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# Integrating Process Inquiry And The Case Method In The Study Of IS Failure

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## Abstract

*This paper examines the integration of process inquiry and the case method in the study of IS failure. Having acknowledged the prevalence of IS failure and the need for continued inquiry in this domain the two predominant methods of enquiry, factor and process studies, are described along with the utility of both methods. The paper then examines the nature of process inquiry and notes its utility and prevalence in the study of IS phenomena, and its potential applicability for inquiry into IS failure. The case study method is then briefly described along with its potential contribution when combined with process inquiry. The final section in the paper describes how the case method can provide an overall framework for the conduct of a process inquiry, and presents an iterative six stage research process model, based on the case method, to assist with the planning, design, preparation, data collection, data analysis, and reporting of findings.*

**Keywords**: Case Study, IS Failure, Process Inquiry.

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## 1. Introduction

IS failure is a recurring theme in both academic and practitioner literature since the beginning of the computer age (Avots, 1969; Bostrom & Heinen, 1977a; Powers & Dickson, 1973), however despite over 50 years of study IS failure continues to be a persistent and costly phenomenon as evidenced by both academic and practitioner studies. Studies of IS failure indicate an outright failure rate of IS projects of between 18% (Eveleens & Verhoef, 2010) and 50% (McDonagh, 2001). In addition many projects not considered to be outright failures fall far below expectations. A study of 5,400 IS projects across a range of industries by McKinsey & Company in collaboration with the University of Oxford (Bloch, et al., 2012) suggests that half of all large IT projects (defined as those with initial price tags exceeding $15 million) run 45 percent over budget and 7 percent over time, while delivering 56 percent less value than predicted.

It is impossible to place a value on the total cost of IS failure because of the lack of a definitive definition and the fact that not all IS failures get into the public domain. Gartner estimate that total global spend on IS for 2014 will be $3.8 trillion. Even a conservative estimate of the percentage of this amount that is spent on underperforming IS represents a significant figure, which is a motivation and justification for continued inquiry in this area (Drevin, 2008).

This paper describes the integration of process inquiry and the case method for the study of IS failure. Process inquiry is the dynamic study of behaviour in organisations, focusing on sequences of events, activities and actions, which unfold over time and in context (Hinings, 1997; Langley & Tsoukas, 2010; Pettigrew, 1997). Process inquiry takes a dynamic rather than static worldview of things in the making (Langley & Tsoukas, 2010) and therefore is particularly suited to the study of IS development and

implementation because of the temporally evolving, longitudinal, and creative nature of such processes. The use of the case method in support of a process inquiry facilitates the study of IS failure in a real life setting which allows the researcher to open the 'black box' of IS projects in order to better understand the broad range of actions, interactions, and reactions amongst actors, which are subject to a range of contextual factors, and contribute to failed outcomes.

This paper first examines the nature of IS failure and the main types of inquiry into the phenomenon. Noting the utility of process inquiry for the study of IS failure (which itself is a process) the paper then examines the nature of process and the utility of process inquiry for the study of IS failure. The paper then describes the value of integrating process inquiry and concludes with a practical six stage guide to utilising the case method for the conduct of a process inquiry.

## 2. The Nature of IS Failure

Despite over 50 years of research in the domain of IS failure it remains as persistent and costly as ever as evidenced in both academic and practitioner literature. One only has to examine reports of national government audit offices to get a picture of the extent of the problem. In fact Mahaney & Lederer (1999) propose that failure has become an accepted aspect of IS implementations, an ominous proposition given the ever increasing complexity of IS (Koh et al., 2011) and its growing importance in achieving and maintaining competitive superiority (Piccoli & Ives, 2005).

The concept of IS failure has not been well defined and there is no universally agreed definition (Al-ahmad et al., 2009; Hyvari, 2006; Sauer, 1993). Based on a survey and classification of the empirical literature on IS failure Lyytinen & Herschein (1987) identified four distinct types of IS failure: (1) *Correspondence Failure:* the system does not ‘co-respond’ to predefined design objectives, (2) *Process Failure:* a failure to produce a system at all or failure to produce a system within planned budgets and timeframe, (3) *Interaction Failure:* failure of the system to meet the needs of its users evidenced by the level of use and the degree of user satisfaction with the system, and (4) *Expectation Failure:* the inability of an IS to meet a specific stakeholder group’s expectations. Sauer (1993) expands on the model above by proposing an alternative definition of IS failure which is consistent with IS deployment as a process unfolding in a systematic web of social action. He proposes a model which he describes as a

triangle of dependences among (1) the project organisation (who develop and maintain the IS); (2) the supporters (stakeholders who support the IS in the expectation that it will serve their purposes); and (3) the information system itself. Success or failure of the system depends on the support each leg gives to the other along with the effects of exogenous factors such as cognitive limits, the environment, organisational politics, structure, and history. In this model failure occurs when the level of dissatisfaction with a system is such that there is no longer enough support to sustain it. Failure in this case is terminal, and referred to as project abandonment (Ewusi-Mensah & Przasnyski, 1994; Pan, 2005). Sauer's approach also supports the notion that failure of an IS initiative can happen long after the system is successfully implemented.

