ECIS 2003 Proceedings

European Conference on Information Systems
(ECIS)

2003

The ERP System as a Part of an Organization's Administrative Paradox

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Abstract

This paper argues that ERP systems take the part of an organization's administrative paradox. An administrative paradox is two sides of the same coin when coordinating organizations – the concurrent striving for flexibility and stability. The analysis of the ERP system is based on an interpretative and qualitative case study of an engineering firm. The theoretical lens used in this paper is structuration theory. One important point in this paper is that information systems can be viewed as a means to formalise coordination from an inter-personal level to a systemic one. This can, for instance, be realised through demands of input, process, and results of actions. In this way information systems can make a contribution to organizing ideals such as reliability and the achievement of sensible outcomes. On the other hand (as part of the administrative paradox) the use of information systems can institutionalize operating procedures and certain patterns of communication and coordination, restrain reorganizing activities and changes in control- and power structures. The information system's constitutive role (consisting of a set of rules and resources, facilitating and constraining, coordinating, human action) is definitely an important issue when implementing, using, and improving ERP systems in organizations.

Keywords

ERP System, administrative paradox, information systems, structuration theory

1. Introduction

Enterprise resource planning systems (ERP systems) have become a major force in organizations' use of information systems (IS)[1] in recent years (Davenport, 2000). ERP systems are often marketed as *the* solution for organizing a firm, and promise huge benefits expressed in terms of a high degree of integration, information commonality, and dramatic gains in an organization's (and even business relations/networks) efficiency and bottom line. ERP systems can also be seen as an answer to several problems with "ordinary" IS, such as low level of integration, disparate data formats and separated databases. But, even if adapted to a certain organization, the ERP system is a commercial commodity (standardized) product made by suppliers, for several companies, often in a

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[1] From now on I will use the term information systems to describe computer-based based IS, and handle ERP systems as a special case of computer-based IS.

certain line of business. The actions that constitute the IS are consequently separated from the actions that are constituted by the system (Orlikowski, 1992). How can one then "promise" positive impacts (structural, communicational, economical etc.) on organizations using ERP systems? Are organizations all the same, with the same initial positions, existing processes, needs and goals? Are the standardized processes (and business logic) offered in ERP systems as "best practice" suitable for the organization in point?

Stability and flexibility can be seen as two sides of the same coin when administering (coordinating) an organization, an IS, and their dialectic relationship. Thompson (1967) discusses stability and flexibility dilemma in terms of an organization's administrative paradox. The paradox describes the contemporaneous striving for stability (a fixed position - not likely to move or change) and flexibility (to be able to change or be changed easily according to a situation) when organizing. I believe that an organization's ERP system becomes a part of this paradox.

According to Orlikowski (1991) the early work on the roles of technology and organization assumed technology to be an objective, external force that has a deterministic impact on organizations. This statement is of immediate interest when studying ERP systems and common assumptions related to the systems. Orlikowski's work has been followed by work that focuses on human action aspects of technology, seeing it more as a product of interpretation, and later on work that sees technology as an external force having impacts on organizations. These impacts are moderated by human actors and take place in organizations. Orlikowski and Robey (1991) argue for a combination of a subjective and an examination of social structures, human actions, and IS. They draw heavily on Giddens's theory of structuration (ST) (1979, 1984). IS are, based on this, a social product of subjective human action *and* have a constitutive role. An IS embodies interpretative schemes, provides coordination facilities and are deeply implicated in linking social action and structure and interaction (Walsham, 1993). And again – ERP systems seem to be no exception, rather an interesting example of the former utterance.

In order to capture the subjective and objective aspects of social structures, human actions, and IS I will use Orlikowski (1992) and Orlikowski and Robey (1991) as points of departure to analyse the case of an engineering firm, their implementation, and use of an ERP system. The purpose of this paper is also to discuss if the ERP system is a part of an organization's administrative paradox.

