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The Effect of ERP System Workarounds on Organizational Control: An interpretivist case study

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An interpretivist case study

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Abstract. Organizations installing an Enterprise Resource Planning (ERP) system often seek to gain better control over their data and operations. Nevertheless, studies indicate that this aim often fails to materialize. Although the literature has looked into the factors that may lead to a successful (or conversely unsuccessful) ERP implementation, it has largely overlooked the actual use of the system after its initial implementation. While implementation outcomes and actual patterns of system use are closely interrelated, close examination of system use in-situ can reveal ways in which users can use the system to cause a decrease in organizational control. This is particularly the case when users create workarounds or try to bypass controls embedded within the system. This paper examines such workarounds and their impact on organizational control, using an interpretive case study and through the conceptual lenses of human and machine agencies.

Key words: Workaround, control, ERP, enterprise resource planning, agency.

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1 Introduction

There are a number of studies dealing with the impact of Information Technology (IT) in general on organizational control (e.g., Bloomfield and Coombs 1992; Coombs et al. 1992; Mansell 1994; Orlikowski 1991; Tang et al. 2000). Coombs et al. (1992) for example note that control is used to draw attention to the intended and unintended consequences of the exercise of power and the use of knowledge in social and organizational relations. IT is then seen as the response to competitive pressures to enhance control over processes of production and distribution (Bruns Jr. and McFarlan 1987).

In spite of the number of studies on IT and control, our understanding of how work mediated by an ERP system in particular affects organizational control is still limited. What distinguishes ERP systems from other Information Systems (IS) is their scale, complexity, and potential for organizational impact (Boudreau and Robey 1999; Davenport 2000; Kallinikos 2004; Koch 2001; Markus and Tanis 2000). Implementation of an ERP system in an organization can have a profound impact on organizational processes (Boudreau and Robey 1999; Koch 2001), as well as on information flow and transparency (Besson and Rowe 2001; Newell et al. 2003). Because of this, ERP systems deserve greater attention with regards to their impact on organizational control.

Much of the research on ERP systems is concerned with the implementation process and provides insights into success factors of ERP implementation (e.g., Akkermans and van Helden 2002; Al-Mashari and Al-Mudimigh 2003; Bradley 2008; Nah et al. 2001; Somers and Nelson 2001; Umble et al. 2003). Only a few studies investigate issues relating to the post implementation of ERP Systems (e.g., Elmes et al. 2005; Sia et al. 2002). This study tries to address this gap by examining a case study of a problematic ERP implementation, where users had to use the system nevertheless to perform their daily tasks. Apart from the challenging implementation, the workarounds carried out by users in the system were seen as leading to decreased operational efficiency, and consequently decreased organizational control. The research question that we therefore explicitly address in this study is the following: How do workarounds employed by users of an ERP system affect organizational control? We are particularly concerned with the negative impact on organizational control, although we also acknowledge the importance of workarounds in Information Systems to create viable organizational processes (Ciborra 2002; Ciborra et al. 2000; Pentland and Feldman 2008). By focusing on computer workarounds, we are also responding to calls to examine workarounds in Information Systems' use (e.g., Orlikowski and Iacono 2001), as well as examining how workarounds are actually re-enacted by users (Orlikowski and Yates 2006).

This study therefore seeks to develop a theoretical account of the impact of workarounds on (decreasing) organizational control. The significance of the contributions of this paper is twofold. First, it sensitizes readers with regards to the impact on the organization of workarounds employed by users of an ERP system. This is important due to the paucity of studies on workarounds, in particular within the context of ERP systems. Second, the paper increases our practical and theoretical awareness of the importance of examining both technological and human aspects in IT studies.

The following sections present a review of the relevant literature on ERP systems, organizational control and workarounds. This is followed by a description of the research approach, including the use of an interpretive case study, the approach in gathering and analyzing the research data, and the theoretical concepts used for the analysis of the data. The presentation and analysis of the case study data then follows, as well as a discussion of the research results and their practical and theoretical contributions.

2 Organizational control and workarounds

2.1 Organizational control and ERP systems

Orlikowski (1991) distinguishes between two broad types of control in organizations: internal and external. In internal control, she further distinguishes between personal and systemic control, with the latter being further divided into control through culture, through social structure, and through technology, as the figure below shows.

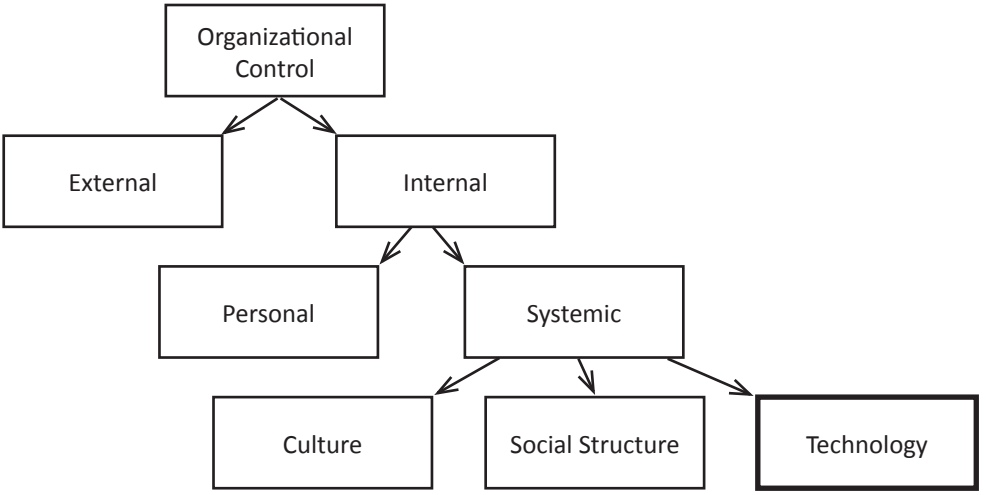

Figure 1: Classifications of organizational control (source: Orlikowski (1991))

In the context of this study we are particularly interested in organizational control through technology (the ERP system), which is a form of internal and systemic control. In any combination of controls however, individuals have the option to act in ways to change a particular form of control. This is referred to as the 'dialectic of control' (Giddens 1979, 1984), whereby subordinates can influence the activities of their superiors, by using some of the resources that they have

available to use (Giddens 1984, p. 16). In our case the end outcome of this dialectic of control is the workaround devised by users in the ERP system.

With regards to organizational control through an ERP system in particular, Hanseth et al. (2001) argue that ERP systems with their emphasis on integrating business processes, streamlining and standardization, are an ideal control technology. Nonetheless, as Hanseth et al. (2001) mention, implementing an ERP system over a global organization in order to enhance control may as well have the opposite effect, i.e., reduce control and cause drift. Although this may come as a surprise when one looks at this from the point of view of IT being a control technology, the fact that more control can lead to more risk is explained with the ubiquitous nature of side effects. The more integrated from a technology and process point of view the organization becomes, the faster and further away side effects have an impact, and the bigger their consequences.

Sia et al. (2002) have also examined whether the introduction of an ERP system in a company entails tighter management control or empowerment of employees. Management control through an ERP system was equalled by Sia et al. with the panoptic features of such a system (i.e. the capability of the system to track user actions, as well as allowing enhanced visibility to management and peers). Sia et al. have concluded that ERPs would mostly tend to be biased towards greater panoptic control, unless there are clear management intentions to break away from existing power structures.

