Communications of the Association for Information Systems

Volume 24 Article 39

6-1-2009

Punctuated Process Modelling of Information Systems Development: An Illustration from a Mid-Sized Enterprise

Mike Newman
Manchester Business School/Norwegian School of Economics, mike.newman@manchester.ac.uk

Shanshan Zhu
KPMG Consulting

Communications of the Association for Information Systems

CAIS

Punctuated Process Modelling of Information Systems Development: An Illustration from a Mid-Sized Enterprise

Mike Newman

Manchester Business School, University of Manchester & Norwegian School of Economics and Business Administration, Bergen, Norway

mike.newman@manchester.ac.uk

Shanshan Zhu

KPMG Consulting, Leeds, UK

Abstract:

Building on previous research, we demonstrate how a punctuated process model can describe and analyze a specific information system development project. In this paper, we focus on an Information Systems (IS) project that was being implemented in a UK retail Small-Medium sized Enterprise (SME) where a new system was being implemented to replace the existing, failing one. Generally, the combination of these IS research models can provide us with a new, practical and valuable way in understanding Information Systems Development (ISD) as a social process. There were several contributions using our punctuated process model. We show how social-technical equilibriums were perturbed by the critical incidents that occurred externally to the project. Furthermore, the ability of the project team in dealing with unexpected events was seen as vital skill in ensuring the stability of a project. In contrast, allowing the project to drift was shown to lead to a degree of chaos. Third, patterns from past project or similar patterns from other system processes, as have been suggested the literature, have significant impacts on current project patterns. However, in practice, we found that the knowledge generated from past project patterns or similar patterns from other systems may be of only limited use: actors in our ISD drama were often reactive, not anticipatory. Despite the limitations and complexity associated with this type of research, our approach demonstrates the possibility of employing the punctuated process model in the study of ISD in a variety of organizations as a descriptive and diagnostic tool. The paper ends with suggestions for scholars in IS research as well as practitioners involved in IS projects.

Keywords: socio-technical systems, social process, punctuated equilibrium, information systems, ISD, success and failure

Volume 24, Article 39, pp. 673-700, June 2009

Editor's Note: The article is based on research originally presented as an IBIMA conference paper (Newman and Zhu, 2005).

Communications of the Association for Information Systems

I. INTRODUCTION

Information System project failures are legendary and have attracted much of the public attention in recent years due to a series of spectacular cases and the spectre of IS failure continues to haunt both the academic and practitioner communities. Instead of entering the traditional debate about the limitations of factor studies, in this paper we will demonstrate, using a case study of a retail organization, the utility of a punctuated process model of ISD and to report on insights generated from this approach. In particular, we will investigate the parallel processes exhibited by the building events and the work (or legacy) events and focus on points of interaction. While it does not solve the success/ failure conundrum, our analysis offers new insights and enables us to comment on theories such as escalation and de-escalation [Keil and Robey 1999] and issues of success and failure. We recognize that many of the examples of IS failure concern very large systems while the project we shall be examining occurred in a mid-sized retail company. This and other examples are our first steps in building a body of knowledge of ISD *from a process perspective* in a variety of organization types.

This study is guided by the following research questions:

- What is the utility of combining of a socio-technical model, a social process model, and punctuated equilibrium theory in describing and explaining the social dynamics of ISD in a retail SME?

- How can this application of the model contribute to our understanding of ISD research and practice in a variety of organization types?

This article starts with a summary of the punctuated process model developed in a previous work (Newman and Robey 1992; Robey and Newman 1996; Pan *et al*. 2006; and Newman and Zhao 2008]. Next, we describe our research approach including a description of the case study used. This research focuses on an IS project that was being implemented in a UK retail organization, where the new system was implemented to replace an old, failing one. The next section describes the case study findings. Here we report on the *build* process and organizational *work* process and how the management of the implementation process and interactions between the work process and build process shaped the outcomes. Findings from the case study will be analysed using the *punctuated process model* and implications for academics and project managers will be discussed. The paper ends with conclusions from the study and with a statement of its limitations.

II. SUMMARY OF THE PUNCTUATED PROCESS MODEL

Models of ISD and its environment can be applied to examine the IS implementation process, where the structure and content of the IS and its interaction with the environment can be described, analysed, and communicated (De Abreu and Conrath 1993]. What follows is a summary of the model.

Process Studies

ISD has long been seen as a socio-technical change process [Kwon and Zmud 1987], and can be “conceived as a sequence of episodes, punctuated by encounters, that follows patterns established in previous development work”[Newman and Robey 1992]. Studying the whole project-implementation process can help researchers get a fuller, richer picture. Rather than focusing on technical features, social process models focuses on social change activities by investigating sequences of critical incidents that link antecedent conditions with outcomes (see Figure 1). The punctuated equilibrium model is one of the theoretical frameworks that has been used by IS researchers to describe and explain organizational change patterns [Newman and Robey 1992; Newman and Zhao 2008]. Kwon and Zmud [1987] suggested that an implementation will succeed “when commitment to change exists, commitment to the implementation effort exists, and extensive project definition and planning take place.” The findings generated from process models are not necessarily inconsistent with those from traditional factor models. Rather, process models play a complementary role [Newman and Robey 1992]. Indeed, some have suggested that the two models should be applied together to provide a more complete view of IS implementation [De Abreu and Conrath 1993].

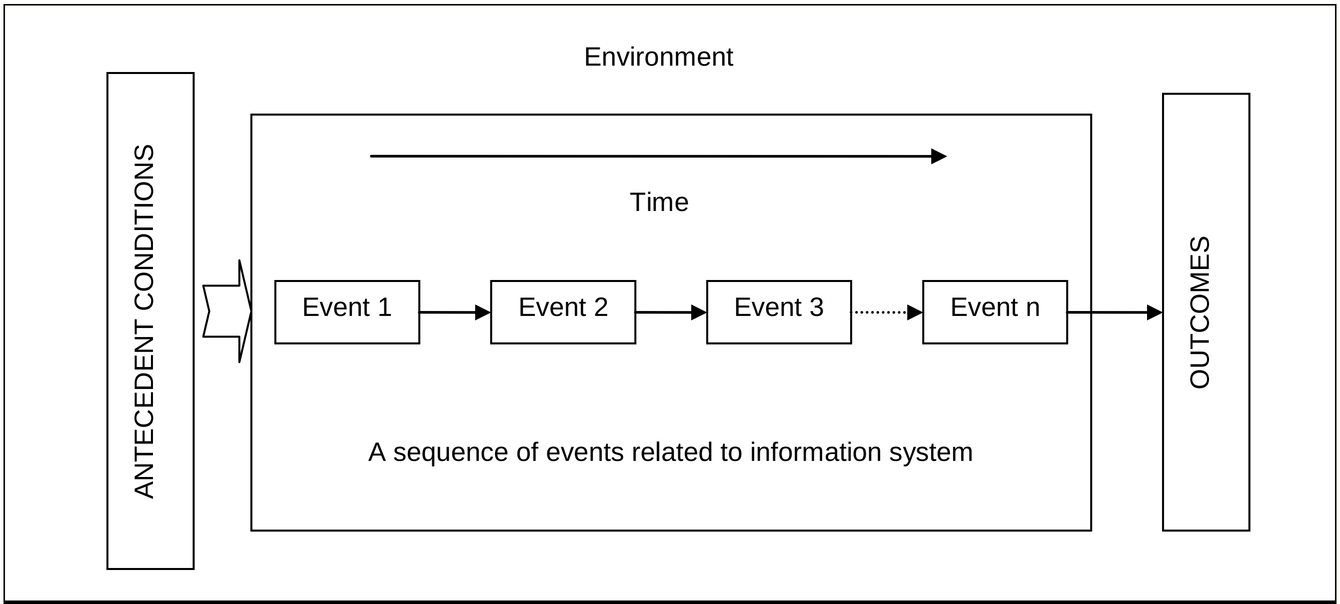


Figure 1. Basic Process Model [Adapted from Newman and Robey 1992]

Conceptual Framework

Based on Newman and Robey [1992], Pan *et al.* [2006], and Newman and Zhao [2008] this study is constructed on three major frameworks: *Leavitt's socio-technical change model (Figure 2)* ; *a social process model (Figures 3 and 4 showing a successful intervention)* ; and a *punctuated equilibrium model (Figure 5)*, and attempts to reach a sufficient understanding of a complex implementation process in its organizational and wider contexts.[1] Leavitt's socio-technical change model is used to identity the relationships between structure, actors, technology, and task and their effects on IS implementation [Leavitt 1965]. The social process model is applied to describe project outcomes through the study of the entire implementation process [Newman and Robey 1992; Robey and Newman 1996; Pan et al. 2006] where the system change is seen as a construction of a sequence of incremental changes and critical incidents representing, respectively, equilibrium periods (stability) and disequilibrium periods (instability) within organizational and external contexts [Gersick 1991; Lyytinen and Newman 2008; Tushman and Anderson 1986; Pettigrew 1990; 1992]. Finally, punctuated equilibrium theory is used to understand how change can occur. ISD is depicted as having relatively long, stable periods, punctuated with opportunities for change to the *deep structure* (e.g. a crisis such as a change in project leadership or major issues arising from software problems that lead to a radical change of approach).

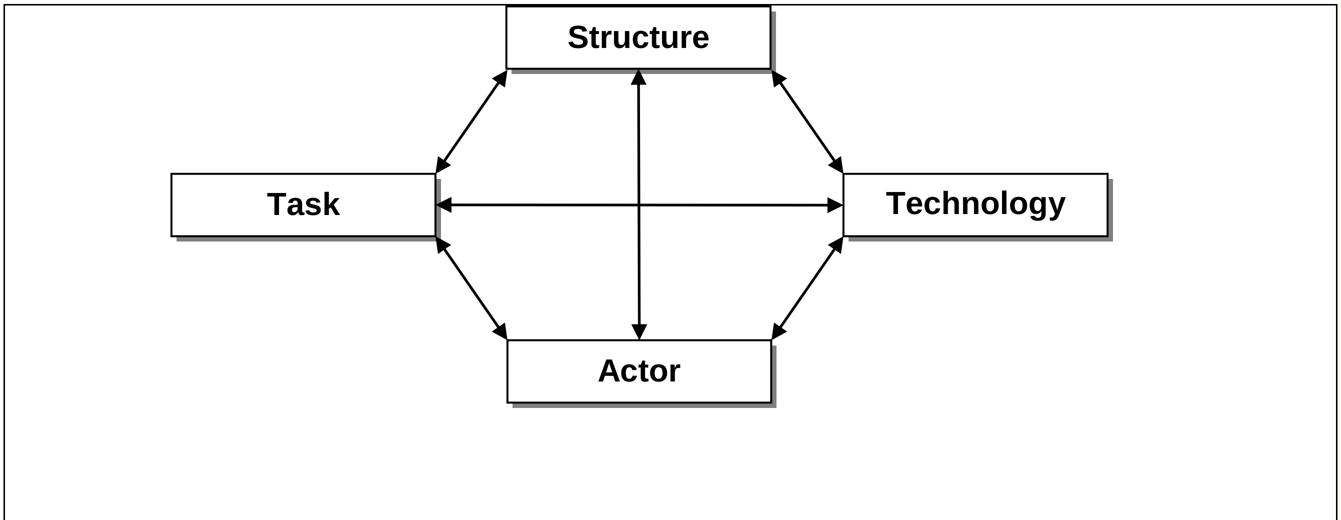


Figure 2. Leavitt's Diamond [Adapted from Leavitt 1965]

[1] Readers are referred to Newman and Zhao [2008] and Lyytinen and Newman [2008] for details of the framework.

Figure 3 depicts a critical incident (or event) that occurs during the project (i.e. building system), which produces a *gap* between the task and the technology. Not all events are critical, but we designate those that are *critical* if they produce a gap in the socio-technical entity as illustrated previously. For example, a pilot test of a new information system may cause major problems to the users of the test system (poor usability, slow response times, etc.), resulting in a gap between the task and the technology. Critical incidents may be planned or unplanned. Gaps may persist for sometime.

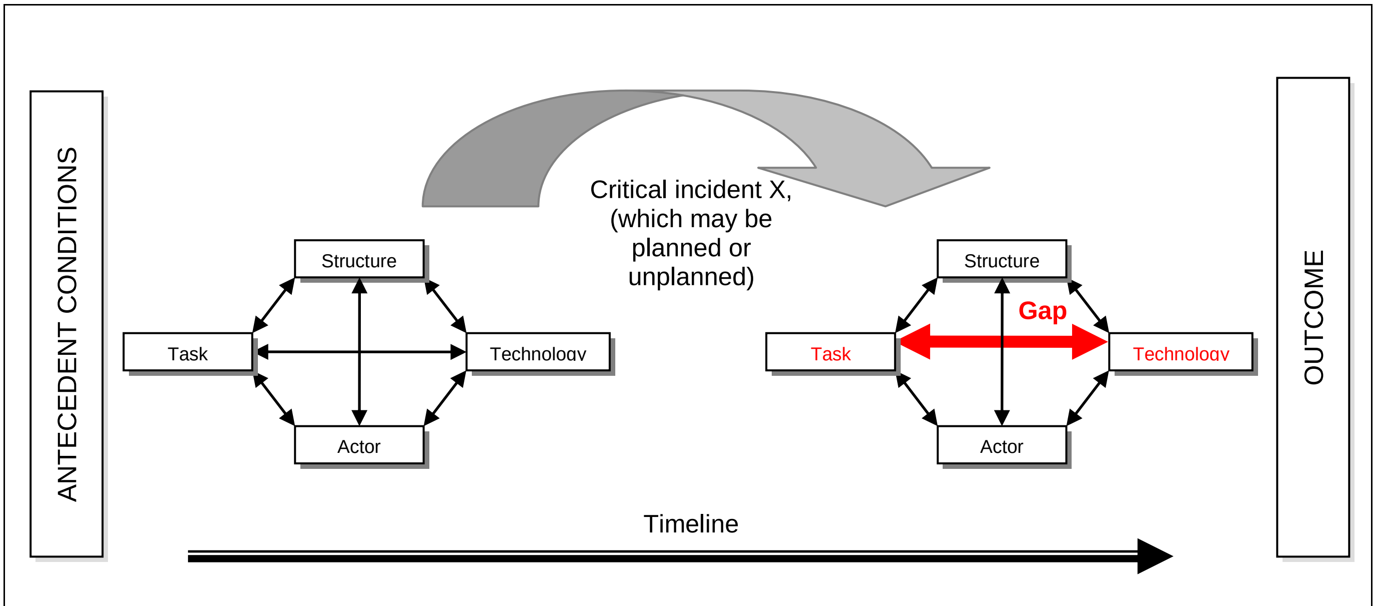


Figure 3. Social Process Model [Adapted from Newman and Zhao 2008; Leavitt 1965; Robey and Newman 1992]

Following from this, we see in Figure 4 that actors, when they recognize the gap, may construct an *intervention* to try to remove this gap (e.g. database re-design) which is *successful* in this example. We also include the elements of *context* (inner and outer) which may interact with the build and work processes [Pettigrew 1990, 1992] as these may also be sources of critical incidences.