The paper is arranged in the following sections; in section 2 I will present the research approach, discuss some theoretical work on ERP systems, the process of organizing, and especially the relation between IS and the process of organizing (sections 3 and 4). After presenting the engineering firm and their use of an ERP system (section 5) the duality of the IS will be analysed together with the administrative paradox. Finally a concluding discussion follows together with a discussion of limitations and future work (section 6).

2. Research Approach

The empirical part of this paper is based on a longitudinal study (from 1998 until 2001) of an engineering firm and their implementation and use of an ERP system[2]. The case is based on twenty interviews, working seminars, and studies of documents (business- and IT-strategy, internal

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[2] My thanks to research colleagues, Henrik Hansson and Fredrik Sjöstrand, for performing this case study.

documents, annual reports etc.). The work performed corresponds to central concepts and ideals in interpretive and qualitative research, such as interpretation, pre-understanding and the use of multiple methods and perspectives (Denzin & Lincoln, 1994; Stake, 1994; Walsham, 1995).

Important points of departure in the interpretation of IS is that reality is a social construction by a human actor, and that there is no objective reality to observe (Berger & Luckmann, 1967; Walsham, 1993). Interpretivism can be seen as an epistemological position concerned with understanding reality and a position that all knowledge is a construction and therefore subjective. "In the interpretive tradition, there are no correct and incorrect theories but there are interesting and less interesting ways to view the world" (Walsham, 1993, p. 6).

3. ERP Systems

According to Davenport (2000) ERP systems have several characteristics, such as a modular construction (contains a selection of application modules), which are based on a client/server architecture, allow configuration (tables can be configured according to business needs), use a common (usually relational) central database, and have variable interfaces (e.g. different languages and currencies used by a company). ERP systems are distinguished from "ordinary" IS by the fact that ERP systems have a high degree of integration and information commonality.

The term integration means to "combine or be combined to form a whole" (Oxford Dictionary, 1999). In the IS area this often means that different systems can exchange data. A high degree of integration means that systems easy can exchange strings of data. This is considered as an important change in the area compared to often historically isolated IS in organizations (with disparate operating systems, data base structures and formats based on disparate technical specifications and free-standing suppliers). Tapscott and Caston (1993) maintain that modern organizations demand integrated IS in order to communicate across functional and organizational borders. If we consider this picture it is easy to understand why the promises of ERP systems seem to be so attractive:

> [ERP systems] allow companies to replace their existing information systems, which are often incompatible with one another, with a single, integrated system. By streamlining data flows throughout an organization, these commercial software, offered by vendors like SAP, promise dramatic gains in a company's efficiency and bottom line. (Davenport, 1998, p. 121)

Organizations efficiency, if we follow Davenport, is primarily based on their ability to coordinate input and actions into results. The fact that IS support (or even obstruct) coordination among people in, and between organizations and provide procedures for accomplishing inter-personal change (Melin, 2002) should probably be especially interesting in the case of ERP systems.

ERP systems are created in different steps: the supplier of the system, the modification of the system, and the use of the system (above). My point, partially following Orlikowski (1992), is that the ERP system, is constituted in at least two steps (by the system supplier and by the system implementer), followed by constituting actions (e.g. for humans in operative work). The reasoning can be related to the duality of technology (below).

4. Information Systems and the Process of Organizing

In this section the relation between IS and the process of organizing will be further investigated. This process takes its point of departure in organizational theory, that later is combined with ST. This section serves as a basis (a theoretical lens - a perspective) for analysing the case.

4.1 The Administrative Paradox in Organizing

The concept of *organizing* is an important verb in describing major actions taken by humans in firms in order to generate appropriate outcomes:

> To organize is to assemble ongoing interdependent actions into sensible sequences that generate sensible outcomes. (Weick, 1979, p. 3)

When people act in organizations, they also create and recreate fundamental elements of social interaction: meaning, power, and norms (Giddens, 1979). These concepts make an important contribution to the understanding of organizing, an organization and its IS. An organizing act can also be viewed as coordination. One important purpose of coordination is to formalize actions in order to reduce undesired variation, and to control and to anticipate actions (March & Simon, 1958; Mintzberg, 1983; Thompson, 1967).