In addition, Elmes et al. (2005) have identified two seemingly contradictory theoretical concepts in Enterprise Systems (ES-such as ERPs): reflective conformity and panoptic empowerment. Reflective conformity refers to the way that the integrated nature of the Enterprise System leads to greater discipline of employees, while at the same time requiring them to be reflective in order to achieve the required organizational benefits from the Enterprise System. Panoptic empowerment then describes the greater visibility of information, which is provided by the shared database of the Enterprise System. This can empower employees to do their work more effectively and efficiently, but at the same time makes their work in the system more visible to others, who can then more easily exercise control over them.

The most relevant studies correlate organizational control through an ERP system with the panoptic (Foucault 1977) features of such systems (e.g., Elmes et al. 2005; Robinson and Wilson 2001; Sia et al. 2002) or their integrative nature (Dechow and Mouritsen 2005; Hanseth et al. 2001). In this study however, we are not interested in electronic surveillance, but rather in organizational control through an ERP system that can arise because 'the generation of information provides a means by which organizations might reduce uncertainty about their environment' (Bloomfield and Coombs 1992, p. 462). We therefore subscribe to the view that Information Technologies in general (and ERP systems in particular) promote organizational control due to their ability to store, compute, retrieve and communicate information quickly (Sewell 1998; Zuboff 1988). As such, we see information handled by users in an ERP system to have a direct impact on organizational control (Finnegan and Longaigh 2002). We are particularly concerned with the case when the quality of such information suffers through workarounds created by users, and hence organizational control decreases. Workarounds are described in the next section.

2.2 Workarounds

As has been mentioned, this study addresses calls to carry out more research on workarounds (Orlikowski and Iacono 2001). The existing literature has acknowledged the fact that users create workarounds when working with an information system (Azad and King 2008a; Ciborra 2002; Suchman 1995), which is also the case with ERP systems (Boudreau and Robey 2005; Wagner and Newell 2006). Workarounds can be seen in many lights, including as hindrances, harmless and essential. Workarounds can also be seen in some cases as a form of resistance of users to new technology (Alvarez 2008; Ferneley and Sobreperez 2006). Alvarez (2008) for example argues that users develop creative workarounds to counteract the perceived loss of power and identity with the introduction of a new Information System. The use of workarounds by users can also be conceptually linked to the notion of 'interpretive flexibility', described by Orlikowski (1992) as an attribute of the relationship between humans and technology. As such, interpretive flexibility is influenced by the characteristics of the material artefact (e.g., hardware and software), the characteristics of the human agents using it (e.g., experience, motivation), and the characteristics of the context where the technology is used (e.g., social relations, resource allocations, task assignments). Interpretive flexibility in the use of an Information System then implies that users assign their own meanings and interpretation to the functions of the IS, which may differ from those envisaged by the designer of the system (Suchman 1987). Some technologies may allow for a greater degree of human agency (and consequently interpretive flexibility) and others for a lesser degree (Boudreau and Robey 2005).

There are only a limited number of studies on workarounds in the use of Information Systems. Azad and King (2008a) for example have studied workarounds in the case of a Pharmacy Dispensing System in the healthcare sector. They observed that for such workarounds to occur in practice an alternative social order had to be enacted, and coordinated action amongst actors involved in the workaround had to occur. In this process the roles of human actors involved in the workaround could change, and some could be empowered. In particular with regards to workarounds in ERP systems, Robey et al. (2002) in their comparative case studies on the dialectics of change brought by the installation of an ERP system, observed that users tried to reinstate the ways in which they worked prior to the introduction of the ERP system, including using workarounds. This included for example pulling data out of the system for analysis using desktop software.

Boudreau and Robey (2005) present similar results, arguing that ERP users employed workarounds to make the system respond to their needs, to compensate for what they considered deficiencies within the system, or to compensate for their ignorance of the features of the system. Boudreau and Robey also cite a number of examples related to workarounds in the ERP system. For example, users bypassed the system's timeout feature which would automatically log the user out if the user did not interact with the system for a defined period of time. Users chose to bypass this in order to avoid having to log into the system multiple times. Rather than agreeing to increased security imposed by the timeouts, users instead chose to ask colleagues to press a key or simulate a transaction in the system from time to time while they were away, to avoid being logged off. Another example would be the case where credit card payment information needed to be recorded within the system. However, as users did not know how to carry out the relevant transaction, they chose to record the required information in other fields that were not

in any way related to credit card information. Similarly, users that needed to change amounts in purchase orders but did not have authorisation to do so, could choose to record a note in an arbitrary text field asking the person who had the authorisation to carry this out for them.

Most of the above studies looked at workarounds from the point of view of human agency and its rationale for employing the workarounds. These studies do not explicitly consider the characteristics of the technology in which the workarounds are carried out. How the machine performs is a design decision and incorporates assumptions about the context where it is used and its expected usage (Orlikowski 1992; Orlikowski and Robey 1991). However, once those assumptions are incorporated into the design of the system and the system becomes operational in the organizational setting, it offers a set of functionalities which users may choose to adhere to or not. To examine this interaction between users and machine, we use the conceptual framework of human and machine agencies in this paper, which is discussed in the next section.

3 Research approach

3.1 Interpretive case study

This paper adopts an interpretive case study approach (Walsham 1993, 1995b). In interpretive studies researchers try to understand phenomena by examining the meanings that participants assign to them, within particular social or organizational contexts (Orlikowski and Baroudi 1991; Walsham 1995a). As Walsham (1993) characteristically declares, 'in the interpretive tradition, there are no correct and incorrect theories but there are interesting and less interesting ways to view the world' (p. 6). We sought to collect rich data with regards to the context where users worked with the ERP system, and to understand their choices and rationale for the actual use of the system.

In particular relating to the use of case study research within an Information Systems setting, Benbasat et al. (1987) argue that this method is appropriate because one can study IS in their natural setting, it allows answering 'how' and 'why' questions, and it is also appropriate when few previous studies in the same area have been carried out.

The next section presents the approach in collecting the research data from the case study company.

3.2 Data collection approach

The primary data sources in interpretive studies are interviews (Nandhakumar and Jones 1997; Walsham 1995b). Van Maanen (1979) refers to the interviewee's constructions as 'first-order data', and to the researcher's constructions as second-order data. Second-order concepts depend upon informed theory and insightful analysis. Simply the collection of field data does not result in second-order concepts in itself, but that depends on the interpretation of the researcher. In this study the first order concepts are the accounts of interviewed employees of the company

examined, while the second-order concepts are the interpretations of those accounts according to the chosen theoretical framework.

In interpretive studies in Information Systems in particular, neither human actions nor technologies are assumed to exert direct causal impact (Sahay 1997). Consequences are then seen to be a result of the interplay of computing infrastructures, and objectives and preferences of different social groups (Markus and Robey 1988). This is in line with the chosen theoretical concepts (used as sensitizing devices) of human and machine agencies.

The data collection for this research involved semi-structured interviews in a large company. Thirty-six interviews (average interview time 50 minutes) with 27 people were carried out between February and August 2005 at the company's premises. All interviews were voice recorded and transcribed verbatim. The interviews were with users and managers from the areas of IT Management, Finance, Materials Management, Service Management, Purchasing, Sales, and Warehouse and Distribution. The profile of the persons interviewed is shown in Table 1.

