2008

The Social Construction of Data Stability: Discovering Four Tactics for Establishing and Preserving Stability in Databases

Karin Axelsson
Linkoping University, karin.axelsson@liu.se

G Goldkuhl
Linkoping University, goran.goldkuhl@liu.se

THE SOCIAL CONSTRUCTION OF DATA STABILITY - DISCOVERING FOUR TACTICS FOR ESTABLISHING AND PRESERVING STABILITY IN DATABASES

Axelsson, Karin, Linköping University, Department of Management and Engineering, Information Systems, Sweden, karin.axelsson@liu.se

Goldkuhl, Göran, Linköping University, Department of Management and Engineering, Information Systems, Sweden & Jönköping International Business School, Department of Informatics, Sweden, goran.goldkuhl@liu.se

Abstract

This paper questions the idea of data stability. We focus on core ideas behind an information centric strategy concerning stability in databases (created through enterprise-wide data modeling). We investigate if and how data stability is obtained when an information centric strategy is implemented in practice. We claim that, even though there are many research contributions about information centric strategies, there are still few papers focusing on problems concerning consequences of the strategies' practical implementation. This is, however, an important issue since data integration is a key element of strategic management in, e.g., ERP-systems, data mining applications, and service-oriented architecture (SOA). It is, thus, most important not to neglect existing experiences, when developing the IT systems of tomorrow. The result of our two case studies reveal four tactics focusing on actions conducted to obtain and maintain stability in databases. The tactics are 1) change avoidance, 2) anticipated generalization, 3) constructive standardization, and 4) expansion to new application areas.

Keywords: Information centric strategy, data stability, data modeling, data integration, organisational language.

1 INTRODUCTION

Many research efforts have been made upon the theme of information centric (i.e., data-driven) approaches, resulting in integrated databases, throughout the years. The ideas of data integration and information resource management have been highly appreciated as being very impressive theoretical constructions by some authors (e.g., Nolan, 1979; Ward et al., 1990). Others have been more negative towards the ideas and have come up with major criticism against such approaches (e.g., Lyytinen, 1987; Davenport, 1997). This paper takes its standpoint in what the results might be when setting these theories into practice. The paper focuses on describing what we would regard as "theory of the empirical", in opposite to the many descriptions of "theory of the ideal" that have been written during the last three decades.

In this paper we define data stability as an ambition to keep the data structure of a database as constant as possible. Data stability implies that the data structure can be kept unchanged when the database once is developed. Necessary changes in applications might occur, but should preferably not affect the data structure. A primary reason for trying to reach data stability is to achieve efficient information management; which implies that information is made accessible, no redundant data occurs, maintenance is facilitated, etc. (Ward et al., 1990). In practice, information management may of course demand changes in data structures due to, e.g., evolving information needs of employees, but this is not regarded as a desirable situation when adopting an information centric approach.

Data modelling is an important activity when designing a stable data structure. It is, though, important to notice that data modelling as an activity should not necessarily be associated with information centric approaches. Data modelling is conducted as an activity in most IT system design projects and is a component in many IS development methods. Such methods can be, e.g., process-oriented or functional and use data modelling to design a database in a late phase of the development process, or such methods may emphasise that the development process should be initially guided by a modelled data structure. In the first case, the data models often represent limited models created for a specific IT system or part of an IT system. In the latter case, the information centric approach is evident and enterprise-wide data modelling is often the starting-point for design activities (Martin, 1990). This difference can be characterised as a database perspective versus an organisational perspective on data modelling.

The purpose of this paper is to examine and question the idea of data stability. We focus on core ideas behind the information centric strategy concerning stability in databases. We are interested in if and how data stability is obtained when such a strategy is implemented in practice. In order to characterise our empirical findings regarding data stability, we use the notion of social construction (originally emerging from Berger and Luckmann, 1979) of data stability. This means that stability in databases is not solely conceived to be given by the inherent nature of data or any technical causes. Data stability is due to people's conceptions and actions, i.e., it is also socially constructed. Case studies in two organisations adopting an information centric strategy have revealed examples of different tactics focusing on actions conducted to obtain and maintain stability in databases. In this paper, we discuss these tactics in order to explain some of their consequences. The main purpose of the paper is to reveal different organisational effects (e.g., dysfunctions) arising from adopting an information centric approach.

