

From Drift to Control: Examining Modular Architecture and Standardization of Organizational Processes Through ERP Systems

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Abstract. This paper analyzes an ERP system implementation from a perspective of complex system and standardization. The examined IT structure can be characterized as a loosely coupled integration with the ERP system as a central integration facilitator. This solution allowed the company to make use of standardization benefits, filling the need of special functionality and at the same time limiting negative unexpected consequences such as decreased activity support and increased complexity. The paper shows how ERP's can contribute to standardization and integration efforts in IT environments with peculiar demands on functionality. It also demonstrates how negative side effects related to implementation of ERP systems can be managed and limited.

1. Introduction

Enterprise Resource Planning (ERP) systems have lately become widely adapted in larger organizations. ERP systems influence business processes through their promotion of “best practices” that results in standardization of processes

(Davenport 1998). It is however highly conceivable that it does not exist a single uniform way of organizing suitable for all organizations. Thus a company implementing the systems face the options of either conforming the business to the “ERP way” or to adjust the system to support the company specific needs (Hong et al. 2002).

Companies in the process industry often have heterogeneous requirements regarding the functionality of information technology (IT) due to industry specific characteristics compared to the “typical” manufacturing company. This paper describes the effects of an ERP system in the Swedish dairy company Norrmejerier. The company is an economic association, jointly owned by approximately 900 farmers, which operate mainly in the northern parts of the country. The yearly turnover lies in the region of 1.5 billion SEK. Norrmejerier has chosen to implement a relatively small number of modules of the ERP system IFS and to complement this with a large number of specialized applications that supports the specific needs of the different business units. The motive for the implementation was a need of integration between different business units (organizational and geographical) and their associated data. This was to be realized in a single system by the replacement of a large number of applications with ERP modules. While this strategy was not viable due to lack of functionality the idea of integration persists. Instead of maximizing the use of IFS modules an IT infrastructure with the ERP system as an integration centre for the different applications was formed. An architecture that can be described as a combination of traditional ERP- and best-of-breed(BoB)structure. IFS modules remain a substantial part of the IT structure but not to the extent that was originally planned.

The element of the IT infrastructure discussed in the paper is the ERP-based solution. This system is however not an isolated artefact; on the contrary its key aspects are emerging as it is becoming an integrated part of a larger infrastructure. Large infrastructures cannot be changed instantly but only piece by piece and over time (Star and Ruthleder 1996; Ciborra et. al 2000). At the same time as an infrastructure is subject to change processes, it has to be operational at all times to support the daily activities in an organization. This requirement severely constrains the introduction of new elements, implying that the existing infrastructure—the installed base—has strong influence on the future development of the infrastructure (Grindley 1995; Hanseth and Monteiro 1998). Corporate IT infrastructures are thus often emergent (Truex et. al. 1999) as they are typically established through side-effects of and spill-over from the implementation of increasing numbers of installed base elements as well as their closer integration (Rönnbäck et al 2007). It has been suggested that the complexity of information systems (IS) may increase due to ambitions to build perfect and universal solutions which in turn leads to a situation that is more difficult to manage (Hanseth et. al. 2006; Benbya and McKelvey 2006). To this

end, ERP systems can be viewed as tools for control and integration but it seems as if they also raise a lot of new questions regarding their own integration and side effects when implemented (Hanseth 2006). A paradoxical example of a reflexive outcome, i.e. the opposite result of what was intended, and of technology drifting at an organizational level as the result of a strive for increased control.

The case is analyzed from a perspective of standardization with an emphasis on the effects on the IT infrastructure. Companies with special need of functionality have to complement universal solutions and the integration of special solutions with an ERP based system is also discussed. While ERP systems can be viewed as tools for organizational control, they are at the same time complex systems involving not only technical aspects but also business processes (Ciborra et al. 2000, Hanseth et al. 2001). The introduction of complex system have often shown to have negative unexpected side effects such as decreased instead of increased order and control (Hanseth et. al. 2006). Limitation of these side effects is thus an important issue both in theory and practice. The research question examined in the paper is: *How can an ERP-based IT solution satisfy functional demands for an organization while negative organizational side effects associated with ERP use are limited?*

The paper is structured as follows: First an introduction to ERP systems and their characteristics is given. Second, a theoretical framework is introduced, containing the concept of information infrastructures, integration, the implications of standards and a discussion about how IS complexity can be understood in this context. Next the research methodology is presented which is followed by the case description. Finally the case is analyzed and conclusions drawn.

