on study purpose and resources.
<i>Opportunistic or emergent</i>	<i>Following new leads during fieldwork; taking advantage of the unexpected; flexibility.</i>

Adapted from Patton [2002]

Homogeneous Sample. If practical constraints preclude the use of the maximum variation strategy, the investigator might defend the use of a more homogeneous sample on the basis of seeking to understand a particular group of individuals well.

Snowball or Chain Sampling. In snowball or chain sampling, the investigator identifies, in whatever way they can, a few members of the group (e.g., system users) they wish to study. These members are used to identify others, and they in turn others. The process continues until the point of redundancy is achieved [Lincoln and Guba, 1985]. Not only does this technique provide more convincing evidence of the credibility of developed theory, but it also allows answering the question, When can I stop sampling?

Purposeful or Opportunistic Sampling. Finally, case research often involves on-the-spot decisions about sampling to take advantage of new opportunities during actual data collection [Eisenhardt, 1989]. During fieldwork, it is almost impossible to observe everything. Decisions must be made about what activities to observe, which people to observe and interview, and when to collect data. These decisions cannot all be made in advance. Purposeful sampling *strategies* provide direction for sampling but often depend on some knowledge of the setting being studied. In contrast, opportunistic, emergent sampling takes advantage of whatever unfolds as it unfolds [Patton, 2002].

Once the question of who to interview is solved, researchers must decide what type(s) of interviews must be conducted. Most commonly, case interviews are semi-structured in nature [Yin, 2003]. Semi-structured interviews are used when the researcher knows most of the questions to ask but cannot predict the answers. It is useful because this technique ensures that the researcher will obtain all information required, while at the same time gives the participant freedom to respond and illustrate concepts. Researchers will prefer conducting unstructured interviews when they know very little about the topic and are learning about it as the interview progresses and as they interview subsequent participants. Basically, the researcher does not use a series of prepared questions to ask because s/he does not know what to ask or even where to start. A third and final option for researchers is to conduct structured interviews. In structured interviewing, the researcher asks all respondents the same series of pre-established questions with a limited set of response categories. There is generally little room for variation in responses and the researcher records the responses according to a coding scheme that is already established. This kind of interview often elicits rational responses, but it usually overlooks or inadequately assesses the emotional dimension.

For an extended discussion on the principles of interview techniques, we recommend the work of Morse and Field [1995], Fontana and Frey [2000], and Miller and Crabtree [2000].

Other Data Collection Methods

Following through with data collection methods, direct observation occurs when a field visit is conducted during the case study. Observation could be as simple as casual data collection activities, or formal protocols to measure and record behaviors. Reliability is enhanced when more than one observer is involved in the task. Observation in qualitative studies produces detailed descriptive accounts of what was going on. Such observation is often crucial to the assessment of a system. For example, in Paré and Elam, observation took place during several training sessions and meetings involving IT implementation project team members, user representatives, and external parties. Direct observation of a few clinicians using the different computer-based information systems was also possible in all three organizational units. Detailed notes were taken during all observations to capture the researchers' impressions and insights. Keil also observed and took notes during several meetings that took place involving users, developers, and managers. Participant-observation makes the researcher into an active participant in the events being studied. This phenomenon often occurs in studies of system development. The technique provides some unusual opportunities for collecting data, but could face some major problems as well. The researcher could well alter the course of events as part of the design team, which may not be helpful to the study.

Physical artifacts can be tools, instruments, computer outputs, emails, or some other physical evidence that may be collected during the study as part of a field visit. The perspective of the researcher can be broadened as a result of the discovery. For instance, Keil collected 275 problem reports filled out by users. These reports were used to corroborate qualitative evidence about system resistance.

Data Triangulation

It is also important to keep in mind that not all sources of information are relevant for all case studies [Yin, 2003; Stake, 1995]. The investigator should be capable of dealing with all of them,

should it be necessary, but each case will present different opportunities for data collection. However, problems of construct validity can be addressed using multiple sources of information, because the multiple sources of evidence essentially provide multiple measures of the same phenomenon. The development of converging lines of inquiry in this manner is better known as "triangulation." Triangulation is generally considered a process of using multiple perceptions to clarify meaning, verifying the repeatability of an observation or interpretation [Stake, 2000]. But, acknowledging that no observations or interpretations are perfectly repeatable, triangulation also serves to clarify meaning by identifying different ways the phenomenon is being seen [Flick, 1998; Silverman, 2000].

For example, the archival documents collected in Paré and Elam provided precious quantitative information which was compared with the responses of the interviewees regarding the value of the electronic charting system over the handwritten method. Survey questionnaires were also compared to qualitative evidence regarding the implementation context, the effectiveness of the implementor's strategies and tactics, and the extent of project implementation success. Similarly, Keil used both objective system usage data and the subjective opinions of individuals to offer confirmatory evidence of project escalation.

Theoretical Saturation

In light of the above discussion, one might deduce that, to be considered as an exemplar or to make a valuable theoretical contribution, a case study requires a highly intensive data collection process which takes place over several months. While we believe the research questions posed by Keil and Paré and Elam required such intensive protocol, we do not posit that all positivist case studies require this type or level of investment. In our view, the number of interviews and the "length of stay" in the field are not appropriate indicators of the quality of a case study. Rather, in exploratory as well as in explanatory case study research, data collection must go on until theoretical saturation [Glaser and Strauss, 1967] is reached; namely, when additional qualitative data no longer contributes to anything new about a concept, a construct, or a relationship between constructs. For example, in a case study of the development of inter-organizational information systems (IOISs) in the aircraft part industry, Choudhury [1997] conducted 13 interviews with key informants involved in the strategic alliance. Albeit, at first glance the number of interviews stemming from the qualitative observations may seem small, they were, however, sufficient to develop a set of theoretical propositions about a specific issue, namely, when a firm will choose a particular IOIS and whether a cooperative or a competitive approach will be used.

Although not all case studies may require a highly-intensive data collection process, case study investigators need to be familiar with every technique and should not favor one over the other. The need for such diversity of skills is frequently overlooked by less experienced investigators, who may incorrectly assume that undertaking case studies is mainly a matter of "living in the field," "telling it like it is," and avoiding numeric data. In fact, a well-executed regression analysis might even be part of a case study [Yin, 1999]. For example, a case study of a system implementation in an organization might include both a quantitative analysis of the users' attitudes toward the system and a qualitative analysis of the implementation strategy in place, to draw conclusions about the success of the project. In this fictive example, the project would be the "case," and conclusions drawn about it would still reflect a single data point; the users would represent a lesser or embedded unit of analysis.