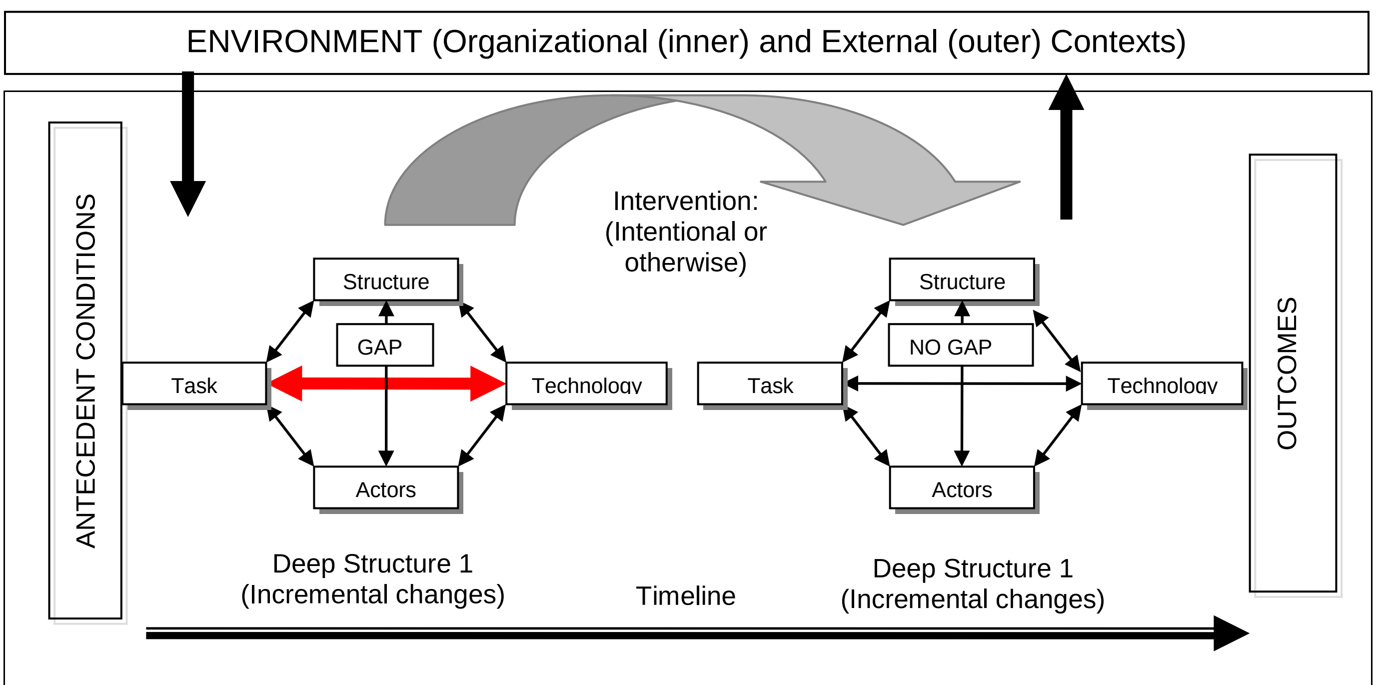


Figure 4. Successful Intervention [Adapted from Newman and Zhao 2008; Newman and Robey 1992]

In contrast, other interventions may be unsuccessful and the gap remains or perhaps even additional gaps appear. Processes may drift into further chaos over time. In all these interventions, the deep structure of the processes [Gersick 1991] remains intact (see previous). However, there will be (infrequent) occasions where changes will make the actors re-examine and change fundamental assumptions about how work is accomplished and/or systems are built. These are called *punctuations*. For example, the project leadership might change from user-led to IS-led. The start of a new project nearly always involves punctuations, first in the build system when the project is established, and later if and when the new information system replaces the legacy system. The full punctuation model can be seen in Figure 5, which shows a successful punctuation and the change in the deep structure [Gersick 1991].

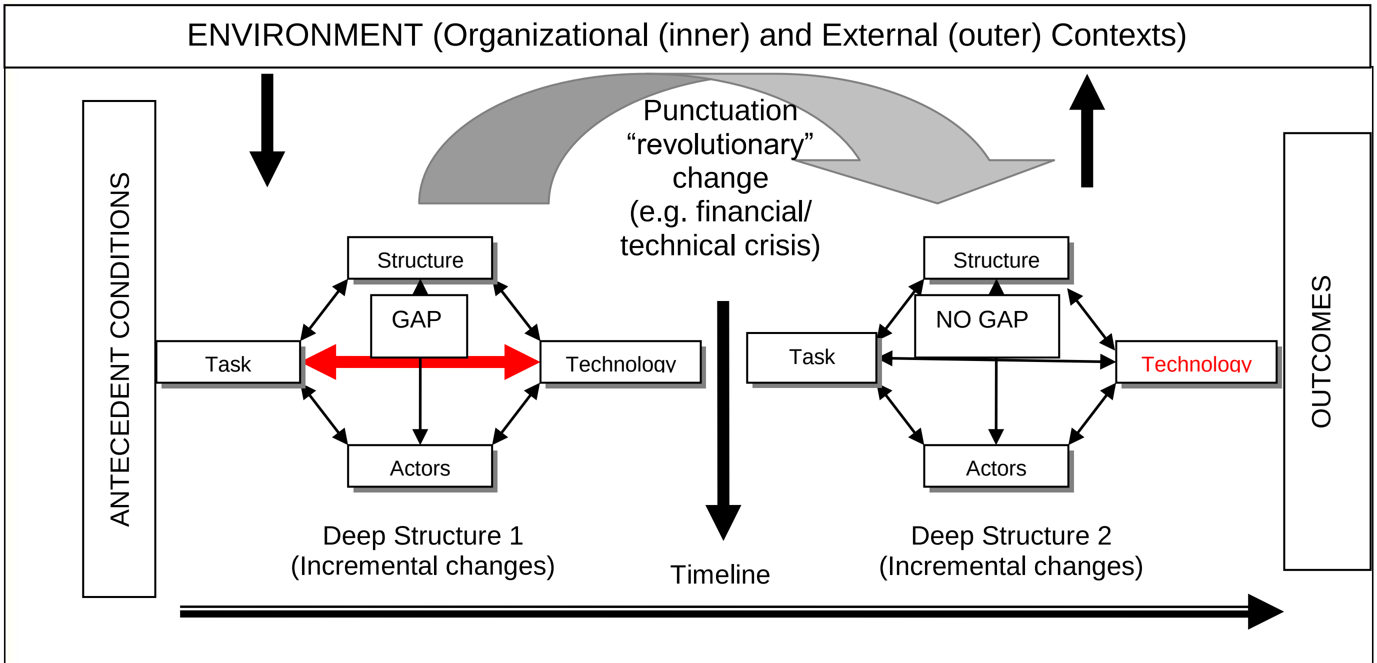


Figure 5. The Contextual Punctuated Process Model (showing a successful punctuation) [Adapted from Newman and Zhao 2008; Newman and Robey 1992]

Parallel Process Model

Because social and organizational environments play such a significant role in IS implementation research, we add the final nuance to study work processes in parallel with IS building processes and the interactions between them. Newman and Zhao [2008] and Pan et al. [2006] introduced the *parallel process model* with the socio-technical entity concept (see Figure 6).

In using the model, we challenge the traditional view of ISD by simultaneously examining the organizational work process as well as the IS building process and their interactions with the environment (Figure 5). This is because IS project implementations will generally influence an organization's existing practices with new technical elements and have impacts on organizational routines. Conversely, changes in existing organizational routines and work processes can become critical incidents, which in turn will affect the project implementation process. Therefore our parallel process model considers that the two sets of build-and-work processes exist and interact with each other in parallel until the end of the project life cycle when the legacy system is replaced with the new one or the new system is abandoned. Further, the trigger for change will often originate from the work system when stakeholders recognize the shortcomings of the legacy system (W1 in Figure 6). This also means that there are two types of socio-technical configurations, one associated with the build process and another with work or legacy process. For example, task is defined in two ways: one is the task of *building* the information system, while the other is defined by the existing *work* practices.

In summary, shaped by an historical context (*antecedent conditions*), existing socio-technical arrangements continue until a *critical incident* (planned or, usually, unplanned) takes place which produces a *gap* between one or more of the S-T pairs. This is an unstable state and actors, when they recognise the problem, may attempt to design *interventions* which may remove the gap successfully or may fail and even result in multiple gaps (i.e. *unintended consequences*). In all these cases there is no threat to the underlying *deep structure* although the model admits small *incremental, first order changes* to this deep structure. In contrast, some interventions (planned or unplanned) may produce *punctuations (or second order changes)* that produce a new, deep structure. Assembling the building team and delivering the final system to replace the existing work processes are both examples of common punctuations but there may be others as well that arise from sources that are internal or external. We now turn to illustrating the punctuated process model in an mid-sized firm.

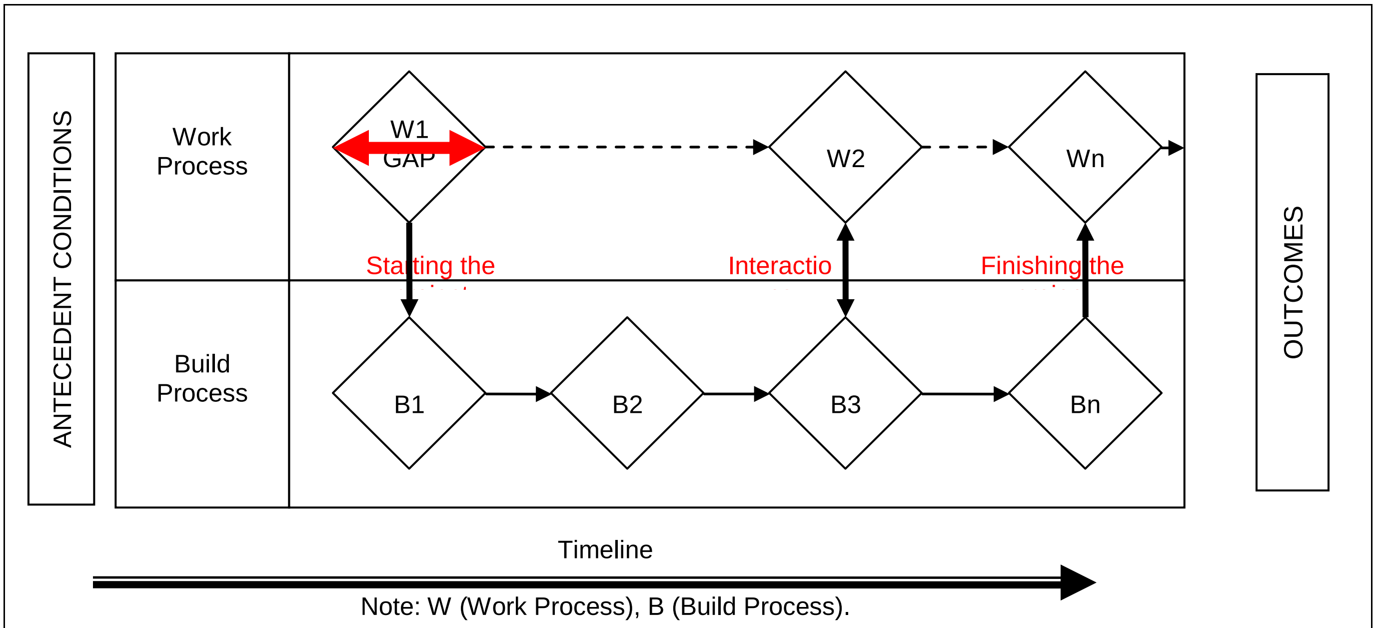


Figure 6. Parallel Process Model with Socio-Technical Entities [Adapted from Newman and Zhao 2008]

III. RESEARCH APPROACH

This study adopts a qualitative research approach with the support of an interpretive case study. The research site was a medium-sized UK retail organization that will be referred to as the Devonshire case throughout this report.[2]

Research Design

Because studying a process is a systematic way to explain changes within the organizations, an important aspect of this research will be to monitor and study the way the IS project is implemented over time in the Devonshire case. The conceptual frameworks have been used to guide the data collection and analysis in ways that will highlight the ISD stages and critical encounters over the project implementation timeline, and explore the connections between preceding events and their consequences that move the project from one stage to another in parallel to the organizational work process. This section illustrates the construction and interpretation of the outcomes from an extended case study using our model. Data were collected to report how a database and data warehouse system (we label this the EPoS[3] system) was developed through a set of stages over a two-year period. The Devonshire case was selected mainly opportunistically because of the high-level access that the authors had in this organization, and secondly, the authors believe that this case could contribute toward IS research in terms of the application of the punctuated process model in an SME.