The interviewees were asked some open-ended questions, but they were free to elaborate on their own thoughts and digress when it was necessary. In response to these digressions, the researcher (one of the authors of this paper) then adapted the questioning, in order to make the interviewees elaborate more on their views and ideas. In addition, if the researcher was puzzled by the responses or they contradicted previous claims by other interviewees, he asked them to elaborate more and explain the perceived contradictions. To provide practical examples of the interviewee responses, interviews were often combined with live demonstrations of the system and the workarounds employed by the users.

The data collected were analysed using the conceptual framework of human and machine agencies, which is presented next.

3.3 Conceptual framework: Human and machine agencies

The concepts of human and machine agencies were discussed by many (e.g., Rose and Jones 2005; Rose et al. 2003, 2005b). In addition, a special volume of the Scandinavian Journal of Information Systems was devoted to the discussion of these concepts in IS research (Hanseth 2005; Orlikowski 2005; Rose et al. 2005a, 2005b; Walsham 2005). In our case these concepts were deemed important in examining ERP use and workarounds, and were elaborated with the case study data as the study progressed, to further assess their applicability and suitability as a framework for the discussion of the collected research data. This means that these concepts emerged bottom-up from the data collected from the case study company, as well as top-down from the relevant theories, instead of forcing the data into pre-defined categories.

Regarding human and machine agencies in an Information Systems setting, Rose et al. (2003) and Rose et al. (2005b) have pointed out an issue central to IS research, which is the relationship between the social and technical aspects of IS. This is the problem of 'agency', i.e., if according to Giddens (1984) agency is the 'capability to make a difference', then how do social systems act upon technology, and vice versa? In studies of the role of technology in organizations, the two extreme poles (social determinism (Bijker et al. 1999; MacKenzie and Wajcman 1999) and technology determinism (Smith and Marx 1994; Winner 1977)) offer a simple answer to the problem of agency. For the social deterministic position, agency lies in humans, whereas for the

Position	*Area*	*I/D*	*Remarks*
IT Manager	IT Management	3 / 100	1 Telephone and 2 Face-to-face interviews
Business Process and Global Information Systems Director	IT Management	1 / 25	Face-to-face interview
SAP Facilitator 1	Service Management	2 / 125	Face-to-face interviews
SAP Facilitator 2	Service Management	2 / 195	Face-to-face interviews with demonstration of system
Production Planner	Service Management	2 / 115	Telephone and face-to-face interviews with demonstration of system
Head of Production	Service Management	1 / 50	Face-to-face interview with demonstration of system
Maintenance Policy Leader	Service Management	1 / 40	Face-to-face interview with demonstration of system
Reliability Group Leader	Service Management	1 / 65	Face-to-face interview
Abnormal Work Manager	Service Management	1 / 55	Face-to-face interview
Shift Planning Coordinator	Service Management	1 / 55	Face-to-face interview
Shift Planner	Service Management	1 / 65	Face-to-face interview
Flow Repairable Controller	Service Management	1 / 40	Face-to-face interview
Assistant Accountant	Finance	2 / 80	Face-to-face interviews
Accounting Reports Manager	Finance	1 / 50	Face-to-face interview
Assistant Finance Manager	Finance	1 / 45	Face-to-face interview
Accounts Payable Clerk	Finance	1 / 55	Face-to-face interview
Billing Clerk	Finance	1 / 40	Face-to-face interview with demonstration of system
Materials Controller 1	Materials Management	2 / 125	Face-to-face interviews
Materials Controller 2	Materials Management	2 / 55	Telephone and face-to-face interviews
Materials Planner	Materials Management	2 / 110	Face-to-face interviews with demonstration of system
Business Improvement Coordinator	Warehouse and Distribution	1 / 40	Face-to-face interview
Logistics Director	Warehouse and Distribution	1 / 50	Face-to-face interview
- Inventory Planner 1 - Inventory Planner 2	Warehouse and Distribution	1 / 55	Joint face-to-face interview
Sales Facilitator	Sales	2 / 70	Face-to-face interviews
Commercial Assistant	Sales	1 / 50	Face-to-face interview
Purchasing Manager	Purchasing	1 / 55	Face-to-face interview

Table 1: Profile of persons interviewed (I/D: number of interviews/total interview duration in minutes)

technology deterministic position, agency lies in technology. Actor Network Theory (Callon 1991; Latour 1999) has tried to bridge the two opposing camps by not distinguishing between human and material actors. In addition from a social viewpoint, in the Structuration Theory by Giddens (1984), agency is synonymous with human actors which are engaged in shaping and being shaped by the structure of social systems.

As both Actor-Network Theory (Cordella and Shaikh 2003; Monteiro and Hanseth 1996) and Structuration Theory (Gregson 1989; Jones 1999; Monteiro and Hanseth 1996) have their shortcomings with regards to their dealing of agency, Rose et al. (2003) have called for an updated model to explain agency. This model is subsequently presented by Rose and Jones (2004), incorporating features from both Structuration Theory and Actor-Network Theory. In this model the distinction is made between human and machine agencies, but the two are also interwoven and affect each other. For the authors, humans and machines both exhibit agency, in the sense of performing actions that have consequences, but these two forms of agency are not equivalent. Human agents have forms of awareness and purposes (intentionality), which machines do not. The agency of machines can be viewed as 'perceived autonomy' (Rose and Truex 2000), or it can be characterised by its 'affordances' (Gibson 1979; Nandhakumar et al. 2005; Norman 1988), i.e. in terms of the actions that it allows or disallows. In the first case machine agency increases when it is viewed as a 'black box', but decreases when the development stage of the machine is considered historically. In the second case, machine agency refers to the actual properties of the machine, i.e. what the machine can or cannot do. This second view of agency is the one adopted in this study. The figure below presents a graphical depiction of the concepts of human and machine agency as used in this research.

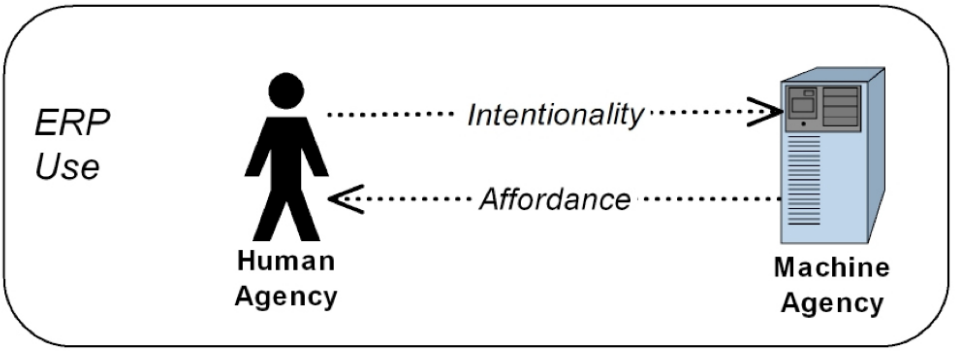

Figure 2: Concept of human and machine agency in ERP use

Using the above conceptual framework, the collected data were analysed using the methodology presented in the next section.

3.4 Data analysis methodology

The methodology that was followed for data analysis was that described by Miles and Huberman (1994). Although Miles and Huberman give some general guidelines for the analysis of qualitative data, they mention that in the end a lot depends on the interpretation of the researcher and his or her analytical skills. Part of their methods also involves data reduction, which refers to the process of simplifying and abstracting the qualitative data collected. This may include the sorting, discarding, sharpening and organization of data, in order to aid in the drawing of conclusions. Data reduction can be aided with the assignment of codes (descriptive, interpretive, or pattern codes) to pieces of text (e.g., interview data or memos).