STAGE 3: ANALYSIS OF THE CASE STUDY EVIDENCE

Case studies tend to produce large amounts of data that are not readily amenable to mechanical manipulation, analysis, and data reduction [Yin, 2003]. Therefore, the basic goal of qualitative data analysis is understanding, i.e., the search for coherence and order [Kaplan and Maxwell, 1994]. Inspired by the work of Miles and Huberman [1994], we divide the data analysis stage into three distinct stages, namely, "Early Steps in Data Analysis," "Within-Case Analysis," and "Cross-Case Analysis." Next, some well-known analytical techniques associated with each of these stages are examined.

Early Steps in Data Analysis

As stressed by Eisenhardt [1989], qualitative data analysis is both the most difficult and the least codified part of the process. Miles and Huberman [1994] proposed a series of methods to help the fieldwork cycle back and forth between thinking about the existing data and generating strategies for collecting new, often better, data. As illustrated in the study by Paré and Elam, field notes and reflective remarks (see earlier section on case study protocol) can be used to help researchers identify themes, develop categories, and explore similarities and differences in the data, and relationships among them. Further, adjustments to the data collection methods and strategy can be facilitated through these two techniques. In Paré and Elam’s study, these adjustments included adding questions to interview guides, reviewing more data sources, observing meetings when the opportunity arose to do so, and interviewing previously unknown individuals who were identified during the study as important actors in the IT implementation projects.

Two other techniques, coding and the development of a case study database, can support case researchers during preliminary analysis steps. Each of these techniques are discussed next.

Coding

In qualitative research, coding is a tool to support researchers during early analysis. Codes are especially useful tools for data reduction. Listing the coding scheme in an appendix helps to facilitate replication of a given study and allows the reader to see the logical link between the theoretical model and the codes. As shown in Table 5, several approaches can be use to create a coding scheme² to serve as a template for organizing the data. On one hand, the researcher or research team can rely on predefined or a priori codes, generally based on understandings from prior research or theoretical considerations. Keil followed this approach. On the other hand, the researchers can develop codes only after some initial exploration of the data has taken place, using an immersion or editing organizing style [Crabtree and Miller, 2000]. A more common, intermediate approach, which was used by Paré and Elam, is when some initial codes are adopted and others are added during the analysis process.

Table 5. Key Coding Issues

Possible approaches to create a coding scheme	Researcher relies on predefined or a priori codes, generally based on understandings from prior research or theoretical considerations
	Researcher develops codes only after some initial exploration of the data has taken place, using an immersion or editing organizing style
	Researcher adopts some initial codes and adds or modifies a few others during the analysis process
Optimal qualities of a coding scheme	Detailed description of each code
	Inclusion and exclusion criteria
	Examples of real text (verbatim) for each code

Adapted from MacQueen et al.[1998]

Keil provides a good example of coding in qualitative research. As a first step in determining whether CONFIG was indeed a case of project escalation, transcripts of interviews and meetings were used to create a detailed history of the project in narrative form. That history was then summarized in the form of a table showing the key project information that was available to decision makers and the resulting decisions or actions that were taken during the course of the project. After validating this table with several individuals who were familiar with the project’s history, the project information available to decision makers was coded as positive, negative, or ambiguous. To avoid researcher bias, the project information was shown to two IS doctoral students with project management experience who agreed to serve as independent raters. For

² Also called a “code manual”

each project information field, the raters were asked to code the information as either purely positive or purely negative. As a measure of interrater agreement, a Kappa coefficient of 0.72 was obtained, indicating that the strength of agreement between the two raters was substantial [Landis and Koch, 1977]. The results of this analysis showed that the majority of the project information was negative, thereby indicating that the CONFIG project satisfied the definition of project escalation (the answer to the first research question).

Paré and Elam offer another good illustration of the coding process. To be consistent with their conceptual framework, the coding scheme developed in their study was divided into three broad categories:

1. contextual conditions,
2. implementation tactics, and
3. implementation success criteria.

As expected in positivist research, specific rules were established to ensure the reliability of the coding scheme and the overall quality of the coding process. First, an initial list of codes was developed based on the conceptual framework. The original list was then used to codify and extract the data from the transcripts associated with case one. As a result of this process, the researchers found the need to add a few codes. Once all transcripts associated with the first project were codified, two coders were selected to determine inter-rater reliability. After an initial briefing by the researchers, each coder was instructed to read coding instructions to become acquainted with the coding scheme. Each coder was asked to assign codes to a series of segments representing contextual conditions, implementation tactics and implementation success criteria. The selected segments were randomly selected from all the segments included in the same category. Once each coder completed the task, the researchers' original coding was supplied, and each coder was instructed to discuss any differences with the researchers. On a pairwise basis, the coders' responses and the researchers' codes were compared. Results revealed a fairly strong agreement (Kappa coefficients >0.8) among the coders.

As mentioned earlier, although most coding categories may be drawn from existing theory or prior knowledge of the setting or system, others might be developed inductively by the evaluator during the analysis, and still others taken from the conceptual structure of the people studied. For this reason, pattern or inferential codes were identified and defined during data analysis in Paré and Elam. Pattern codes are ones that identify an emergent theme, pattern, or explanation that the site suggests to the researcher [Miles and Huberman, 1994]. Pattern coding is, for qualitative researchers, an analogue to the cluster-analytic and factor-analytic devices used in statistical analysis. Pattern coding reduces large amounts of data into a smaller number of analytic units and helps researchers build a cognitive map, an evolving schema for understanding what is happening locally. In Paré and Elam, these codes reflected perceived relationships among constructs included in the conceptual framework such as the influence of contextual conditions (e.g., beliefs of key actors) on the choice of a particular implementation tactic or the effect of a coping tactic (e.g., incremental implementation) on a contextual condition (e.g., users' attitudes) and the extent of success of a project.

In short, the coding scheme represents a key data management tool for researchers; it is used to organize segments of similar or related text for ease in interpretation and to search for confirming/disconfirming evidence of these interpretations. How detailed the coding scheme becomes is often a function of where the researcher is in the research process [Crabtree and Miller, 2000]. While preliminary studies may require a much broader net to catch alternate explanations, a study designed to enlighten several specific hypotheses emerging from earlier research may need more specific and narrow codes. As shown in Table 5, MacQueen et al. [1998] suggest that a good coding scheme should include specific elements of information. If a theme is particularly abstract, it is suggested that the researcher also provide examples of the theme's boundaries and even some cases that are closely related but not included within the theme.

For more information on how to construct and use codes (and coding schemes) in case research, we recommend Tesch [1990], Miles and Huberman [1994], and Ryan and Bernard [2000]. Coding itself can be performed with the help of a specialized computer program which makes the sorting, cutting, and pasting operations more efficient. Here, we refer the reader to Weitzman [2000] for an extensive, recent discussion on what software can and cannot do in case research.