### 2.1 Some Unique Features of IS and Failure

Failure is an inherent aspect of complex technological and organisational systems (Cook, 2000; Sauer, 1993) including IS (Nelson, 2007). IS are both innovative and inherently complex as they are built on conceptual rather than material constructs (Brooks, 1987), making the development of IS systems a high risk undertaking (Lyytinen & Robey, 1999). A number of reasons have been put forward for this. Firstly the conceptual and abstract nature of software creates a difficulty of visualisation which can lead to over-ambitious aspirations, misunderstanding, and excessive perceptions of flexibility by stakeholders, and fallible decision making during specification, and design (Al-ahmad et al., 2009; Goldfinch, 2007). Secondly the typical lifespan of an IS innovation means there is usually a degree of uncertainty about what the final outcome will be, how the process of constructing the product will progress in the face of possible unforeseen situations (Boddy et al., 2009; Sauer, 1993), and the potential for late detection of problems (Al-ahmad et al., 2009). Thirdly the number of stakeholders affected by an IS makes it difficult to satisfy all expectations (Boddy et al., 2009; Sauer, 1993). Fourthly the systemic nature of organisations means that the introduction of a new system in one part of the organisation has implications for others and may disturb the existing socio-technical balance (Berg, 2001; Boddy et al., 2009; Fortune & Peters, 2005; Keen, 1981; Sauer, 1993) implying the need to have a thorough understanding of not only the technology but the business processes it impacts. Lastly the implementation of an IS requires change in the way humans work yet companies continue to inject technology without

making the necessary organisational changes (Markus & Robey, 1988; Sauer, 1993). Clegg et al., (1997) and Marchland & Hykes (2006) state that IS projects are mostly technology led, and that many organisations lack an integrated approach to organisational and technical change, and often design the social system around the technology.

### 2.2 Factors Contributing to IS Failure

Flowers (1996) in Yeo (2002) describes the performance of IS developments as a function of managing a range of critical failure factors that may be broadly grouped as the conduct of the IS project and the organisational and people contexts within the domain of influence of the IS project (Yeo, 2002). Yeo (2002) identifies three spheres of influence over IS project outcomes as: (1) *process driven issues* such as misalignment of business/IS planning, inadequate project planning, and project management and control; (2) *content driven issues* such as complexity, inadequate business process design, poor system design, and inadequate professional knowledge and skill-sets; and (3) c*ontext driven issues* such as organisation culture, politics, and people. These spheres of interest are broadly in line with the people, process, and project risk categories noted by Kappelman et al. (2006) and the three higher order subsystems of IS project risk (social subsystem risks, project management risks, and technical subsystem risk) identified by Wallace et al. (2004). Although different in approach each of the studies acknowledge three similar overarching spheres of influence on the outcome of an IS project. These studies provide a useful framework for a detailed study of IS risk/failure as they embody the full range of project, process, people, and organisational/contextual factors that may impact on the outcome of an IS initiative. Furthermore the study by Wallace et al. (2004) found a link between all spheres of influence such that social subsystem risk influences technical subsystem risk which in turn influences the level of project management risk, and ultimately project performance, thereby indicating a systematic connectedness among all spheres of influence.

### 2.3 Research in IS Failure

Sauer (1999) identifies a number of difficulties in researching IS failure. Firstly, as stated above, the concept of IS failure has not been well defined and there is no universally agreed definition (Al-ahmad et al., 2009; Hyvari, 2006; Sauer, 1993). Secondly the study of IS failure raises a number of difficulties including the difficulty

in developing theory because of the need to combine technical, human, and organisational characteristics associated with the phenomenon, and the absence of explanatory theories of failure from other fields (Sauer, 1999).

Studies of IS failure fall broadly, although not exclusively, into two categories viz. factor analysis studies and process studies. Factor analysis studies attempt to explain, and sometimes rank in importance common factors that contribute to IS failure. Process studies examine the process by which IS have failed by examining sequences of events, activities and actions, which unfold over the duration of the process, leading to the failure outcome. Both types of study offer valuable insight into the phenomenon of IS failure.

Factor analysis studies highlight many of the important issues that have contributed to IS failure in the past, and the difficulty in addressing them (Goldfinch, 2007). Factor analysis studies fall into two main categories, those that attempt to analyse in detail a particular factor which led to failure e.g. escalation of commitment (Keil, 1995), failure to learn from failure (Lyytinen & Robey, 1999), failure of governance (Avison et al., 2006), and those that identify and attempt to prioritise lists of critical failure factors based on perceived importance (Al-ahmad et al., 2009; Kappelman et al., 2006; Schmidt, Lyytinen et al., 2001). Failure factor research has been criticised because of the lack of a standard naming convention for failure factors leading to ambiguity and difficulty in comparing studies (Al-ahmad et al., 2009), failure to capture the levels of importance of factors at different stages of the implementation process (Larsen & Myers, 1999), failure to identify relationships among the factors (Ginzberg, 1981), and a focus on project factors at the expense of broader contextual factors (Bussen & Myers, 1997; Nandhakumar, 1996).