We claim that, even though there are many research papers written about both pros and cons of information centric approaches in theory, there are still few papers focusing on problems concerning consequences of their practical implementation. Information centric strategies were intensively discussed in literature during the eighties, but these approaches should not be viewed as a solely historical phenomenon. Even though the ideas behind them were developed in the early seventies and had a peak in the late eighties, there is still a very current interest in these fundamental approaches. Seemingly new IT innovations, such as data warehousing, data mining, and not at least enterprise resource planning (ERP) systems (e.g., Davenport, 1998), all rely on the very same ideas of

information integration. Recently, research in the field of ontology engineering (e.g., Spyns et al., 2002; Jarrar et al., 2003) and service oriented architecture (SOA) (e.g., Bieberstein et al., 2005) has put focus upon conceptual data modelling activities. In the emerging discipline of enterprise engineering it is most important not to neglect existing experiences, when trying to develop the enterprise architecture of tomorrow. All together there are many important reasons why these issues still need to be investigated and discussed.

After this introduction, the paper is organized in the following way: In Section Two we review literature on data modelling and information centric strategies. The research design is reported in Section Three. The empirical findings are analysed resulting in four tactics for establishing and preserving data stability, in Section Four. The social construction of data stability is discussed in Section Five. The paper is concluded in Section Six, where we also make some statements about the need for further research efforts in this area.

2 LITERATURE REVIEW

In this section we discuss previous studies regarding enterprise-wide data modelling and its effects on organisational languages. We also review some earlier studies of practical consequences when realizing an information centric strategy.

2.1 Enterprise-wide Data Modelling and Organisational Languages

Ever since the relational database technology made it possible in the early seventies (Codd, 1970), there has been a movement towards centralisation of data in integrated, enterprise-wide databases. Such information centric approaches for strategic management of IS and IT emphasise the importance of an overall view of corporate data. Many of these approaches have been gathered under the label of Information Resource Management (IRM). IRM focuses on effective development, management, and utilisation of organisational information (Ward et al., 1990; March and Kim, 1992). This means that information should be planned by data modelling, captured only once at the source, and stored in a way that makes it accessible for everyone in the organisation.

Oppenheim et al. (2001) discuss the concept of information as an asset, which is an important standpoint in information centric strategies (see e.g., Nolan, 1979). By viewing information (and consequently data) as a vital asset for the entire organisation, i.e. a common resource, information should be made accessible to all users within the organisation. See Wernerfelt (1997) for a further discussion of the resource-based view of firms. Information becomes a common resource thanks to common, integrated databases, created in an information centric design process. As mentioned above, a first important activity during such IT design is conceptual data modelling. The result of this activity is a view and a structure of vital organisational concepts, i.e. a data model. The data model often covers an enterprise-wide view of data and data relations. This is necessary in order to design integrated databases for the common information resource of the organisation. Such enterprise-wide data models are sometimes called corporate data models. Shanks and Darke (1999, p. 19) mean that corporate data models are required when designing cross-functional IT systems, that integrate information from different sources. They argue that corporate data models meet a renewed interest as data warehousing and IT systems supporting re-engineered business processes increase (ibid.).

Organisations have a set of partly overlapping organisational languages. These professional languages consist of vocabulary (terminology and concepts) and rules for communicative actions (Lyytinen, 1981). A professional or organisational language is developed and used by human beings in the organisation in order to perform a professional task and communicate about this (Goldkuhl and Lyytinen, 1982). Consequently, there exist sub-languages for different actor groups within an organisation, such as purchasers, sellers, and product developers, and these languages consist of concepts relevant to the activities performed by these actors. Some of the concepts are common to the entire organisation but others are used by a certain group of actors. Organisational concepts are

socially constructed and inter-subjectively meaningful to people (Berger and Luckmann, 1979). During data modelling the organisational languages are formalised.