However, to reduce variation in organizations by formalizing action, can be in conflict with the demands for flexibility that is highly ranked in the organizational agenda. Probably it is a question of reducing undesired flexibility *and* allow and encourage desired variation. Another challenge (and possibility as well) is that what can be considered as desired and undesired variation is dependent of time and actor. Organizing is also a question of getting access to one's own or other organization's resources. Stability is consequently an important aspect of organizing and organizations. According to Thompson (1967) one important purpose with establishing organizations is certain slowness in change. The dichotomy that continuity (stability) on one hand, and change (or flexibility) on the other hand, represents is labelled as the *administrative paradox* (ibid.).

4.2 The Relation between Information Systems and the Process of Organizing

IS are closely associated with the organizing of work. IS are implicated in work through information storage, retrieval, and transmission capabilities, through providing a tool to accomplish tasks, and imposing a rhythm and schedule on the work processes. IS accomplish this by providing technical vocabularies to mediated meanings ascribed to events, objects, and relationships, and through coordinating activities over time and space (Orlikowski, 1991).

DeSanctis and Poole (1994) also elaborate the concepts of IS and organizations, especially focusing on structures. They describe that prior to development of IS there exist structures in an organization such as reporting hierarchies, organizational knowledge, and standard operating procedures. The technology then presents an array of social structures for possible usage in interpersonal interaction (including rules and resources). When these rules then are brought into action, they become instantiated in organizational life – there are structures in technology *and* in action, one shaping the other.

But, turning back to the question above: Can IS be suitable for a flexible organization? Maybe IS fit traditional organizations, with bureaucracy as a starting-point. An IS can be viewed as a bureaucrat

in an electronic version (Checkland & Holwell, 1998). Common features are for instance the possibility to program instructions, define formalised tasks and perform an efficient processing of data. In this scenario IS could make problems with undesired bureaucracy even worse.

The relation between IS and the process of organizing is complicated – implications of IS are full of nuances and full of contradictions (Keen, 1981). This relation is also discussed by Markus and Robey (1988). They also conclude that effects of IS are not deterministic, similar IS can result in different effects dependent upon the interplay between the IS and human actors that use and legitimate the systems. A social meaning is also attributed to the system.

In this paper I will use Orlikowski's (1992) structurational model of technology in order to interpret the nature of the ERP system and the structuring of the firm (section 5). This model, and the adherent perspective, is primarily based on Giddens's (1979, 1984) ST. I will only outline some key elements of this extensive social theory here. In short, structuration is viewed as a social process that involves the reciprocal interaction of human actors and structural characteristics of organization. Structures are viewed as having two sides (the duality of structure), enabling and constraining, human action. At the same time structures are products of human action. When humans act in organizations, they also create and recreate the elements of social interaction: meaning, power, and norms. Human action, as in the case of creating *meaning* and communication, is linked to structures of *signification* (at an institutional level) by *interpretive schemes* (e.g. to make sense of one's own and others actions). *Power* is linked to structures of *domination* by *resources* (e.g. human agents allocate material and human resources, and by that create, reinforce or change structures of domination). As a last dimension, *(moral) sanction* is linked to structures of *legitimation* by *norms*. E.g. humans sanction their own actions by drawing on norms or standards, and by that maintain or modify social structures of legitimation (Walsham, 1993).

Interpretive schemes are "stocks of knowledge" and form the core of mutual knowledge in the production and reproduction of interaction. Interpretive schemes also serve as a constraint. Resources mediate power (the ability to transform the social and material world). Norms are rules that legitimate or appropriate conduct. The elements of social interaction (meaning, power, and norms) are dependent on technology. Orlikowski (1992) deals with the duality of technology and its part in the structuration of organizational settings (figure 1).
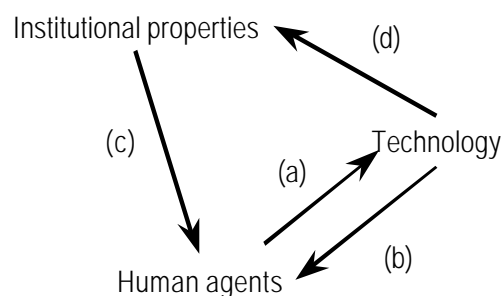