Process studies of IS failure present an analysis of one or more failed initiatives, usually over the entire course of the initiative (Drevin, 2008). Process studies of IS failure differ from factor analysis studies because in addition to describing the causes of failure they go further by placing the causes within the context of the IS development (Sauer, 1993), and attempt to unearth the complex social and political web in which IS initiatives are undertaken (Markus & Robey, 1988), thereby offering a richer explanation in terms of both agency and context (Pettigrew, 1997). By facilitating a more incisive study of the process of failure over the entire course of the initiative process studies offer richer explanations of causal links than factor studies

(Sauer, 1999) and a better explication of how IS affects, and is affected by, the people who use it (Nandhakumar, 1996). Although process research is more appropriate to the complexity of IS failure it also has limitations in terms of the complexity of analysis and theoretical foundations and the lower amount of accumulated research when compared with factor analysis studies (Sauer, 1999). This warrants a more detailed discussion on the nature of process inquiry and in particular its utility for inquiry into IS failure.

## 3. The Nature of Process Inquiry

Process inquiry is the dynamic study of behaviour in organisations, focusing on sequences of events, activities and actions, which unfold over time and in context (Hinings, 1997; Langley & Tsoukas, 2010; Pettigrew, 1997). Process studies address questions about temporally evolving phenomena, that is of things not being but rather in the making (Ferlie & Mcnulty, 1997; Langley & Tsoukas, 2010).

Mohr (1982) illustrated the nature of process studies by highlighting the difference between variance models and process models. A variance model provides explanations of phenomena in terms of a deterministic causation relationship (outcome) among dependent and independent variables in which X implies Y. A process model on the other hand views outcomes as discontinuous phenomena, or changes of state, rather than variables that can take on a range of values. Thus in a process model X does not imply Y, but rather Y implies X. Process models provide explanations in terms of patterns in events, activities, and choices over time (Mohr, 1982), and unlike variance models emphasise necessary causality rather than necessary and sufficient causality because the impact of any event will depend on what precedes it and what follows it. Thus variance models are appropriate for a static worldview whereas process models are most appropriate for a dynamic worldview of things in the making (Langley & Tsoukas, 2010).

Process models are typically multi-directional rather than linear (Tsoukas & Chia, 2002), cumulative and non-reversible (Sztompka, 1993) in (Pettigrew, 1997), reflecting social processes which are inherently discontinuous (Markus & Robey, 1988), and open ended. Process models may incorporate several different types of effects into their explanations, including critical events and turning points, factors that

influence the sequencing of events, and contextual and other factors that influence the direction of change and causal influence (Van de Ven & Poole, 2005). Process models have a lower capability to explain variance but provide richer explanations of how and why outcomes occur (Markus & Robey, 1988) by untangling the history that altered the trajectory of events (Shaw & Jarvenpaa, 1997), and identifying multiple intersecting conditions that link context and process to outcomes (Pettigrew, 1997).

### 3.1 The Ontological Assumptions of a Process Worldview

Sztompka (1993), in Pettigrew (1992) provides a list of ontological assumptions which are relevant for scholars of process. These are:

*Social reality is not a steady state but, rather, a dynamic process***:** A process orientation prioritises activity over product, change over persistence, novelty over continuity, and expression over determination (Langley & Tsoukas, 2010). Process employs the language of verbs (becoming) rather than nouns (being) to explain the origins, event sequences, and outcomes of phenomena (Pettigrew, 1987) in terms of *"What was there-then, is included in what is here-now"* (Langley & Tsoukas, 2010: p10). The process approach does not deny the existence of events, states, or entities, but seeks to reveal the complex activities and transactions that take place and contribute to their constitution.

*The social process is constructed***:** The social process is created by human agents (individually or collectively) through their actions and interactions (Pettigrew, 1992; Sztompka, 1993; Tsoukas & Chia, 2002). Human agency is continuously influenced by rules and norms that are made relevant by the actors themselves through a dynamic process of adjustments to social conditions. In this way organisational rules are constantly adjusted, modified, or even ignored in the carrying out of actual organisational tasks (Tsoukas & Chia, 2002). This is further influenced by differences in power, knowledge, and other resources (Pettigrew, 1992). Events are also socially constructed and may be individually interpreted (Peterson, 1998) leading to different understanding and interpretation of event sequences and outcomes.

*Social life is a process of structural emergence via actions which occur in the context of encountered structures:* Action occurs in the context of encountered structures, which it shapes in turn, resulting in the dual quality of structure (as both shaping and shaped) and the actors (as both producers and products) (Sztompka, 1993) in

(Pettigrew, 1992), (Pettigrew, 1997; Pettigrew, 1987). Tension between actions and structures is the ultimate moving force of process (Sztompka, 1993) in (Pettigrew, 1992) which ultimately links processes to outcome (Pettigrew, 2012).

