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## PROCESS MODELING INFORMATION SYSTEMS DEVELOPMENT: The SellCo Case

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### Abstract

*We build on previous research to demonstrate how, with a combination of a socio-technical change model, a social process model, and punctuated equilibrium theory, we can describe and analyze a specific information system development project. In this paper, we focus on an information systems project that was being implemented in a UK retail organization 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 of understanding information systems development (ISD) as a social process. Despite the limitations associated with this type of research, this study attempts to contribute to the further understanding of process research into ISD.*

*Through our case study exemplar, several findings were generated. First of all, the project implementation context, including organizational context and external environmental context, was shown to play a significant role in the project implementation process. We show how social-technical equilibria can be 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 a vital skill in ensuring the stability of a project. In contrast, drift is shown to lead to a degree of chaos. Third, the past project patterns or*

*Please use the following format when citing this chapter:*

Newman, M., and Zhu, S., 2007, in IFIP International Federation for Information Processing, Volume 235, Organizational Dynamics of Technology-Based Innovation: Diversifying the Research Agenda, eds. McMaster, T., Wastell, D., Ferneley, E., and DeGross, J. (Boston: Springer), pp. 63-81.

*similar patterns from other system processes, as suggested the literature, have significant impacts on current project patterns. Finally, when it comes to critical events that occur totally unexpectedly, 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.*

*Our approach illustrates the utility of the contextual process model in the study of ISD and, in particular, the distinction between project and work processes. The paper ends with suggestions which may be helpful to 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

## 1 INTRODUCTION

Despite the numerous methods and strategies designed to ensure information systems project success such as information systems development (ISD) methodologies, project management techniques, and software process improvement, it is still not possible to guarantee a successful project outcome for all interested parties. IS failures are legendary and have attracted the public attention in recent years due to a series of spectacular cases. For instance London Stock Exchange's Taurus paperless share settlement (see IT Cortex Statistics at <http://www.it-cortex.com>), London Ambulance Service's Computer-Aided Despatch System (LASCAD) (Beynon-Davies 1999), and French Railway Company SNCF's computerized reservation system, known as SOCRATE (Eglizeau et al. 1986; Mitev 1996) are all such examples. More recently, newspapers have reported on several notorious public sector cases in the UK such as the Passport Office, the Department of Social Security and the National Health Service.<sup>1</sup> The specter of IS failure continues to haunt both the academic and practitioner communities.

In particular, we 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 further insights and enables us to comment on theories such as escalation and de-escalation (Keil and Robey 1999) and the many factor, cross-sectional studies reported in the literature. This and other examples are the first steps in building our knowledge of ISD *from a process perspective*.

This study is guided by the following research questions:

- How can a combination of a socio-technical model, a social process model, and punctuated equilibrium theory be used to describe and explain the social dynamics of ISD in a retail organization?
- How can this application of the model contribute to our understanding of ISD research?

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<sup>1</sup>“NHS IT Upgrade Set for Criticism,” BBC News, June 16, 2006 (available online at <http://news.bbc.co.uk/1/hi/health/5084596.stm>).

This paper starts with a summary of the punctuated process model developed in a previous work (Newman and Robey 1992; Newman and Zhu 2005; Pan et al. 2006; Robey and Newman 1996). 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 and these are analyzed using the *punctuated process model* and the implications for academics and project managers will be discussed. The paper ends with conclusions from the study and with a statement of its limitations.

## 2 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 information system and its interaction with the environment can be described, analyzed, and communicated (De Abreu and Conrath 1993). In general, there are two identifiable streams in the literature: factor studies and process studies.

### 2.1 Factor Studies

A large number of IS implementation studies have tried to identify factors that are related to IS implementation success and failure (e.g., Burke et al. 2001; Kanter and Walsh 2004; Poon and Wagner 2001; Somers and Nelson 2001; Umble et al. 2003). This model and its later variants such as structural equation modeling remains as the largest research stream in the IS implementation literature; it uses independent and control variables and their associations with dependent variables (i.e., the project outcomes; Lyytinen 1987). The value of these studies is that they use cause–effect patterns to investigate IS implementation difficulties, and that they have provided valuable insight into the nature of IS problems (De Abreu and Conrath 1993).