2. IS and Their Organizational Context

2.1 ERP System- a Tool for Increased Control?

A user-centered approach on ERP systems research has been applied and showed to be useful in e.g. reinvention, improvised learning and other issues related to unintended actions (Boudreau and Robey 2005). Most research on implementation of ERP systems has however employed a structural perspective, primarily focusing on processes and structures. Explaining empirical outcomes of IT implementation from a human agency perspective suggest that people are relatively free to use and form technology. An explanation of this bias on the research agenda can be the constraining characteristics of these systems (for a discussion and critique see Kallinikos 2004).

Implementing new IT in an organization affects internal practices and/or structures as well as linkages with external systems. The effects of this vary

between different systems where narrow and specialized systems do not affect the organization to the same extent as those involved in larger parts of the business. During the last couple of years the use of ERP systems has increased dramatically. The examples of successful implementations of ERP systems and their contribution to business success are numerous but so are the failures (Davenport, 1998; Chen, 2001; Spathis & Constantinides, 2003; Kholeif et al. 2007). Since the strength of ERP systems to a large extent lies in the integration of data from many different sources and standardization of processes throughout the firm they have a significant impact on organizational business processes. Implementing an ERP system is thus not only about implementing IT; it is also about implementing processes, which implies organizational change (Beheshti 2006; Yeow & Sia 2008). As an executive in a company with experience of implementing SAP expressed it: "SAP's system isn't software package; it's a way of doing business" (Davenport, 1998, p.125).

The changes in business processes are significant in two ways; an external actor drives them and they are based on an assumption of "best practices". It is a radical thought that lies behind this assumption of relatively homogenous demands from different industries. The degree to which the ERP system matches the organizational needs is a critical implementation success factor (Hong and Kim 2001). It has also been shown that misfit is more likely to emerge when the organization does not share the culture of the "typical one" (Soh et al. 2000), it seems probable that this also could be applied to organizations with differing demands.

It seems clear that the technology in itself is not what differentiates in most businesses (for a discussion on this topic see e.g. Carr 2003 and the respond to his article of Vandebosch and Lyytinen 2004). Instead it is the way IT is used in relation to, and integrated with, business processes that affects the competitive strength of the organization. Applying the thought of use and integration in a context, instead of the possession of IT, as the main contribution of technology to the competitive position on ERP systems presents us with an interesting challenge. One of the main characteristics of these "off the shelf" integration solutions is, as earlier discussed, the use of so called best practices, an industry universal best way of executing business processes. A problem with this concept is for whom the system is developed. When developing an IT infrastructure the main objective is (or at least should be) to satisfy the needs of the organization(s) using it. The problem in doing so by using a standardized system is to identify the end user since it is built to support more or less all kinds of organizations. To satisfy as many of the potential customers as possible the system is developed for a "typical" customer that doesn't exist. The result of the "one size fits all" can in the worst-case scenario be "one size fits nobody" (Hanseth et. al. 2006). The organization has the option to customize the system to some degree, for example by choosing which modules that are installed, use the possibilities to configure

the system, make some kind of integration solution to other systems that are deemed to offer better results or even changing the software code (Davenport 1998). Some problems related to customizing the ERP by replacing modules with other applications or making changes in the ERP systems code is that it could make it harder to communicate with other systems, for example from suppliers and customers (Davenport 1998) and that the costs of maintenance can increase (Hanseth et al. 2001).

ERP systems have frequently been criticized for being rigid, massive and consequently hard to implement and control (Hanseth et al 2001.). Because of the integrated and ubiquitous nature, ERP requires adopters, implementers and users to define a common set of business rules, data standards, processes and procedures that span the entire organization (Alvarez et al. 2002). ERP systems implementation differs from more traditional information systems implementation in terms of scale, complexity, organizational impact, and the costs involved (Grabski et al. 2003). Consequently, different types of problems may arise due to cross-module integration, data standardization, adoption of the underlying business model, compressed implementation schedules, and the involvement of a large number of users (Soh et al. 2000). Ciborra et al. (2001: 4) have called this deviation phenomenon 'drifting'. Drifting, in this setting, means that an organization encounters unexpected circumstances that show the incompleteness and possible failure of an initial technological design without organizations having yet feasible alternatives. The concept of technology drift has been originally coined by Winner (1977: 88) while discussing technological determinism. In his view it should be seen as a state of affairs resulting from a multiplicity of technologies "acting and interacting in countless ways beyond the anticipations of any person or institution" (Winner, 1977: 89). Due to the increasing speed and extent of technological innovation societies face the possibility of "going adrift in a vast sea of "unintended consequences"" (Winner 1977: 89). This drift strategy builds on the assumption that drift can play a necessary role to accommodate to the idiosyncratic context and multiple interests of those who are involved in the implementation process (Holmström & Stalder, 2001).