A coding approach was followed for data analysis in this research, with coding done with the aid of the qualitative analysis software NVivo (Gibbs 2002). Coding included mainly the transcripts of interviews, and to a lesser degree written-down observations from the field, researcher thoughts, and other forms of communication with respondents such as e-mails and informal discussions. NVivo was used mainly as a data management tool (for the categorisation and grouping of the research data into lower and higher level codes), as well as examining the interrelationships between the emerging concepts (with conceptual matrices linking together two or more concepts, e.g., examining the link of workarounds in ERP use with organizational control). Codes for example were related with the concepts of 'workaround' or 'machine agency' at a high level, and those then included sub-codes at lower levels, according to the types of workarounds or examples of machine agency observed within particular areas of the system.

The analysis was an iterative process that happened in parallel with data collection, as well as at the end of it. At the end of the data collection, a summary of the findings was developed and sent to the interviewees concerned, for their feedback on the findings. In addition, there were two researchers involved in this study. Although the elaborate coding process was carried out by one of the two researchers involved, a summary of the collected data, associated codes and emerging concepts were shared with the other researcher in order to further assess their interpretation and potential bias. This was an iterative process where the data, codes and concepts were repeatedly elaborated and validated both with the interviewees as well as with the second researcher. The next section describes and analyzes the case study.

4 Case description and analysis

4.1 Case background

TransCom (a pseudonym) is a world leader in transport infrastructures, being a worldwide player in equipment and services for rail transport. It is present in 70 countries, with a worldwide turnover totalling around €14 billion.

Sites from the UK part of TransCom were visited for the purposes of this research. In particular, the operational headquarters for the UK operations located in West Midlands were

visited, as well as train maintenance and repair depots at Lancashire, North-West England and Greater London. At Lancashire there were also warehouse facilities, serving mainly the depots of the West of England.

As a contractor for the maintenance of rail stock, TransCom had customer contracts with main train operators in the UK. These contracts were for the regular maintenance of the customer trains, the fixing of faults on the trains as they happened, or a combination of both.

4.2 ERP system

At the time of the interviews, TransCom was using the SAP R/3 ERP system, version 4.5. The modules of SAP used in the UK sites examined were Materials Management, Purchasing, Service Management, Finance, Sales & Distribution. The impetus for installing SAP in TransCom was the fact that the company needed an integrated system that would manage its whole business. Before the SAP system, TransCom was using another ERP system (BAAN) at various locations in the UK, as well as a standalone finance system. The implementation of SAP in the UK started in June 2000, and finished in January 2002.

The next section focuses on some of the factors that shaped the use of the ERP system at TransCom. We will not carry out a detailed analysis of the Critical Success Factors (CSFs) that were not followed at TransCom and which led to a troubled implementation, as those are described extensively in the existing literature. Instead our purpose is to present some of the factors from the implementation that filtered through to the use of the system, in order to subsequently concentrate on the workarounds employed by users.

4.3 Implementation history of the ERP system

New business unit. The importance of user participation in ERP system implementation for the contribution of business-specific knowledge is well documented (e.g., Akkermans and van Helden 2002; Bingi et al. 1999; Nah et al. 2001; Ngai et al. 2008; Umble et al. 2003). In our case study however, user participation in one particular area of the company was non-existent. This was in the creation of a new business unit, which was built around SAP. This unit was named PartsLink, and its aim was to stock and supply the depots in the UK (and especially the West Coast area) with spare parts for trains. This was important, as TransCom did not have a proper parts business to deal with spare parts for trains, and therefore it also did not have the systems to manage the spare parts.

As a parts business did not exist before, people within TransCom did not know in detail how the business should be supported by the ERP system. External consultants were hired to help with the implementation, and suggest ways that the newly created parts business could be supported by the system, in terms of for example ordering processes, purchasing, inventory, warehouse, and logistics functionalities.

Although the consultants based their implementation of SAP for the parts business unit on best business practices, the resulting system was seen by most of the interviewees in TransCom as being very inadequate. When it first went live in April 2001, and as the business unit was new

and built around the system, it seemed to be functional for about three months. After this time however, it was realised that some of the processes were quite inefficient, especially the financial ones. After about six months the company realised that they were making a big loss on the new business unit that they did not expect to make. The consultants were blamed for the perceived poor implementation:

> [The consultants] thought they knew how to implement a spare parts management system in SAP, we did not have the expertise here in-house, which meant that they were always able to convince the people they were dealing with what the right answers were. And it was a very poor implementation. (Logistics Director)

Four years after the initial implementation of SAP at the parts business, when the interviews were carried out, there were still many complaints from the users of the system:

> We've got a very complicated repair and quote process, and that process takes ages. It's an awful process; we haven't had time to sort it out. It's been in position for some years and people do it, they'll just say, well, if you want me to take 40 minutes to do this stupid thing, I'll do it! (Logistics Director)

Nevertheless, the users were forced to use SAP at PartsLink despite its many problems, as there was no other way of carrying out the business processes there.

The next section describes the role of the IT department in the use of SAP.

IT department role. Within TransCom there was a central unit called ITC (IT Central) responsible for the IT infrastructure of the whole business worldwide. They were based at the headquarters of TransCom, outside the UK. After the introduction of SAP, their responsibilities also included the maintenance of the system worldwide.

To aid them in their duties, and in particular with regards to the maintenance of SAP, a unit that organizationally resided below ITC was created in March 2004 in the West Midlands in the UK. This unit was called Business Process and Global Information Systems (BPnGIS). The BPnGIS team's responsibilities included amongst others the installation of new instances of SAP in countries where it was not installed, training users, and carrying out modifications to the system according to user requests. The BPnGIS team was completely under the control of ITC, and for any major work that needed to be done, there always had to be the sanctioning from ITC. The BPnGIS team as it was located in the UK, also collected the requirements and complaints of UK users with regards to SAP.

From the sites visited in this study, there were a lot of negative views for the BPnGIS team, as well as for ITC. As ITC wanted to keep the configuration and use of the ERP system as standard worldwide, it was very reluctant to update it, unless the updates would affect the majority of the countries where SAP was installed. As most users in the UK interfaced with the BPnGIS team directly, and not with ITC, most of the negative criticisms were directed towards the former. In particular this was with regards to BPnGIS not having the power to configure SAP to match their business needs. As a result, there were many tensions between users and the BPnGIS team, as well as between the BPnGIS team and ITC. The users also blamed BPnGIS for lack of training, which is described next.

Training. The importance of user training and education for a successful ERP implementation is well documented in the literature (e.g., Akkermans and van Helden 2002; Al-Mashari and Al-Mudimigh 2003; Bingi et al. 1999; Bradley 2008; Dowlatshahi 2005; Ngai et al. 2008; Scott 2005; Umble et al. 2003; Yu 2005).

In TransCom, the BPnGIS team responsible for SAP training in the UK claimed that they were understaffed, with the result that they could not respond efficiently to user requests for training. One common complaint from most users of the system was that they had not received enough training, and that either they did not understand how the system worked, or could not use it to its full potential. When training was eventually carried out, this was mostly on the workings of SAP, and not on the business rationale for carrying out business processes within SAP in a way that was different to the pre-SAP era. Users consequently mentioned that they could not understand why they were carrying out particular actions in the system and how these would impact other users. They therefore tended to favour various workarounds or bypassed control mechanisms where they found that SAP allowed them to do so. These are described next.