Nonetheless, some researchers (e.g., Markus and Robey 1983; Newman and Robey 1992) noted that factor models have been of little practical utility in coping with IS problems, due to the lack of deep understanding of implementation process features (i.e., they only emphasize **what** factors are associated with outcomes, not **how** they shape those outcomes). Processes are largely ignored and are treated as a closed box.

### 2.2 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, p. 250). Studying the whole project implementation process can help researchers get a fuller, richer picture. Rather than focusing on technical features, process models focuses on social change activities by investigating sequences of critical incidents that link ante-

cedent conditions with outcomes (Newman and Robey 1992). 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 Zhu 2005; Robey and Newman 1996).

### 2.3 Conceptual Framework

Based on previous work (Newman and Robey 1992; Newman and Zhu 2005; Pan et al. 2006; Robey and Newman 1996), this study is constructed on three major frameworks: *Leavitt's socio-technical change model* (Figure 1), a *social process model* (Figures 2 and 3 showing a successful intervention), and a *punctuated equilibrium model* (Figure 4), and attempts to reach a sufficient understanding of a complex implementation process in its organizational and wider contexts. Leavitt's socio-technical change model is used to identify the relationships between structure, actors, technology, and task and their effects on IS implementation (Leavitt 1964). The social process model is applied to describe the project outcomes through the study of the entire implementation process (Newman and Robey 1992; Pan et al. 2006; Robey and Newman 1996) 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 2005; Pettigrew 1990, 1992; Tushman and Anderson 1986). 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 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

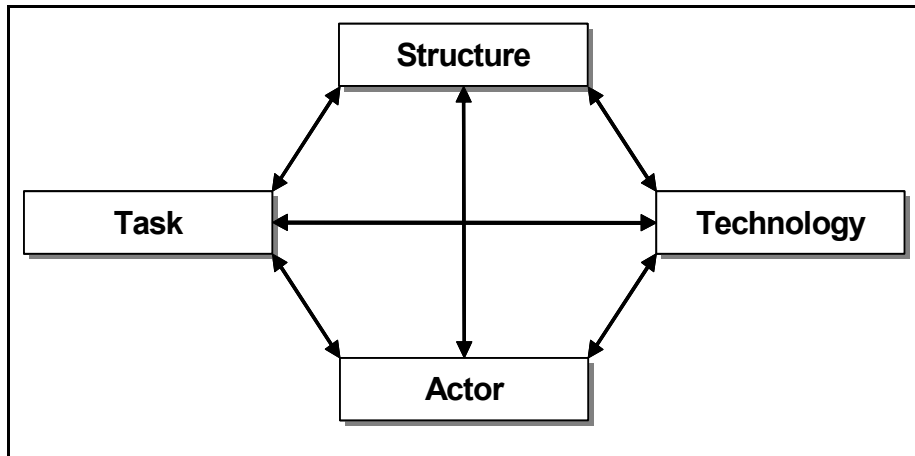
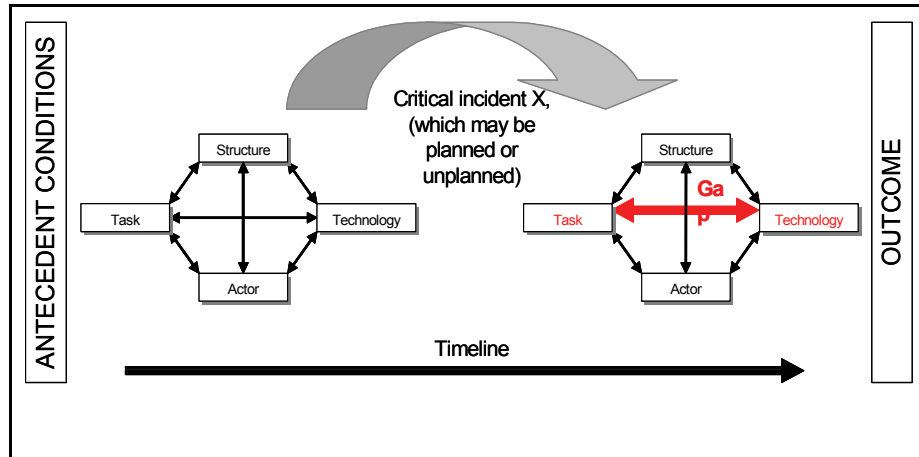
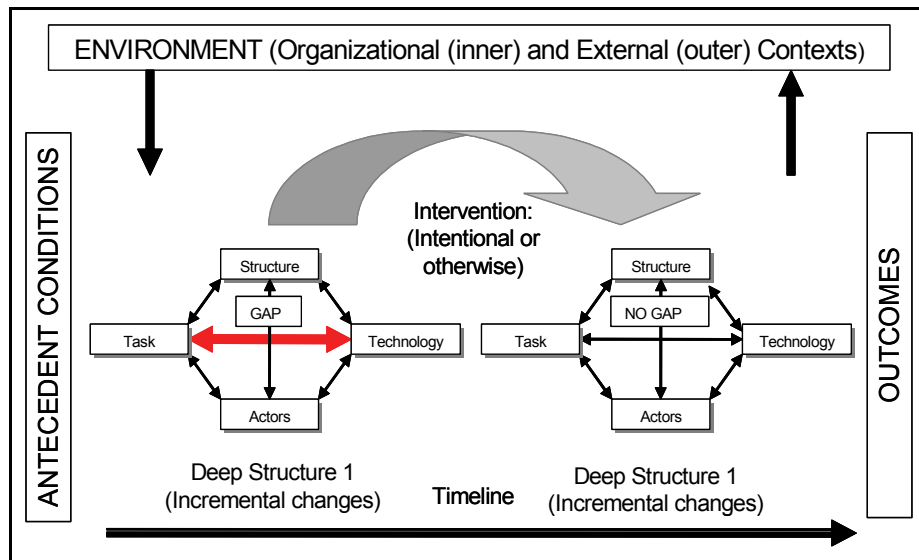