In contrast, control – here considered in the context of ERP implementation – can be viewed as the opposite of drift. Control has been defined as purposive influence toward a predetermined goal (Beniger 1986), or as attempts to ensure that individuals working on organizational projects act according to an agreed-upon strategy to achieve desired objectives (Kirsch 1996). Control is thus aimed at preventing technologies to drift and to reduce the risks associated with drifting. The thought of control through integration permeates ERP's; it is the very rationale the systems are built on (Davenport 1998, Hanseth et al. 2001).

However, as recent research suggests, organizations that stick to traditional risk control strategies are likely to face the paradox of control (Hanseth et al.

2001). On one hand, the ubiquitous standardization of business processes enhances organizational control. On the other hand, control becomes less as the ERP system becomes larger and harder to change and adapt (Hanseth et al. 2001).

The following chapter takes a closer look at some of the issues involved in major IT changes.

2.2 Information infrastructures; Integration, Standardization, and Complexity

ERP's could be characterized as complex systems due to their reach and range. Integration issues involved with this kind of system include not only large parts of the organizational data but also processes. Complex systems involving great number of actors, data and processes imply great challenges due to heterogeneity. It has been suggested that the ambitions of building perfect systems involving more or less all of the organizational data reinforces complexity, striving for universal solutions increases the risk of failure (Hanseth 2006).

The IT infrastructure of an organization does not only include technical artefacts but is rather made up of what Hanseth refers to as socio-technical networks. These consist of people, organizations, institutions, technological components etc. (Ciborra et. al 2000). Infrastructures are embedded; they exist in a context and are entrenched into other structures (i.e. social, technological) (Star and Ruthleder 1996). Infrastructures are made up of standardized interfaces. It has even been claimed that standards constitute a condition for infrastructures rather than bilateral arrangements (Ciborra et. al 2000). Creating infrastructures is never done in a vacuum, in some way they are always linked to what already exists, the installed base. (Star and Ruthleder 1996; Ciborra et. al 2000) Hereby they are deeply affected by the operational context. The installed base implies that infrastructure is not something that can be easily changed in a radical way. The installed base has to be formed or linked to the new infrastructures and actors wanting to make use of it. In this way the existing IT infrastructure influences the organizations possibilities to respond to changes in needs and demands. A rigid structure restrains organizational flexibility.

Infrastructure could be viewed as relations in the sense that they get their meaning in relation to other activities (e.g. airports are in need of other transportation infrastructures as well as airlines using them to get their meaning) (Star and Ruthleder 1996). It could also be argued that infrastructures consist of intertwined artefacts and "sub infrastructures" that are linked together (e.g. Internet is made up of a number of nodes and local networks). Hanseth (Ciborra et al. 2000) describes this as that they consists of ecologies of infrastructures that are built by either being layered on each other, by linking logical related networks or integrating independent components. This implies that the installed base,

integration and standardization are key concepts of IT infrastructure. The relational aspects of infrastructures also involve people and processes.

Integration is a question of linking related objects and actors and hereby creating new values. One example of increased value through integration is networks and in particular the Internet where connecting a huge number of seemingly independent actors create new and unexpected values. In an organization integration can have impacts on control in the form of better quality of data (updated, shareable and accurate). ERP systems contribute with integration in two ways, process and data wise: “the uniqueness of the database and the adoption of workflow management systems support the integration of the information flows that connect the different parts of the firm” (Beretta 2002, p. 257). The integration of data and processes requires standardization of classifications and decreases risks of redundancy, thus improving data quality in an organization. Integration however does not only have the potential to improve data quality, it also conveys unexpected outcomes. These side effects can be both positive and negative, new values can be created and new problems can arise. Hanseth et al. (2001) showed that ERP's can increase not only integration of data but also of functional and geographically dispersed units. They also found the somewhat unexpected effect that the system generated more maintenance and integration work, thus increasing organizational maintenance costs. It seems like ERP's cannot provide “total integration” due to great heterogeneity regarding functionality needs and processes of the customers (Dechow and Mouritsen 2005). ERP's can however be good tools for securing data quality and standardization. The scope of these systems implies that when implemented they form an important and integrated part of the installed base, not easily changed. At the same time the systems has to constantly evolve to satisfy the heterogeneous customers implying frequent error corrections and updates. As earlier discussed ERP systems influences business processes significantly through the use of so called “best practises”. The use of this kind of complex systems hereby presents organizations with great challenges and uncertainty. One problem being that in many areas the new standardized process is not adapted to the organizational context.