Figure 1. Structurational Model of Technology (Orlikowski, 1992, p. 410)

When humans interact with technology (a) there exists an interpretive flexibility according to Orlikowski (1992). This interpretive flexibility operates in two modes, the design mode and the use mode. In the design mode humans build certain interpretive schemes into technology, certain

facilities (resources), and certain norms. In the use mode, humans appropriate technology in assigning inter-subjective meanings to it.

Human actors use technology, consequently it mediates human activities (b). Technology can also constrain performance by facilitating it in a particular manner. However technology does not determine social practices (cf. Markus & Robey's technological imperative from 1988); it only conditions them according to Orlikowski (1992). Another important statement from Orlikowski, based on Giddens (1984), is that the technology does not only constrain or enable social practice, it does both – it is not the question of "positive" or "negative".

Human action in organizations can be viewed as situated action and shaped by organizational contexts (c). When acting on technology humans are influenced by the institutional properties (figure 1) of their setting (knowledge, resources, norms etc. to perform work). The (d) arrow in figure 1 shows the relation between technology and institutional properties of an organization. The institutional properties (signification, domination, and legitimation) can be either reinforced or transformed by human actors use of technology. The reinforcement of institutional properties is more frequent than transformation (Orlikowski, 1992). Technology users are often unaware of their role in reaffirming or disrupting institutional properties (ibid.).

5. The Engineering Firm – an Empirical Illustration

This section presents the case called "The Engineering Firm", their organizing process, and implementation and use of an IS.

5.1 The Case - The Engineering Firm

The Swedish engineering firm studied has its roots in a large group of organizations with long traditions. From being a project in this group in the 1970s, a subsidiary in the 1980s and 1990s, it has become a firm in its own right with new owners. The firm has several sales units around the world, combined with external sales representatives. The company's growth rate has been high both up front and in the shadow of its former owners in the group.

The firm is in 2001 a global supplier of production equipment and has a turnover of more than $ 100 million, and approximately 500 employees. The proportion between turnover and employees indicate that this is no "ordinary" engineering firm. From the beginning they have used an extensive outsourcing strategy, for manufacturing, parts of design and administration, warehousing and distribution, and IT services.

5.2 The Implementation and Use of an ERP System

The IS studied in the firm is ERP system, Movex from Swedish Intentia (one of the top ten ERP system suppliers), used for several critical processes in the organization. Intentia describe their IS with keywords such as "fully integrated", "collaborative revolution", and "ease…upgrades". The system is organized into six application groups.

The engineering firm has a well-developed IT strategy that supports systems that are centralised, highly integrated and standardized. Implementation of the system in the whole organization has been carried out relatively fast and with a high degree of centralised control in order to standardize work

processes and to have few adjustments in the system. The use of IS for inter-organizational communication and coordination is, however, low (telephones and fax are the most frequently used media). Visions for more extensive future use of IS in inter-organizational settings are present, but not realized when studied.

Movex is described as an important part of the firm's IT platform and is a fully integrated system with its heart in the administration and company logistics. When implementing the system the IT department compared it with several other systems, e.g. SAP's R/3. They chose Movex because they thought that this system should be easier and cheaper to implement than for example R/3 – they were also used to an older version of Movex. Movex is seen by the CIO as "organizational ungainly, but at the same time indispensable":

> A heavy global system creates certain inertia, but it offers a global infrastructure where everybody can work and where we can keep up the essential logistics process. (CIO, The Engineering Firm, October, 1999; all citations translated from Swedish)

To keep up and develop the logistic process a "centrally managed and well-oiled information system" is needed according to the CIO. This is one reason why the engineering firm chose an ERP system of this kind. At the same time wanting or not wanting a system like Movex is mentioned in several of the interviews carried out. The support a system like Movex can provide the firm is also full of paradoxes.