Shanks and Darke (1999, p. 20) highlight that corporate data models are conceptual data models with an abstract representation of information requirements. A problem with corporate data models is that these models often consist of generic and abstract concepts that are not easily related to the actual terminology used within a specific organisational unit. Thus, it is often difficult to communicate about the model. The usefulness of corporate models is then missed as they do not increase the common understanding in the way they were meant to do (ibid.).

2.2 Information Centric Strategy Put into Practice

Information centric strategies have been criticised for being difficult to successfully implement in practice. Davenport (1997, p. 19) argues that such approaches are much more impressive in theory than in practice. Iivari and Hirschheim (1996, p. 566) judge information centric approaches as viewing IT systems in organisations in a technical, mechanistic way. The information needs of users are analysed in an objective sense relating functions and data to each other. This is made in an impersonal way, which makes human beings invisible in the analysis (ibid.). Davenport (1997, p. 20) has the same opinion when he states that the advocates of an information centric strategy assume that organisations work as systems rather than as individuals and communities with diverse interests. The result of this is that it becomes difficult to motivate people in the organisation to follow information centric guidelines. There are also forces within an organisation that, for some reasons, do not want to make information accessible throughout the entire organisation, and therefore work against the these ideas (ibid.). Similar findings are reported in a study of beliefs and attitudes that affect the willingness to share information within organisations (Kolekofski and Heminger, 2003). In order to make an information centric strategy work it is necessary for the information managers to become "information czars" (Davenport, 1997) with total control of all information. Studies also claim that data integration benefits, such as organisation-wide coordination and decision making, should be compared to possible disadvantages, like losses in local autonomy and flexibility, and changes in IT system design and implementation costs (Goodhue et al., 1992).

We have, so far, been using the concepts of data and information in this paper. Mutch (1996, p. 61) focuses on the difference between data and information when he points out that information resource management as a concept might be confusing and misleading, since it in practice deals mainly with data. Handling data effectively is a vital discipline, but it should not be confused with information (ibid.). We agree that there is an important conceptual difference between data and information, but regarding our aim and focus in this paper the two concepts are overlapping. In this paper we use information modelling and data modelling as synonyms.

King and Kraemer (1988, p. 10) have studied information centralization through information resource management in government contexts and they find that: "IRM is enacted to treat information as a resource, but in practice its focus is mainly on the management of information technology. The great breadth of IRM objectives is so far out of the reach of most managers that, in practice, their IRM 'strategy' immediately devolves to management of technology. The goal of managing information seldom is resurrected."

Despite the mentioned problems that might occur when information centric strategies are put into practice, we also acknowledge benefits from this approach. To summarise the ideas behind an information centric approach, we distinguish some possible advantages: 1) Data modelling facilitates a proper analysis of organisational concepts, which may result in a feasible data structure. 2) An aim of data modelling is to achieve inter-subjectivity concerning organisational languages and concepts. 3) Adopting an information centric strategy means a total solution for information management in an organisation, from data provision to data presentation and utilisation. 4) Centralised management of information resources facilitates a proper overview and administration of information. 5) The organisation is managed in an integrated way. 6) Management of information resources may be cost

effective and safe, for example due to lack of redundant data. 7) High quality of data may be obtained. 8) Information is made accessible in the entire organisation, which could be seen as a democratic issue.

3 RESEARCH DESIGN

In this section our research context and case study design are reported, as well as the processes of data collection and data analysis.

3.1 Research Context and Case Studies

The findings reported in this paper are results from a research project that focused on effects of practical implementation of two different architectural approaches for IS planning and design. One of the studied approaches was an information centric strategy. The main purpose of the research project was to answer two research questions by conducting six case studies: 1) Is it possible to practically apply the theoretical ideas behind an architectural approach? and 2) What effects and consequences can be identified in organisations adopting an architectural approach? An empirical finding from the research project was that the information centric strategy (as well as the other studied architectural approach) could be realised in practice, but there occurred to be many effects, both of intended and unintended nature, in the organisations. These findings revealed that many effects could be related to the notion of data stability, which is the reason why we highlight these issues in this paper.