Figure 1. Leavitt's Diamond (Adapted from Levitt 1964)

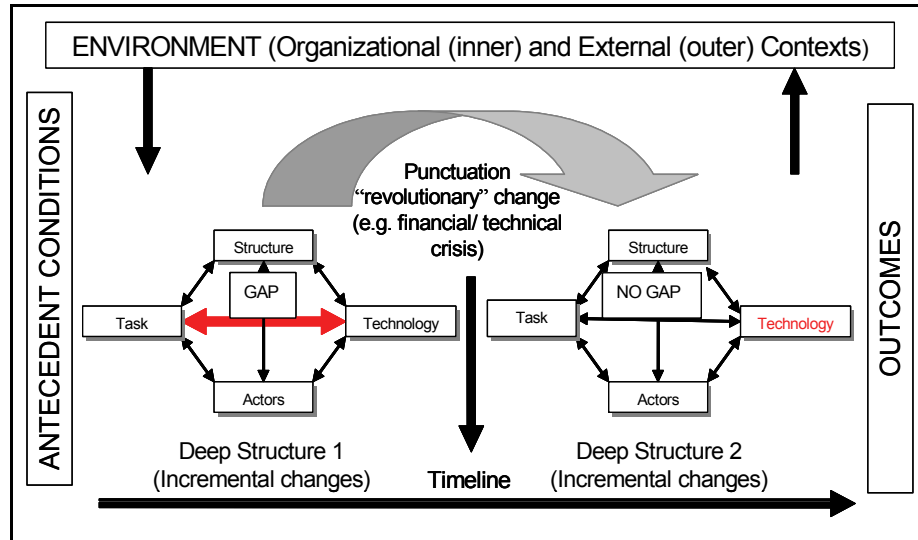


**Figure 2. Social Process Model (Adapted from Leavitt 1964; Newman and Zhu 2005; Robey and Newman 1992)**



**Figure 3. Successful Intervention (Adapted from Lytinen and Newman 2005; Newman and Robey 1992; Newman and Zhu 2005)**

socio-technical entity as above shows. 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.