Research Site: The Devonshire Retail Firm's Industry Background

Over the preceding years, the UK's industrial sales show a continued growth, especially in the retail Industry, where the retail sales have continued at a robust rate as indicated by the latest results from the Office for National Statistics (see Figure 7). According to National Statistics [2004], the headline three-month growth rate has stayed between 1.7 percent and 2.0 percent since last December. The total sales volume in June 2004 was 7.2 percent higher than in the same time last year. This follows an annual growth rate of 7.5 percent in May 2004, which was recorded as the highest annual growth since April 2002. Store retail and other non-store retail also showed strongest growth in sales volumes during June 2004, where in the non-store retail, increased sales for mail order and Internet companies helped raise the annual growth in sales volumes.

---
[2] Not its real name. Anonymity was a prerequisite of access to the company.
[3] Electronic Point of Sale

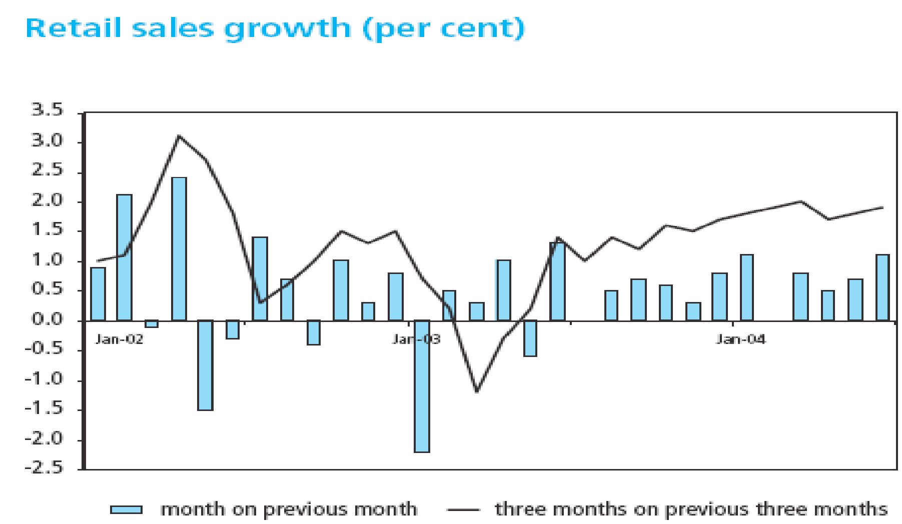


Figure 7: Retail Sales Growth 2002-2004 [Source: National Statistics 2004]

Consequently, with the robust retail sales growth, there have been increases in the general demand for ICT products in the retail industry, where numerous information systems were required to be implemented in retail organizations in order to keep track with its sales growth and fierce competition. Overall, Mahajan [2004] showed that between 1992 and 2001, the overall demand of ICT products in the UK has grown by 141.9 percent.

Company Background

Devonshire is a mid-sized retail firm based in the UK. It began with just one store; and it now has more than 50 stores nationwide, a wholesale network, and a dynamic e-commerce system, all with ambitious plans for growth. In 2002, it re-branded and is rolling out the new brand across the country as part of a massive investment and expansion program designed to keep Devonshire at the leading edge of retailing. Devonshire faced strong competition in the industry with many other low-cost retailers; increasingly a number of supermarkets challenged Devonshire for its position. Devonshire is currently loss-making, but was looking to turn a profit of £1 million by the end of 2006. The organizational structure is flatter and more centralized than most, as seen in Figure 8. The business is striving toward a customer-focused business, providing an efficient service in all areas within the market place. Its strategic direction is to increase brand identity, synonymous with low cost, quality, and customer services. Specifically, the strategic objectives for the store sales channel are full KPI (Key Performance Indicators) visibility, cost base alignment, and active selling. For the wholesale channel, key partnerships are being developed and margins are predicted to improve. The growth, innovation, and Web site customizations are especially focused on the Internet sales channel.

Nevertheless, there were two key elements that prevented Devonshire from achieving these goals. First, the existing DOS-based information system was coming to the end of its technical and functional life span as the business was developed, creating an ever-increasing cost base for maintenance and support. The risk of major system failures was growing, potentially causing a drop in sales through till failures and polling anomalies, reduction in revenue, potential loss of channel to market, and increased storage charges. Secondly, the existing system had major shortcomings within both store and central functions. Examples of these include: insufficient visibility of holdings and location of stock, insufficient ability to control prices and therefore margin, and insufficient control of markdowns, resulting in high levels of reported stock losses.

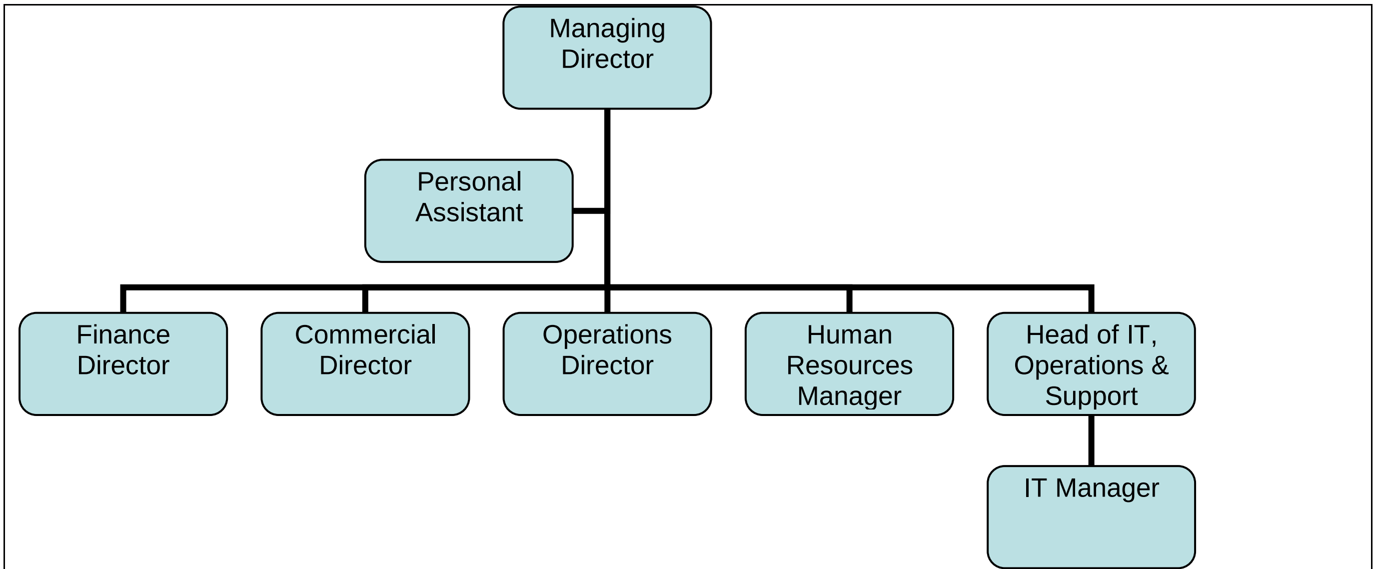


Figure 8. Organizational Structure

This study focuses specifically on the new database and data warehouse system—the EPoS system (Electronic Point of Sales) —that was being implemented at the organization to improve its efficiency and effectiveness.

The project implementation was still in progress by the time of the research, but the system was being rolled out successfully to the stores. In order to comprehend different perspectives relevant to IS project, personnel at all levels within the organization were targeted, with five main stakeholder groups studied: system developers, end users, IT experts, management, and vendors. Over the period from March 2004 to August 2004, a total of 11 interviews were conducted with actors from these user groups, and some subjects were interviewed more than once for continuity purposes. The interviews were carried out in a "snowballing" style, in which the author was recommended to people who were relevant in terms of this IS implementation by previous interviewees. The sample was chosen to include those who are apparently embracing the changes as well as others who appear to be experiencing difficulty or discomfort. Table 1 shows details of the dates of interviews, the titles of interviewees, the duration and whether the interviews had been used to derive a transcript. No attempt was made to privilege one view over another.

Table 1. Interview Schedule

Date (dd/mm/yy)	Title	Duration (minutes)	Transcript Y/N
08/03/04	IT manager	60	Y
25/05/04	IT manager	25	N
09/07/04	Help desk assistant	70	Y
09/07/04	IT manager	85	Y
14/07/04	Head of operation and support	50	Y
15/07/04	Store Manager	60	Y
15/07/04	Store Staff A	40	N
21/07/04	Financial process administrator	55	Y
29/07/04	Project manager	65	Y
30/07/04	Retail manager	50	Y
04/08/04	Vendor	30	N

Data Collection

With the aim of understanding Devonshire's organizational background, past IS conditions, current initiatives, future vision, and the driving forces, semi-structured interviews, documentation analysis, and observations were used to collect data. Transcripts of the interviews became the primary source of data. Although it has been argued that, "post hoc rationalisations tend to emphasise particular causes, perhaps to simplify the lessons learned" [Brown and Jones 1998], the memory traces and stories of project participants are often the only way to gain access to a project's history and in particular the actors' perceptions of events.

Semi-Structured Interviews

While the purpose of the research demands that the interviews tap into the subjective world of the interviewees' experience of change, it is also essential that the data collection process is as objective and rigorous as possible. In particular, it is important that any contamination of the data by the researcher's own pre-conceived ideas is minimised. The interviews attempted to create a time dimension to the interviewees' stories of change: as well as the current picture, a retrospective perspective was sought from the subjects. Appropriate and open-ended questions were used in this process, which were intended to enable the interviewees to expand and deepen the breadth and level of their disclosures.

The interviews were conducted mainly at interviewees' workplace and on a one-to-one basis. Subjects were encouraged to tell *their stories* in *their own words*. In order to get a subject's story, a mirroring technique was used to reflect the subject's words [Myers and Newman 2007; Rubin and Rubin 2005]. For example, if a subject commented: "I *wouldn't choose this vendor* if I was in the project team," would be mirrored back to the subject as: "Why *wouldn't* you *choose that vendor*?" Interview questions were organized to begin with general questions, such as, "Can you tell me about your role here?" leading to more focused questions, such as "Why do you think the EPoS system is being introduced?" in order to drill down to the detail. Most of the interviews were recorded and subsequently transcribed as the main source for later analysis. During the interviews we had the subjects focus on *critical incidents* in telling "their story." Indeed, we subsequently used these stories to triangulate on critical incidents. Both researchers examined the data and together took a view on what was critical and what was not in order to produce the final trajectory (Figure 9).

Documentation Analysis

Both internal and external documentation were examined to provide additional verification to interview data, including project plans, test documents, user acceptance testing documents, some specification documents, Web-based information, and software update release documents. Documentation analysis enables the researcher to obtain the language and words of informants through an unobtrusive source of information which can be accessed at a time convenient to the researcher. It represents data that informants have given attention to when compiling them [Creswell 1994].

Observation

As interviews may provide "indirect" information filtered through the views of interviewees, observations were also used to gather additional data to supplement data gathered through semi-structured interviews, such as unusual aspects of organizational change. Observations were carried out on-site during interviews to supplement some additional data, for example, how store staff interacted with the till system.

Limitations

There are inevitable limitations associated with this type of research. In total, only 11 interviews were conducted to study the project-implementation process. The data collected cannot reflect the every side of the story. Each interviewee had a unique individual angle in looking at the project and its process, and a complete view of the "story"is impossible to be obtained. The types of documents that were used during the analysis phase were limited due to the limited access gained by the authors and also security reasons. Furthermore, interpretation bias may have been introduced in this study as a common weakness of the nature of qualitative research [Miles and Huberman 1984]. Interviews could not be recorded without the permission of the interviewees so data from those unrecorded interviews had to be analyzed from the notes taken by the authors. Moreover, due to the resources, this research was not able to pursue the case project to the end, and the research ended before the final testing commences at the time of writing. Finally, the case-study approach, especially the single case research in this report, has suffered various criticisms. Generalization from this type of research is said to be a problem; it can hardly represent a typical IS project in the UK retail industry [Gummesson 1991] as is a lack of representativeness [Hamel et al*.,* 1993]. But generally, this research provides a better understanding to the concept of the event trajectory through case research and has utility in developing theory.

Data Analysis

Each interview transcript or set of notes taken from documentation analysis and observation was subjected to an intensive six-step process of data analysis (see Figure 9, which represents the indicative process we followed). The research process started with the frameworks that have been explained in previous section, which describes socio-technical change, social process, and critical incidents associated with the IS project. Essentially, it is an iterative process of data generation, with reflection on the transcript data, inductive and deductive analysis mediated by frames, and deduction and induction mediated by the data (Hence, the generation of concepts and frameworks forms an ongoing part of the data analysis as well as its conclusion).