Benbya and McKelvyva (2006) argues that a top-down approach on IS design results in static systems satisfying a temporal snapshots of demands. Instead of an ambition of building “correct” systems resulting in organizations chasing their own shadow they suggest a flexible approach on IS where design is viewed as an ongoing process. This can be described as striving to build flexible, adaptable systems that is better suited for a changing environment instead of constructing a perfect, rigid model of a “reality” that already has changed once the project is completed. Law (2000, p. 14) points out that “the search for system perfection is not only impossible but, more strongly, may be self defeating”. Hanseth et al. (2006) criticizes traditional IS design for overestimating the universality of work

practises regarding complex situations. If these assumptions do not hold they become a risk in standard making and might lead to a “reflexive self-destructive process”. One solution to the complexity problems according to Hanseth et al. (2006) could be the use of a multiplicity of simpler standards that are loosely coupled instead of one universal standard. They also recommend searching for elements that will not change (practices, instruments and IT solutions) and turn these elements into standards.

3. Research Design

This research is based on an interpretive epistemology where people’s impression and understanding of their world are at center stage (e.g. Walsham, 1995). The data used in this paper was generated by semi-structured interviews conducted with seven persons conducted in December 2007 and January 2008, two of whom are working in the IT consultancy business, and five at Norrmejerier. Interviews with a limited number of respondents that yields qualitative data was chosen due to the explorative character of the research question. In addition, a relatively small number of persons were judged to possess deeper insight into the research area at the organization in question. This led to the conclusion that the interpretive paradigm, and a deeper examination of the experiences among the key-respondents, would be the approach best fitted to help answer the research question at hand.

The selection of respondents where based on specific requirements in different parts of the research project. In the beginning a basic understanding of the nature of ERP systems and Norrmejerier’s business were judged to be important which resulted in interviews with a wide perspective and respondents suited to provide this knowledge. As data was collected and knowledge of the authors generated respondents with more specialized knowledge of systems and processes were chosen. The number of respondents was not made explicit beforehand. Instead the aim was to gather enough data in order to be able to make a relevant comparison in respect to the research question while at the same time allowing “a detailed and nuanced focus” as recommended by Mason (2002, p.136). Before the data collection phase started somewhere between five to ten interviews were judged to be a suitable sample size. As it turned out seven interviews were deemed to provide enough material since the relevant new knowledge gained from respondents was dramatically decreasing. One limitation of the data set is that none of the respondents from Norrmejerier worked directly with the production process, the reasons being a focus of the research on organizational effects, rather than on user centered ones (even though a clear distinction between the two of course is hard to make), and practical limitations. This might have affected the data since perceived disadvantages such as system rigidity and limitations imposed on users probably might not be as clearly stated as they would be

otherwise. As mentioned the study however focuses on organizational impacts and on this level these potential problems does not seem to have been a major issue.

The interviews lasted between 30 minutes and one and a half hour and where performed at the respondent's workplace. All but one (that provided deeper understanding of the issues but not directly relevant material for the study) of them where later fully transcribed in order to enable a broad analysis of the impact of the systems and minimizing the risk of neglecting relevant information.

In the analysis phase all of the transcribed interviews where read through at least two times which resulted in four categories that the data was sorted into; standardization, integration, effects on processes and functionality needs.

4. Case Description

4.1 Norrmejerier and the dairy industry

The Swedish company Norrmejerier is based in the northern part of the country with three geographically dispersed dairies. Norrmejerier was founded in 1971 through a fusion of three smaller local actors. In 1991 Norrbottens läns producentförening (NLP), a dairy association operating in the northernmost part of Sweden, was incorporated and what today is Norrmejerier was established. The company is an economic association owned by approximately 900 farmers of which roughly 600 supplies the production process with almost 190 000 tons of milk annually. The legal form of the company implies that the economic goal is to maximize the price paid to suppliers for their milk rather than maximizing Norrmejerier's profit. The yearly turnover is approximately 1.5 billion SEK. Norrmejerier's logistics operations include not only delivery of their products directly to almost 2400 different customers but also handling the transport of milk from the farmers to the production sites.

During the late nineties and beginning of the millennium Norrmejerier suffered from a lack of homogeneity in processes and data treatment. Not only where the dispersed units working in different ways, measurements of data also showed local differences. This might be partly explained by the incorporation of NLP that implied a challenge in the form of integration of the two different companies. The fact that the company is an economic association and not an ordinary corporation might also have had implications on the governance of the firm in the sense of a decentralization of management. A culture of relative self-governance allows the different geographical and functional units to develop a local flexibility and improve their "own" processes, the downside being a lack of organizational uniformity hampering data quality.

Three large actors, ICA, COOP and Axfood, dominate the Swedish market for groceries. The influence of these actors on their suppliers is huge due to their market domination and this also includes their ability to make demands in regards to the IT structure. Integration against these large and influential customers does not only involve issues such as forms of Electronic Data Interchange (EDI), bad data or local differences in processes are simply not acceptable.