Development of a Case Study Database

Another initial step consists in presenting the case study evidence (raw data) separately from the investigator's interpretations of the evidence. This separation is common in quantitative studies, in which results and data tables are presented before interpretation takes place. Unfortunately for case studies, the traditional mode of presentation, a narrative, does not typically distinguish between evidence and interpretation – again leading to a frequent complaint that case study investigators are presenting only the evidence that supports their interpretations.

The desired remedy is to construct a case study database analogous to the “raw data” in a laboratory study or survey. Because the case study evidence may be qualitative or quantitative, the database may be diverse, containing in part the same kind of raw data as in a survey but also containing narrations and word tables reflecting the qualitative evidence. The database can be structured by following the line of inquiry or research questions in the case study protocol, so that evidence bearing on each question is assembled in the same place. The final case study should then draw from this database, presenting critical portions of it but citing the data as findings and not interpretation [Yin, 1999].

Yin [2003] suggests that the development of a case study database be described in terms of four components:

- field notes: case study notes which result of interviews, observations, or document analysis
- documents: Case study documents along with an annotated bibliography
- database: Tabular materials collected from the site or created by the researchers
- narratives: Narratives produced by the case study researchers during the analysis phase

Field Notes

Much information in case research is often revealed in casual conversation and needs to be recorded in the form of field notes. Van Maanen [1988] describes field notes as an ongoing stream-of-consciousness commentary about what is happening in the research. Researchers may write brief notes during the course of the day and then, later, dictate summaries, expanding on those jottings. Field notes should be as complete as possible and include not only verbal information but nonverbal communication and descriptions of the context of the conversations. By reviewing field notes frequently, Paré and Elam immediately identified important issues or conflicting answers provided by different individuals. Selected key informants were interviewed again to clear up any questions and to provide any additional information that was missing. The field notes also were useful in revising the interview guides as the study progressed. Keil also took copious notes during the interviews and additional observations were noted immediately after each interview was concluded.

Documents

Many documents relevant to a case study will be collected during the course of a study. These documents may be of varying importance to the database, and the researcher may want to establish a primary file and a secondary file for such documents. Again, the main objective is to make the documents readily retrievable for later inspection. In those instances when the

documents are relevant to specific interviews, one additional cross-reference is for the field notes to cite the document [Yin, 2003].

Database

The database may consist of tabular materials, either collected from the site being studied or created by the research team. The materials may include survey and other quantitative data. For instance, in the study by Paré and Elam quantitative data were used primarily to support the theoretical arguments developed through analysis of qualitative data. Survey instruments were developed to collect data that would either confirm or refute their interpretation of qualitative data. Respondents were the identified key informants; namely, the individuals actively involved in the three CPR implementation projects who had been interviewed earlier. To ensure that the responses were valid, the surveys were administered toward the end of data collection, although complete analysis of the interview data was not complete. Descriptive statistics associated with each survey were stored as part of the case study database.

Narratives

Certain types of narratives, produced by the case study investigator, also may be considered a formal part of the database and not part of the final case study report. A common form of narratives is called reflective remarks. These remarks are directly entered into the interview transcripts within brackets. They are ways of getting ideas down on paper and of using writing as a way to facilitate reflection and analytic insight. They are a way to convert the researcher's perceptions and thoughts into a visible form that allows reflection [Strauss and Corbin, 1990; Miles and Huberman, 1994]. In short, reflective remarks help researchers start thinking, making deeper and more general sense of what is happening, and explaining things in a conceptually coherent way. Examples of reflective remarks from Paré and Elam are presented in Table 6.

Table 6. Examples of Reflective Remarks (Adapted from [Paré and Elam, 1997])

EXCERPTS OF TRANSCRIPTS	REFLECTIVE REMARKS
Project champion : <i>"The residents always use the system because it helps them a lot. The attendings, on the other hand, get the residents to do everything. If they need a lab result they have their resident to do it. When the system came online it was the attendings' responsibility to get the lab results using their confidential access codes. Of course, we got some resistance at the beginning. Some gave their code to their residents."</i>	[Effects of hierarchy on system acceptance and use.]
Project champion : <i>"The people in the ICU didn't adapt easily to the changes compared to the nurses in the resus unit. In the ICU, nurses know how their day will go in advance, everything is a routine and the computer was a disruption to them. While in the resus, work is chaotic, constant disruption. You never know what's going to happen in the next five minutes. So, for them, the introduction of the system did not have the same meaning and they did not offer resistance."</i>	[Impact of work environment and structural conditions on resistance to change.]
Systems manager : <i>"We have always had a very close relationship with our vendor. It is a bit less close now that there are 41 other sites as opposed to us being their third contract. But still on new applications, our input is always listened to."</i>	[Advantages associated with being a "Beta" site.]

Within-Case Analysis

As stressed by Eisenhardt [1989], a key step in building theory from case research is within-case analysis. The analytical techniques usually adopted during this phase include the adoption of a dominant mode of data analysis, the use of visual displays, and the review of case reports by key informants. Each of these aspects will be discussed below.

Dominant Mode Of Analysis

How data are analyzed and interpreted represents another key question in positivist case study research. Yin [2003] suggests that every case investigation should have a general analytic strategy, so as to guide the decision regarding what will be analyzed and for what reason. He presents three possible analytic strategies: (1) pattern-matching, (2) explanation-building, and (3) time-series analysis. In this article, we will limit our discussion to the two most widely adopted strategies, pattern matching and explanation building. Detailed guidance for time-series analysis, see specialized works such as [Kratochwill, 1978]. Nault and Dexter [1995] offer a good illustration of how time-series analysis can be applied in IS positivist case research.

Pattern-Matching

Pattern matching is considered to be one of the most desirable strategies for case analysis [Trochim, 1989]. This type of logic compares an empirical pattern with a predicted one. Internal validity is enhanced when the patterns coincide. Yin [2003] recommends using rival explanations as pattern-matching when independent variables are involved. To do so requires developing rival theoretical propositions, but the overall concern remains the degree to which a pattern matches the predicted one. The approach followed by Keil is a variation of the pattern-matching strategy. As a first step, the CONFIG case was compared against the array of factors included in the taxonomy and noting which of these seemed to be present in the case. The next step involved the identification of additional factors that were present in the case study but which were not widely discussed in the escalation literature. The entire analysis process was highly iterative. Before a factor was identified as a possible cause of the escalation, a considerable amount of cross-checking of interview transcripts was performed to verify that at least two or more sources of evidence supported that factor.