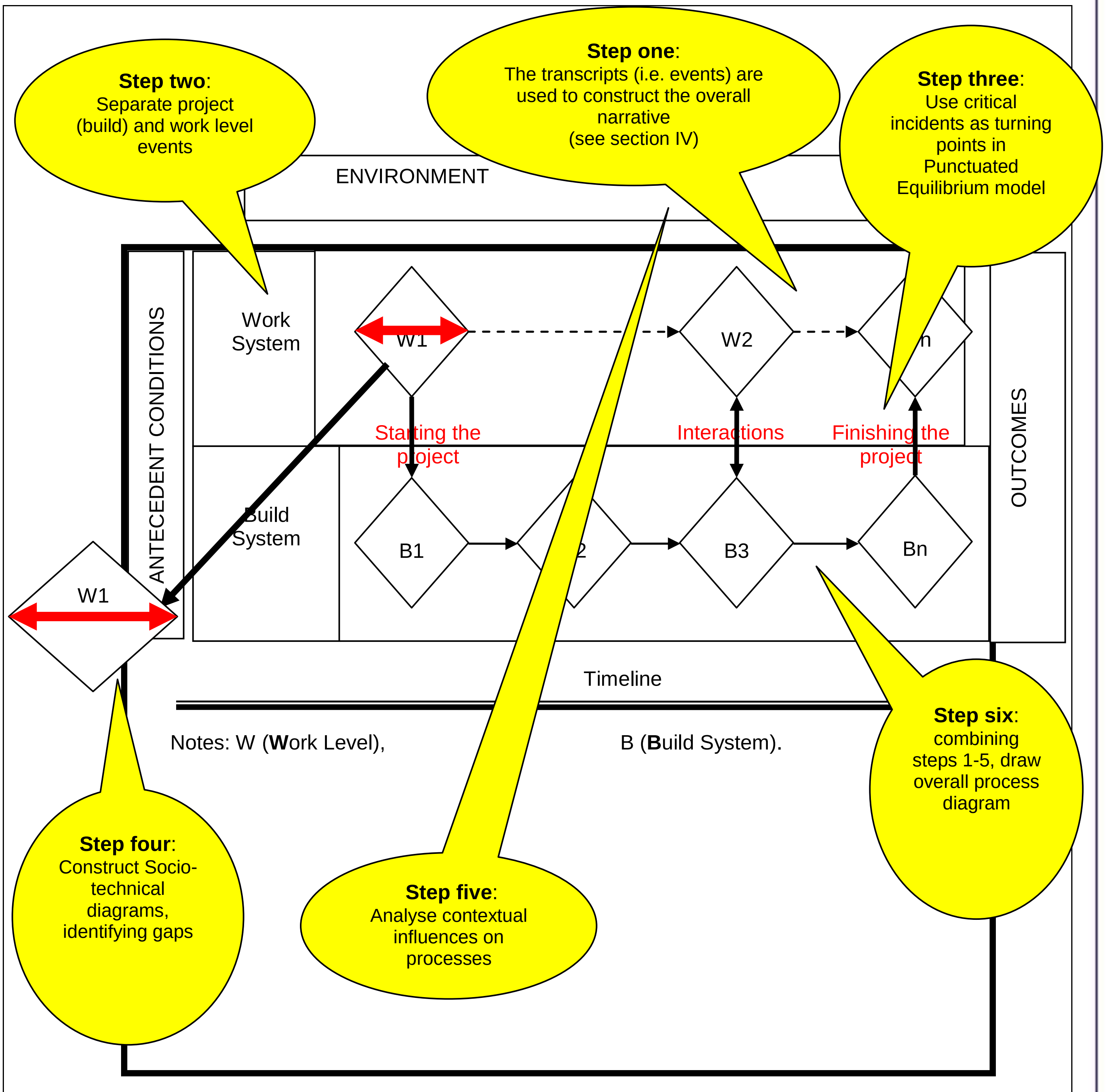


Figure 9. Six Step Data Analysis [Based on Lyytinen and Newman 2008]

In step one, the data (transcripts) are used to produce a basic narrative of the overall process: what happened; when did it happen; what went before; what were the outcomes; and what were the influences? These features were identified mainly through examining the interview transcripts using a microscopic approach [c.f. Strauss and Corbin 1998], which is an analysis of each paragraph and each line of the paragraph. This basic narrative is shown in Section IV ("Case Study Findings") and expanded in further detail in Section V. During the first analytical step, the antecedent conditions for the project implementation were also identified. This was used to attempt to identify the events, episodes, and stages related to the implementation. For example, in responding to what the organization can benefit from the new system, the IT manager responded:

The key benefits are increased stock visibility through our warehouses, and greater flexibility for users and system administrators……..we will have the ability to plan company strategy in more detail, allowing us to increase market focus. (IT manager, 09/07/04)

From this manuscript, it was possible to identify the problems that the organization had with its old system, i.e., lack of stock visibility, lack of flexibility, lack of detailed strategy planning, and market focus. Many of these kinds of issues were surfaced from the interview manuscripts. In the second step, we looked for critical incidents, separating them into work and project events. We also looked for interactions between the processes. For step three, we used the punctuated equilibrium model [Gersick 1991] to analyze these critical incidents. Essentially, the model depicts project and work life as relatively stable (evolutionary) periods punctuated by shorter, turbulent (revolutionary) periods which are capable of influencing the projects' trajectory. The critical incidents are associated with these revolutionary periods. Fourth, we interpreted the data to draw the individual socio-technical diagrams, identifying the four components and any gaps between them. The authors grouped those identified events into the four categories according to Leavitt's model [1965], namely, task, actors, technology, and structure. Because there are no clear-cut boundaries between the four components, the categorization was based on the authors' interpretations. Subsequently, gaps [Newman and Zhao 2008] between the four variables were identified. In the fifth step, we analyzed organizational and wider contexts for their interactions with process. Finally, for the sixth step, combining data from steps one to five, we constructed the overall process diagram (Figure 27). With the events identified as well as the phases and stages in relation to the IS project implementation, the sequential patterns were arranged in chronological order. Although we describe the data analysis as a series of steps, this is an inevitable simplification: there were many interactions and iterations between the stages. Further details of this analysis are presented in Figure 9.

IV. CASE STUDY FINDINGS

The following is a brief narrative of the project, its antecedent conditions, context, and outcome. It was derived from the transcripts, documents and observations. This is followed by a detailed set of S-T diagrams for each critical incidence for build (B) and work (W) levels. These are then assembled as a summary of the processes (Figure 27).

Antecedent Conditions: Problems with the Legacy System

The legacy system in Devonshire was a DOS-based system, which was used for stock control throughout the retail business. In general, the legacy system was successful with regard to meeting all its original objectives; however, over time, due to the outdated status of the hardware and software, the legacy system has been reported variously as very slow, unreliable, and inflexible, which resulted in difficulties in carrying out management reporting, system support, and maintenance processes. As a result of the number of negative issues associated with the legacy system, a decision was made by the Devonshire top management at the end of 2002 that an EPoS system would be implemented to replace the legacy system. This project was instigated to radically overhaul the internal processes and supporting systems of Devonshire to enable the business to function more efficiently as a retailer and wholesaler leading to increased customer satisfaction and profit realisation. The project aimed at amending the Devonshire processes and supporting systems to address the significant shortfalls and help meet their objectives. In summary, the historical picture of ISD at the Devonshire was generally positive but the legacy systems were well past their sell-by dates and needed "punctuating" with a new system (Figure 10).

The New EPoS System

Generally, the main benefits identified were improved management information through better visibility of stock flow and sales through the business, improved merchandise management, in-store efficiency, affinity sales and promotions features, an improved stock control capability, higher quality of reporting and analysis through business objects for strategic planning, fully integrated system from warehouse to store, and improved security visibility, and off-stock movement.

In contrast, there was some apprehension and resistance to change that surfaced as complaints from users, who were used to the way the legacy system worked. Their jobs were organized around the legacy system's functionality. The user resistance was said to be attributed to the failure of users to initially take responsibility for their own training and also by the over-reliance on IT staff for problem solving. However, with the further training, store staff quickly adjusted to the easy-to-use graphical interface. The initial work appeared to be slower during the bedding in period due to the change in work methods and increase in system functional complexity. This was soon overcome for the majority of users as the interface was similar to the Windows XP operating system.

The Project Implementation

The Selection of the System

The new EPoS system was bought from a UK software company as an off-the-shelf package with customized components built especially for the Devonshire. In selecting the system, the cost and the level of customisation the vendor could undertake to the core product were the main considerations. Time was a tertiary factor, as the project had to be delivered in a slightly compressed timeframe. However, management at the Devonshire expressed dissatisfaction toward the vendor. This was due to a number of reasons. First, the vendor's software had not been proven in the commercial situation. Second, the system delivered was not delivered in a test-friendly environment for Devonshire as they required. Third, instead of implementing the system with Devonshire's perspective in mind, the vendor implemented it from their own perspective. Finally, before the system was delivered, the vendor failed to test the system adequately from a user or a store operator's perspective. Generally these problems were solved by adding more specifications to the system required by Devonshire and developing the software further.

The Project Team

This system implementation project started in 2002 and had one year in the planning stage and one year in the implementation stage. From mid-2003 to early 2004, the system was being implemented by the vendor. Training was provided afterward for the head office users, the store managers, the supervisors, and the IT experts. Testing was carried out in mid-2004, especially on the head office system, shop tills, and configuration. The pilot store system testing and roll out was scheduled to take place in late 2004, and the system was due to be rolled out to the rest of the stores in the following two months.

In late 2004, the project was in the final phases of testing and user acceptance testing was taking place. After testing, as planned, the system was due to be rolled out to all the stores in two months on a one-by-one basis. However this was not the original schedule: it was about six months behind although it was still within the financial budget. The system was a new product and unproven in a commercial situation. It had not been tested in a variety of retail situations.

Detailed Analysis of Project Trajectory

We now present our detailed analysis of the data specified in Section III and referred to in general terms at the beginning of this section. For each recognized event, we present the social-technical details including our assessment of the gaps between the model's "variables" and this was applied to Build (B) events and Work (W) events consecutively. In addition to the diagram, we provide an explanatory text for each event. These form the bricks we use to construct the overall process diagram (Figure 27).

Detailed Analysis of the Build (B) System

Devonshire is a medium-sized retail company based in the UK. It began with just one store; and it now has more than 50 stores nationwide, a wholesale network, and a dynamic e-commerce network, all with ambitious plans for growth. In 2002, it re-branded and is rolling out the new brand across the country as part of a massive investment and expansion program designed to keep Devonshire at the leading edge of stock disposal retailing.

This study focuses on the new database and data warehouse system—EPoS system—being implemented at the organization. The new EPoS system is implemented to improve efficiency and effectiveness. It has six levels to track the stock at individual item level. It enables the company to have better market focus; the company can now pull data out of database to see what items are selling well in which stores. Each till in the store will have a list of all stock item; therefore, when ticket tags are missing, instead of contacting the head office to check the prices, they can just check from the till screen. This project was led by top management: a *punctuation* to the build system (Figure 10).

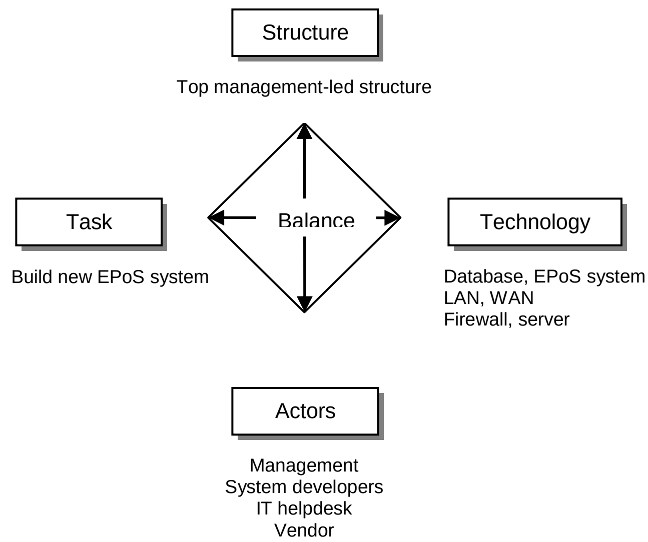
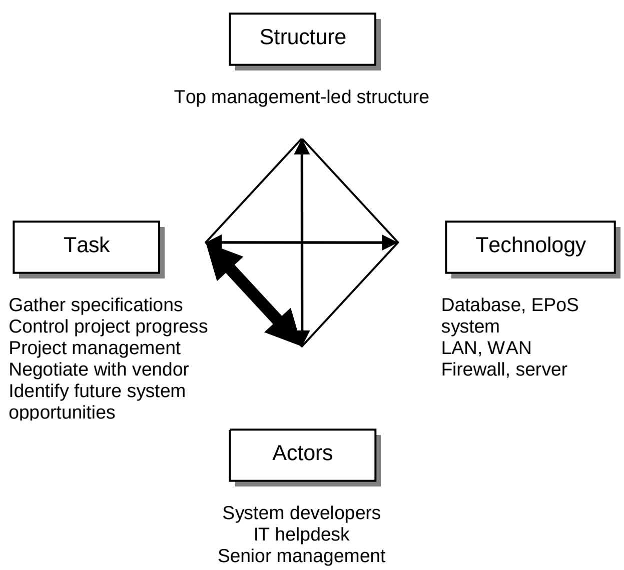


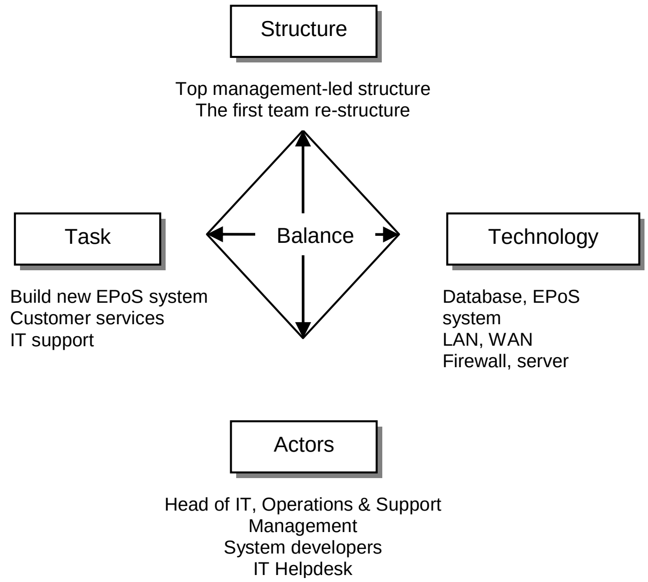
Figure 10. B1 – Antecedent Conditions



As well as the head of IT, operations and support, the project leader had high work pressure. On the organizational work level, the project leader is responsible for managing all the IT support for the entire organization, and also managing operations, stock, warehouse and audit. On the project level, his responsibilities involve gathering user specifications, negotiating with the vendor about the system delivery, overlooking the project management, ensuring that the project is delivered on-time, on-schedule and on-budget, and identifying future opportunities for system expansion and integration.