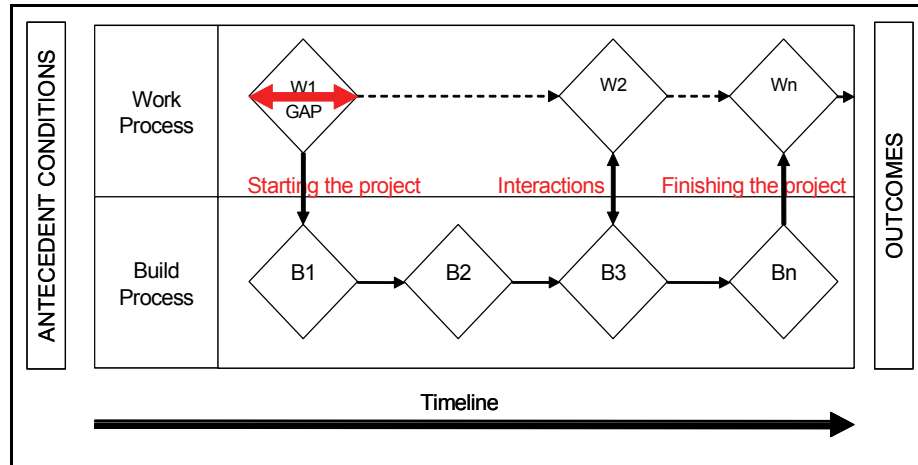
**Figure 4. The Contextual Punctuated Model (Showing a Successful Punctuation) (Adapted from Lyytinen and Newman 2005; Newman and Robey 1992; Newman and Zhu 2005)**

Following on 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 redesign), 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.

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 of these interventions, the deep structure of the processes (Gersick 1991) remains intact. However, there will be infrequent occasions where changes will make the actors re-examine and change fundamental assumptions about how work is accomplished 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 is shown in Figure 4, depicting a successful punctuation and the change in the deep structure (Gersick 1991).

## 2.4 Parallel Process Model

Since 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 Zhu (2005), Pan et al. (2006) and Lyytinen and Newman (2005) introduced the **parallel process model** with the socio-technical entity concept (see Figure 5).



**Figure 5. Parallel Process Model with Socio-Technical Entities (Adapted from Lyytinen and Newman 2005; Newman and Zhu 2005)**

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 recognize 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 of 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.

### 3 RESEARCH APPROACH

This study adopts a qualitative research approach with the support of an interpretive case study. The research site was a UK retail organization that will be referred to as the SellCo case throughout the report.<sup>2</sup> Data were collected to report how a database and data warehouse system (we label this the EPoS system) was developed through a set of stages over a 2 year period. The SellCo case was selected mainly opportunistically because of the high-level access the authors had in this organization, and, secondly, because the authors believe that this case could contribute to IS research through the application of the punctuated process model.

<sup>2</sup>Not its real name; Anonymity was a prerequisite of access to the company.

SellCo is a medium-sized retail company based in the UK. It began with just one store; it now has over 50 stores nationwide, a wholesale network, and a dynamic e-commerce system, all with ambitious plans for growth. In 2002, it rebranded and rolled out the new brand across the country as part of a massive investment and expansion program designed to keep SellCo at the leading edge of retailing. SellCo faces strong competition in the industry with many other low-cost retailers; increasingly a number of supermarkets have also challenged SellCo for its position. SellCo is currently loss-making, but it was looking to turn a profit of £1 million by the end of 2006.

Nevertheless, there were two key elements that prevented SellCo 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 is 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. Second, the existing system had major shortcomings within both store and central functions. Examples of these include insufficient visibility of holdings and locations of stock, insufficient ability to control prices and therefore margin, and insufficient control of markdown, resulting in high levels of reported stock loss.

This study focuses specifically on the new database and data warehouse system—the EPoS system (electronic point of sales)—that was being implemented in 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, in total 11 semi-structured interviews were conducted *in situ* with actors from these user groups and some subjects were interviewed more than once for continuity purposes. We also did extensive documentary analysis as well as observing the subjects' interactions with technology. Where appropriate, we followed Klein and Myers' (1999) principles in collecting and interpreting data. For example, the principle of suspicion was employed using one subject's disclosure as a check against those from others. We also used mirroring techniques to tap into the subjects' life worlds (Myers and Newman 2007). Each interview transcript or set of notes taken from documentation analysis and observation was subjected to an intensive six-step process of data analysis. The research process started with the frameworks, explained earlier, describing socio-technical change, social process, and critical incidents associated with the IS project. Hence, the generation of concepts and frameworks forms an ongoing part of the data analysis as well as its conclusion.