4.4 Workarounds in ERP use

Workarounds in access profiles. Within SAP access control profiles had to be specified, in which specific groups of people were only allowed access to specific areas of the system. The profile for specific users would then be set to indicate the data, screens and transactions a user could access. The access profiles also distinguished between display-only and full (or no) access to data. This mechanism of access controls in essence reflected a segregation of duties and control of responsibilities in the system.

Management of the access profiles was carried out centrally by the ITC team, through the input received from local offices. Although ITC would determine the level of authorisation that could be given to different categories of users, no company rules with regards to the setting of these access profiles actually existed. As a result, it was identified that these profiles were not very well developed, and that users had in many cases the incorrect level of access to the system that they needed.

At the time of the interviews there were many complaints from the users with regards to the setting of these profiles. Many of these complaints had to do with the limited access to screens and transactions in the system, when access was required, but was not given due to the incorrect setting of the access profiles. On the other hand, users also pointed out that there were many cases where users were allowed to carry out tasks on the system, which they did not necessarily need to. The result was that the intended controls in SAP were seen to be very lax in some cases, because people had authorizations to do many things outside their immediate area. In many cases users 'abused' their increased access, because it was easier for them to do a transaction in the system itself that they should not be carrying out, rather than asking the person that should be doing that transaction. As one interviewee mentioned:

> For example, if there is something to be posted in the material master, because they [users outside the Materials Management area] have got authorisation and they've got some knowledge of the material master, they think, right, OK, I'll do it myself, rather than

> going to somebody who's got better knowledge, and say, right, OK, can you add this so I can carry on with my processing. (Business Improvement Coordinator)

The way that access profiles were set up by ITC and used by users locally also depended on the affordance of the system. For example, in the Materials Management area SAP placed a restriction that display-only profiles in the materials master (which contained the definitions of all materials used in the company) were not allowed, only full or no access profiles. The reasoning behind this was that it was deemed necessary to always be able to change material definitions in the materials master, if the user was to have access to view those materials in the first place.

The users in the workshops that put, picked up and relocated those materials into particular bin locations needed occasional access to the materials master in order to get information about those materials. Although display-only access would be sufficient in this case, SAP did not allow this and hence full access had to be granted to those users. This meant that the workshop users could change (intentionally or inadvertently) the materials master, although they were not supposed to. According to a materials manager, what was stopping them from doing it was that:

> 1. they probably don't know how to do it, 2. they've got brains. If somebody wants to go in and start messing things around, then they could do that. You can't live with access to a particular part of the materials master; you either got it, or you haven't. (Materials Controller 2)

In addition, users could also work around the different login profiles offered by SAP. For example in the Materials Management area in a train maintenance workshop in Manchester, there were four or five users present at any one time, but only one SAP terminal available. Although each of those users had a unique username and password allocated to them, the first person that came to the machine logged in, and did not log out until he/she finished his/her shift. In the meantime, if other users came, they would use that person's log-in; they would not log that person out and log themselves in the system in order to use SAP.

When asked why the different log-ins were not respected, the response by the relevant users was that it would not be viable to do so, due to delays in logging in and out all the time for different users, as they were quite busy with other things in the workshop as well:

> Everybody has their own login. Like, I'm logged in now. But if say there were 4 or 5 of us on duty today, somebody wouldn't come to it and log on; we'd use whatever was in, just for speed. I suppose really, if I walk away from it, I should log off, and the next person who comes would log in. But it just takes time to keep logging off and logging in when you're busy. (Materials Planner)

Using one log-in for everybody in the workshop essentially meant that the intended controls in the system were bypassed by the users. Having a generic log-in also meant that it would be impossible if the need arose to identify in the system which person actually carried out a transaction. If a mistake was made in the system and was attributed to a user who was logged in and his/her action was tagged in the system, the user could say that he/she did not do it and that other people were using his/her login.

Using a generic log-in also meant that users could abuse extra authorities given to their colleagues to carry out transactions in the system. However, it was mentioned in the interviews

that they would probably not know what to do with this increased access, and would therefore not abuse it. It was also mentioned that trust played an important role in letting other people use one's account:

> Everybody is more or less very trustworthy. Nobody would abuse it, I don't think. If somebody walks away from it [SAP] and leaves it logged in, they can more or less rely on people not to abuse that password. (Materials Planner)

The next section describes workarounds by users using their interpretive flexibility in SAP.

Workarounds by interpretive flexibility. Interpretive flexibility (Cadili and Whitley 2005; Orlikowski 1992) in the use of SAP at TransCom was mainly observed with the use of free-text fields. An example that we discuss is that of recording hours worked on a service order. In this case any work (maintenance or remedial) carried out on a train within TransCom required the use of service orders that described the work that needed to be done, as well as the manpower and materials. Before the introduction of SAP, the process of dealing with service orders and correctly allocating hours worked on them was very complicated, purely because they were paper-based. With the introduction of SAP, the handling of service orders improved greatly, as they were now held within the system.

Nevertheless, there were still problems in terms of correctly allocating hours worked on these service orders in SAP. This was mainly due to the fact that the users at the workshops were asked to distinguish their working hours according to whether it was normal work (according to pre-existing customer contracts for maintenance) or abnormal work (according to per-se work outside contractual obligations that had to be billed separately). Most of the time, the users at the workshops lacked the knowledge to determine which jobs were considered normal and which were abnormal. Consequently, users tended to record the time they had spent working on a train in a descriptive text field in the service order instead of the actual allocated field in SAP for the hours worked. By doing so, no analysis could be carried out such as total hours worked on a service order, as the field was just text with no functionality behind it.

The managerial response to this problem was to commission two members of the Service Management department (named as SAP Facilitators) to investigate methods of streamlining the process of entering hours worked in service orders in SAP, so that actual hours could be correctly recorded against every single service order. This information was important to the company in case they were going to make a claim with a client for abnormal work (which needed to be billed per se according to hours worked). It was also important for labour efficiencies issues.

The workaround initially investigated by the SAP Facilitators was to make fields that were not mandatory in SAP look visually as being mandatory (although the system would not throw an error if they were left empty). Apart from the possibility that users could eventually realise that such fields were not really mandatory, more realistic considerations were the lack of time to deal with the perceived complexity of service orders in SAP:

> If it was for me, I would say, make all the fields mandatory, and you have to fill them all in. In the real world, you could never do that. There's time constraints for one, availability of information, two. So you would have the end user who wouldn't use the system. (SAP Facilitator 2)

To avoid lengthy training of staff on business and SAP issues, the short-term solution consequently proposed by the SAP facilitators was to record the hours worked in another numerical field in SAP (independent of normal or abnormal work considerations). The Sales department (that had the information to decide which type of work was normal and which abnormal) would then have to manually go through all service orders and for these that was not a corresponding customer contract classify them as abnormal and bill them accordingly. The suggested workaround of using another (unrelated) numerical field instead of the text-based one meant that at least some more straightforward processing on this field (such as totals) could be carried out. However, the Sales staff would still need to go through all service orders individually, and as such this workaround still kept the operational inefficiencies.