In this paper we are focusing on practical implications of information centric strategies and we are using two of the six case studies in order to show our empirical findings. The case studies were interpretive and qualitative (Walsham, 2006). They were conducted in two Swedish organisations; a construction firm and a municipality office. Both these organisations had been adopting an information centric strategy for several years and possessed a distinct information centric IT solution. The organisations were chosen because they had deep practical experience from using an information centric approach in their design efforts.

The construction firm has approximately 150 employees and its organisation is flat and dynamic. The work is organised in projects, where staff categories with required competencies are working together (purchasers, calculating personnel, project leaders, etc.). The construction firm is hired by its customers to take full responsibility for a construction project, i.e., to contract and coordinate different actors during the construction of, e.g., a building. The projects are conducted with standardised methods and information, which imply that all projects are conducted in a similar way. The business idea is to coordinate and structure the projects in this certain way in order to provide continuity for the customers. The IT system, developed with an information centric approach, is a project management system including applications for calculating, tendering, purchasing, and cost management. These applications use the same integrated database. The IT system covers all stages within a project and all staff categories use one or several applications. The IT system development started with enterprise-wide data modelling, where consultants modelled organisational concepts together with persons representing different staff categories.

The case study at the municipality office was conducted at a department responsible for health and environmental inspections at industries, restaurants, shops, or lakes and watercourses. There are approximately 25 employees at this department, both inspectors and administrators. The department performs inspections both on behalf of external requests and on own initiative. The inspections are conducted as projects with one or several inspectors involved, depending on which competence that is needed. All employees are highly specialised in different areas. The IT system, developed with an information centric approach, is a system for official registration of documents. It was developed by an external consultant, with low involvement from the organisation. The IT system is used for entering information in the diary, handling different errands, and invoicing. The IT system is used by all employees. All commissions are registered in the system, which is also used for information about

every incoming and outgoing document. The IT system is used for library information as well. This makes the IT system very central for this organisational unit.

3.2 Data Collection and Data Analysis

We conducted in total seven individual, semi-structured interviews with managers, system developers, and users. Each interview lasted for approximately two hours. The interviews were conducted by two researchers, who documented and transcribed the result close after each interview. The interviewees were chosen so that they represented different organisational groups and units. While studying the IT system, we interviewed users and managers responsible for organisational activities that were supported by the IT system, as well as system developers responsible for the IT system. We also conducted organisational analysis and actively participated during modelling seminars together with several representatives from the organisation. These seminars resulted in documentation of, e.g., business processes, organisational problems, strengths, and goals. Participation in these analysis activities and seminars resulted in deep understanding of the studied organisation. Data was also collected from observations of users interacting with their IT system, and from document studies; i.e., data models. The observations were done during the user interviews so that the user could exemplify from his or her work tasks while answering our questions.

When analysing data we have used a multi-grounded theory approach (Goldkuhl and Cronholm, 2003), which is inspired by grounded theory (GT) by Strauss and Corbin (1998). We performed open and axial coding of the empirical data from interviews and modelling seminars. The reason for using this data analysis approach is that it gives methodological support for creating categories and theory from empirical data. From the initial GT approach (Glaser and Strauss, 1967) it has emerged different versions of GT. The version of Strauss and Corbin (1998) is less doctrinaire and more open to the use of other theories and pre-categories than the original. Goldkuhl and Cronholm (2003) build their multi-grounded approach (MGT) on GT by Strauss and Corbin (1998), by adding three grounding aspects into a combined view allowing both inductive analysis of data and some deductive use of other theories. In the MGT approach, theory is grounded in (ibid.): 1) Empirical data (preferably collected in mainly an inductive way) – empirical grounding, 2) Pre-existing theories (well selected for the theorized phenomena) – theoretical grounding, and 3) An explicit congruence within the theory itself (between elements in the theory) – internal grounding.