Being in an industry with sharp limitations on durability for large parts of the product portfolio short lead-time for distribution is often essential. There are however big differences between the products of the company. While milk goes bad after approximately a week the main challenge in cheese production is storage during the age process (e.g. for the trademark protected cheese "Västerbottensost" the minimum aging time is one year). The combination of working with short time limits, differentiated products, direct distribution to a relatively large number of customers and operating over large geographical areas implies great requirements of data quality. It also means that the sales process consists of a high number of unique orders, most of them due for delivery in the next couple of days. All these demands led to an internal need of a centralized data structure with unified measurements and processes. Norrmejerier's response to the situation was to implement an ERP system.

"the administrative systems had some solutions from the old Norrmejerier and some that were brought in from NLP during the fusion. Naturally they were not made to fit together in any sense, getting the most important parts to function fairly ok was a huge work. This was the situation in the late nineties before the expected millennium bug and it was here that the thought of creating a more unified treatment of administrative systems was born and the idea of an ERP system was rooted. In the beginning of the new millennium an ERP system was implemented as the foundation, to decrease the fragmented situation." (The central information officer (CIO) of Norrmejerier)

The process of implementing this system was initially based on the idea of total integration of the different IT applications into a single solution. This strategy with a complex solution combining wide range and specialization soon was abandoned due to an insight that there were too many industry and company specific demands on functionality. Instead Norrmejerier opted for a strongly modular solution that could provide them with a platform for standardization and integration of core parts of the business such as administration and logistics. After the fusion with NLP the company was left with three different platforms, AS/400, Unix and Microsoft NT. Before implementing the ERP system Norrmejerier had made the strategic choice of standardizing the IT environment on a Microsoft platform. This was a basic criterion when deciding which system to implement that decreased the number of candidates significantly. In the end the choice was to invest in IFS's solution, mainly because the company was seen as stable and providing a less complex system that promised a modular solution.

4.2 The IT Infrastructure

4.2.1 Organization and Strategy

Infrastructures can be viewed as socio-technical networks consisting of actors and technical artifacts. At Norrmejerier the main responsibility for IT related issues lies organizationally within two different departments, the IT- and the IS group. Somewhat simplified the IT department is responsible for the more strategic topics while the IS department handles the more operational questions. The IT structure of Norrmejerier is divided into two different parts, one based on production and one on administration. The production based IT systems has been built incrementally by a number of different suppliers which has led to a fragmented structure. With new demands on interconnectivity between different artifacts this is creating new challenges. According to the CIO this has been identified as a problem and is something that they try to address gradually. The main topic of this paper is however the administrative systems and foremost IFS. These systems were suffering from very much the same problems with fragmentation, local solutions and different ways of measuring. With increasing demands on interconnections and integration of data this led to a situation that had to be addressed.

As discussed earlier some of the processes in the company are to a high degree industry-specific, which means that the ERP system cannot offer the functionality that the company is in need of. The strategy with an IT structure based on an all-in-one solution was therefore quickly abandoned. Instead a strategy of using the modules of the ERP that supports the administrative and logistical functions of a firm was developed. These parts of the business can be seen as more or less standardised in the way that they do not differ all that much between industries. The role of IFS can be described as providing a foundation of the IT structure that supports the different processes with standardized and uniform data. The more industry and organizational specific demands are handled by different applications from other suppliers where one demand is that they are built on a Microsoft platform.

“We have repositioned the ERP system so that it now constitutes a foundation for all activities. Since ERP systems are becoming more and more open you end up in a strategic challenge of how to integrate but today there are integration engines that are really powerful. This opens up new possibilities to use them as a foundation that does most things right, nothing really 100% but it catches all essential parts of our business in an acceptable way. Then we combine this with really specialized systems.” (The CIO)

4.2.2 The ERP System at Norrmejerier

Norrmejerier's use of IFS modules includes distribution, finance, production and maintenance. A condition for creating this structure with a limited scope of the

ERP is the modularity of the solution where the different modules offer needed functionality without demanding implementation of other, undesired ones.

“The system is based on modules and we are using far from all of them. We were a bit doubtful, all the suppliers of systems said that our systems are modular and they were. However when we scrutinized many systems they still demanded that you used all of the available modules to provide the needed functionality despite the fact that you only used a small portion of each. I have to say that IFS was surprisingly modular.” (The CIO)

The distribution module handles orders, inventory, distribution to customers and purchases. The inventory part is at the moment complemented with a new pick-by-voice system. This system allows the person collecting products for specific orders to get instructions by a headset and to control the system through voice commands. This is an example of integration between the ERP system and applications offering special functionality. Orders are being handled in IFS where the inventory balance is kept; the system produces a list of what needs to be gathered that is sent to the pick-by-voice application. When the process is executed a notification is sent to IFS is where a delivery note and an invoice is created. A web site that is integrated with the ERP system also allows customers to place their orders online.