Movex is described as a basic requirement to integrate (make communication possible) between head office and sales units all over the world. Sales units are offered a direct access to product data and have a possibility to order products immediate through the system. This support is interpreted to only being realized by using a "centralized and relatively heavy information system".

To implement an ERP system is considered to be a laborious process – especially since it was done globally. This is not unique for Movex according to the CIO. One of the reasons for the process to be regarded as laborious is that:

> The cultural clashes are bigger than you expect. The implementation is more about communication between people than information technology issues. (CIO, The Engineering Firm, October, 1999

It is perceived as a large challenge to get support from people in the organization for the implementation of IS. As cited above the implementation is not "only" a new technical solution in the organization that automatically is accepted and used as intended.

The firm has implemented the IS together with standardized measuring and evaluation systems for accounting and quality. This work is done with both determination and some degree of anxiety. One aspect that results in anxiety is whether common, standardized IS restrain human actors' creativity – a creativity that is interpreted as the foundation of the firm's success over the years.

The firm has certain approaches to handle the balancing between the more creative (reflective) work and the more routine oriented work. One example is that certain organizational units (e.g. product development departments or newly acquired companies) are given a larger freedom of action than the more routine oriented (established) work units. To use the IS in units that should explicitly be creative and dynamic can be counterproductive according to the firm's CIO.

The implementation of the ERP system is dependent on its architecture. It is emphasized that "all data is stored in one bucket". Examples of this are that there exists a common data register for all customers and suppliers, and a common accounting plan. Interviewees at the firm often puts this database strategy in contrast with smaller, distributed, locally based and diversified applications.

Their opinions (at least at the headquarters as seen below) are evident; IS should be centralised and standardized. Otherwise the cost will be too high and the solution will be ineffective. The top management at the firm has supported this strategy. Challenges in the organization to this centralised and highly standardized IS is however present. A standardized IS brings with it standard operating procedures and can be viewed as restricting freedom of action for e.g. people at sales units.

> Just imagine the financial manager in the United States who is not allowed to choose his accounting plan, and not even his own accounts. He must apply for accounts at the headquarters in Sweden. (Sales Unit Coordinator, The Engineering Firm, October, 1999)

The contemporaneous intention to standardize certain processes (to avoid undesired flexibility), together with the maintenance of organisation flexibility and freedom of action, shows the complexity of IS implementation.

6. Analysis, Discussion, and Further Research

6.1 The Duality of the ERP system in Use

The implementation and use of the IS exemplified in the case corroborates the thesis that IS maintain, and even reinforce, existing administrative organizational structures. The ERP system even centralizes control, creates norms, and enhances power for actors in positions of authority (top management) (cf. Orlikowski, 1992; Schwarz, 2002). One example of the latter identified in the case appears when significant actors, the headquarters, by using the ERP system, standardize and constrain the US financial manager's choice of accounts and accounting plans. Discussing this scenario explicitly using the structurational model (Figure 1) results in the following reasoning: The ERP system (the technology providing interpretive schemes, facilities, and norms) reinforces (and partially transforms) institutional properties in the organization. The institutional properties (e.g. a specified set of accounts and accounting rules, intentions, norms and resources provided by the headquarters, mediated by the ERP system) then influence human actors using the ERP system at the sales units (institutional consequences of the interaction with technology).

To put it in other words the ERP system is itself a product of human action (performed by the system supplier, implementation consultants, and stakeholders at the firm), enabling and constraining human action, imposing a rhythm and schedule of the work processes (Orlikowski, 1992) creating elements of social interaction. This is the notion of the duality of technology (ibid.) as it appears also in the case studied.

The social structures provided by an ERP system can also be discussed using DeSanctis and Poole's (1994) terms for IS and group decision support systems; *structural features* and the *spirit* of these features. Features and spirits together forms an information system's *structural potential*. Structural features of the given ERP system are the set of rules, resources and capabilities offered by a system. Spirits of the features of the ERP system identified in the engineering firm are concerned with the general intent, e.g. values and goals underlying a given set of structural features (how to act when using the system, and how to interpret features). The spirit of features can be compared with Giddens's legitimation (a normative frame provided by the IS). Typical questions that can be asked and answered are: What kinds of goals are being promoted by IS? What values are being supported?