In our analysis, we found four tactics focusing on actions to establish and preserve data stability. Different categorised phenomena (identified in, e.g., interview statements or observations) have been related to each other as causal-pragmatic relations during the analysis (see Axelsson and Goldkuhl (2004) for theory models of these relations). Since we use a qualitative research approach, our identified tactics cannot be generalized to every conceivable situation. Instead, our research approach intends to help us find empirical explanations that are valid for analytical generalisation, according to Yin's (1989) definition.

4 TACTICS FOR ESTABLISHING AND PRESERVING DATA STABILITY

When analysing our empirical data, we discovered four tactics focusing on actions to establish and preserve stability in databases. We define these tactics as: 1) Change avoidance, 2) Anticipated generalisation, 3) Constructive standardisation, and 4) Expansion to new application areas. These four tactics are described by empirical examples from the case studies.

4.1 Data Stability Obtained through Change Avoidance

The two studied organisations had both adopted a strict information centric approach when developing their IT systems. This implies that the design process began with data modelling activities, which had important effects on the resulting IT system. The data model was used for construction and

implementation of the database. At the construction firm, the data modelling led to an implementation of a data structure that later occurred to be infeasible. The data structure was not equal to the users' habitual organisational language.

"Contract by tender" was a vital concept at the construction firm. During the data modelling, this concept was divided into two sub-concepts according to the planning process for construction work; "inquiry package" and "buying package". This division was not in concert with the users' understanding of their reality. They accepted the new concepts during the data modelling seminar since they did not understand what consequences this would have on their future work. When the IT system was implemented, the users felt very unfamiliar with these two new concepts. After a while, users requested a change in the IT system back to the old concept of "Contract by tender". This was not any easy change from a technical perspective, though. Since the requested change affected many tables in the database, the IT department decided not to accomplish this change immediately. An extensive IT system change was planned for a later occasion, when the IT infrastructure should be replaced. Together with this migration to a new platform, some other postponed database changes were promised to be accomplished.

When we conducted the case study, the users had been requesting this conceptual change for a long time, but nothing happened and no one seemed to know when it would be done. Therefore, the users had to adjust to this other, unfamiliar data structure. This was the result of the IT department's non-action; to *avoid change*. The database administrator had his rational reasons for not wanting to make any changes in the database. This non-action had, though, several effects. The users had to conceptually adapt themselves to the database, which decreased the user acceptance of the IT system. Some users refused to use the IT system, even though it was part of their work tasks. Unsurprisingly, this led to deteriorated relations between the IT department and the users. The IT department had launched the IT system as being easy to change (although they did not include database changes in this statement), since they had used a relational database and a high-level software development tool, in accordance with an information centric approach. This kind of software development tools often facilitates changes. All kinds of changes are, however, not easy to accomplish. If a fundamental conceptual mistake is made during data modelling, this might lead to implementation of an unfeasible data structure that could be difficult (but of course not impossible) to change later on. During our interviews, the system developers admitted that they had been too successful in launching the information centric approach and the software development tool to the users. The backlash came when they could not fulfil the users' high expectations.

It might sound odd to argue that data stability is obtained through avoidance of change. To some extent this is of course obvious; if you avoid changes the database remains unchanged. The interesting thing here is to discuss under which circumstances this non-action occur, what the motives are, and what the effects are. To perceive an unchanged precondition as a non-action is only justified when there exists a request for change actions (as in our case). Otherwise, it is not meaningful to view change avoidance as a tactic to obtain data stability.

4.2 Data Stability Obtained through Anticipated Generalisation

The data modelling at the construction firm did not result in a straight mapping of the reality. In some cases, the aim was also to generalise concepts to a more abstract level. The reason for this action was that the construction firm had an affiliated decoration company. The decoration company was not supposed to use the same database as the construction firm in the near future, but the managers considered this to be possible later on. The decoration company had some similarities concerning business practices compared to the organisation we studied, but there were also many differences.