The financial module includes the standard parts of economic administration such as general ledger, accounting and fixed assets. Parts of the budget are created here even though the main work is done in a relatively newly integrated decision support system, Insikt. Norrmejerier is cooperating with other dairies when it comes to storing products in different geographical parts of the country. Exchange of data between these actors is handled through XML files. Many of the other dairies do not use ERP systems and according to a person working with integration against these actors it is obvious that they do not have the same access to updated and accurate data regarding their inventory.

In the production module recipes and raw materials constitute the main parts involved with the ERP system. A production scheme is exchanging data with the inventory part of IFS where status of raw material is automatically updated when they are used in the production.

Norrmejerier is using the maintenance modules for two different parts of their business, the production in the dairies and cooling tanks at the farms. In the production an object structure is used for the different machines with records of what parts they consist of, maintenance work is then distributed on the different objects. The company is responsible for the cooling tanks at the local farmers and the data regarding status and maintenance of these are also kept in IFS. The use of Freon in these cooling tanks is regulated by demands from the authorities. Before they started using this module the records were kept in excel files, the new way of handling data has lead to a situation where Norrmejerier is in a better position to satisfy these demands.

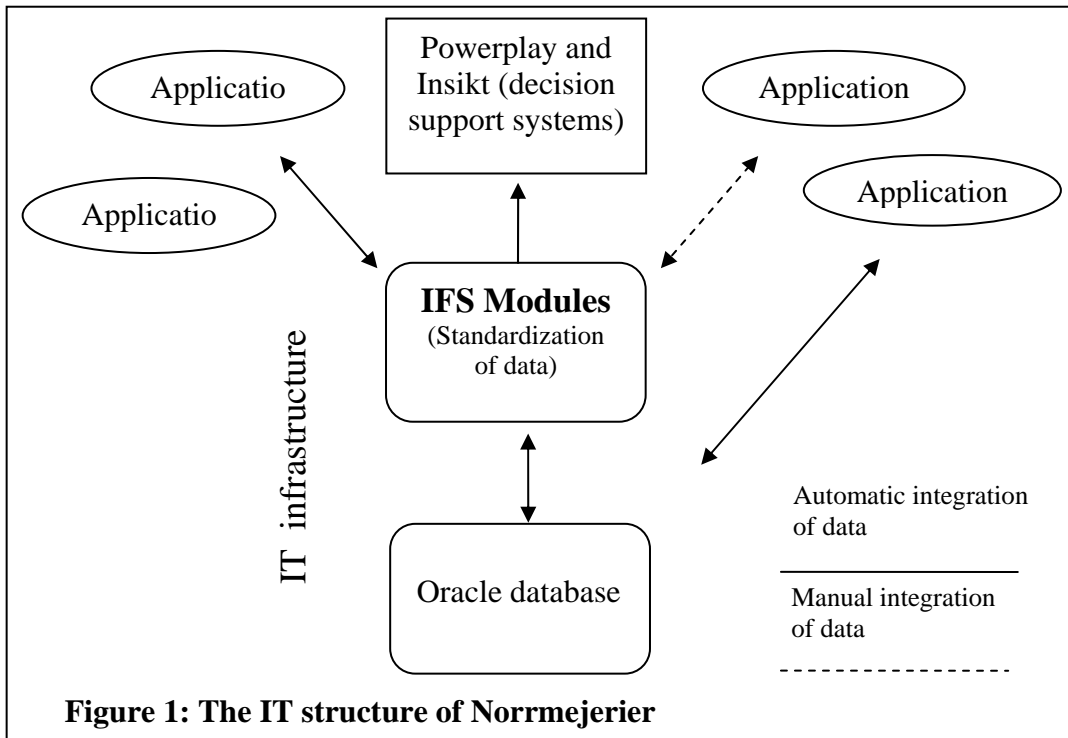
Even though much of the IT infrastructure has been standardized some of the applications are not directly integrated with the ERP system. As shown in figure 1

some of the data is instead transferred manually. Both the manual and the automated integration of data into the ERP system demand standardized ways of measuring. IFS hereby contributes with the possibility of using data in many different contexts, a possibility to integrate data rather than being a fully integrated IT solution.

4.2.3 The Structure

Due to a lack of well functioning decision support in IFS the standardized data is mainly analyzed in two external applications, Powerplay and Insikt. Powerplay is an older system that has been in use in the company for a number of years and is described by the business planner as more powerful than Insikt that instead provides a user-friendlier interface.