Explanation Building

Explanation-building, is also considered a form of pattern-matching in which the analysis of the case study is carried out by building an explanation of the case. This form of analysis is most useful in explanatory case studies, but it is possible to use it for exploratory cases as in the study conducted by Paré and Elam. The strategy is to develop a case description, which would be a framework for organizing the case study. To understand the how and why associated with each IT implementation project and hence to provide answers to their research questions, the authors established a logical chain of evidence [Yin, 2003]. This chain of evidence was built in several steps. The first task was to identify the challenges encountered during the implementation process. Challenges were identified through an in-depth analysis of the contextual conditions surrounding the implementation project. In turn, for each challenge we described the tactics adopted to cope with the problems encountered, anticipated or not. The extent to which each challenge was overcome was explained by

1. providing evidence of the effectiveness of each coping tactic,
2. identifying and explaining how certain contextual conditions enhanced the effectiveness of coping tactics and
3. explaining how other conditions prevented the adoption of tactics by acting as compensatory mechanisms.

As recommended by Yin [2003], each chain of evidence was established by having sufficient citations in the case report.

Visual Displays

Visual displays are another important part of qualitative analysis. Displaying data is a powerful means for discovering connections between coded segments [Crabtree and Miller, 2000]. Miles and Huberman [1994] present in great and helpful detail, a cornucopia of possible displaying matrices that can be created from textual data based on sorted codes. For example, besides

indicating who has formal authority over whom and what the role names are among actors, context charts developed by Paré and Elam were useful in telling researchers about the quality of the working relationships between actors (or groups of actors) involved in each IT implementation project. These charts showed who the *key actors* were as well as the role played by every individual. Figures and charts also served two other key functions, namely, data reduction and presentation of data, allowing data to be grasped as a whole [Miles and Huberman, 1994]. For example, checklist matrices were used in Paré and Elam to synthesize the overall evaluation (qualitative and quantitative) of 1) the implementation situation or context and 2) the extent of implementation success. A short glance at these tables allowed the researchers to identify clearly the challenges that were encountered over the course of each project and the extent of project success.

Keil also adopted several display tools to achieve the goals of data reduction and presentation. As a first example, the author presents a figure that displays the cascading sequence of events that set the stage for project failure in the case of CONFIG. This figure not only presents the sequence of key events in the case (whatandhow), but also shows whythings happened. Similar displays could be used in future case studies of system implementation. As another example, the mapping of CONFIG project information was inspired by the work of Newman and Robey [1992] who proposed a similar type of process mapping for analyzing the social character of user-analyst relationships. A detailed chronology of the project was reconstructed using meeting minutes as a foundation. These data were supplemented by examination of agenda items, priority lists, and presentation slides associated with each meeting. The resulting chronology was finally validated by several individuals who were familiar with the project's history. The mapping display helps convince the reader that the CONFIG project satisfied the definition of project escalation. It is interesting to note that the information displayed in the mapping figure was complemented by a matrix [Miles and Huberman, 1994] containing excerpts and coding information from the case study (also shown in an appendix of that paper).

Causal Map Networks

Another popular form of displays is called causal maps or causal networks. These maps do not display the raw data but rather the independent and dependent variables or constructs in a case study and the relationships among them [Miles and Huberman, 1994]. The plot of these relationships is directional, rather than solely correlational. It is assumed that some factors exert an influence on others: X brings Y into being or makes Y larger or smaller. A causal map or network, to be useful, must have associated analytic text describing the meaning of the connections among factors [Miles and Huberman, 1994]. Basically, it must be intended from the beginning of data collection to produce a causal map, so that successive rounds of data collection, interim analysis of all the data, and iterations of the map itself all build toward that end. But there exists two different ways of approaching the task, which can be loosely labeled "inductive" and "deductive." In the inductive approach, the researcher discovers recurrent phenomena in the stream of local experience and finds recurrent relations among them. These working hypotheses or propositions are modified and refined progressively in the next fieldwork pass. The local causal map emerges piecemeal and inductively. In the deductive strategy, the researcher has some orienting constructs and propositions to test or observe in the field. For example, Keil identified a set of factors (project, psychological, social, and organizational) which formed a model of IT project escalation based on the literature. These factors were operationalized and then matched with data from a case study. The resulting causal map is presented in Figure 7 of Keil's article.

Project Reviews

When using this strategy, the researcher solicits research subject or participant views of the credibility of interpretations and findings [Yin, 2003; Devers, 1999; Patton, 1990]. It is a procedure used to corroborate the essential facts and evidence presented in the case report [Schatzman and Strauss, 1973]. Notwithstanding its importance, this practice was reported in only 15% of all case articles surveyed in Dubé and Paré [2003]. In Paré and Elam's study, one site analysis

meeting for each case took place toward or at the end of data analysis. Participants in these meetings were those in a position to reflect on the case's big picture. Keil also validated his interpretation of the CONFIG project by gathering feedback from key informants. The adoption of this tactic is also illustrated in several other case studies including Goldstein [1990], Levine and Rossmore [1993], and Cavaye and Christiansen [1996].

Cross-Case Analysis

Coupled with within-case analysis is cross-case search for patterns. Why do cross-case analysis? One reason is to enhance generalizability. Although it is not argued that this goal is inappropriate for case study research, the question does not go away. Most qualitative researchers, especially in an applied field like ours, would like to know something about the relevance or applicability of their findings to other similar settings, to transcend "radical pluralism" [Firestone, 1993]. Multiple cases, when adequately sampled and analyzed carefully, can help researchers make sense beyond the reasonable question "Do these findings make sense beyond this specific case?" [Miles and Huberman, 1994]. A second, more fundamental reason for cross-case analysis is to deepen understanding and explanation. Glaser and Strauss [1970] argued for using "multiple comparison groups" to find out "under what sets of structural conditions [the] hypotheses are minimized and maximized." Last, multiple cases also help the researcher find negative cases to strengthen a theory. That process is much quicker and easier with multiple cases than with a single case [Glaser and Strauss, 1970].

Eisenhardt [1989] and Miles and Huberman [1994] proposed several tactics that may be applied to all types of case studies. Such a tactic is to select categories or dimensions, and then to look for within-group similarities coupled with intergroup differences. The research problem or the existing literature can suggest dimensions, or the researcher can simply choose some dimensions. As an example, Stoddard and Jarvenpaa [1995] analyzed the change tactics of three organizations' reengineering initiatives to understand whether and how revolutionary versus evolutionary change management tactics were used. Seven dimensions were extracted from the literature (e.g., leadership, employee involvement, communication) to contrast the change tactics for the revolutionary and evolutionary models. Data from the three cases were analyzed all at once. Tables were effectively used to compare the change tactics used for each initiative and summarize whether the use of revolutionary tactics decreased or increased during the initiatives' pilot and implementation phase from that of the design phase. One variation of this cross-case searching tactic consists of selecting pairs of cases and then listing similarities and differences between each pair. This tactic forces researchers to look for the subtle similarities and differences between cases. Another variation of this tactic is to divide the data by data source. For example, one researcher combs observational data, while another reviews interviews, and still another works with questionnaire evidence [Eisenhardt, 1989].