A possible future integration of these two organisations' databases affected the data modelling at the construction firm. Parts of the resulting data model were made too abstract to really fit the existing organisation at the construction firm. Instead, the construction firm was seen as a "special case" of the data model, due to this anticipated generalisation of concepts. Creating a data model based on

anticipated generalisation means that the data model might resist future changes. It would be possible to use the database for other situations than it was originally developed for. There will be no need for changes in the database as long as new "special cases" are covered by the generalised data structure. This tactic implies the striving for generalisation of data (i.e., creating abstract categories) with the intention to make the existing organisation a special case of the data model.

This discovered tactic means that future organisational changes do not have to result in database changes. The tactic may, though, have consequences for users of the IT system. As was the case in our first tactic, described above, this tactic might also result in a gap between the conceptualisation of objects in the database and the users' organisational languages. In the database, there are abstractions (objects) that do not fully correspond to the concepts used by different user groups. An interesting finding in this case is that the data modellers refute themselves, according to a strict information centric approach. An important idea in an information centric strategy is to make a correct mapping from reality to the data model and then further on to the database, as discussed above. This tactic implies that the data modellers are searching for categories on a more abstract, general level compared to the existing concepts. Thus, if these data objects were totally stable there would be no need for any general level. The anticipated generalisation of concepts is made because data are not stable. This tactic builds on the apprehension that future organisational changes might lead to changes in organisational concepts; i.e., an apprehension about data instability! This is obviously a practical contradiction according to the theoretical information centric ideas.

4.3 Data Stability Obtained through Constructive Standardisation

The next empirical example derives from the municipality office, where we studied an IT system for official registration of documents. The user groups were highly specialised in different issues concerning health and environmental inspections. In this organisation, there existed only manual working routines when the integrated IT system should be developed from an information centric approach. An integrated database was developed for users with different inspection tasks and so far very varying (individual) ways of working. To be able to develop such a database a generalised data model had to be made, that could be used by all different user groups. This is not the same as the anticipated generalisation, described above. In this case, a totally new data structure was constructed to be valid and usable for all user groups. This meant that the concepts in the data model, to a large extent, were new to all user groups. An important precondition for this design process was that the new concepts should be used by everyone in the organisation; i.e., a new concept standard was introduced.

The introduced data structure had four levels; object, business, commission, and document. The object level corresponds, for example, to a building or a lake where inspection should be performed. Due to this constructive standardisation, a structure was developed that could be used by all actors regardless of their specialisation. This also meant that all user groups had to adjust themselves to these new, and to some extent more abstract, concepts. This data structure implied some problems. The different inspection tasks were not fully supported by the new structure. Since the aim was to develop a general standardised structure for all user groups, some specified concepts for different user groups were left outside the data model. As an effect of this, some users had to use manual register files beside the IT system. Users were forced to do extra work when translating between manual and computerised structures. This way of action also resulted in some redundant information storage, which is in contradiction to the theoretical ideas of an information centric strategy.

There are other examples of how this standardisation led to insufficient organisational support. Actors still had to do work tasks manually, that should have been conducted by the IT system instead. It is obvious that this *constructive standardisation*, aiming at finding a least common denominator, resulted in an IT system that did not support all users in a suitable way. During the first data modelling phase there was no particular effort put into finding and understanding the varying characteristics, needs, and working routines of the user groups. This way of action is, however, in accordance with the information centric approach, where the data model is supposed to be independent of individual working

routines and information needs. When using constructive standardisation it is obvious that no strict reality mapping is performed. To develop a database for multiple user groups with differing working routines and needs, a conceptual construction must be done; i.e. a construction of usable, abstract, general concepts. This striving for a corporate data model implies construction rather than mapping.