With such heavy job roles, the project leader was struggling in dealing with all the responsibilities. And a gap emerged between the actors and task component (Figure 11).

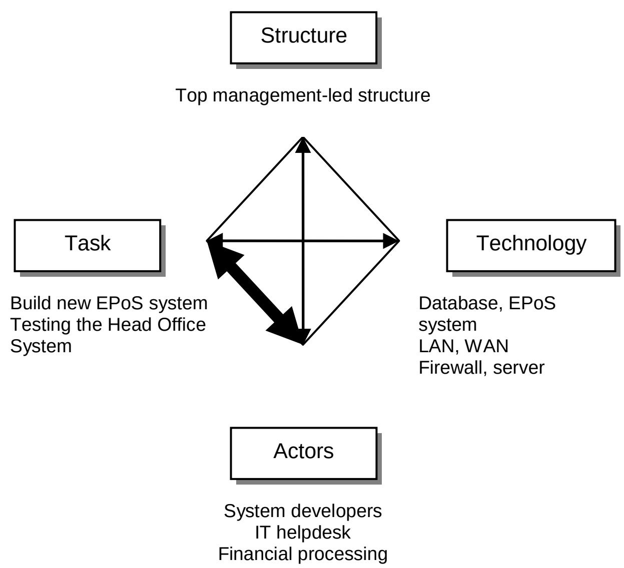
Figure 11. B2 – Pressure on Project Leader



Early 2004, a new IT manager joined the organization and the project team. He was assigned with various job roles. On the organizational work level, he has joint responsibilities with the head of IT, operations and support for managing IT support for the entire organization (responsible for the helpdesk and support for Devonshire), customer services, managing equipment and computer assets throughout the organization, and ordering equipment parts to ensure the organization continues to run smoothly. On the project level, he is responsible for the system testing, setting up and configurations, server maintenance and backup, the network, and system support for users. He is also jointly responsible for the management of the new EPoS system.

With many joint responsibilities, the IT manager plays a supporting role to the Head of IT, Operations & Support. And the gap between actors and task component was removed and balance of the system was restored (Figure 12).

Figure 12. B3 – The First Project Team Restructure

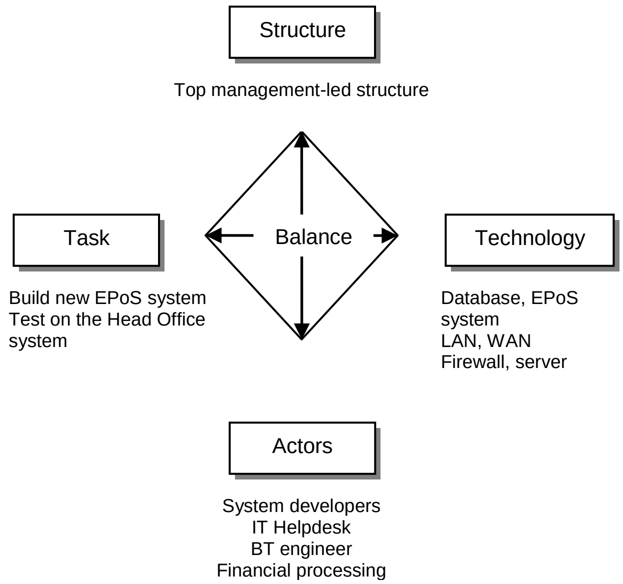


The legacy system communication breakdown was a result of an accident in the city. A BT major junction box was destroyed after an accidental fire in the tunnel.

At that time, the old financial processing is transmitted by BT telephone lines, because most of the time, banks accept payment through telephone lines for security reasons. As a direct result, financial processing could not reconcile the payment information, and the payment files could not be transmitted to the bank. Therefore the customers could not get charged and the company was not able to get incomes from the sales.

On the project level, the testing on the head office system was undergoing. Consequently, the extra work generated by this accident for the IT department delayed the head office system testing phase, and a gap was therefore generated between actors and task components (Figure 13).

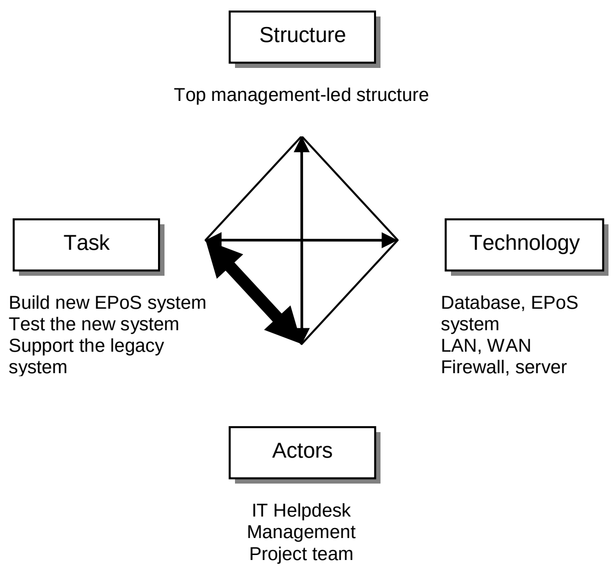
Figure 13. B4 – The Problem with the Legacy System Communication



Since the broken BT major junction box affected many people and organizations, it was repaired shortly afterward by the BT engineers. However, the problem generated backlogs of payment files. In order to get the system balance stored, the IT helpdesk had to clear the backlogs of payment files created by the accident, and regenerate the payment files. The organizational work-line process was then restored.

On the project level process, the head office system testing was continued, and the system balance was restored. This head office system testing was described as crucial at the time by the project leader, because it was almost the end of the testing deadline. If the testing was delayed by any longer, the whole project would be delayed, and project deadline would not be possible to meet.

Figure 14. B5 – BT Major Junction Box Repaired

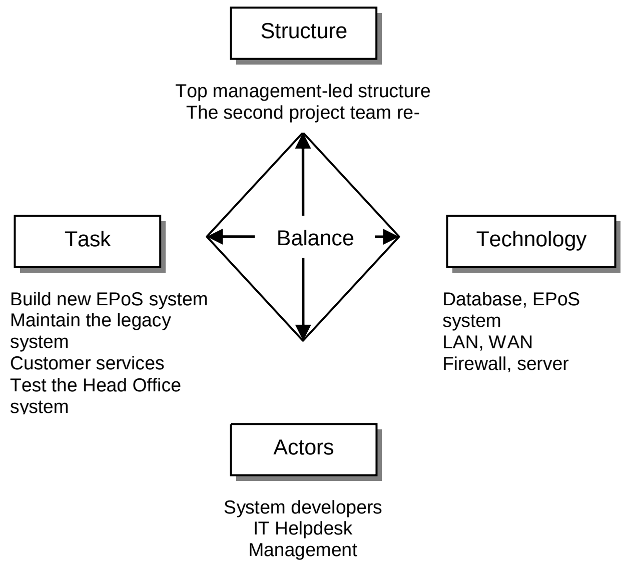


Normally, when employees want to leave the company, they are required to give the company at least two months notice in advance so that the company can have time to recruit new people to replace the job roles; the employees may give the new recruits necessary training before their departure.

However, one major IT person left the company failing to give the company notice in advance, which affected the organizational structure, organizational work process, and project process. His responsibilities in the project were to look after the legacy system and test the new system. Therefore, his leaving put more strain and work loads on the other people in the IT helpdesk department and project team. This reexamination of the build system constitutes a punctuation.

The system testing was slowed down, and a gap emerged between actors and task (Figure 15).

Figure 15. B6 – A Team Member Leaves

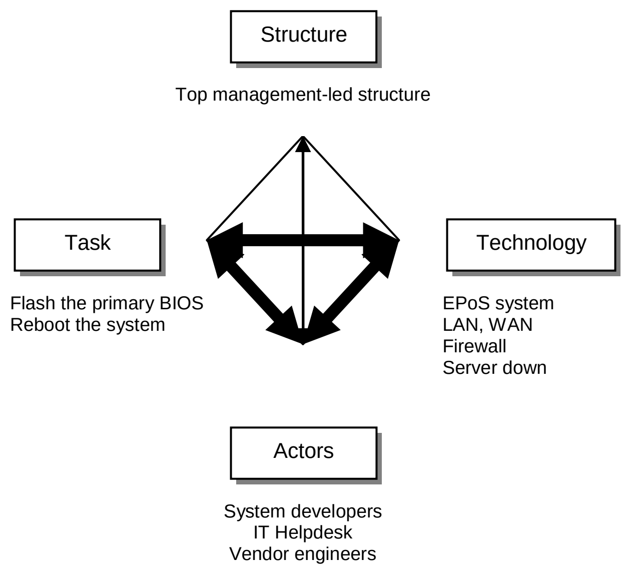


Two months later, two more people were recruited to cover that person's job. On the project level, they help the management and testing of the new system.

On the organizational work level, the job purpose of these new recruits is to work as part of the IT helpdesk team, providing support to the stores and head office. Their key accountabilities include: daily collation of store sales figures, payment processing, customer services, providing sales details for financial processing, trouble shooting store till systems, IT support for head office users, and remote users, maintaining the helpdesk call database, organizing network service requests, and updating and managing the Devonshire Intranet.

In summary, the recruitment has filled the gap left by the major IT person's leaving. And the system balance was restored (Figure 16).

Figure 16. B7 – The Second Project Team

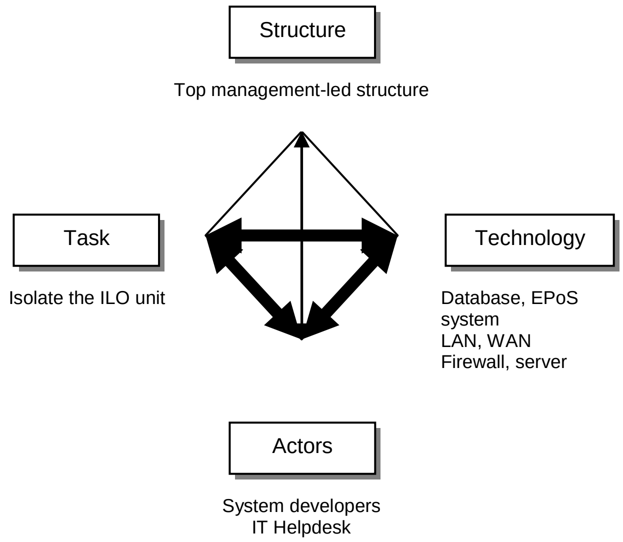


In July 2004, the new EPoS system server crashed. The IT helpdesk found a recognized fault in the both primary and backup/secondary BIOS (Basic Input/Output System), which contain information for booting the system. The vendor engineer tried to solve the problem by flashing (i.e. upgrading) the primary BIOS. After the reboot, the system crashed it again, and the system switched to the backup BIOS automatically as a default setting. However the system crashed the third time, because when the vendor engineer flashed the BIOS, they did not upgrade the backup BIOS. Therefore when the system switched to the outdated backup BIOS, a further problem occurred.

After ward, the system could not contact the server and boot up, because the BIOS settings had been reset, the system could not recognize the raid array controller.

Consequently, the testing was once again delayed and gaps emerged among actors, task and technology components (Figure 17).

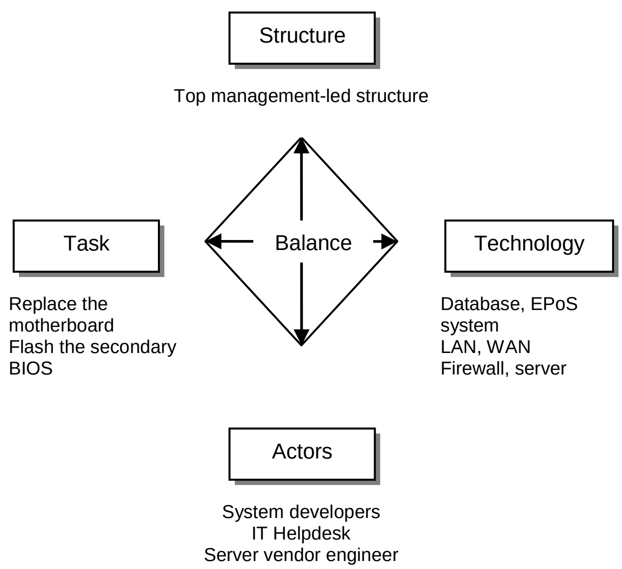
Figure 17. B8 – New Server Crisis



After the third server crash, the project team found out that the Integrated Light Out (ILO) unit in the motherboard was damaged. The ILO unit was described as a mini computer inside the main computer. Hence, when the main computer went down, a remote login could not be established with the mini computer in order to fix problems in the main computer.

The project team had to isolate the ILO unit and contacted the server vendor. Therefore the testing was still delayed and the gaps among actors, task and technology remained (Figure 18).

Figure 18. B9 – New Server Crisis Remained

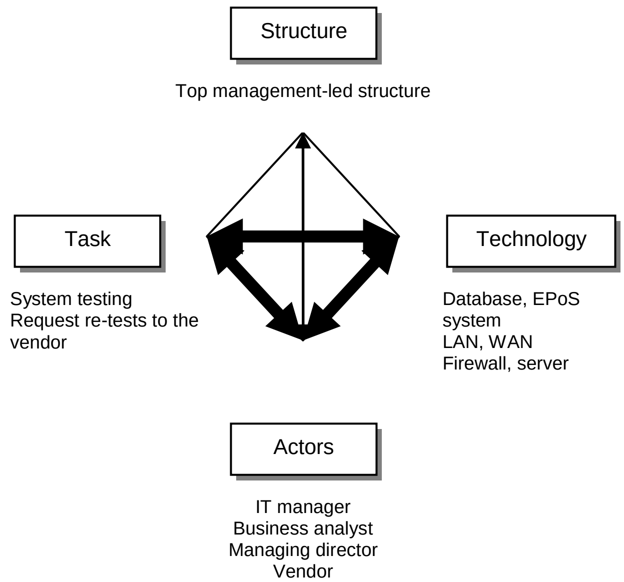


When the server problem remained, the project team called the server engineer. The vendor engineer spent an entire day and replaced the motherboard.