The use of free text fields as a demonstrator of the interpretive flexibility of SAP users was a norm in TransCom, as people did not understand what the rest of the fields in SAP denoted, and preferred to capture all the relevant and important information in those fields, instead of the ones allocated by SAP. Another example of this was the practice of some users in the Sales department to record prices in a sales order for the selling of stock owned by TransCom, in text fields. This of course had a direct impact on Finance, who could not for example examine sales levels, or automatically update its ledgers. This issue was a training one, involving not only technical training regarding the use of SAP, but also general business training to understand how the actions of users in one department impacted other users. Due to operational pressures this training was postponed for a long period of time and hence operational inefficiencies continued to be present.

The next section describes workarounds in the case of using systems external to SAP.

Workarounds by using external systems. One of the major perceived workarounds in TransCom was that of using external systems to process data in a manner that would be difficult or costly to carry out in SAP. The most common example of this was the use of Microsoft Excel for the production of reports and the manipulation of data produced by SAP. Excel was used in TransCom for its reporting needs, because the corresponding functionality of SAP was seen to be poor, for example in terms of layout. Excel was considered more advanced in this case, in terms of being able to summarize and carry out calculations on the data, produce graphs, etc.

The use of Excel was not a panacea for the production of reports. Users had to learn Excel quite well in order to be able to manipulate the data coming out of SAP. For example, in the Materials Management area the output from a variety of screens had to be extracted, and each of those combined in Excel using specialist functions such as 'vlookup'. This was seen as being too complicated and time-consuming to learn and carry out, distracting the users from the main job that they should be doing.

In addition to data produced by SAP and entered into Excel for the compilation of reports, Excel was also used for the downloading of data from SAP and the communication of this data to other users. For example, a list of trains to be cleaned overnight was produced from SAP, downloaded into an Excel spreadsheet, and sent by e-mail to the cleaning team who would do the cleaning work on the trains, and who did not have access to SAP.

Excel was also used as a means of communicating with customers. For example, there was a lot of e-mailing back and forth with customers using Excel spreadsheets, with details of work carried out on their trains. SAP was only used to initially get the data out in the first instance,

and then any changes or updates were made outside the system, directly on the Excel spreadsheet. Those changes could involve for example any disagreements that the customer had regarding the work carried out, the pricing of it, etc.

By working outside of SAP and inside Excel in all of the above cases, there was a possibility of changing the data to give a false picture of the company. This was because the access controls that were enabled by SAP were essentially lost, as no access controls applied to Excel:

> You have that functionality, it's very good, you can export it [data from SAP]. The problem is, that you can then manipulate the data [in Excel] into any way you want, you know, anyhow you want. And for me, that's potential loss of control, because, OK, if you imagine, 2 groups of people are producing the same data in theory, manipulating it slightly differently, and potentially you turn up with 2 individuals at the same meeting, with 2 different sets of data. (SAP Facilitator 2)

Using external systems as a workaround was a special case of manipulating data outside the system. Manipulating data within the system was also observed, as discussed next.

Workarounds in data manipulation. Within the system there was functionality to enable users to specify a 'moving average price' for each type of materials held within the system. This was necessary in order for the purchasing department to be able to monitor the variation in the prices of materials that the company bought from suppliers. The system constrained the user to input a value for the relevant field, otherwise the corresponding materials in the system could not be checked out, or transferred to another site.

The responsibility to enter the moving average price in the system resided with the users in the Materials Management area, who had to maintain this field. However, those users did not see the importance of maintaining this field and its impact on the purchasing department. They therefore neglected maintaining it, with consequent problems in the transfer of materials.

As a result of this, when materials needed to be transferred off site, the users that needed to do the transfer in SAP went into the system and put a fictitious price to make it work. This was usually one penny. Although they could phone the people that did the booking in of the materials and ask them to change this price, this was perceived as time-consuming and holding them back from booking the materials, therefore they preferred doing it themselves in order to save time. If the wrong moving average price was not spotted and corrected however, this would then mean that the wrong price would be used for the relevant materials, resulting in loss of control over the accuracy of the data in SAP.

A similar workaround existed in the case of using a 'source list' within SAP. This contained the suppliers from which the company could buy items required for the maintenance and repair of trains. The source list existing in the system was created and maintained by system administrators from the BPnGIS team; a block was put in the system to disallow other users from amending it, so that only authorised suppliers identified in the source list could be used to buy materials from.

Users nevertheless identified a way to bypass this, not by changing the BPnGIS-maintained source list (which they didn't have access to), but by creating a new source list. The creation of new source lists was enabled by the BPnGIS team specifically for the purpose of transferring

materials between different sites within TransCom. For this reason, users were given the authority to create new source lists, in order to specify by themselves the transfer sites they wanted to transfer materials from/to. However, users found out that they could also use this in order to specify new source lists for buying materials from outside suppliers as well. SAP did not distinguish between internal and external suppliers; therefore users could abuse their extra authorisation for buying items from external suppliers. This meant that they could effectively include any supplier in their own source list, without consideration to the approved external suppliers in the BPnGIS-maintained source list.

Having presented and analyzed the use of SAP in TransCom, the next section discusses the results of this research.

5 Discussion

5.1 The context of SAP use

The case description indicates that the site where we investigated the use of an ERP system (SAP) had a troubled implementation. Understandably, the level of success of an ERP implementation subsequently affects the efficient use of the system (Peslak et al. 2008). However, the purpose of this study was not to identify the reasons or missing critical success factors leading to the poor implementation, but rather to examine the subsequent workarounds employed by users and their impact on organizational control. We also deemed it necessary to supply the reader with the context of this implementation, so that the reasons and rationale behind some of the workarounds employed by users could be better understood.

Some examples we analysed had to do with the implementation history of SAP itself, e.g., in the creation of a new business unit to deal with the parts business of TransCom. There was not any business leadership in this case, as the business unit was new and built around the system, and the company therefore trusted the consultants to implement their own recommendations. When the system became operational however, it was found that it was very inefficient. There were also organizational issues such as the global IT department not wanting to give authorisation to local IT teams to carry out changes to the system to match local needs, as the global IT team wanted to keep the system standardised worldwide. Training was also a big factor that was to a large degree missing and impacted on the way users perceived and used the system.

In our analysis we did not overlook relevant literature on the acceptance of technologies that could explain why users at TransCom devised workarounds. There are indeed many theories to account for user acceptance such as Diffusion of Innovation Theory (Bradford and Florin 2003; Fichman and Kemerer 1999; Plouffe et al. 2001; Rogers 1995), Theory of Reasoned Action (Ajzen and Fishbein 1980; Davis et al. 1989; Karahanna et al. 1999), Theory of Planned Behaviour (Ajzen 1991; Harrison et al. 1997), or the Technology Acceptance Model (Davis 1989; Davis et al. 1989). Nevertheless, the focus of this study was not to explain why users at TransCom used SAP in certain ways, but rather to examine the actual workarounds employed by users

in the troubled implementation of SAP, and how these impacted negatively on organizational control. This is presented next.

5.2 Workarounds in SAP use and their impact on organizational control

Workarounds in the existing literature can be seen either as beneficial (Ciborra 2002; Ciborra et al. 2000; Pentland and Feldman 2008), or as harmful and temporary (Boudreau and Robey 2005). We do acknowledge that workarounds are needed in many cases to make the system work and match business needs, and in this case workarounds can be seen to be positive and essential. Our aim in this paper was to examine in particular the cases where workarounds were seen in a negative light and decreased organizational control.