*The interchange of action and structure occurs in time and is cumulative***:** Time is an integral part of a process orientation as time sets a frame of reference for what changes are seen and how those changes are explained (Pettigrew, 1987). Process models treat time as always shaping the emerging future (Pettigrew, 2012) by its location in the process sequence, and the multiple levels of changing contexts in which the process is embedded (Langley & Tsoukas, 2010; Pettigrew, 2012).

### 3.2 The Use of Process Inquiry in the Study of IS Phenomena.

In contrast with much of the factor analysis based IS failure studies which focus either on a single failure factor, or present failure factors as a ranked list, process studies are particularly suited to the study of IS development and implementation because of the temporally evolving, longitudinal and creative nature of such processes (Van de Ven & Poole, 2005). Process inquiry facilitates the study of IS failure across the entire duration of the failure incorporating a broad range of complex activities and transactions undertaken by actors, which are subject to a range of contextual factors that contribute to the outcome. Unless you look at the process of IS failure it is not possible to gain an understanding of the complex interaction of actors, events, contexts and the emergent conditions that influence the trajectory over time, and their impact on the object of inquiry. The study of the process of IS failure therefore provides insight which cannot be completely explicated using variance type methodologies in a 'hands-off' fashion. Process research is seen as problem solving (Hinings, 1997) and many process studies have been motivated by a desire for a better understanding of events leading to a positive or negative outcome (Langley & Tsoukas, 2010), which confirms its appropriateness as a suitable method for the study of IS failure, and also indicates its practical relevance (Hinings, 1997; Langley & Tsoukas, 2010). Process inquiry has a strong connection with qualitative / interpretive research (Hinings, 1997; Langley & Tsoukas, 2010; Langley, 2008), and frequently employs case study investigations (Hinings, 1997; Radeke, 2010) and in particular longitudinal case studies which facilitate inquiry over the entire duration of the IS failure (Wilson & Howcroft, 2002). In support of this Pan, et al. (2008) call for more

longitudinal studies on project failures, especially those that involve in-depth case studies, in order to provide a deeper understanding of the dynamics of this phenomenon in various contexts.

The largely qualitative nature of process inquiry has raised concerns about the lack of generalisability of such studies however using only the nomothetic or scientific approach unnecessarily limits the use and applicability of any qualitative inquiry (Walsham, 2006) as a phenomenon such as IS failure may not be amenable to quantification (Bonoma, 1985) or generalisation in the nomothetic sense (Gerring, 2004; Hinings, 1997; Lee & Baskerville, 2003) as IS failure is subject to the influence of a potentially large set of precursors which interact in a systematic but nondeterministic way. Practical issues relating to all qualitative research include the need to show in a convincing manner how the data was analysed, highlighting all assumptions made, and demonstrate how the issue of bias was addressed (Shaw & Jarvenpaa, 1997). Pettigrew (1990) also highlights the sheer amount of data that can result from a process inquiry, referred to as the danger of *"death by data asphyxiation"* [p281], indicating a need for efficient data management throughout the inquiry. Many of the practical issues and other criticisms of process inquiry often reflect the reality of poor research planning and design, and the absence of a guiding methodology for the inquiry. Process inquiry, with an emphasis on action and events over time and in context, imposes a rigor on data collection that some other qualitative methodologies do not, however Pettigrew (1990) states that there are no fixed recipes for undertaking process studies.

Many of the practical difficulties in conducting a process inquiry can be reduced by the use of a systematic methodology to guide the conduct of the inquiry which can also provide the necessary tools and frameworks to underpin rigor and accuracy in the research process. The use of a case study methodology is well proven for the study of phenomena related to IS and provides such a framework for the conduct of a process inquiry. The case study methodology is briefly discussed in the next section of this paper along with its appropriateness and utility for the conduct of a process inquiry.

# 4. The Value of Integrating Process Inquiry with the Case Methodology

Yin, (2009: p18) defines a case study as: "*... an empirical enquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident"*. Case study research is the most widely used qualitative method in IS research (Darke et al., 1998), its popularity due mainly to the indivisible connection between IS and the context in which it is implemented and deployed (Benbasat, Goldstein, & Mead, 1987; Markus & Robey, 1988). Doolin (1993) states that because IS development is a complex, protean, social phenomenon the rational-technical view of systems development presented in most textbooks is a caricature, and that simple prescriptions grossly oversimplify the actual realities of systems work. Case study allows the researcher to open the 'black box' of IT focusing on the 'what', 'why', and 'how' questions which capture the dynamic changing conditions (Pare, 2004) that are appropriate for the conduct of a process inquiry.