Afterward, the secondary BIOS was upgraded to the new version. The project team reconfigured the ILO unit, because it had a unique serial number and a web address through which the ILO unit can be accessed.

The server was repaired, and the testing process was resumed. As a result, the system balance was restored (Figure 19).

Figure 19. B10 – New Server Repaired

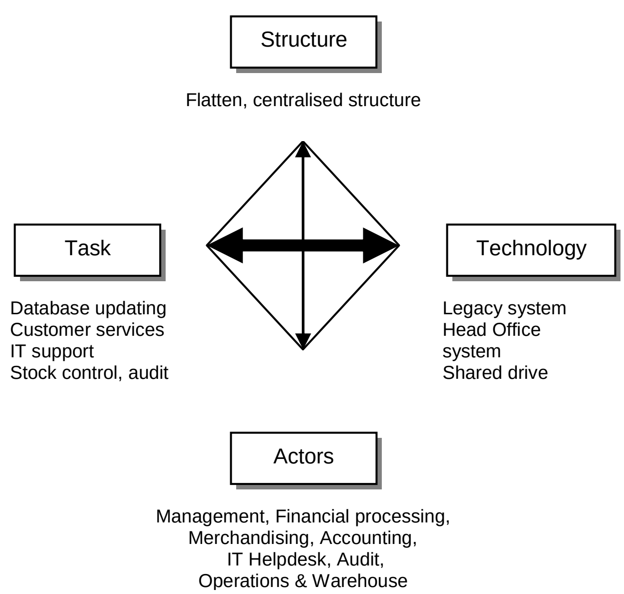


As mentioned earlier, there are three types of testing: alpha stage (i.e. work or not); beta stage (further to more life cycle testing); and user acceptance stage (if the system work as it is supposed to). When delivering the system, instead of delivering the system in the user acceptance stage as specified, the vendor provided the system in the beta stage. Therefore in August 2004, when the project team started user acceptance testing on the head office system and the till system, many errors were identified. For example, a communication error occurred between the two systems, till sales data could not be passed to the head office system. A meeting held among the IT manager, business analyst, managing director, and the vendor to discuss the problems. It was settled that more specifications were given to the vendor and the system was required to be redelivered in two weeks.

In summary, gaps emerged between actors and task, and technology, and task and technology. This may produce a punctuation in the build system in the future (Figure 20).

Figure 20: B11 – System Testing Crisis

Detailed Analysis of the Work (W) System



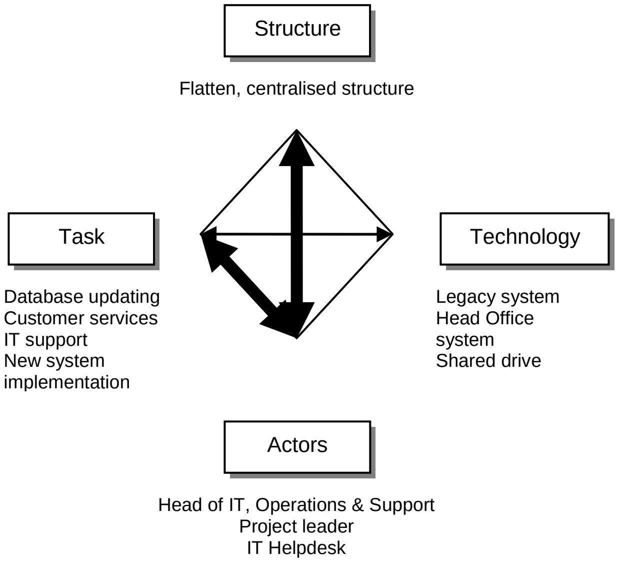
Previously, with the legacy system, sales data was recorded through tills, which was connected to backup database for each store, and the backup database is connected with a lease line to central computer. Every night, central computer polled each back office computer to obtain sales data; every day central computer pulls the data out of database to verify the sales progress.

However, there were many problems associated with the legacy system:

1. The legacy system is not reliable, with many associated hardware and software problems.
2. Limited and complex head office reporting
3. Inflexible management and reporting systems
4. System support and maintenance are often difficult to carry out.

The problems with the legacy system and the advances of rivals' technology drove the organizational change in Devonshire. The implementation of an EPoS system was proposed. As a result of the legacy system, gaps emerged between organizational tasks and technology (Figure 21).

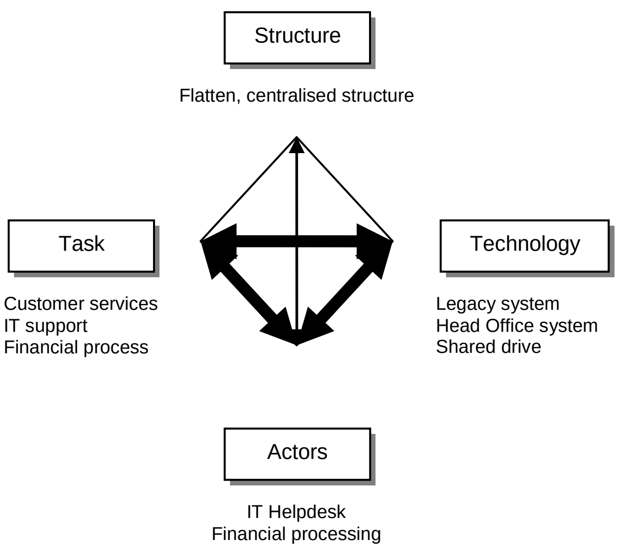
Figure 21: W1 – The Legacy System



As well as the head of IT, operations and support, the project leader had high work pressure. On the organizational work level, the project leader is responsible for managing all the IT support for the entire organization, and also managing operations, stocks, warehouse and audit. On the project level, his responsibilities involves gathering user specifications, negotiating with the vendor about the system delivery, overlooking the project management, ensuring that the project is delivered on-time, on-schedule and on-budget, and identifying future opportunities for system expansion and integration.

With such onerous roles, the head of IT, operations and support was struggling in dealing with all the responsibilities. And gaps emerged between actors and task, and actors and structure components (Figure 22).

Figure 22: W2 – Pressure on Head of IT & Support

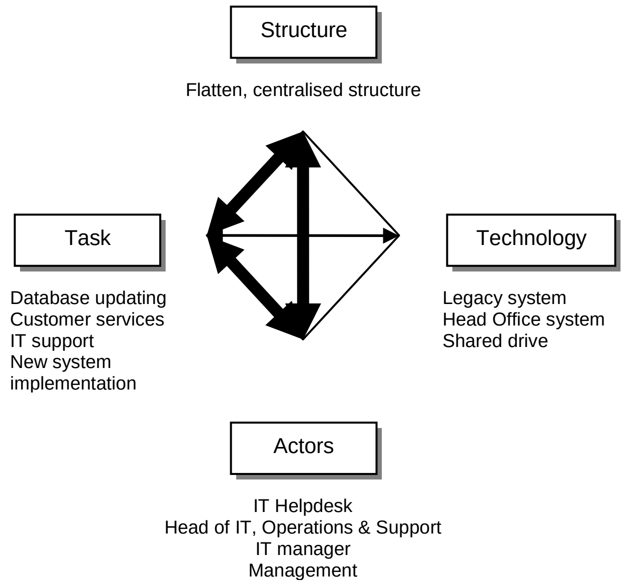


The legacy system communication broken down was a result of an accident in the city. A BT major junction box was destroyed after an accidental fire in the tunnel.

At that time, the old financial processing is transmitted by BT telephone lines, because most of the time, banks accept payment through telephone lines for security reasons. As a direct result, financial processing could not reconcile the payment information, and the payment files could not be transmitted to the bank. Therefore the customers could not get charged and the company was not able to get incomes from the sales.

As a result, gaps emerged between people and task, actors and technology, and task and technology component (Figure 23).

Figure 23. W4 – The Legacy System Communication Broken Down

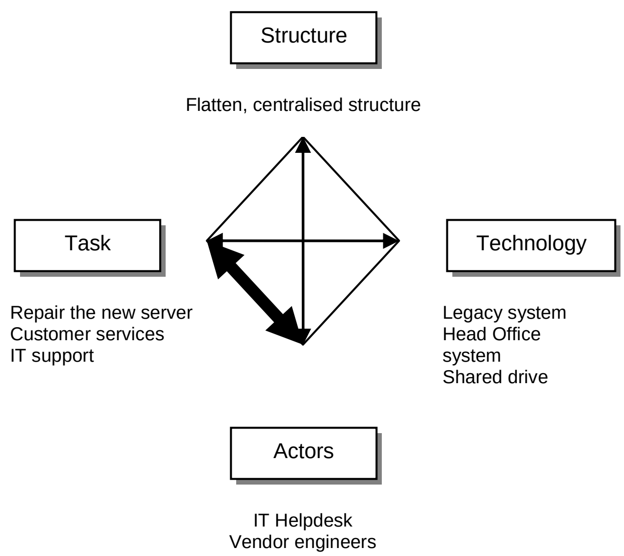


Normally, when employees want to leave the company, they are required to give the company at least two months notice in advance so that the company can have time to recruit a new person to replace the job role and the employee may give the new recruit necessary training before his/her leaving.

However, one major IT person left the company failing to give the company notice in advance, affecting the organizational structure, organizational work line process and project process. His responsibilities in the project were to look after the legacy system and test the new system. Therefore his leaving put more strain and work loads on the other people in the IT Helpdesk department and project team.

As a result, gaps emerged between actors and task, actors and structure, and task and structure components (Figure 24).

Figure 24. W6 – A Major IT Person Leaves

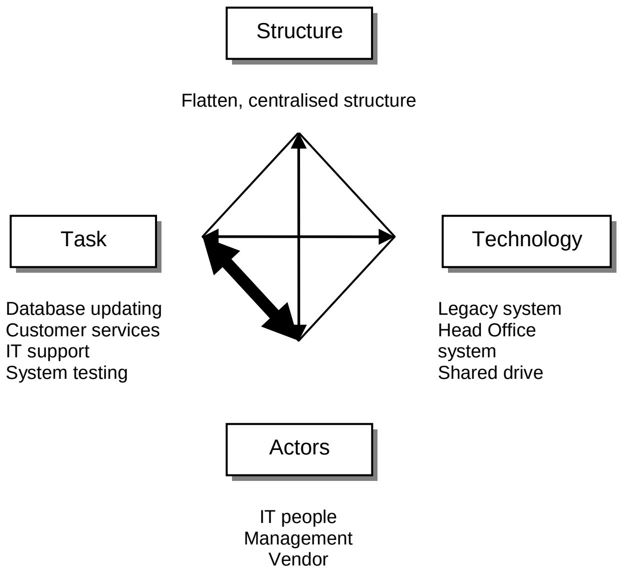


In July 2004, the new EPoS system server crashed. The IT Helpdesk found a recognized fault in the both primary and backup/secondary BIOS (Basic Input/Output System), which contain information for booting the system. The vendor engineering tried to solve the problem by flashing (i.e. upgrading) the primary BIOS. After the reboot, the system crashed it again, and the system switched to the backup BIOS automatically as a default setting. However the system crashed the third time, because when the vendor engineer flashed the BIOS, they did not upgrade the backup BIOS. Therefore when the system switched to the outdated backup BIOS, a further problem occurred.

Afterward, the system could not contact the server and boot up, because the BIOS settings had been reset, all the system could not recognize the raid array controller.

Consequently, the organizational work process was delayed and gaps emerged among people and task, and actors and technology components (Figure 25).

Figure 25. W8 – New EPoS Server Crisis



As mentioned earlier, there are three types of testing: alpha stage (i.e. work or not), beta stage (further to more life cycle testing), and user acceptance stage (if the system work as it is supposed to). When delivering the system, the vendor provided the system with beta stage.

Therefore in August 2004, when the project team started user acceptance testing on the Head Office system and the till system, many errors were identified. For example, a communication error occurred between the two systems, till sales data could not be passed to the head office system.

A meeting held among the IT manager, business analyst, managing director, and the vendor to discuss the problems. It was settled that more specifications were given to the vendor and the system needed to be returned in two weeks.

In summary, gaps emerged between actors and task components at the organizational work level (Figure 26).

Figure 26: W11 – System Testing Crisis

General Case Interpretation

Figure 27 is a pictorial summary of the EPoS project trajectory [Pentland 1999; Langley 1999] using the punctuated process model. The project is seen as a punctuated equilibrium process, where critical incidents emerged at different levels at Devonshire, i.e. in both organizational and external contexts, affecting the stability of the building process. The building process is presented as a sequence of socio-technical entities (represented by diamond shapes) and gaps (shown as thicker arrows) that may appear between the four components following the occurrence of critical events. The organizational work process is organized in a similar way. The mutual influences between these two parallel processes are also shown on the diagram, presented as thick black vertical arrows. These vertical arrows between the diamond shapes on the parallel processes demonstrate the significant points at which the two parallel processes intersected. Critical incidents generated gaps in the socio-technical components at the organizational work level process, which in turn resulted in gaps on the project level process. The more gaps at any one point, the larger the problems. The equilibrium of the EPoS project was punctuated not only by the events in its organizational context such as new IT manager appointment, but also by the factors in its external environment. For example, the technical damage to the BT junction box, was outside the control of Devonshire.

The first row "External context issues," the second row "Organizational context issues," and the last row "Build level issues" represent the critical incidents that occurred from its implementation context during the implementation process. The external context includes issues that are beyond the organizational boundary, such as industrial rivalry (e.g. competitive pressure) or even events outside the industrial boundary (e.g. government regulation or a recession). Organizational context takes account of planned or unplanned events that had significant impacts on the project implementation and also managerial decisions in relation to the implementation. Build management issues are issues that take place within or outside the project affecting the implementation process, such as a project team re-structuring.