Paré and Elam, on the other hand, adopted a completely different approach in searching for cross-case patterns. As stressed earlier, the ultimate intent of that study was to gradually build a new theory of IT implementation. This iterative process started with the development and presentation of an initial set of theoretical propositions based on evidence from the first IT implementation project. The initial propositions then became a vehicle for generalizing to the other two projects. As a second step, the emergent propositions from the first project were systematically compared with evidence from the second project. The theoretical propositions were supported by the evidence, revised, or not supported for lack of sufficient evidence. As a third and final step, the process was repeated when refined theoretical propositions were systematically compared with evidence from the third project. Hence, contrary to the approach followed by Stoddard and Jarvenpaa [1995], data from the three cases were not analyzed simultaneously. Rather, the central idea was to iterate toward a theory that fit the data, where projects which supported the emergent theory enhanced confidence in its validity, while projects which did not support the theory often provided an opportunity to refine and extend the theoretical model [Eisenhardt, 1989].

In short, we do not posit that one approach for searching cross-case patterns is superior to or better than the other. In reality, the choice of a particular approach is often dictated by pragmatic constraints of time and resources. The idea behind the application of these tactics is to force investigators to go beyond initial impressions, especially through the use of structured and diverse lenses on the data. It should be noted that visual displays can also be extremely useful for the presentation of cross-case material [Miles and Huberman, 1994]. In short, cross-case searching tactics enhance the probability that the investigators will capture the novel findings which may exist in the data [Eisenhardt, 1989].

STAGE 4: WRITING UP THE CASE REPORT

The reporting aspect of a case study is perhaps most important from the user (reader) perspective. It is the contact point between the user and the researcher. A well-designed research project that is not well explained to the reader will cause the research report to fall into disuse. Drawing on and extending the work of Zeller [1987] and their own previous work, Lincoln and Guba [2002] describe and explicate four classes of criteria which address the goodness of case reports:

- resonance,
- rhetoric,
- empowerment, and
- applicability.

Each of these classes is examined in turn.

Resonance

By resonance, Lincoln and Guba mean the degree of fit, overlap, or reinforcement between the case study report as written and the basic belief system undergirding that alternative paradigm which the inquirer has chosen to follow. In the case where the alternative paradigm is positivism, for example, the case study report must at the very least

- demonstrate the objective reality constructed by the respondents in the inquiry;
- rely on *a priori* constructs, theories or meta-theories;
- pursue generalizability and the drawing of nomothetic conclusions; and,
- reflect the objectivity of the investigator in the scientific process.

Rhetorical Criteria

Rhetorical criteria refer to those relevant to assessing the form, structure, and presentational characteristics of the case study. Zeller [1987] attempted to develop four such criteria "imposed by the dictates of good writing" (pp.197-198).

1. First, a case study might be judged on the criterion of unity, which suggests that the components of a study are "well-organized" and "should advance some central idea" by means of the narrative structure.
2. The criterion of unity also encompasses structural characteristics such as coherence and corroboration. By coherence, Lincoln and Guba [2002] mean to assert that the case study must exhibit a unique internal consistency, logic, and harmony.
3. By corroboration, they mean that the evidence for assertions that are made and conclusions that are drawn must be internally substantiated and self-evident from the way in which data are displayed. In short, there ought not to be loose ends, stories left dangling, or characters who disappear from the cast.

4. The final rhetorical criterion is simplicity or clarity. A strength of the case study approach is its accessibility to many persons who could not comprehend a typical scientific technical report. Simplicity and clarity are achieved by the “careful construction of sentences (shunning inappropriate usage of the third person and passive voice), a thorough rigorous editing, and thorough avoidance of jargon or technical language” [Zeller, 1987: p.201].

Zeller contends that writing a case study that fulfills the requirements of rhetorical criteria demands craftsmanship. Writing, rewriting, and writing again and again are probably the only techniques for advancing the art of craftsmanship. But it is evident when we see it.

Empowerment Criteria

Empowerment criteria refer to those assessing the ability of the case study to evoke and facilitate action of the part of readers [Lincoln and Guba, 2002]. Such criteria include fairness, educativeness, and actionability, or the power of such an inquiry to enable those whom it affects directly or indirectly to take action on their circumstances or environments. For example, an inquiry might help an IT project champion whose major responsibilities are to actively and vigorously promote their personal vision for (1) deploying and using information technology and push the project over or around approval and implementation hurdles (2) to enable other project team members to understand better how users react to radical change. At the very least, empowerment implies consciousness-raising. Perhaps it means providing arguments that readers can use in their own situations should they attempt action based on the case report.

Applicability

Applicability refers to the extent to which the case study facilitates the drawing of inferences by the reader that may have applicability in his/her own context of situation. To make that judgment possible for a reader, a thick description is needed, not in the sense of long and detailed descriptions, although that may be necessary, but in the sense which Geertz [1973] uses the term, as making clear levels of meaning. Figure 6 presents the desired qualities of a case study report.

- Resonance criterion (degree of fit between the case study report as written and the set of beliefs undergirding the philosophical paradigm which the investigator has chosen to follow);
- Rhetorical criteria (unity, coherence, corroboration, simplicity and clarity);
- Empowerment criteria (fairness, educativeness, and actionability, i.e. the ability of the case study to evoke action on the part of readers);
- Applicability criterion (extent to which the case study facilitates the drawing of inferences by the reader).

Adapted from [Lincoln and Guba, 2002]

Figure 6. Qualities of a Case Study Report

Table 7 summarizes how the various concepts, techniques and tools drawn from the proposed methodology are applied in the two exploratory case studies examined in detail in the present article.