Some authors have looked into how workarounds can be avoided during the implementation phase. For example, Wagner and Newell (2006) have used the conceptual framework of social ordering (Fuller 1978) to examine common aims and coordinated action in order to make a troubled IS (and in particular ERP system) work during its implementation phase. They argue that it is not necessary to seek consensus of all parties with regards to the workings of the ERP, but rather to put emphasis on coordinating action during its implementation, even if this involves compromises between actors involved. They also argue that customization may be necessary to create employee commitment and motivation in the use of the ERP system.

We depart from the implementation phase in this study however, and are more interested in the use of the ERP system after the implementers have left the implementation site. We are therefore interested to see in which ways users can devise workarounds in the system, and how this affects the organization. Our results here contradict some authors (e.g., Kallinikos 2004), who argue that ERP systems enable the construction of accountable and governable patterns of behaviour in organizations. We have instead found that users can create workarounds even in the case of ERP system that are seen by many authors as being rigid and constraining user action outside processes embedded in the system (e.g., Chae 2001; Dillard et al. 2005; Pozzebon 2001; Rolland 2000). Our results therefore agree more with studies on ERP use (e.g., Boudreau and Robey 2005), which argue that although ERP systems may be seen as rigid and inflexible, there is still scope for human agency to take place within such systems.

The above cited studies mainly look (implicitly or explicitly) at the re-enactment of human agency within ERP systems. It is important however to also consider the agency of the machine (the ERP system) in facilitating (enabling or constraining) the human agency, thus avoiding viewing the ERP system in a constructivist 'black box' approach (Kallinikos 2002). By drawing on both human and machine agencies, we acknowledge the importance of both the social and material aspects of ERP systems (Howcroft et al. 2004). In the table below we present the examples of workarounds employed during SAP use that we observed at TransCom, together with their (negative) impact on organizational control. Our aim is to explicitly address the issues of human and machine agencies, in contrast with studies that do so in a more implicit manner (e.g., Boudreau and Robey 2005). As already mentioned, we are interested in instances of decreasing organizational control through workarounds in this case, although we do not claim that

other types of workarounds may not be important for re-enacting or adapting business practices (e.g., as described by Azad and King 2008b).

Human Agency (Intentionality)	*Machine Agency (Affordance)*	*Work around Type*	*Workaround Description*	*How it affected Organizational Control*
Users wanting to have display-only access to the Materials Master	SAP not allowing display-only profiles for Materials Master	Access Profiles	Users given full access to Materials Master (but having to exercise caution not to accidentally modify it)	TransCom eventually did not have control over which cases the Materials Master could be updated
Users in the Materials Management area not wanting to waste time logging in and out of SAP	SAP allowing different profiles (by usernames and password) to different users		Users using only one person's login to log into the system and relying on trust in order not to abuse the person's profile	TransCom lost control on who was or was not using the system
Wanting to record hours spent working on a service order, but not being able to distinguish between normal and abnormal work	SAP offering special fields to record hours worked on service orders (according to normal or abnormal work)	Interpretive Flexibility	Users recorded hours worked on a descriptive text field as they couldn't distinguish between normal and abnormal work	TransCom could not directly account for normal and abnormal work, but had to manually inspect all work done as entered in the system
Wanting to record prices in sales order (but not knowing how to do it)	SAP allowing the recording of sales prices in appropriate numerical fields		Users using a text-based field to record sales prices	Similar to the above, TransCom lost control over sales data

Human Agency (Intentionality)	*Machine Agency (Affordance)*	*Work around Type*	*Workaround Description*	*How it affected Organizational Control*
Users wanting to produce reports from SAP	SAP not having sophisticated reporting capabilities	External Systems	Users exporting and manipulating data in Excel	TransCom could loose control by not being able to account on how users manipulated and presented data in Excel
Cleaning teams wanting to have a list of cleaning tasks to be carried out on trains, but not having access to SAP	SAP allowing export of cleaning tasks in Excel format		Data on cleaning tasks taken out from SAP and loaded into Excel	Similar to the above
TransCom wanting to communicate with customers with regards to work done on trains in order to bill them accordingly	SAP allowing export of service orders in Excel format		Taking data out of SAP and loading it into Excel before sending it to customers	Similar to the above
Wanting to transfer materials off-site but no moving average price present to allow them to do this	SAP allowing the inputting of moving average price	Data Manipulation	Users outside the Materials Management are inputting a moving average price of 1 penny to enable them to transfer the materials	TransCom lost control over the true price of the materials
Users wanting to buy materials from external suppliers but not having authority to update the corresponding source list of approved suppliers from which to buy	SAP allowing the definition of additional source lists in the system		Users creating a new source list of their own with their preferred suppliers instead of using the administrator-maintained one	TransCom lost control over which suppliers to buy materials from

Table 2: SAP Workarounds in TransCom (through the lenses of human and machine agencies) and their negative impact on organizational control

One would then need to ask why these workarounds occurred in the first place and what their impetus was. Existing literature tells us that users may develop workarounds in ERP systems in order to counteract the perceived loss of power and identity arising from the use of the system (Alvarez 2008), or trying to re-enact previous working practices prior the introduction of the system (Robey et al. 2002). Relevant studies argue that such reasons are to make the system respond to users' needs, to compensate for what they considered deficiencies within the system, or to compensate for their ignorance of the features of the system (Boudreau and Robey 2005).

In our study there was little evidence of any apparent loss of power or identity, mainly because of the way the system was set up in its lax access controls. We have observed that the way access controls within SAP were set up in many cases gave users much more access than they needed, and consequently more power to do different things in the system. Therefore, users tended to abuse their increased access with consequent loss of organizational control. We have not observed instances where users tried to re-enact previous practices before the introduction of the ERP system. This was in particular the case with the creation of the new business unit for parts handling which was built around the system. In this case users could not devise workarounds to re-enact previous working practices (system-based or manual), simply because there were not any. Our reasons for users devising workarounds in this case were more closely related to those given by Boudreau and Robey (2005). Our analysis seems to indicate that workarounds at TransCom occurred mainly because users did not understand the system functionality and considered its workings deficient. We traced this back to the poor implementation history of SAP at TransCom, as well as the perceived lack of efficient training, and the rigidity of the IT department in not being able to efficiently address local needs with regards to the use of SAP. Consequently we have provided some examples when users devised workarounds simply to be able to perform some work in the system, albeit not in the way they were supposed to. Future training and change in the organizational procedures (e.g., with regards to customization of the system) could address many of these issues, but the efficiency of the remedial actions after the system has been used for many years mainly with workarounds and potentially institutionalised as such, is beyond the purposes of this paper.

Figure 3 below summarizes our findings regarding the workarounds employed by users of SAP in the particular organizational context of TransCom, and the impact of these workarounds in decreasing organizational control.

Figure 3 shows the dynamics of the existing 'decreased control' from the troubled ERP implementation at TransCom affecting the use of the system. This led to workarounds employed by users (human agency) based on what actions the ERP system (machine agency) afforded them to perform within the system. This in turn led to more decreased organizational control, as the company could not account for the way the system was used by its users. Therefore, cycles of decreased control affecting and being affected by the use of the ERP system where observed at TransCom. The next section presents the implications of our study for theory.