Case studies may be longitudinal in nature (Burch, 2001; Pettigrew, 1990; Ployhart & Vandenberg, 2010), facilitating the collection and analysis of process data over time. Because the subject is studied within its real life context the researcher has access to a broad range of primary and secondary data (Kaplan & Maxwell, 2005) including documentation, archival records, other artefacts, direct observation of events and processes, and the opportunity to engage in interviews with appropriate informants. The multifaceted data collection methods as well as the use of qualitative and quantitative evidence are ideal for addressing the vivid and dynamic phenomena necessary to develop complete process models (Newman & Robey, 1992) as in the case of an IS failure. The overheads of time and data volume can easily be justified in terms of the rich data and insight produced. Furthermore the richness of data sources facilitated by the case study methodology assists with triangulation (Ann Langley, 2009; Mathison, 1998), a key to confirming findings and reducing bias. Direct access to participants also provides multiple perspectives (narratives) regarding the events, situations, actions, processes, and outcomes which have, or are, taking place, and the elicitation of views and personal aspirations within this context (Kaplan & Maxwell, 2005; Walsham, 1995a, 2006) adding further richness to the inquiry.

# 5. Integrating Process Inquiry and the Case Study Method in the Study of IS Failure

Two clear advantages of the case study methodology for the study of IS failure are (1) it facilitates the in-depth study of IS failure within its real life context thereby providing a real life setting within which to carry out the inquiry; and (2) the case study methodology includes a well-documented set of tools and procedures for the conduct of the case study and for managing the resulting body of data. This unique set of features provides an ideal framework for the conduct of a process inquiry as it provides a real life case of IS failure within which to conduct the inquiry and, if conducted correctly, forces a rigor at all stages of the inquiry, which in turn will strengthen the research findings.

A research design is a plan of the logical sequence that connects the empirical data to a study's initial research questions, and ultimately to its conclusion, such that the reader is able to follow the derivation of any evidence from initial research questions to the conclusions of the study (Wilson, 2011; Yin, 2009). The researcher must describe in detail how the research was conducted and how the results were arrived at, and present a coherent, persuasively argued point of view (Walsham, 1995b). Sufficient evidence for the research result must be presented along with consideration of alternative interpretations of the data (Benbasat et al., 1987; Dube & Pare, 2003; Walsham, 2006; Yin, 2009) and the case overall.

Yin (2009) describes case study research as a linear but iterative process with six key components which are: plan, design, prepare, collect data, analyse data, and report findings. This method, also supported by other exponents of the case method (Carroll & Swatman, 2000; Pare, 2004), may form the basis of a methodology for the conduct of a process inquiry, and is depicted in Figure 1 below:

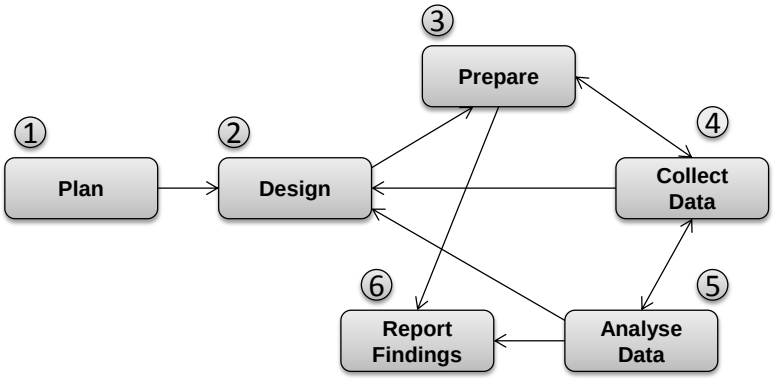


**Figure 1. Case Research (adapted from Yin (2009) Pare (2004) Carroll & Swatman (2000))**

Although depicted as six discrete steps the research process is both iterative and systematic, often requiring a return to previous stages as new data or concepts emerge. This model is congruent with the inductive-deductive cycle described by (Pettigrew, 1997) for the conduct of a process inquiry.

*research question → related themes and questions → preliminary data collection → early pattern recognition → early writing → disconfirmation and verification → elaborated themes & questions → further data collection → additional pattern recognition → more refined study vocabulary and research questions*

The six step model is described below in the context of undertaking a process inquiry.

### 5.1 Stage 1 - Plan:

This stage is mainly concerned with deciding on the most appropriate research strategy to answer the research question(s) including an assessment of one's own ontological and epistemological position, and the use of any guiding theory. For the purpose of this paper it is assumed that a qualitative process inquiry has been selected and justified as the appropriate method of inquiry into an IS failure within a case based setting.

### 5.2 Stage 2 - Design:

The case study design is concerned with ensuring that the inquiry is conducted in a systematic manner which will increase the overall quality and robustness of the research findings. This stage is concerned with selecting the appropriate unit of analysis for the inquiry, selecting the appropriate case design, and addressing the issues of validity and reliability of the research.