III. CONCLUDING REMARKS

As mentioned previously, it is clear that current research standards evolved and are more demanding for researchers than they were in the early 1980s. Today, IS case study research needs to be well documented as a process mainly to help

Table 7. Application of the Positivist Case Study Methodology in two IS Studies

STAGE	CONCEPTS, TECHNIQUES AND TOOLS	KEIL [1995]	PARÉ AND ELAM [1997]
1. Design of the case study	Research questions	Why, What	To what extent, How
	Prior theorizing	Existing typology of factors as a basis	Conceptual framework/teleology theory of change
	Unit of analysis	Events and decisions that occurred during project escalation	Events and decisions that occurred during implementation
	Number of cases	1	3
	Selection of cases	Critical case	Literal replication logic
	Case study protocol	Overview of project Diagram of design Interview protocol	Overview of project Interview protocol
2. Conduct of the case study	Qualitative data collection methods	Interviews Documents Observation Physical artefacts	Interviews Documents Archival documents Observation
	Quantitative evidence	System data usage	Survey data
	Sampling strategies for interviews	Maximum variation Snowball	Maximum variation Snowball
	Data triangulation	Yes	Yes
	Theoretical saturation	Yes	Yes
3. Analysis of the case study evidence	Field notes	Yes	Yes
	Reflective remarks	Yes	Yes
	Coding of raw data	Yes	Yes
	Case study data base	No mention	Yes
	Dominant mode of analysis	Variation of pattern-matching	Explanation building
	Visual display techniques	Cascading sequence of events and chronological mapping	Context charts and Checklist matrices
	Project reviews	Yes	Yes
	Cross-case analysis	N/A	Yes (iterative process)
4. Writing up the case study report	Resonance criteria	Fit with the positivist paradigm	Fit with the positivist paradigm
	Rhetoric criteria	Central idea articulated, coherence, corroboration, clarity	Central idea articulated, coherence, corroboration, clarity
	Empowerment	Evokes action on the part of readers	Evokes action on the part of readers
	Applicability	Practical insights	Practical insights

us learn [Dubé and Paré, 2003]. Purposes of auditing aside, we need to understand more clearly what is going on when we analyze data, to reflect, to refine our methods, and to make them more generally useable by others. This study showed that challenges or difficulties can emerge at almost every stage of the case study method. In any particular case study, some of these hurdles can be overcome, some cannot. It is thus important that IS case study investigators be aware of the potential consequences of or implications (both positive and negative) associated with the various design decisions that they make.

Contributions to the IS field from this article are fourfold.

- We offer a rigorous step-by-step methodology for developing theories and provide specific and detailed guidelines for IS researchers to follow in carrying out positivist exploratory case studies.

- We describe and explain the optimal qualities associated with several of the proposed concepts, techniques and tools.
- We illustrate how the methodology proposed here can be applied in IS research in order to contribute to the discovery of a number of new perspectives and empirical insights.
- We provide insights into the many choices that case researchers must make when adopting this methodology for exploratory purpose.

In short, we argue that applying a well-defined methodology along the lines described in this paper shall help to position case studies even more in the mainstream of IS research.

While several of the concepts and tools in the methodology proposed here might be relevant to all positivist case studies, some were specifically targeted at exploratory cases. For example, a clean theoretical slate represents a design criterion in exploratory case research only [Eisenhardt, 1989]. Explanatory cases, on the other hand, are suitable for doing causal studies, mainly to test theories. In this particular context, then, other criteria or concepts such as the use of rival theories and natural controls become relevant [Lee, 1989; Yin, 2003]. A methodology similar to the one presented here could then be developed for explanatory case studies. Similarly, since standards of quality vary with the assumptions of each philosophical tradition [Klein and Meyers, 1999; Anderson, Herriot and Hodgkinson, 2001; Jensen and Rodgers, 2001], it would appear both relevant and important to propose a scientific method or approach for conducting interpretive case study research in our field and describe the optimal qualities of the concepts, techniques, and tools associated with the methodology.

Despite the potential contributions of positivist case study research in our field, we still need to consider the overall demands of the approach on IS researchers. For instance, process research usually results in the collection of large amounts of data, vulnerable to subjective interpretation and surpassing human ability to compile. Because of the demands and problems encountered during qualitative research, researchers must possess great interest in and dedication to the object of research [Barley, 1990; Leonard-Barton, 1990]. While it is important to gain the trust and confidence of organizational members, it is also important, as positivist researchers, to remain sufficiently detached so as to be objective. Researchers should not underestimate the time and effort required to conduct these kinds of studies. Experience shows that investigators must often be willing to spend lunches, evenings, and weekends collecting data at the site. Despite these constraints, qualitative studies remain, we believe, the best approach available for studying complex phenomena like system design and implementation as well as several emerging IT management issues. The reward clearly appears to be a deeper and broader understanding of such phenomena and the ability to contribute significantly to cumulative knowledge in our field.

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REFERENCES

- Alavi, M. and P. Carlson (1992) "A Review of MIS Research and Disciplinary Development" *Journal of Management Information Systems* 8(4), pp.45-62.
- Anderson, J.G. and C.E. Aydin (1994) "Overview: Theoretical Perspectives and Methodologies for the Evaluation of Health Care Information Systems" in J.G. Anderson, C.E. Aydin, and S.J. Jay (eds.) *Evaluating Health Care Information Systems, Methods and Applications*, Thousand Oaks, CA: Sage Publications, pp.5-29.
- Anderson, N., P. Herriot and G.P. Hodgkinson (2001) "The Practitioner-Researcher Divide in Industrial, Work and Organizational (IWO) Psychology: Where are we now, and Where

- do we go from here?" *Journal of Occupational and Organizational Psychology* 74(4), pp.391-411.
- Barley, S.R. (1990) "The Alignment of Technology and Structure Through Roles and Networks" *Administrative Sciences Quarterly*, 35, pp.61-103.
- Barrett, M. and G. Walsham (1999) "Electronic Trading and Work Transformation in the London Insurance Market" *Information Systems Research* 10(1), pp.1-22.
- Benbasat, I., D.K. Goldstein and M. Mead (1987) "The Case Research Strategy in Studies of Information Systems" *MIS Quarterly* 11(3), pp.369-385.
- Bonoma, T.V. (1985) "Case Research in Marketing: Opportunities, Problems, and a Process" *Journal of Marketing Research*, 22, pp.199-208.
- Broadbent, M., P. Weill and D. St.Clair (1999) "The Implications of Information Technology Infrastructure for Business Process Redesign" *MIS Quarterly* 23(2), pp.159-182.
- Brockner, J. (1992) "The Escalation of Commitment to a Failing Course of Action: Toward Theoretical Progress" *Academy of Management Review* 17(1), pp.39-61.
- Brown, C.V. (1999) "Horizontal Mechanisms under Differing IS Organization Contexts" *MIS Quarterly* 23(3), pp.421-454.
- Caron, J.R., S.L. Jarvenpaa and D.B. Stoddard (1994) "Business Reengineering at CIGNA Corporation: Experiences and Lessons Learned From the First Five Years" *MIS Quarterly* 18(3), pp.233-250.
- Cavaye, A.L.M., and J.K. Christiansen (1996) "Understanding IS Implementation by Estimating Power of Subunits" *European Journal of Information Systems* 5(4), pp.222-232.
- Choudhury, V. (1997) "Strategic Choices in the Development of Interorganizational Information Systems" *Information Systems Research* 8(1), pp.1-24.
- Crabtree, B.F. and W.L. Miller, W.L. (2000) "Using Codes and Code Manuals" in *Doing Qualitative Research*, 2nd edition, Thousand Oaks: CA, Sage Publications.
- Cross, J., M.J. Earl and J.L. Sampler (1997) "Transformation of the IT Function at British Petroleum" *MIS Quarterly* 21(4), pp.401-423
- Devers, K.J. (1999) "How Will You Know "Good" Qualitative Research When We See It? Beginning the Dialogue in Health Services Research" *Health Services Research* 34(5), pp.1153-1188.
- Dubé, L. and G. Paré (2003) "Rigor in IS Positivist Case Research: Current Practices, Trends, and Recommendations" *MIS Quarterly* 27(4), pp.597-635.
- Eisenhardt, K.M. (1989) "Building Theories from Case Study Research" *Academy of Management Review* 14(4), pp.532-550.
- Feagin, J., A. Orum and G. Sjöberg (1991) *A Case for Case Study*, Chapel Hill, NC: University of North Carolina Press.
- Firestone, W.A. (1993) "Alternative Arguments for Generalizing from Data as Applied to Qualitative Research" *Educational Researcher* 22(4), pp.16-23.
- Flick, U. (1998) *An Introduction to Qualitative Research: Theory, Method and Applications*, London: UK, Sage Publications.