5.3 Implications for theory

The theoretical contribution of this paper has been in the development of a theoretical account (figure 3) of the (negative) impact on organizational control of the workarounds employed by

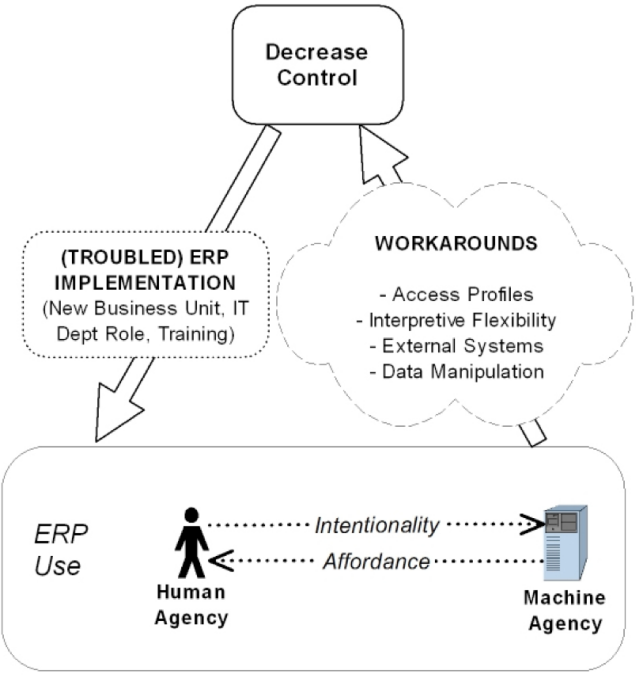

Figure 3: Decreasing organizational control through SAP workarounds in a troubled ERP Implementation at TransCom

ERP system users. In studies of IS the concept of human agency (e.g., Boudreau and Robey 2005; Kallinikos 2004; Orlikowski 2000) as well as machine agency (e.g., Askenas and Westelius 2000; Dillard et al. 2005; Rose and Truex 2000) and the interplay between the two (e.g., Ignatiadis and Nandhakumar 2006, 2007; Rose and Jones 2005; Rose et al. 2003) have been examined in the literature. In this study we have used these concepts to develop a theory to account for the decrease of organizational control through workarounds in ERP system use. Our focus in particular was a case study with a troubled ERP implementation.

As Walsham (1995b) argues, in interpretive studies the results are generalizable to theoretical propositions with four types of generalizations: (1) the development of concepts, (2) the generation of theory, (3) the drawing of specific implications, and (4) the contribution of rich insight. In our case the contributions of this study were in the generation of theory and the provision of rich insight, in the case of decreasing organizational control through workarounds in ERP systems, examined through the concepts of human and machine agencies.

Our findings indicate that workarounds can occur because of user ignorance of system functionality (which can be traced back to poor training), organizational policies (e.g., of the IT department) on the setting of system properties and characteristics (e.g., access profiles), as well as uncertain user requirements during the implementation of the ERP system (as may be the case when a new business unit is built). Therefore, it is important to examine the business con-

text (including implementation history, business practices and culture, individual perspectives) when accounting for particular patterns of ERP (or other IT) system use and its impact on the organization.

Although we did not carry out a longitudinal study, we think it would be useful to examine how the workarounds were shaped with the passage of time, what actions management took to counteract or support them, and how their impact on organizational control evolved over time. Therefore, future research on workarounds could be carried out with longitudinal studies, in order to better understand the evolvement of the workarounds in particular organizational contexts and their impact on the organization.

5.4 Implications for practice

We have documented various workarounds devised by users in this troubled ERP implementation. We have in particular concentrated on the negative impact of these workarounds on organizational control. In addition, our focus was also a particular ERP system (SAP) in a particular industry (rail maintenance). Although in this regard our study was quite focused, we do think that some general observations can be made with regards to the workarounds devised by users in other settings with troubled ERP implementations as well.

It is not surprising that training (Akkermans and van Helden 2002; Al-Mashari and Al-Mudimigh 2003; Bingi et al. 1999; Bradley 2008; Dowlatshahi 2005; Ngai et al. 2008; Scott 2005; Umble et al. 2003; Yu 2005) is a major determinant in correct ERP use and we will not linger on this subject. We believe that this training should not be only in the way the ERP system should be used, but more importantly on the business rationale behind it, and how user actions on the system affect other users of the system (Yu 2005). This is very important as the introduction of the ERP system may to a large degree bring a change in organizational processes (Boudreau and Robey 1999; Koch 2001; Markus and Tanis 2000; Rao 2000), and users therefore need to understand what these new processes are and how they are represented in the system.

The findings seem to indicate that the correct setting of access profiles must be carefully examined as well. This may sound straightforward, but by examining machine agency our results do indicate that the capabilities of the system with regards to the setting of these profiles must be carefully matched to organizational needs. In case access profiles as allowed by the system are either too wide or too narrow for the business needs (as our examination of SAP has revealed), this would point to either further customization of the system, or external business rules to cater with the access problems (e.g., periodic monitoring of user transactions or forcing escalation of transactions to users with increased access). These would still be considered workarounds in making the system work according to business needs, but if carefully managed they would lead to an increase instead of a decrease in organizational control.

To examine the above issues in detail, it may be necessary to carry out Post-Implementation Reviews (Nicolaou 2004) at various intervals after the go-live stage of an ERP system. According to Nicolaou, such reviews should include a number of dimensions including project scope and planning, driving principles for project development, misfit resolution strategies, attained benefits, and user and organizational learning. We would also like to add that in particular when examining misfit resolution strategies, any perceived workarounds employed by users in the

system should be systematically documented. It should then be decided whether the machine agency of the system allows for these workarounds to be improved, to what degree these workarounds are beneficial or detrimental to the company, and whether these workarounds could be institutionalised or totally rejected and new ways of solving business problems sought.

6 Conclusions

In this paper we set out to examine workarounds and their impact on organizational control in a post-implementation context of an ERP system. We do not overlook the case when workarounds can be institutionalised as routines, which can be a source of both stability and change in organizations (Feldman and Pentland 2003; Pentland and Feldman 2008). We acknowledge that workarounds can 'enable people to make dynamically complex systems work in practice' (Orlikowski and Iacono 2001, p. 51). The relevant studies however implicitly assume that such types of workarounds are inherently used to enhance organizational efficiency. In our study we have instead chosen to concentrate on workarounds that decrease organizational control and cause a decline in organizational efficiency. By drawing on the concept of dual (human and machine) agencies we were able to analyze both the intentionality of human users in carrying out the workarounds in the system, as well the affordances of the ERP system in enabling or constraining patterns of user action.

Our results depict the types of workarounds devised by users in troubled ERP implementations and their impact on organizational control. Given that many ERP implementations are not successful and the expected business benefits are not attained (Chew et al. 2003; Ross and Vitale 2000; Yu 2005), we think it is useful to provide examples of the consequent user behaviours in using the system. Nevertheless, future studies on troubled ERP implementations should examine not only workarounds devised by users, but also issues related to post-implementation reviews (Nicolaou 2004), post-implementation changes (Nicolaou and Bhattacharya 2006), end-user acceptance of the system (Nah et al. 2004), and the impact of those on organizational control. This will be a point of departure from the existing literature on Critical Success Factors for successful ERP implementations, and a focus on more post-implementation issues regarding the use of ERP systems.

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