When applying this reasoning on the ERP system studied I have identified certain structural features, e.g. standard operating procedures when choosing accounting plans, choosing accounts and performing accounting. The capabilities provided by the ERP system are for instance sets of functions/features and regulate possible human actions related to accounting tasks at different organizational levels (sales units and headquarters, section 5.2). Values and goals supported concern the selection of certain accounts (a set of accounts), accounting strategy, and division of labour (a centralized process design) in order to achieve an effective organizational process.

6.2 Coordination, the Duality of Technology and the Administrative Paradox

ERP systems possess the potential to perform coordination of actions that are important when organizing firms (assemble interdependent actions into sensible patterns that generate sensible outcomes, cf. Weick, 1979). The use of IS in coordination implies that certain coordination is allocated from a particular coordination situation to a systemic situation. This allocation can result in a higher share of pre-defined, stable and formal coordination at the sacrifice of an inter-personal, and sometimes more flexible, coordination. The allocation can be viewed both positive and negative. If coordination on a systemic level is increasing (by using an ERP system together with policies, rules, and a corporate culture) the need for inter-personal communication and coordination can be reduced, and instead be a complement to the systemic one (e.g. when different breakdowns occur). Coordination is in this way changed from a direct mode to an indirect (separate actors in time and space possible) (Melin, 2002). A high share of standardisation (pre-defined, stable and formal) however, does not need to negative for users of an ERP system in the sense that the system restricts possible actions. Consider Orlikowski's (1992, p. 406) statement:

> If the users change the information system every time they use it (interpretively or physically) it would not assume the stability that are taken for granted and somehow necessary to keep up a high level of standardisation (institutionalisation) (op. cit.).

Askenäs and Westelius (2000) also state that it is not possible for all users (stakeholders) to change the IS according to their own personal wishes. An IS will consequently never be able to adapt totally to every individual's wishes or collective wishes on an organizational level.

Several empirical findings from the engineering firm shows that the IS is a part of an administrative paradox (Thompson, 1967), the concurrent search for flexibility and security (reliability) in organizational action.

6.3 Concluding Discussion

One important point in this paper is that IS can be viewed as a means to formalize coordination from an inter-personal level to a systemic. This can be realised through the demands of input, process, and results of actions. In this way IS can make a contribution to organizing ideals such as reliability and the achievement of sensible outcomes. On the other hand (part of the administrative paradox) the use of IS can institutionalize operating procedures and certain patterns of communication and coordination, restrain reorganizing activities and changes in control and power structures. The information system's constitutive role is definitely an important issue when implementing, using, and improving ERP systems in organizations. The coordinating principles (patterns) both embedded in the ERP system, and the desired set of coordinating principles from the business point of view is

important to acknowledge and analyse. If an ERP system has embedded coordinating principles not uncovered, not understood, and not eligible the implementation and use of an IS can be counter effective and the "promise" discussed in the introduction certainly not realized.

6.4 Limitations and Future Work

This paper partially has an exploratory purpose, to use the structurational model and perspective in order to analyse an ERP system together with an interest of organizing processes. A more thorough analysis can be made using more empirical data from the case study that is shortly presented above.

One can of course also ask oneself: what is so special with ERP systems compared to other IS? Characteristics of an ERP system can differ from other kinds of IS – but what can be learned more explicitly from the field of IS when analysing ERP systems? The lack of such discussion is a limitation in this paper. It could also be interesting to study other ERP systems, and to involve system suppliers in future work – and a combination of supplier-customer relationships. Orlikowski's (1992, p. 421) thesis: "The greater the temporal and spatial distance between the construction of a technology and its application, the greater the likelihood that technology will be interpreted and used with little flexibility" can also be further elaborated when studying ERP systems. The temporal and spatial distance in the case of ERP systems, especially when a highly standardized strategy of implementation is chosen, can be an issue for further research.

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