- Fontana, A. and J.H. Frey (2000) "The Interview: From Structured Questions to Negotiated Text" in N.K. Denzin and Y.S. Lincoln (eds.) *Handbook of Qualitative Research* (pp.645-672), second edition, Thousand Oaks: CA, Sage Publications.
- Geertz, C. (1973) "Thick Description: Toward an Interpretive Theory of Culture" in C. Geertz (ed.) *The Interpretation of Cultures* (pp.3-30), New York: NY, Basic Books.
- Glaser, B. and A.L. Strauss (1970) "Discovery of Substantive Theory" in W. Filstead (ed.) *Qualitative Methodology* (pp.288-297), Chicago: IL, Rand McNally.
- Glaser, B. and A. Strauss (1967) *The Discovery of Grounded Theory: Strategies of Qualitative Research*, London: UK, Wiedenfeld and Nicholson.
- Goldstein, D.K. (1990) "Information Support for Sales and Marketing" *Information & Management* 19(4), pp.257-268.
- Guba, E.G. and Y.S. Lincoln (1989) *Fourth Generation Evaluation*, Newbury Park: CA, Sage Publications.
- Guha, S. et al. (1997) "Business Process Change and Organizational Performance: Exploring the Antecedent Model" *Journal of MIS* 14(1), pp.119-154.
- Jensen, J.L. and R. Rodgers (2001) "Cumulating the Intellectual Gold of Case Study Research" *Public Administration Review* 61(2), pp.235-246.
- Kaplan, B. and J.A. Maxwell (1994) "Qualitative Research Methods for Evaluating Computer Information Systems," in Anderson, J.G., C.E. Aydin and S.J. Jay (eds.) *Evaluating Health Care Information Systems, Methods and Applications*, Thousand Oaks : CA, Sage Publications, pp.45-68.
- Keil, M. (1995) "Pulling the Plug: Software Project Management and the Problem of Project Escalation" *MIS Quarterly* 19(4), pp.421-447.
- Klein, H.K. and M.D. Myers (1999) "A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems" *MIS Quarterly* 23(1), pp.67-94.
- Kochen, M. (1985) "Are MIS Frameworks Premature?" *Journal of Management Information Systems* 2(3), pp.92-100.
- Kratochwill, T.R. (1978) *Single Subject Research*, New York: NY, Academic.
- Landis, J.R. and G.G. Koch (1977) "The Measurement of Observer Agreement for Categorical Data" *Biometrics* 33(1), pp.159-174.
- Lee, A.S. (1989) "A Scientific Methodology for MIS Case Studies" *MIS Quarterly* 13(1), pp.33-52.
- Leidner, D.E., and S.L. Jarvenpaa (1993) "The Information Age Confronts Education: Case Studies on Electronic Classrooms" *Information Systems Research* 4(1), pp.24-54.
- Leonard-Barton, D. (1990) "A Dual Methodology for Case Studies: Synergistic Use of a Longitudinal Single Site with Replicated Multiple Sites" *Organization Science* 1(3), pp.248-266.
- Leonard-Barton, D. (1988) "Implementation and Mutual Adaptation of Technology and Organization" *Research Policy* 17(5), pp.1-17.
- Levine, H.G., and D. Rossmore (1993) "Diagnosing the Human Threats to Information Technology Implementation: A Missing Factor in Systems Analysis Illustrated in a Case Study" *Journal of Management Information Systems* 10(2), pp.55-73.

- Lincoln, Y.S. and E.G. Guba (2002) "Judging the Quality of Case Study Reports" in A.M. Huberman and M.B. Miles (eds.) *The Qualitative Researchers' Companion*, Thousand Oaks: CA, Sage Publications, pp.205-216.
- Lincoln, Y.S. and E.G. Guba (1985) *Naturalist Inquiry*, Beverly Hills: CA, Sage Publications.
- MacQueen, K.M. et al. (1998) "Codebook Development for Team-Based Qualitative Research" *Cultural Anthropology Methods Journal* 10(2), pp.31-36.
- Markus, M.L. (1997) "The Qualitative Difference in Information Systems Research and Practice" in A.S. Lee, J. Liebenau, and J.I. DeGross (eds.) *Information Systems and Qualitative Research*, London: UK, Chapman and Hall, pp.11-27.
- Markus, M.L. (1989) "Case Selection in a Disconfirmatory Case Study" in J.I. Cash and P.R. Lawrence (eds.) *The Information Systems Research Challenge: Qualitative Research Methods* (volume 1), Harvard Business School, pp.20-26.
- Markus, M.L. (1983) "Power, Politics, and MIS Implementation" *Communications of the ACM* 26(6), pp.430-444.
- Markus, M.L. and D. Robey (1988) "IT and Organizational Change: Causal Structure in Theory and Research" *Management Science* 34(5), pp.583-598.
- Miles, M.B. and A.M. Huberman (1994) *Qualitative Data Analysis: An Expanded Sourcebook*, Beverly Hills, CA: Sage Publications.
- Miller, W.L. and B.F. Crabtree (2000) "Depth Interviewing," (chapter 5) in B.F. Crabtree and W.L. Miller (eds.) *Doing Qualitative Research* (2nd edition), Thousand Oaks: CA, Sage Publications.
- Mohr, L.B. (1982) *Explaining Organizational Behavior*, San Francisco: CA, Jossey-Bass.
- Montealegre, R. (1997) "The Interplay of Information Technology and the Social Milieu" *Information Technology & People* 10(2), pp.106-131.
- Morse, J.M. and P.A. Field (1995) *Qualitative Research Methods for Health Professionals*, 2nd edition, Thousand Oaks, CA: Sage Publications.
- Mukhopadhyay, T., S. Kekre and S. Kalathur (1995) "Business Value of Information Technology: A Study of Electronic Data Interchange" *MIS Quarterly* 19(2), pp.137-156.
- Myers, M.D. (1997) "Qualitative Research in Information Systems," *MISQ Discovery*, May 20, 1997.
- Nault, B.R. and A.S. Dexter (1995) "Added Value and Pricing with Information Technology" *MIS Quarterly* 19(4), pp.449-464.
- Newman, M. and D. Robey (1992) "A Social Process Model of User-Analyst Relationships" *MIS Quarterly* 16(2), pp.249-266.
- Orlikowski, W.J. (1992) "The Duality of Technology: Rethinking the Concept of Technology in Structuration" *Organization Science*, 3(3), pp.398-427.
- Orlikowski, W.J. and J. Baroudi (1991) "Studying IT in Organizations: Research Approaches and Assumptions" *Information Systems Research* 2(1), pp.1-28.
- Palvia, P.C., J.A. Perkins and S.M. Zeltmann (1992) "The PRISM System: A Key to Organizational Effectiveness at Federal Express Corporation" *MIS Quarterly* 16(3), pp. 277-292.