It is clear that the two parallel processes have significant influences over each other at various points (Figure 27). On the one hand, events on the organizational work process that need to be given priority can affect or delay the building process. On the other hand, incidents that occurred in the build process sometimes needed to be dealt with at the organizational work level.

We have identified two punctuations and one possible punctuation. The first punctuation is to the build system when the project team is established (B1) after it is recognized by senior management that the legacy systems are inadequate and must be replaced (outer and inner contexts). The second punctuation (also to the build system) comes later into the building process when a major IT person leaves the Devonshire (inner context) and the project team has to be re-structured. A third possible punctuation involves both the work and build processes (W11 and

B11) and arises from the ongoing testing crisis. At the time of writing, it was not possible to say if this crisis would be resolved successfully or lead finally to a system failure. Either way, it can be described as a punctuation.

Overall, the project appears to be still on budget, but it has been delayed by approximately six months. According to De Wit [1988], this could be considered as a project-management failure. But it is not clear what would make the company cancel the EPoS project, because it was crucial to their modernization efforts. However, the outcomes of this project cannot be predicted at this stage with total accuracy, because they are dependent on the subsequent events. As the system appears to be rolling out successfully, we would expect that the Devonshire will be using the EPoS system in the near future. However, there are some clouds on the horizon: technical problems with the software could prove crucial to the success of the project.

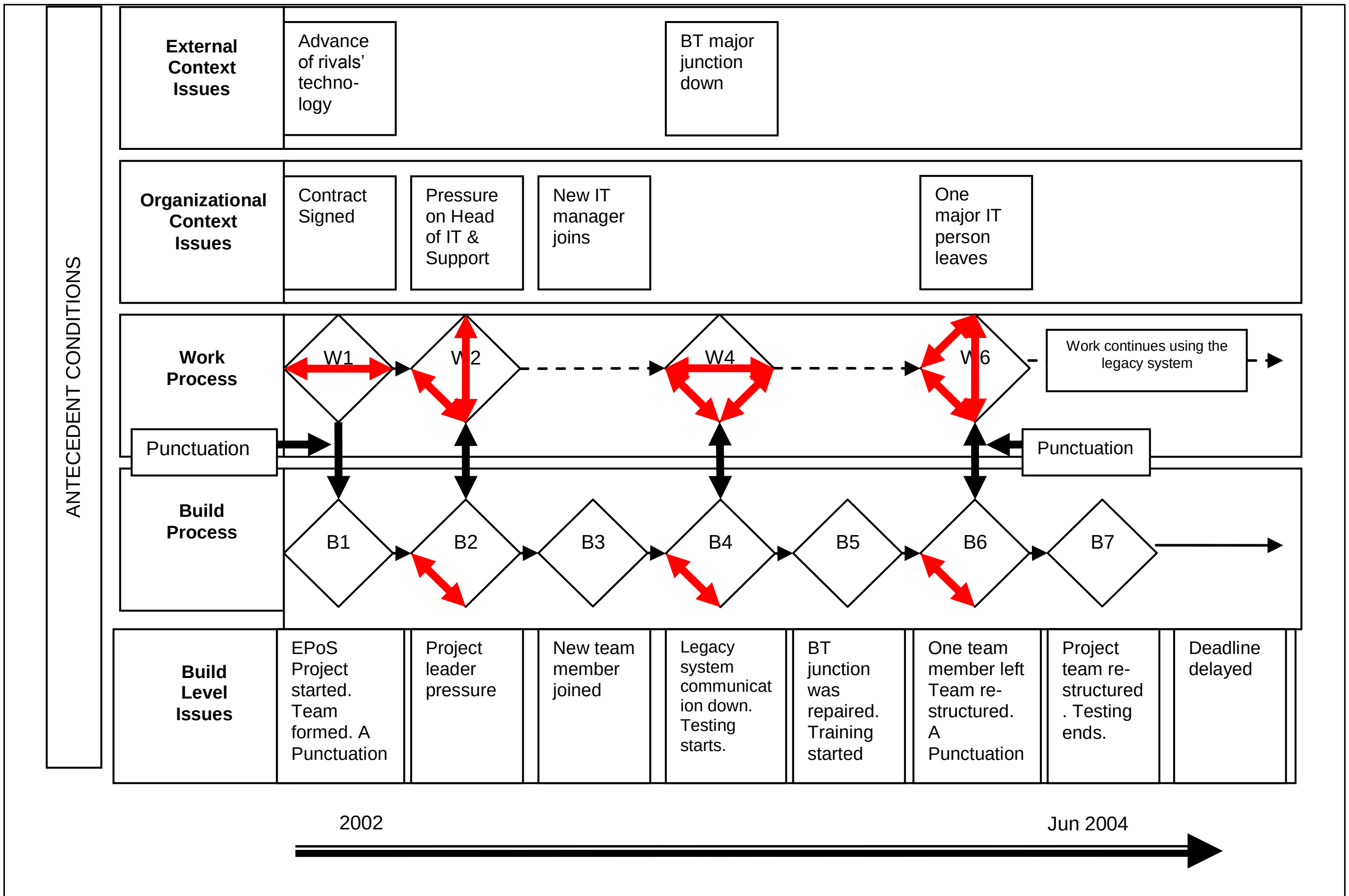


Figure 27. General Structure of the EPoS Project Trajectory (also see Section IV for further details)

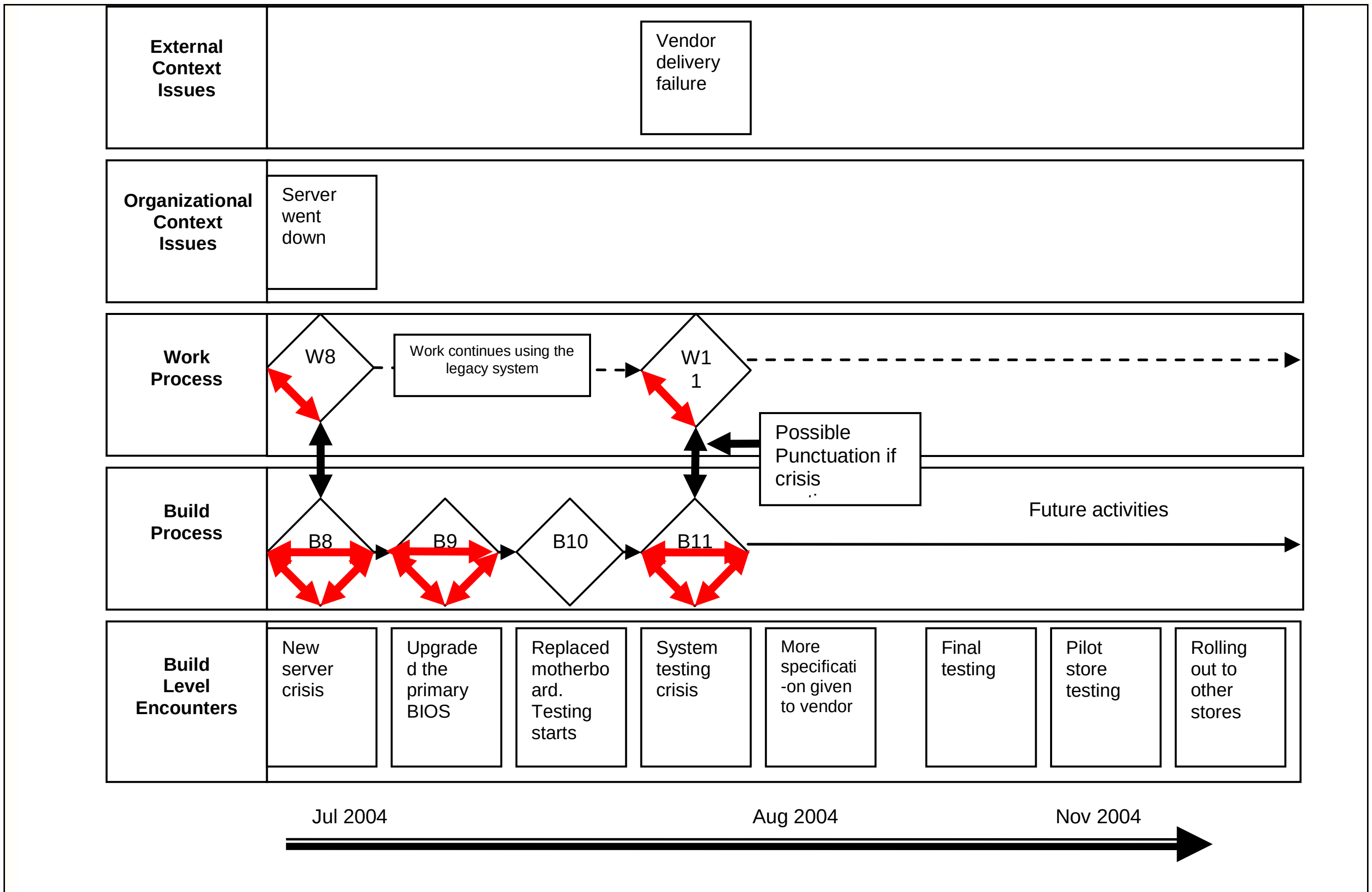


Figure 27. General Structure of EPoS Project Trajectory (cont.)

V. DISCUSSION AND CONTRIBUTIONS

Returning to our research questions, we can now examine what we found and what the contributions of our study are for the research and practitioner communities. We originally asked: What is the utility of combining of a socio-technical model, a social process model, and punctuated equilibrium theory in describing and explaining the social dynamics of ISD in a retail mid-sized enterprise? We also asked: How can this application of the model contribute to our understanding of ISD research and practice in a variety of organization types?

By careful use of our transcripts, documents, and observations, we found that we were able to describe and explain a specific project effectively. We could show how the project arose (out of the antecedent conditions) and how the major events shaped the processes and led to the outcome. By detailed analysis of work-and-build activities, we are able to demonstrate the importance of events, their timing and sequence (see Figure 27). What are the advantages of the punctuated process model? The pictorial representation in Figure 27 compresses vast amounts of data into a single diagram [Pentland 1999; Langley 1999]. In one diagram, we can portray the essence of the whole project. This is then supplemented by further explanatory details for both work and build processes (Section IV). While we acknowledge that the process diagram is still complex, we argue, following Ashby [1960, 229], that the complexity of our model has to have “requisite variety.” Further, we argue that the combination of a socio-technical model, a social process model, and punctuated equilibrium theory provides sufficient complexity to represent the activities of a real project. It depicts the trials and tribulations of a real project where the success of a project cannot be taken for granted but has to be accomplished by professionals who are subject to forces not always under their control. While the project timetable had slipped by six months at the time of research, the project was showing some signs of success.[4]

[4] Resources and access issues did not allow us to follow the project through to its conclusion.

Research Contributions

There were several contributions which are of interest to the IS research community. First, we demonstrate the advantage of separating build-and-work processes. Often, the work (or legacy) system will provide the origin of the project, as in our case. For example, gaps in the old system at Devonshire between the task and the technology coupled with external competitive forces motivated the firm to change its system and begin the project. While the project is unfolding, the legacy system with all its failings has to continue to function, in our case for at least two years. Moreover, there will be times that intense interactions occur between the project team and the legacy system involving the users. At Devonshire, these occurred at points 2, 4, 6, 8, and 11 in Figure 27. If the system is finally implemented there will be further interactions. These are often pressure points for the users, and the developers as users will often be called upon to work on the existing legacy system and help develop the new one. The punctuated process model enables us to detail these processes and their interactions revealing the twists and turns of the project and showing how the outcome is linked to these.

Second, our process study is able to provide insights into the patterning effects of success and failure. By this we mean the historical patterns that develop and that are reinforced by repetition [c.f. Robey and Newman 1996]. That is why it is vital that the historical context of the project is revealed. At Devonshire, there was reported to be a relatively successful history of systems development and the legacy system, while it now had its limitations, was well-liked. In other words, there was a positive pattern of project work which would, other things being equal, render a successful outcome more likely. Of course, it could be argued that a positive history could induce greater attachment to the legacy system and hence, resistance to change. In failing situations, the opposite can occur and a company can enter a cycle of failure and rejection by the user community which without any decisive action to break the pattern would be repeated in any new project [e.g. IT Cortex Statistics 2004; Beynon-Davies 1999; Eglizeau et al*.* 1986; Mitev 1996, Robey and Newman 1996; Lyttinen and Robey 1999].

Fourth, our study also provides insights in understanding the complexity of success and failure in ISD and concepts such as escalation and de-escalation [e.g. Keil and Robey 1999]. By linking history, process, and context we can trace the trajectory of a project and show how the process is uniquely related to the outcome and how the various stakeholders can variously capture the rhetoric of success. For example, in a previous case [Newman and Robey 1992], the project was delivered five years late and four times over budget but was still believed by the managers to be a success. This and other examples indicate that escalation or the commitment of resources to a failing project and the demand to de-escalate such systems, appear to be simplistic from a process perspective. In the case of Devonshire, the EPoS system was essential to their future effectiveness and to abandon it prematurely would be to compound their problems. The time overruns might be escalating, but they still needed the system. In other words, there was no escalation or de-escalation in the demand for the system: they could not abandon it. This situation will apply to some organizational projects but not to others; thus, potentially offering insights as to why some projects escalate and others do not [Pan et al*.* 2006]. Fifth, SMEs have some advantages of size and complexity when it comes to implementing IS. Projects tend to me smaller and simpler at SMEs. This has to be balanced with a lack of resources and expertise that, for example, a large corporation could call upon. In the Devonshire case, the EPoS system seemed to be a good match for their resources although they did experience problems that required them to call upon resources and expertise “owned” by the vendor.

Finally, for the research community, we acknowledge that case studies of this nature are highly labor intensive. However, other researchers should consider following a similar research paradigm as there is a clear dearth of such studies. Such studies will derive rich data sets and theoretical understandings. They offer plausible descriptions and explanations of ISD phenomena and greater transparency of the process [Klein and Meyer 1999].