## 4 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.



## **4.1 Antecedent Conditions: Problems with the Legacy System**

The legacy system in SellCo 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 of its original objectives. 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, resulting in difficulties in carrying out management reporting, system support, and maintenance processes. As a result of the number of issues associated with the legacy system, a decision was made by the SellCo top management at the end of 2002 that an EPoS system would be implemented to replace the legacy system. In summary, the historical picture of ISD at SellCo was generally positive but the legacy systems were well past their sell-by dates (see Appendix A).

## **4.2 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, improved market 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 familiar with the way the legacy system worked, and their jobs were normally 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.

## **4.3 The Project Implementation**

### **4.3.1 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 SellCo. In selecting the system, the cost and the level of customization 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 time frame. However, management at SellCo expressed dissatisfaction with the vendor. This was due to a number of reasons. First, the vendor software had not been proven in a commercial situation. Second, the system delivered was not delivered in a test-friendly environment for SellCo as required. Third, instead of implementing the system with SellCo'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 perspective. Generally these problems were solved by adding more specifications to the system required by SellCo and developing the software further.

#### **4.3.2 The Project Team**

The project team consisted of roughly 20 people, formed by using staff from different levels of the SellCo. The project manager represented SellCo's IT outsourcing company. The project leader from the IT department was in charge of project management. A business analyst from the management level was responsible for the alignment between the business and the new system. The IT manager was mainly responsible for system implementation, testing, and coordination of data transfer between the legacy system and the new system. The technical team dealt with extracting data from the current system, checking the accuracy of data, and providing interfaces to the new system. The IT Helpdesk team was to handle the new system testing and feedback. All of the store managers were responsible for the new system testing and feedback from their store staff.

#### **4.3.3 The Project Schedule**

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 for late 2004, and the system was due to be rolled out to the rest of the stores in the following 2 months.

After testing, as planned, the system was to be rolled out to all the stores in two months on a one-by-one basis. However this was not on the original schedule: it was about 6 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.

### **4.4 General Case Interpretation**

Figure 6 is a pictorial summary of the EPoS project trajectory (Langley 1999; Pentland 1999) using the punctuated process model. The project is seen as a punctuated equilibrium process, where critical incidents emerged at different levels at SellCo (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 pro-

cesses 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 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 damage to the BT junction box, which was outside the control of SellCo.

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). 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 restructuring.

It is clear that the two parallel processes have significant influences over each other at some points (Figure 6). 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 needed to be dealt with at the organizational work level. In the next two sections, the socio-technical entities on both the project level (Appendix A) and the organizational work level process (Appendix B) are selected and summarized with the associated critical events in order to give a clearer explanation.

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 SellCo (inner context) and the project team has to be restructured. 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 within budget, but it has been delayed by approximately 6 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 as it was crucial to their modernization efforts. However, the outcomes of this project cannot be predicted at this stage with total accuracy as they are dependent on the subsequent events. As the system appears to be rolling out successfully, we would expect that SellCo 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.