The unit of analysis for an inquiry (Miles & Huberman, 1994; Yin, 2009) defines the boundary of what is to be studied, how the study relates to the broader body of knowledge in the research domain (Dube & Pare, 2003), and the potential generalisability of resulting theory (Pare, 2004; Yin, 2009). The unit of analysis should be a concrete real-life phenomenon rather than an abstraction (Benbasat et al., 1987; Yin, 2009), and must provide sufficient breadth and depth of data to allow the research question to be answered (Darke et al., 1998). A typical unit of analysis for inquiry in IS failure is the IS initiative which has been deemed to have failed.

A primary decision in designing the inquiry is the choice between multiple-case and single-case design. That is between the analytic and generalisability benefits of replication of a multiple-case design and the depth and richness of data associated with a single-case design. Given the sensitivity that surrounds IS failure (Keil, 1995; Sauer, 1999) the researcher may seldom have the opportunity to structure multiple case-study design, however the complex and longitudinal nature of large IS failures offers the opportunity to present an empirically rich and unbroken case narrative that is a key component of process inquiry.

Consideration must also be given to the quality of the research output in terms of validity and reliability. Yin (2009) summarises a set of tactics for increasing validity and reliability of case study case research. These tactics have been combined with Lincoln & Guba's (1985) validity and reliability criteria for qualitative research and expanded to include the relevance of such criteria to process inquiry. The resulting framework is shown in Table 1 below. The challenge of ensuring the quality of research must of course be continually addressed during all phases of the research (Runeson & Höst, 2009; Yin, 2009).

| **Validity Criteria** (Yin, 2006) | **Validity Criteria** (Lincoln & Guba, 1985) | **Case Study Tactic** | **Phase of Research** | **Relevance of Case Study Tactics to Process Inquiry** |
|---|---|---|---|---|
| **Construct Validity** | N/A | • use multiple sources of evidence<br>• establish chains of evidence<br>• have key informants review draft case study report | data collection<br>data collection<br>composition | Multiple sources of evidence may be used to confirm actions, events, and outcomes facilitating the construction of verifiable process chains (cause and effect) using visual mapping and other techniques. Process narratives may also be used to confirm findings with informants |
| **Internal validity** | Credibility | • do pattern matching<br>• do explanation building<br>• address rival explanations<br>• use logic models | data analysis<br>data analysis<br>data analysis<br>data analysis | Failure outcomes may be explained using chronological mapping to explicate the process of failure and verified by the construction of alternative explanations to test plausibility of findings. Findings may also be compared with previous research findings as a further test of credibility or novelty. |
| **External validity** | Transferability | • use theory in single cases<br>• use replication logic in multiple case studies | research design<br>research design | Depends on the type of inquiry and the potential for generalizing from the findings, whether a guiding theory is used for the inquiry and the number of cases. Process inquiry in IS failure often relies on a single case of IS failure because of difficulties in access to multiple cases at any one time. |
| **Reliability** | Dependability | • use case study protocol<br>• develop case study database | data collection<br>data collection | The case study protocol should specify how the process inquiry is to be conducted and specify how data will be stored using the case study database. Data analysis tools should also be explained including the use of any software tools. |

**Table 1. Application of Positivist and Qualitative Validity and Reliability Criteria for the Conduct of Process Inquiry (Adapted and expanded from Yin 2009, Lincoln & Guba 1985)**

## 5.3 Stage 3 – Prepare

Thorough preparation is a key precursor to the conduct of an inquiry. The preparation stage should include attention to the issues of ethical behaviour for the conduct of the inquiry, consideration of sources of bias, and the preparation of a case study protocol to guide the research process.

Considerations about ethical behaviour (harm to participants, informed consent, invasion of privacy, deception) apply to the conduct of all research. Research in IS failure however requires a particular focus on ethical behaviour because of confidentiality issues that may surround the case, non-disclosure of information, and the threat of litigation (Sauer, 1999).

Another issue which relates to all research is the question of bias. Walsham (2006) cautions that neutrality, on the part of the researcher, is not the same as unbiased therefore the researcher must ensure that sources of bias are made explicit and eliminated or reduced as far as possible. Types of bias are (1) *subject bias* whereby the subject's response is influenced due to a personal bias or external influence; and (2) *observer bias* whereby the interpretation of the research is subject to the bias of the researcher. For the study of IS failure the researcher must be particularly attentive to bias during the interview process because of the tendency of informants to rationalise their own roles and the tendency for selective narration (Sauer, 1999).

The case study protocol is a comprehensive set of guidelines that describes the procedures for conducting the research (Maimbo, 2003; Runeson & Höst, 2009; Yin, 2009). The use of a case study protocol enforces a rigor for the conduct of the inquiry which in turn contributes to the validity and reliability of findings (Maimbo, 2003; Yin, 2009). For process inquiry the case study protocol can be used to specify the research instruments such as as interview guidelines, questionnaires etc., the specific types of data to be collected, and guidelines for data analysis (Maimbo, 2003; Runeson & Höst, 2009). Radeke (2010) also proposes the explication of the data collection procedure to enhance the quality of the research and reliability of findings. Explication of the data collection procedure is best achieved by the use of the case study protocol document (Yin, 2009) which states the procedures for data collection along with general rules to be followed. Documenting the actual research procedures enhances reliability of research findings.