4.4 Data Stability Obtained through Expansion to New Application Areas

At the municipality office, a data model of high generalisation and standardisation was developed, as described above. This situation also made us discover a fourth tactic for obtaining data stability. The case study revealed that it was possible to expand this data model into other application areas than it was originally developed for. When the database had been in use at the municipality office for some time, the office clerical staff also started to use it. The office clerical staff used the database and the application for official registration of documents to administer the library of the municipality office, a work task that the database and the application were not originally developed for. Since the data structure was not appropriate for this, it was unnatural to use the database for literature administration. Book titles were, for example, treated as "commissions" and authors as "documents", according to the data structure mentioned above. This did not only result in a distinct deviation from the organisational language, but also in less usage of the IT system. The IT system was optimised to support registration of health and environmental inspection errands at the office. When using the IT system for library administration this caused severe technical performance problems; even a very simple library search had an unacceptable response time.

This expansion of the data model to a new application area is interpreted as yet another tactic to preserve data stability. When expanding the data model to be used in another situation, the need for changes in the implemented data structure was avoided. A negative effect was, however, that this way of action forced the users to make, sometimes extensive, adjustments in their organisational languages. It is, though, not only in information centric approaches that an already implemented data structure is reused. Still, an information centric strategy seems to create exaggerated expectations in the organisation, due to its striving for integration and data stability as means to fulfil the goals of non-redundant data and common data accessibility. These expectations could find expression in, e.g., unfeasible expansion of the data structure.

5 DISCUSSION

All the discovered tactics cover problems about conformity in the organisational languages, although identified within different work settings. There is an obvious need to create common concepts in organisations in order to develop usable IT systems. Information centric strategies have definitely an important point here, but corporate data modelling does not always seem to be the proper way to conduct this conceptual analysis. Proposing that a common organisational language can be agreed upon in the data model is commendable as far as it concerns the aim of making a thorough concept analysis. On the other hand, it neglects the existence of several overlapping organisational languages and supposes that only one common language is enough for the entire organisation. This is an apprehension that our case studies have proven to be wrong. A conclusion from this is that the benefits of an information centric strategy listed earlier are important, but when practically implementing these ideas, other negative effects seem to overshadow and sometimes even replace these possible advantages.

Our findings that data stability is difficult to obtain in practice, are in accordance with a study by Hamilton (1999). He reports on a longitudinal study over two decades where the reliability of four different assumptions, important to succeed with IS integration, are examined. One of the assumptions (Martin, 1990) is that core organisational data, information, and associated process structures are sufficiently stable in the long-term for an integrated IS structure to be implemented, managed and maintained (ibid.). The assumption of stability is required from the change management perspective, since volatility is incompatible with an initiative that requires years to complete (Hamilton, 1999). Hamilton's (ibid.) study shows that even though data stability is clearly required for a long-term

integration to be viable, this assumption was not realised in practice. The empirical findings indicate that data is driven by business needs and not possible to keep totally stable over time. Even if data does not change rapidly, it is not static, and changes will cause problems when the data structures are embedded in the databases (ibid. p. 78).

The tactics can be related to Mintzberg's (1991) way of distinguishing between intended and realised as well as deliberate and emergent strategies. Two of the tactics (Anticipated generalization and Constructive standardization) are tactics for stability planned and intended by designers. The other two tactics (Change avoidance and Expansion into new application areas) have emerged without or despite organisational intentions.

One of the discovered tactics, change avoidance, is concerned with actions to preserve data stability once the database is developed. The other three tactics concentrate on how to establish data stability from the beginning. The common solution in these three tactics is different kinds of generalisation. In the tactic concerning anticipated generalisation, the data model is made more abstract than the originally organisational concepts are. In the tactic concerning constructive standardisation, a new, generalised conceptual standard is developed. The tactic concerning expansion to new application areas is in line with the same idea of generalisation, i.e., to be able to use the database for other purposes than it was developed for. Data stability is becoming a self-fulfilling prophecy, especially if one views our four tactics all together. The case studies show that an implemented data structure is used as long as ever possible. The data structure becomes more stable than there are any organisational reasons for.