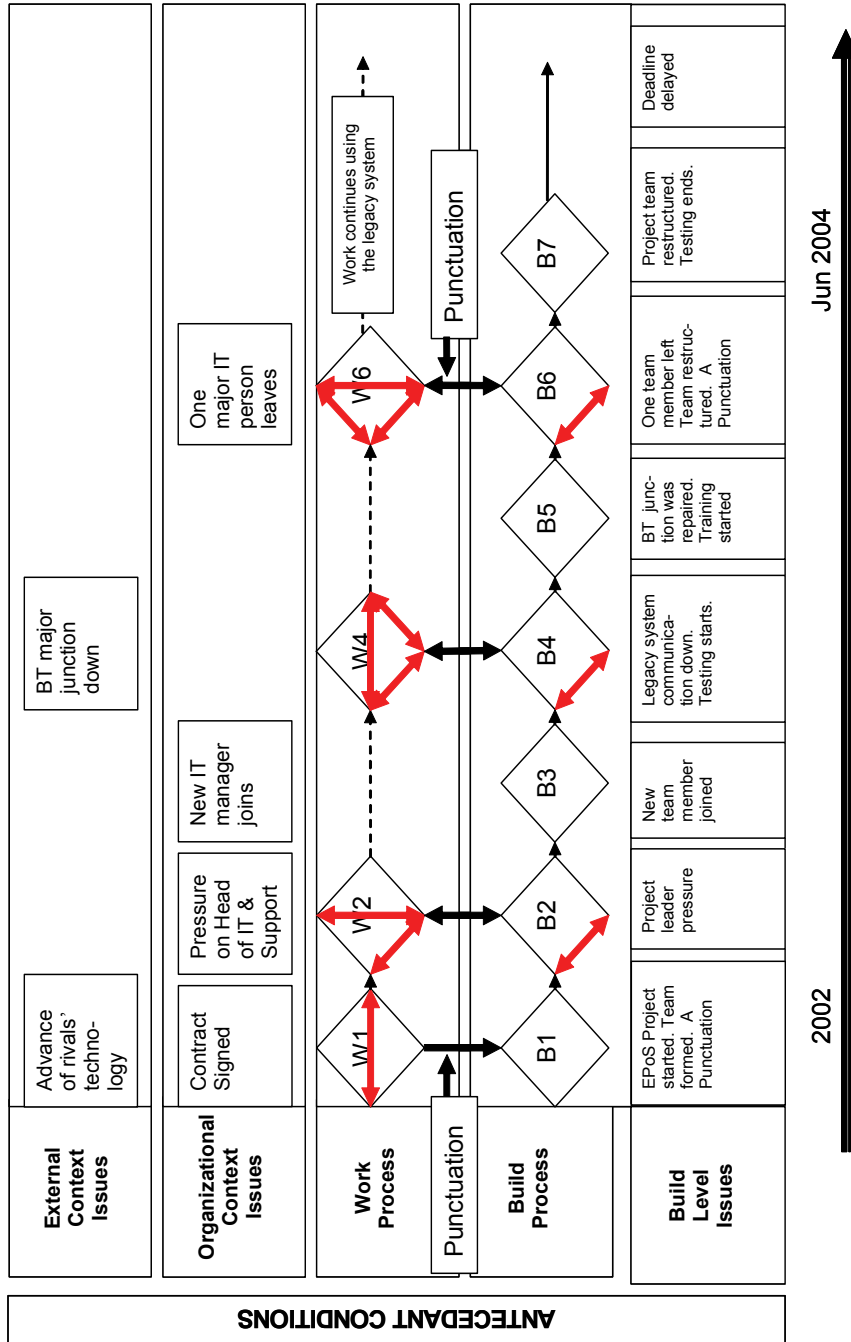


Figure 6. General Structure of the EPoS Project Trajectory (see also Appendices)