By implementing Insikt the aim is to decentralize the use of information by



giving a large number of users access to it. Before the implementation of this application more or less all reports were created centrally by a person working with planning and analyzing and thereafter distributed. The hope is that with the new decision support system users will be able to extract the information they are in need of. What Norrmejerier is trying to create through this solution can be described as a centralization and standardization of data but a decentralization of decisions. When implementing the new structure a new database was introduced. IFS is only compatible with Oracle databases, which meant that Norrmejerier could not comply to their strategy of Microsoft based products in this case. A graphical outline of the IT structure can be viewed in figure 1.

4.3 Implications of the ERP system

That the difference between IT and business questions at the very least can be considered as blurred is widely acknowledged in IS research (e.g. Orlikowski 1992, Davenport 1993, Kallinikos 2004, Vandenbosch and Lyytinen 2004). The profound impact of ERP systems on business processes makes the question of purpose, responsibility and authority involving implementation of these systems pressing. In the implementation of IFS, Norrmejerier's management looked upon this as an IT issue. However the decision to implement turned out to have significant impacts on business processes. *"Most of these implementations, and also ours, was driven or at least named IT projects but when you think about it most of them actually were more of business projects."* (The CIO)

The IT structure of Norrmejerier has a tradition of being developed in a decentralised way, before the implementation of the ERP system local custom solutions were common. When incorporating NLP Norrmejerier faced the challenge of integrating two different IT structures. The strategy to do this can be described as merging what already existed in a way that was based on "getting things to work" rather than a deep reengineering based on new functional demands. The implementation of IFS meant that parts of the IT structure, processes, measurements and nomenclature had to be unified.

"Before the project started it felt like the most important purpose was to ensure the quality of data. You can measure everything in different ways, which meant that you could not always compare two values with same name because they used different sampling methods. IFS forced all incoming part to use the same values, they had to be quality ensured. This effect should not be underestimated because it means that now we know what we are measuring. There are not multiple ways of doing it."(The business planner)

This need of a standardization of processes, measurements and nomenclature can mostly be characterized as management issues. A reasonable question when considering the situation is if Norrmejerier really needed a new IS to achieve this. The IT structure clearly was in need of a new structure providing better integration between data sources but what was the role of the IS? It seems like the implementation became the catalyst of this process and maybe also a political tool.

"It forced everyone to act in the same way, without this solution I believe that some units would have tried to postpone this to keep their solution, because no one will tell you that IFS was easy to implement. These islands were pretty strong and sometimes they were right, sometimes IFS was stupid but IFS could not do it in any other way so we had to conform them."(The business planner)

What the business planner expresses here is both interesting and important when analyzing the impacts of IFS. The main advantage that Norrmejerier have gained from the ERP system seems to be associated with conformity and consistency in data treatment. From the viewpoint of individuals and local units the IS might even be experienced as a deterioration. Among the administrative and managerial actors that were interviewed consensus however existed in the

opinion that the company as a whole had benefited from a more unified data structure.

“The big advantage is that people understands the big picture in a better way. The personnel at inventory realize that if they do something they should not it affects us working with financial questions. This linkage did not exist before but if they do something wrong we see it directly now which leads to an increased understanding of the whole process.”(Controller)

5. Discussion

The case described in this paper presents an example of how to circumvent the assertive problem of complexity involved with ERP systems. Implementation of this type of IS presents the organization with severe challenges in form of alignment between the processes structure of the system and the existing business. It is often argued that effects on processes through e.g. Business Process Reengineering (BPR) with adaptations of so-called “best practices” is some of the major advantages that they convey (see for example Al-Mashari 2003). This might be true as long as the area that is going through this reengineering or standardization to the “ERP way” of doing things is one that does not differ all that much from the system model. ERP systems are in general built with a broad customer base in mind, this leads to a “one size fits all approach”. An ERP system is not only an IS, it is rather a package of process standards based on an idea of far-reaching integration. The notion of management control permeates this kind of system but is most often met by resistance arising from misfit with the context they are implemented in, very much in line with the ideas of Ciborra et al.(2000)

The initial strategy behind the ERP implementation at Norrmejerier was a fully integrated system that provided the company with the main part of the needed IT support. Soon it was discovered that this was not a realistic approach since no ERP system was able to offer the functionality that was needed. Thereby the somewhat utopian hope for a total vendor-supplied integration was not fulfilled. The ambition of a “perfect solution” that represents the vast majority of organizational processes permeates these systems. A system aimed at providing process support in a huge number of areas that is also tightly integrated implies complexity. The systems also impose rigid standards regarding data and processes, standards developed for a deeply heterogeneous customer base. So how to make use of the benefits that ERP systems have the potential to provide while at the same time decreasing the unpredictability of the systems? One way could be to follow the advices of Hanseth et al. and look for areas that are more or less stable and universal and restrict use of system modules to these. Hereby the strengths of ERP systems regarding data quality can be used as a platform providing better quality through standardization and integration of central data that is complemented by more specialized systems. The structure created can be

described as a mixture of an ERP structure as it is thought of in the traditional sense and a BoB approach.