- Paré, G. (2002) "Implementing Clinical Information Systems: A Multiple-Case Study within a US Hospital" *Health Services Management Research*, 15, pp.71-92.
- Paré, G. and J.J. Elam (1998) "Introducing Information Technology in the Clinical Setting: Lessons Learned in a Trauma Center" *International Journal of Technology Assessment in Health Care* 14(2), pp.1-13.
- Paré, G. and J.J. Elam (1997) "Using Case Study Research to Build Theories of IT Implementation" in A.S. Lee, J. Liebenau, and J.I. DeGross (eds.) *Information Systems and Qualitative Research*, London: UK, Chapman & Hall, pp.542-568.
- Paré, G., J.J. Elam and C.G. Ward (1997) "Implementation of a Patient Charting System: Encountered Challenges and Adopted Tactics in a Burn Center" *Journal of Medical Systems* 21(1), pp.49-66.
- Paré, G., J.J. Elam and C. Lima (1996) "Implementation of an Electronic Medical Records System: How Can Health Care Managers Ensure its Success?" *Journal of Information Technology Management* 7(3), pp.1-16.
- Patton, M.Q. (1990) *Qualitative Evaluation and Research Methods*, (2nd edition), Newburk Park: CA, Sage Publications.
- Patton, M.Q. (2002) *Qualitative Evaluation and Research Methods*, (3rd edition), Newburk Park: CA, Sage Publications.
- Robey, D. and M. Newman (1996) "Sequential Patterns in Information Systems Development: An Application of a Social Process Model" *ACM Transactions on Information Systems* 14(1), pp.30-63.
- Ryan, G.H. and H.R. Bernard (2000) "Data Management and Analysis Method," in N.K. Denzin and Y.S. Lincoln (eds.) *Handbook of Qualitative Research* (2nd edition), Thousand Oaks: CA, Sage Publications.
- Sabherwal, R. and P. Tsoumpas (1993) "The Development of Strategic Information Systems: Some Case Studies and Research Proposals" *European Journal of Information Systems* 2(4), pp.240-259.
- Sambamurthy, V. and R.W. Zmud (1999) "Arrangements for Information Technology Governance: A Theory of Multiple Contingencies" *MIS Quarterly* 23(2), pp.261-290.
- Sarker, S. and A.S. Lee (2000) "Using A Case Study To Test The Role of Three Key Social Enablers in ERP Implementation" *Proceedings of the International Conference on Information Systems*, Brisbane, Australia.
- Schatzman, L. and A. Strauss (1973) *Field Research*, Englewood Cliffs: NJ, Prentice Hall.
- Silverman, D. (2000) "Analyzing Talk and Text" in N.K. Denzin and Y.S. Lincoln (eds.) *Handbook of Qualitative Research* (2nd edition), Thousand Oaks: CA, Sage Publications.
- Stake, R.E. (2000) "Case Studies" in N.K. Denzin and Y.S. Lincoln (eds.) *Handbook of Qualitative Research* (2nd edition), Thousand Oaks: CA, Sage Publications.
- Stake, R.E. (1995) *The Art of Case Study Research*, Thousand Oaks: CA, Sage Publications.
- Staw, B.M. and J. Ross (1987) "Behavior in Escalation Situations: Antecedents, Prototypes, and Solutions," in B.M. Staw and L.L. Cummings (eds.) *Research in Organizational Behavior* (9), Greenwich: CT, JAI Press, pp.39-78.
- Stoddard, D.B. and S.L. Jarvenpaa (1995) "Business Process Redesign: Tactics for Managing Radical Change" *Journal of Management Information Systems* 12(1), pp.81-107.

- Strauss, A.L. and J. Corbin (1990) *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, Newbury Park: CA, Sage Publications.
- Tesch, R. (1990) *Qualitative Research: Analysis Types and Software Tools*, New York: NY, Falmer.
- Trochim, W. (1989) "Outcome Pattern Matching and Program Theory" *Evaluation and Program Planning* 12(4), pp.355-378.
- Van de Ven, A.H. and M.S. Poole (1995) "Explaining Development and Change in Organizations" *Academy of Management Review* 20(3), pp.510-540.
- Van Maanen, J. (1988) *Tales of the Field: On Writing Ethnography*, Chicago: IL, University of Chicago Press.
- Weitzman, E.A. (2000) "Software and Qualitative Research" in N.K. Denzin and Y.S. Lincoln (eds.) *Handbook of Qualitative Research* (second edition), Thousand Oaks: CA, Sage Publications, pp.803-820.
- Yin, R.K. (1999) "Enhancing the Quality of Case Studies in Health Services Research" *Health Services Research* 34(5), Supplement Part 2, pp.1209-1224.
- Yin, R.K. (2003) *Case Study Research, Design and Methods*, (3rd edition), Beverly Hills: CA, Sage Publications.
- Yin, R.K. (1993) *Applications of Case Study Research*, Beverly Hills: CA, Sage Publications.
- Zeller, N. (1987) *A Rhetoric for Naturalistic Inquiry*, unpublished doctoral dissertation, Indiana University, Bloomington.

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