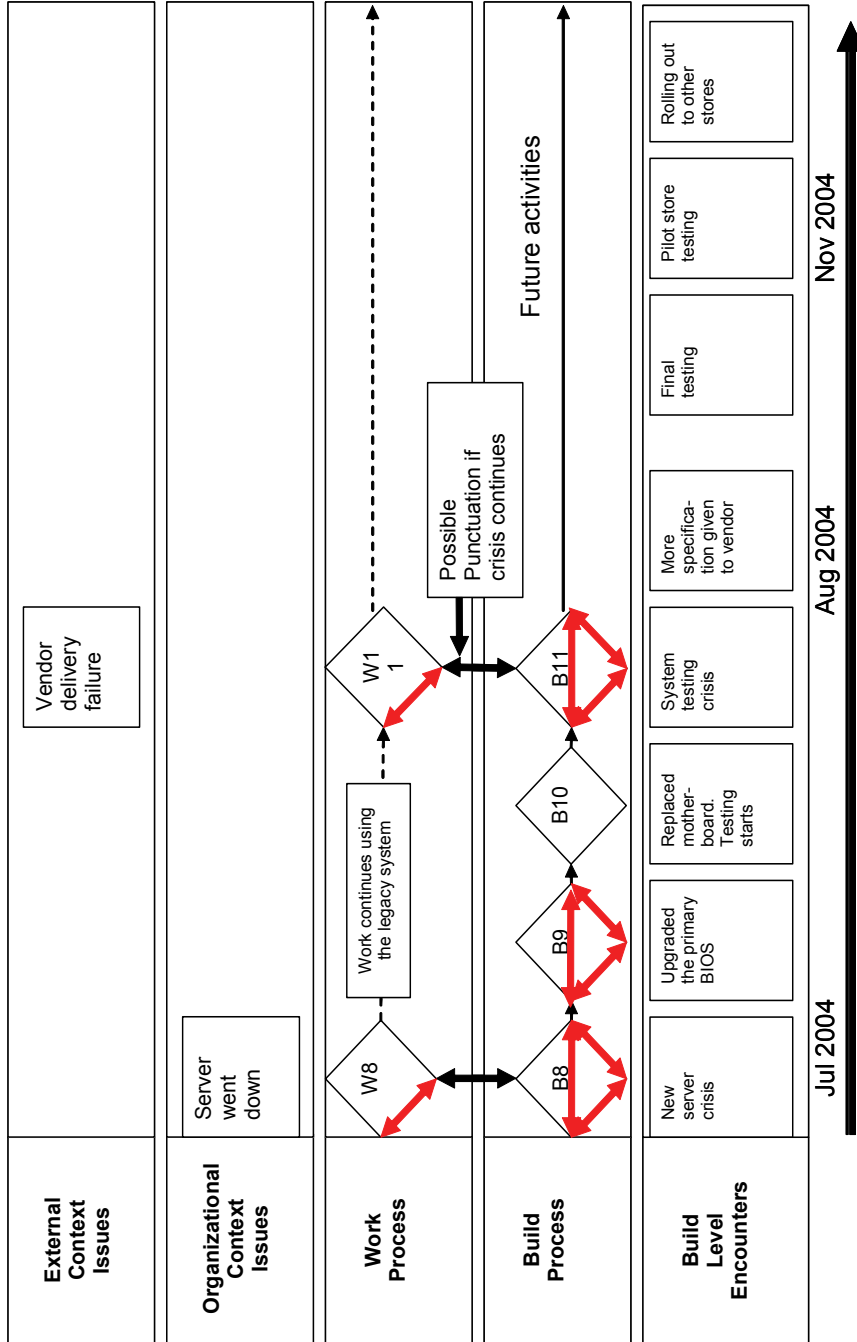


Figure 6. General Structure of the EPOS Project Trajectory (Continued)

## 5 DISCUSSION AND CONTRIBUTIONS

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 (the antecedent conditions) and how the major events shaped the process 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 6). What are the advantages of the punctuated process model? The pictorial representation in Figure 6 compresses vast amounts of data into a single diagram (Langley 1999; Pentland 1999). In one diagram we can portray the essence of the whole project. This is then supplemented by further details in the appendix for both work and build processes. While the project timetable had slipped by 6 months at the time of writing, the project was showing signs of success.<sup>3</sup>

### 5.1 Research Contributions

There are several contributions of interest to the IS research community. First, we can comment on the proliferation of **factor studies** in IS studies and the latest variations using structural equation modeling. These frequently involve mail shots or web surveys where many subjects are sampled from one or many organizations. Using ordinal-scaled questions, these studies elicit subjects' opinions on dependent and independent factors or variables loosely based on hypotheses derived from the literature. They are normally studies without history and without context. Associations are sought statistically linking the dependent and independent variables and the findings are compared with the hypotheses. While they are able to comment on the significance and strength of the relationships, they essentially treat the process as unknown and indeed unknowable (e.g., Burke et al. 2001; Kanter and Walsh 2004; Poon and Wagner 2001; Somers and Nelson 2001; Umble et al. 2003). In contrast, process studies, while targeting just one or a few cases, focus on the major events, their timing and sequence in order to describe and explain how history, process, and outcome are linked. Given the surfeit of factor studies in IS research, we need to balance these with process studies such as the current one (Olikowski 1992; Robey and Newman 1996).