### 5.4 Stage 4 – Collect Data

The desired outcome of the data collection phase of a process inquiry is a well organised and categorised set of case data (Darke et al., 1998) that is relevant to the inquiry. A major strength of the case study method is the use of multiple primary and secondary data sources. This provides a rich pool of data which is ideal for process inquiry. In particular the opportunity to conduct interviews with informants is suited to process inquiry as it brings us closer than any other method to an intimate knowledge of people and their social world (Hermanowicz, 2002), and facilitates the search for meaning, intentionality, and context, all of which are major objectives of a process inquiry. Multiple sources of data can be cross referenced, and triangulated to corroborate findings (Mathison, 1998; Yin, 2009) and construct *"converging lines of*

*enquiry"* (Yin, 2009: p115) which can be used to mediate conflicting accounts (Pan & Tan, 2011), which in turn supports a more convincing narrative, and ultimately increases the reliability and validity of research findings (Dube & Pare, 2003; Kaplan & Maxwell, 2005; Yin, 2009).

Pettigrew (1990: p277) states that for the purpose of process inquiry data collecting should be *"processual, comparative, pluralist, historical, and contextual"*. Data collection therefore should focus on the process models' main components, viz. event sequence data, causal and consequential factors, and the identification of relationships among these components as shown in figure 2 below.

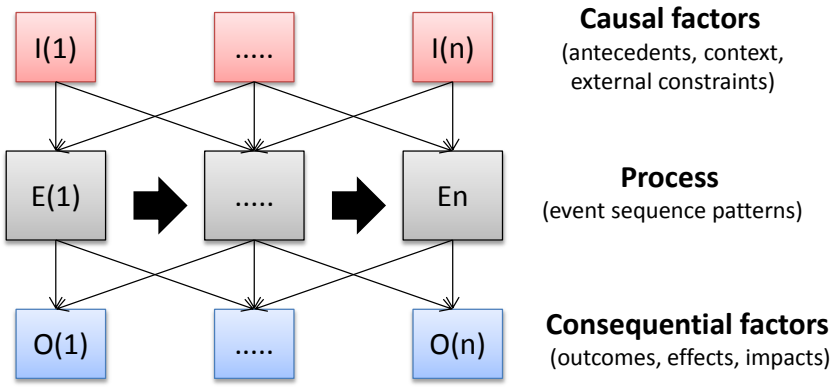


**Figure 2. The Components of Process Inquiry (Adapted from Radeke (2010))**

Poole et al. (2000) presents five strategies to focus data collection in a process inquiry: (1) identify events and event types; (2) characterise and classify event sequences and their properties; (3) identify dependencies in the sequences identified; (4) evaluate the data in the context of the outcome if possible; and (5) identify coherent patterns that integrate the narrative and provide explanation.

A key to management of the rich sources of data and to guard against the 'data asphyxiation' cautioned by Pettigrew is the use of the case methodology for structuring the data. This includes the use a case study database as a single repository to store, organise, and categorise the collected data, along with case study notes and other material (e.g. process maps etc…). Use of a case study database provides a single repository of case material which provides evidence supporting the case narrative and findings, which is accessible for review. The case study method also

advises on constructing chains of evidence to facilitate tracing of the steps taken from the initial research question to the research conclusions including include sufficient cross-referencing to methodological procedures carried out, and the resulting evidence leading to the research findings as depicted below.

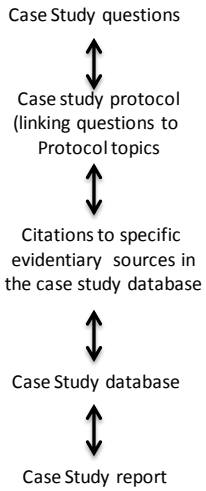


**Figure 3. Research Chain of Evidence (Adapted from Yin, 2009)**

The construction and maintenance of a chain of evidence is greatly supported by the use of the case study database, as described, with appropriate referencing, and further enhances the validity and reliability of the research findings.

### 5.5 Stage 5 – Analyse Data

The purpose of data analysis in a process inquiry is to develop or confirm theory relating to the phenomenon under investigation. Process theory describes and explains connections among phenomena (Sutton & Staw, 1995) by emphasising a dynamic view of the phenomena (Radeke, 2010) in terms of three main components: the process itself; causal factors; and consequential factors (Radeke, 2010). Process theory moves beyond a description of the components by explaining the connections among them, the underlying mechanisms that drive them, including action and context, and their relationship to certain outcomes or consequential factors (Gregor, 2006; Hinings, 1997; Radeke, 2010). Such theory has led to important new insights into phenomena related to IS (Gregor, 2006) and is therefore appropriate for the study of IS failure.