Practitioner Contributions

In this section, we want to offer insights that may be valuable to various stakeholders among the practitioner community. These include IT managers and project leaders, senior management, users and user managers. First, the IT manager is, as in this case, often the boundary-spanner between management and the technical community and should be comfortable in both worlds. But ISD projects can cause major sources of stress as at Devonshire. The IT manager was involved in choosing the packaged software, but the case revealed there were continuing nagging problems resulting from this choice from quality and functionality perspectives. The process perspective enables us to see how early decisions can cause an escalation of problems later which require many “band aids.” This does not mean that the IT manager had alternatives in this case, but it seems wise to invest time and resources in these crucial early decisions. While this is hardly surprising, it does point to the importance of first moves in a project and the path dependent nature of ISD. This is an issue that could be addressed in greater depth in subsequent studies.

Second, project leaders also need a facility with users and developers. In the course of managing the project, there will be effects within their control and other, external effects arising from context and beyond their control. So both reactive and proactive stances are desirable and this was noted in the Devonshire case. Apart from issues arising from the project's context (Figure 27), the process perspective also reveals the possibility of creating change through initiating critical events [Newman and Robey 1992]. The project manager would do well to recognize when a project is lurching toward failure or getting mired in a dispute and try to unfreeze the process [Lewin 1951]. The model identifies periods when problems accumulated in terms of multiple gaps. These could be used diagnostically to find pressure points and try to resolve them (e.g. Figures 17-18).

Finally, from the senior manager's perspective, the project's budget and length is, unsurprisingly, often underestimated. In our case, the monetary penalty seemed containable, but time was slipping which may have financial implications in the future for the business. Although this is hardly surprising, we can push the analysis further and recognize the importance of antecedent conditions. It is pointless beginning a large IS project if the company has a habit of IS failure without first fixing the underlying problems. Negative patterns need to be broken. These poor patterns need to be acknowledged and managed. Companies, like team sports, have "form." In the case of sporting events, they are with regard to winning games, but in our examples with producing successful IS. And like sports teams they often repeat historical behaviors. For the Devonshire, the history of ISD and use was relatively successful which bodes well for future projects such as the EPoS one. But while success is difficult to maintain we know it is all too easy to throw away with one or two major failures until an organization drifts into a pattern of failure. Again, this asymmetry is a crucial issue but currently with little research attached to it and needs to be addressed further.

VI. CONCLUSIONS AND LIMITATIONS

In the field of ISD, many events, either expected or unexpected, may occur during the project process. Some critical issues related to ISD have been extensively discussed in the literature on organizational change, IS project implementation process, and IS success and failure. This research followed Newman and Zhao's [2008] and Pan *et al*. [2006]'s approach that has illustrated through the use of a contemporary case study in the Devonshire that critical events that occurred during the project process can affect the stability (i.e. equilibrium) of the project process. The equilibrium of the IS development process was influenced over time by critical events occurring around the build process, the organizational context, or the external context. The process itself in the case of Devonshire was identified as a sequence of events where the connections between a preceding event and its consequences were depicted, where each of these events was analysed by the interplay among its four components, i.e. actors, structure, technology, and task, and gaps were identified among the components in the case of critical incidents. The interactions between the organizational work process and build process were also analyzed. For example, we show that a misbalance on the organizational work level can generate misbalance on the build level, and vice versa.

Through our case study, several findings were generated. First of all, the project implementation context, including organizational context and external environmental context, was shown to play an essential role in the project implementation process. Process equilibrium can be seriously disturbed by the critical events that occurred in the implementation context. However, critical events do not necessarily have impacts over the project process equilibrium. Gaps between the components are generated by critical incidents, but the project process can still be carried out on a daily basis, i.e. the project equilibrium is still maintained. Furthermore, the ability of the project team in dealing with unexpected events is vital in ensuring the stability of a project process. In contrast, inattention and drift can lead to eventual chaos. Unquestionably, the past project patterns or similar patterns from other system processes, as have been suggested in much literature, have significant impacts on the present project patterns. We have shown how negative or positive patterns can be reproduced. However, when it comes to the case and critical events occur totally unexpectedly, such as a natural disaster, the knowledge generated from past project patterns or similar patterns from other systems may be of little value.

Future Research Challenges

Further case studies are being conducted in the U.S., UK, and Saudi Arabia to provide a richer understanding and to develop the model further in a variety of organizational forms (size, industry etc.). For example, we would like to explore the punctuated process model and particularly the issue of tightly versus loosely-coupled processes and the asymmetry of success and failure patterns. While the innovation of parallel processes has provided great insights into the overall trajectory, we should like to further build on this and focus on the interaction between the legacy process and the build process and explore in greater depth the topics of antecedent conditions and path dependency. Process research, while long, complex and resource consuming, will provide further insights into the enigma of IS success and failure.

REFERENCES

Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the paper on the Web, can gain direct access to these linked references. Readers are warned, however, that:

1. These links existed as of the date of publication but are not guaranteed to be working thereafter.
2. The contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
3. The author(s) of the Web pages, not AIS, is (are) responsible for the accuracy of their content.
4. The author(s) of this article, not AIS, is (are) responsible for the accuracy of the URL and version information.

Ashby, W. R. (1960). *Design for a Brain*. New York: Wiley.

BBC News. (2006). http://news.bbc.co.uk/1/hi/health/5084596.stm (accessed 16.06.06).

Beynon-Davies, P. (1999). "Human Error and Information Systems Failure: The Case of the London Ambulance Service Computer-Aided Despatch System Project," *Interacting with Computers* (11) 6, pp. 699-720.

Brown, A. D., and M. R. Jones. (1998). "Doomed to Failure: Narratives of Inevitability and Conspiracy in a Failed IS Project," *Organization Studies,* Berlin, (19)1, pp. 73-88.

Burke, R., B. Kenney, K. Kott, and K. Pflueger. (2001). "Success or Failure: Human Factors in Implementing New Systems," http://www.educause.edu/ir/library/pdf/EDU0152.pdf.

Creswell, J. W. (1994). *Research Design: Qualitative and Quantitative Approaches,* SAGE Publications.

De Abreu, A. F., and D. W. Conrath. (1993). "The Role of Stakeholders Expectations in Predicting Information Systems Implementation Outcomes," *Proceedings of Conference on Computer Personnel Research,* pp. 408-415.

De Wit, A. (1988). "Measurement of Project Success; *International Journal of Project Management* (6)3, August, pp.164-170.

Eglizeau, C., O. Frey, and M. Newman. (1986). "SOCRATE: an Implementation Debacle," *Proceedings of the 4th European Conference on Information Systems,* June, Portugal.

Gersick, C. J. G. (1991). "Revolutionary Change Theories: A Multilevel Exploration of the Punctuated Equilibrium Paradigm," *Academy of Management Review* (16)1, pp.10-36.

Gummesson, E. (1991). *Qualitative Methods in Management Research,* Revised Edition, SAGE Publications.

Hamel, J., S. Dufour, and D. Fortin. (1993). "Case Study Methods," *Qualitative Research Methods,* Vol.32, SAGE Publications.

IT Cortex Statistics. (2004). http://www.it-cortex.com.

Kanter, J., and J. J. Walsh. (2004). "Toward More Successful Project Management," *Information Systems Management* (21)2, pp.16-21.

Keil, M., and D. Robey. (1999). "Turning Around Troubled Software Projects: An Exploratory Study of the De-escalation of Commitment to Failing Courses of Action," *Journal of Management Information Systems* (15)4, pp. 63-87.

Klein, H., and M. Myers. (1999). "A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems," *MIS Quarterly* (23)1, pp. 67-94.

Kwon, T. H., and R. W. Zmud. (1987). "Unifying the Fragmented Models of Information System Implementation," in Borland, R. J., and R. Hirschheim, (Eds), *Critical Issues in IS Research,* John Wiley & Sons Ltd, Chichester.

Langley, A. (1999). "Strategies for Theorizing from Process Data," *Academy of Management Review* (24)4, pp. 691-710.

Leavitt, H. J. (1965). "Applied Organizational Change in Industry: Structural, Technical and Humanistic Approaches," in March, J. G., (Ed) *Handbook of Organization,* Rand McNally, Chicago.

Lewin, K. (1951). *Field Theory in Social Science: Selected Papers,* (Cartwright, D., Ed.), New York: Harper.

Lyytinen, K. (1987). “Different Perspectives on Information Systems: Problems and Solutions,” *ACM Computing Surveys* (19)1, pp. 5-44.

Lyytinen K., and D. Robey. (1999). “Learning Failure in Information System Development,” *Information Systems Journal* (9)2, pp. 85-101.

Lyytinen, K. and M. Newman. (2008). “Explaining information Systems Change: A Punctuated Socio-Technical Change Model,” *European Journal of Information Systems* (17)6 pp. 589-613.

Mahajan, S. (2004). “Information, Communications and Technology, 1992-2001,” Office for National Statistics, http://www.statistics.gov.uk/articles/economic_trends/ET603mahajan.pdf.

Markus, L. and D. Robey. (1983). “The Organizational Validity of Management Information Systems,” *Human Relations* (36)3 pp. 203–226.

McManus, J., and T. Wood-Harper. (2003). “Information Systems Project Management: The Price of Failure,” *Management Services,* May, (47)5, pp.16-19.

Miles, M. B. and A. M. Huberman. (1984). *Qualitative Data Analysis: A Sourcebook of New Methods.* Beverly Hills: Sage Publications.

Mitev, N. N. (1996). “More than a Failure? The Computerised Reservation Systems at French Railways,” *Information Technology & People* (9)4, pp. 8-19.

Myers, M. and M. Newman. (2007). “The Qualitative Interview in IS Research: Examining the Craft,” *Information and Organization* (17)1, pp. 2-26.

National Statistics. (2004). “Economic Trends 609,” August, http://www.statistics.gov.uk/downloads/theme_economy/ET609.pdf.

Newman, M., and D. Robey. (1992). “A Social Process Model of User-Analyst Relationships,” *MIS Quarterly,* June, pp. 249-266.

Newman, M., and S. Zhu. (2005). “A Contextualised Socio-technical Process Approach to ISD,” In K. Soliman (ed.) *Information Management in Modern Enterprises: Issues and Solutions*, IBIMA ISBN: 0-9753393-3-8.

Newman, M. and Y. Zhao. (2008). “The Process of ERP Implementation and BPR: A Tale from Two Chinese SMEs,” *Information Systems Journal* **(**18)4, pp. 405–426.

Orlikowski, W. J. (1992). "The Duality of Technology: Rethinking the Concept of Technology in Organizations," *Organization Science* (3) 3, pp. 398-427.

Orlikowski, W. J., and J. D. Hofman. (1997). “An Improvisational Model for Change Management: The Case of Groupware Technologies,” *Sloan Management Review* (38)2, pp.11-21.

Pan, S. L., G. Pan, M. Newman, and D. Flynn. (2006). “Escalation and De-escalation of Commitment to Information Systems Projects: Insights from a Post-implementation Evaluation Model,” *European Journal of Operations Research* (173)3, pp. 1139-1160.

Pentland, B. (1999). “Building Process Theory with Narrative: From Description to Explanation,” *Academy of Management Review* (24)4, pp. 711-724.

Pettigrew, A. (1990). “Longitudinal Field Research on Change: Theory and Practice,” *Organization Science* (1)3, pp. 267-292.

Pettigrew, A. (1992). “The Character and Significance of Strategy Process Research,” *Strategic Management Journal* (13), pp. 5-16.

Poon, P., and C. Wagner. (2001). “Critical Success Factors Revisited: Success and Failure Cases of Information Systems for Senior Executives,” *Decision Support Systems* (30)4, pp. 393-418.

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, Jan, pp. 30-63.

Rockart, J. (1988). “The Line Takes Leadership: IS Management in a Wired Society,” *Sloan Management Review,* Summer, pp. 57-64.

Rubin, H. J., and I. S. Rubin. (2005). *Qualitative Interviewing: The Art of Hearing Data,* (2nd ed.). Thousand Oaks, CA: Sage.

Somers, T. M., and K. Nelson. (2001). "The Impact of Critical Success Factors across the Stages of Enterprise Resource Planning Implementation," *IEEE,* Proceedings of the 34th Hawaii International Conference on System Sciences, Vol.8, http://csdl.computer.org/comp/proceedings/hicss/2001/0981/08/09818016.pdf.

Strauss, A., and J. Corbin. (1998). *Basics of Qualitative Research Techniques and Procedures for Developing Grounded Theory,* SAGE Publications Ltd., Thousand Oaks, CA, USA.

Tushman, M. L., and P. Anderson. (1986). "Technological Discontinuities and Organizational Environments," *Administrative Science Quarterly* (31)3, pp. 439-465.

Umble, E. J., R. R. Haft, and M. M. Umble. (2003). "Enterprise Resource Planning: Implementation Procedures and Critical Success Factors," *European Journal of Operational Research* (146)2, pp. 241-257.

ABOUT THE AUTHORS

Mike Newman (BSc, MSc., PhD) is professor of Information Systems at the Manchester Accounting and Finance Division, Manchester Business School, University of Manchester, UK and is a visiting professor at Copenhagen Business School and the Norwegian School of Economics and Business Administration, Bergen, Norway. Since graduating with a PhD in MIS from the University of British Columbia in 1981, he has authored many academic articles in journals including *MISQ, ISR, JIT, JMS, AMIT, ISJ, EJOR, I&O, EJIS, CAIS* and *Omega*. His research focuses on the process of information systems development. He currently serves on the editorial board of *JIT* and *JAIS.* He was an AE for *MIS Quarterly* and *ISR* and is currently an AE for *Information and Organization*. He has held visiting positions at the University of Connecticut, Florida International University, Erasmus University, Rotterdam and the Free University, Amsterdam. He has served as a track co-chair, doctoral consortium co-chair and program co-chair at ICIS.

Shanshan Zhu (MSc) is a consultant for KPMG, Leeds, UK.

Communications of the Association for Information Systems

ISSN: 1529-3181