Well functioning standards contributes with control and predictability. The creation of standards in complex heterogeneous situations has instead been shown to generate reflexive effects such as disorder, e.g. creating the opposite effect (Hanseth et al. 2006). In this paper it is argued that the scope of ERP systems and the variety of contexts they are supposed to be able to handle are so great that it creates complexity related problems. Norrmejerier's solution to this problem was to delimit the use of their ERP system to transactional data regarding relatively universal organizational areas. Here the system was able to function well as an integration facilitator and a tool for improving data quality. The standards of the system works well since the basic structures of finance and inventory are relatively stable and universal, also between different industries. The ERP system has hereby contributed to better data quality through integration resulting in a redundancy decrease and a standardization of measurements, nomenclature and processes. An integration on data level rather than on application level. One downside of this strategy is that the promise of more or less total integration is not fulfilled, however in practice this is more often than not also the case in full scale implementations (Davenport, 1998; Chen, 2001; Spathis & Constantinides, 2003; Kholeif et al. 2007). Another possible issue might be that maintenance work can increase as proposed by Davenport (1998).

The role of the system presented in the case can be described as a foundation or platform that supplies a relatively stable and standardized environment for other systems that provides special functionality. Instead of an "all in one solution" the systems position hereby rather becomes an infrastructural one. The ERP system becomes a filter that standardizes data and provides an interface against which the specialized systems can interact in a fairly predictable way. The scope of many ERP systems is truly amazing, providing modules directed at the most diverse areas. Since they often claim to be adapted to more or less all organizations an important question is however if they are able to provide the customer specific need of functionality. Considering the variations in characteristics of the customer base this seems unlikely which should implicate unnecessary complex systems. The systems are trying to reproduce a context that not only varies greatly between different actors it is also in a constant state of change. Benbya and McKalvey (2006) illuminate problems regarding preconceived, top-down IS designs with the words "they result in temporal snapshot that ultimately leave organizations with static systems that they have to suffer with in a dynamic world". It seems probable that this basic problem of trying to build "perfect" systems also can be applied to ERP systems.

It appears like the prevailing strategy is to try to build a universal solution that offers modules in the most diverse areas. This results in complex structures that hardly can offer the same specialized functionality as more focused systems. The

solution with the system as a platform, an infrastructure that is complemented with separate specialized systems that more easily can be adapted or replaced due to changes in their environment seems to have worked well at Norrmejerier. A condition for the realization of this strategy seems to be a truly modular structure of the ERP system that allows the host organization to only implement the needed modules. Absence of this modularity most likely results in a complex IT structure. In most business relationships it lies in the interest of manufacturers to expand the scope of the customer activities that they are involved in. It is however possible that this is not the customer optimal outcome in the case of ERP systems.

6. Conclusion

In this paper the contribution of an ERP system to Norrmejerier's business and IT structure was investigated. The complexities of ERP systems are hard to manage and can lead to reflexive outcomes such as decreased - instead of increased - organizational control. Technology aimed at reinforcing organizational control can instead cause organizational disorder, drift when implemented due to incompleteness of the solution in relation to the social context. Based on Hanseth et al. (2006) one plausible solution to this problem could be to aim at restricting the use of standards to more or less universal processes.

The case describes how an ERP system is used as a platform that provides integration and standardization of data and processes, rather than a fully integrated IT solution. A structure with an ERP system complemented with a BoB strategy in order to achieve the desired functionality. Limiting implementation to processes that are relatively generic for industrial firms has resulted in an integration that takes place at data level rather than at application level. To this end, the system plays an infrastructural role, enabling other more specialized systems to use standardized and quality secured data while they provide the needed functionality. The ERP system thus contributes to data quality improvement, integration, and a process-based mindset in the company. At the same time negative side effects to a high degree seems to have been limited. A prerequisite when creating this solution was the modular structure of the ERP system that allowed a less complex system and hereby reduced possible side effects.

Complex systems such as ERP's are known to create great challenges for the hosting organization. This paper illuminates the importance of reducing ERP structure complexity and the importance of modularity when struggling to achieve this. The findings made in this paper suggests that one way to fulfill the notion of standardization and control, while at the same providing needed functionality, is to restrict the use of universal solutions to generic functions and complement them with specialized application. Applying the ideas of Hanseth et al. (2006) regarding standardization of stable and delimited areas it presents an

example of how to mitigate drifting and achieving a higher degree of control, both of implementation effects and on the business itself. Something that is undisputedly desirable when discussing implementation of this kind of IS that is built on the very concept of increased control.

7. References

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