The strength of analysis is derived from the strength of the explanation of the phenomena based on the interpretation of the data (Darke et al., 1998). Eisenhardt (1989) proposes that induced theory is likely to be empirically valid when it is tightly linked to the data, a view supported by Walsham (1995a) who emphasises the importance of detailed descriptions of how findings were derived. Data analysis should be both systematic and disciplined, and should display a logical pattern of thought processes and assumptions that result in sufficient evidence for the research outcome (Walsham, 1995a), along with consideration of alternative interpretations and reasons for rejection. Carroll and Swatman (2000) note that the main difficulty when employing qualitative research is demonstrating the linkage between the data collected and conclusions drawn.

Analysis of case study evidence is one of the least developed aspects of the case study methodology (Yin, 2009) however this does not diminish its utility for the conduct of a process enquiry as a number of strategies already exist for the development of theory from a process inquiry, which are well supported by the overall case study methodology, in particular the data collection and organisation practices as described above. For example the rich sources of data available using the case study method can form the basis of the data analysis framework presented by Miles & Huberman (1994) which supports Pettigrew's description of the cycle of induction and deduction, described earlier, for the conduct of a process inquiry. In particular the case study database is an ideal repository facilitating the systematic organising and distilling of the mass of raw data collected during a case based process inquiry into some meaningful form during the first phase of analysis, referred to as the *data reduction phase*. This involves an iterative process of selecting, simplifying, abstracting, and transforming the data without diluting any of its embedded richness leading to a set of initial categorisations which form the input to the second stage called *data display* which involves further synthesises and summarisation of the data (presented as a combination of text and diagrams, including process charts) to produce an organised, compressed assembly of information that facilitates the final stage of *conclusion drawing and verification.* The use of a case study database facilitates the ordering and storage of data during each phase of the analysis process and the construction of chains of evidence, supported by triangulation, which facilitate the process of refinement of the data and continuous testing for plausibility of findings, which

ultimately results in theory that is credible, defensible, warranted, and able to withstand alternative explanations.

The systematic collection and organisation of data as proposed by the case study methodology supports established tools for the development of theory arising from a process inquiry. This includes the construction of narratives relating to the process of IS failure as an essential first step in developing a process theory (Hirschheim & Newman, 1987; Langley, 1999) which assists with the data reduction stage of data analysis (Miles & Huberman, 1994) by indicating patterns in the data (Pettigrew, 1997) facilitating initial identification of key themes and categories. The deep structure of a narrative, explained by Pentland (1999), in terms of the underlying processes (generating mechanism and fabula), can be systematically categorised and depicted textually or graphically in the case study database and used in support of a description of the underlying motors (generative mechanisms) that drive the process.

Other strategies for analysing and sense making from process data as described by Langley (1999) including, quantification, alternate templates, grounded theory, visual mapping, temporal bracketing, and synthetic strategy are all supported by the conduct of an inquiry in a real life setting and the use of the data collection and storage practices recommended by the case study methodology.

### 5.6 Stage 6 – Report Findings

There is no standard for reporting on process studies (Shaw & Jarvenpaa, 1997), however the use of well established guidelines for reporting the results of case study research (Blonk, 2003; Pratt, 2008; Yin, 2009) provide a useful template which may be applied. For example the report must contain sufficient evidence to support the research findings and should be complemented by a case study database (Yin, 2009). To demonstrate validity the report must describe in detail how research results were arrived at and must present a coherent and persuasively argued point of view (Walsham, 1995b). Sufficient evidence for the research results must be provided and alternative interpretations must be rejected with clear reasons (Darke et al., 1998). The validity of the findings must also be demonstrated by providing appropriate chains of evidence along with a discussion of how bias was addressed during the inquiry process. Although reporting is depicted as the last element of the case study process it should be given explicit attention throughout the earlier phases of the study (Yin,

2009), and should be commenced before data collection and analysis have been completed in order to facilitate continued refinement (Yin, 2009). This is consistent with Pettigrew's (1997) inductive-deductive cycle which is carried out throughout the course of the inquiry.

## 6. Conclusion

This paper has examined the nature of IS failure and the utility of process inquiry for the study of IS phenomena including IS failure. One of the striking features of process inquiry is the sheer amount and complexity of data produced which, if not managed properly, can result in *"death by data asphyxiation"* as described in Pettigrew (1990: p281). Pettigrew (1990) also notes the lack of standard procedures for undertaking process inquiry. The paper notes the widespread use of the case study methodology for the conduct of research in the IS domain and proposes that this methodology is suited to the conduct of process inquiry because it specifies that the investigation be conducted within its real life context (a case of IS failure), and provides a well-documented set of tools and procedures, for the conduct of the inquiry and for managing the resulting body of data, which are easily adaptable for process inquiry. The paper then presents a practical six stage guide to utilising the case method for the conduct of a process inquiry which provides the benefits of a structured approach to data collection and categorisation whilst also facilitating the inductive-deductive data analysis process that is applicable for the conduct of a process inquiry.

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