Second, 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, at SellCo, gaps in the old system 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, in our case for at least 2 years, the legacy system, with all its failings, must still be made to work. Moreover, there will be times that intense interactions occur between the project team and the legacy system involving the users. At the SellCo, these occurred at points 2, 4, 6, 8, and 11 in Figure 6. 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

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<sup>3</sup>Resources and access issues did not allow us to follow the project through to its conclusion.

on the existing 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.

Third, 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 (see Robey and Newman 1996). That is why it is vital that the historical context of the project is revealed. SellCo was reported to have 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. In other 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., Beynon-Davies 1999; Eglizeau et al. 1986; Mitev 1996; Robey and Newman 1996; see also IT Cortex Statistics at <http://www.it-cortex.com>).

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 SellCo, 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. There was no escalation or de-escalation in the demand for the system: they could not abandon it.

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 Myers 1999).

## 6 CONCLUSIONS AND LIMITATIONS

In the field of information systems development, 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 Lyytinen and Newman's, Newman and Zhu's, and Pan et al.'s approach, shown through the use of a contemporary case study (SellCo), that critical events occurring along 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 SellCo 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 analyzed 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 a misbalance on the build level, and *vice versa*.

Through our case study, several findings were generated. First of all, in line with previous empirical studies, 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. But this is hardly news. 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 is still carried out on a daily basis (i.e., the project equilibrium is still maintained). Furthermore, we found that the ability of the project team in dealing with unexpected events is vital in ensuring the stability of a project process. In contrast, 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 patterns can be reproduced. However, when it comes to the case that 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 use. Process research, while long, complex, and resource-consuming, will surely provide further insights into the enigma of IS success and failure.

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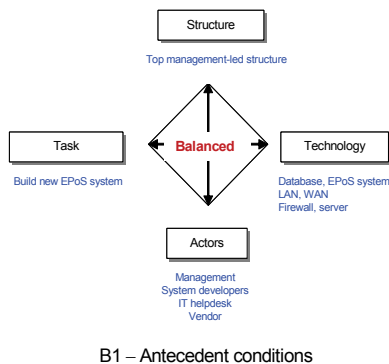
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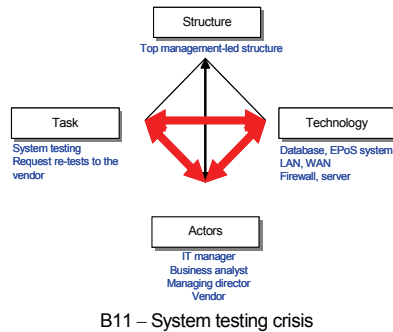
## Appendix A. Selected Summary of Project Trajectory (Build System)



SellCo is a medium-sized retail company based in the UK. It began with just one store; it now has over 50 stores nationwide, a wholesale network, and a dynamic e-commerce network, all with ambitious plans for growth. In 2002, it rebranded and is rolling out the new brand across the country as part of a massive investment and expansion program designed to keep SellCo 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 a 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.

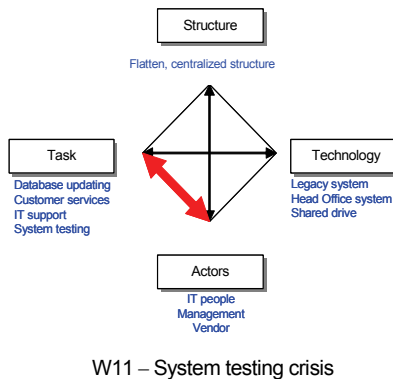


As mentioned earlier, there are three types of testing: alpha stage (i.e., work or not), beta stage (further to more life cycle testing), and user acceptance stage (if the system works as it is supposed to). When delivering the system, instead of delivering the system in the user acceptance stage as 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, and till sales data could not be passed to the Head Office system.

A meeting held between the IT manager, business analyst, managing director, and vendor was held to discuss the problems. It was settled that more specifications would be given to the vendor and the system would 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.

## Appendix B. Selected Summary of Organizational Trajectory (Work System)



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 works as it is supposed to). When delivering the system, the vendor provided the system at 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, and till sales data could not be passed to the Head Office system.

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

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