A question that might be asked is whether our findings do not view the result of poor data modelling? We cannot prove that the data modelling activities in the cases we have studied were altogether excellent. Of course, there might be mistakes made during the data modelling that have affected the outcome in some sense. We are, however, confident that this cannot explain that data stability was not reached without special actions (the discovered tactics). The tactics are the result of consciously made decisions, either during the data modelling or after. They are either a deviation from the theoretical ideas of information centric approaches made in order to solve a practical problem during the data modelling (e.g., anticipated generalisation) or they are a way to obtain stability after the database has been developed (e.g., change avoidance).

As mentioned earlier, data stability as a superior aim in information centric approaches has its explanation in the striving for achieving an efficient information management (e.g., Ward et al., 1990). The underlying reasons for trying to obtain data stability are sometimes hidden behind the apprehended importance in keeping the data structure stable. Thus, we find it vital to relate our empirical findings to the main goal of an information centric strategy; i.e., to make correct, useful, and non-redundant information accessible to all users that request it. Our four tactics all indicate that, although the database might be developed in accordance with these ideas, the users are not fully supported by their IT systems. The information in the database might be captured close to the source, stored only once, and made accessible to everyone. Still, if the database does not reflect the organisational languages familiar to the users, then different translation problems and user dissatisfaction will occur.

In information centric approaches there is a strong striving for integration; to see similarities and (as our cases have indicated) to extend bounds for what these similarities are, as well as to reduce the differences. This striving for data generalisation, to make data objects general and more abstract, implies an increased level of data stability. This way of action might, on the other hand, lead to decreased organisational support. This reveals an identified goal conflict between data stability and organisational support.

6 CONCLUSIONS

Many advocates of an information centric strategy state that data are stable when the "true" data structure once is captured through conceptual data modelling. This statement includes a notion of the

relation between the IT system and the organisation. This notion has been called the reality mapping view by, e.g., Lyytinen (1987). Reality mapping supposes a mapping process from the real world to a formal, conceptual model. The model is then seen as a representation (a mirror) of the real world (ibid.). Our empirical study has, however, shown that data stability cannot be taken for granted when adopting an information centric approach during the design process. Instead, we have identified tactics to establish and preserve data stability. Actors in organisations adopt different action patterns in order to create and sustain stability in databases. From this we draw the conclusion that data stability is not to be conceived as a pre-given fact, but rather as a socially constructed phenomenon.

We have, in our interpretive case studies of information centric approaches in practical realisation, discovered several things. In short, each of the four revealed tactics implies a lesson. *Change avoidance* – a non-action means a stable condition, but the aim to treat information as a common valuable resource important to the entire organisation is not reached when users are not supported by the IT system in their work tasks. *Anticipated generalisation* – if data modellers really thought stability was reachable in the long run, there should not be any need for abstractions and generalisations. *Constructive standardisation* – in order to develop a corporate database to be used by several user groups, concept construction rather than reality mapping seems to be necessary. *Expansion to new application areas* – too strongly emphasise on an information centric approach's possibility to integrate data resources and develop corporate solutions might lead to unsuccessful examples of data structure expansion. As these statements show, there are several contradictions between the theoretical ideas behind an information centric strategy and its practical realisation. These four tactics may be useful both for researchers and practitioners. Researchers interested in, e.g., practical IT system design effects in organisations can use our tactics to explain occurances and analyse organisational situations from a data stability perspective. Practitioners might use the tactics as lessons about data stability when trying to avoid negative organizational consequences of IT system design. These lessons are not at least important for responsible managers who need to understand the implied risks with an exaggrerated and unfounded striving for data stability in their strategic IS/IT management.

In this paper we have discussed problems that might occur when realising an information centric strategy in practice. The problems are the result of a mismatch between the theoretical ideas of data integration and practical situations where other things besides theoretical constructs also affect the outcome. These are, as we regard it, timeless results that might arise no matter what technology, what kind of IT systems, or what period of time we consider. The findings are important to take into consideration during IT system design in any organisation. We have only studied this phenomenon in an intra-organisational setting so far. Though, initiatives such as governmental national-wide databases and electronically supported transactions between customers and suppliers, just to mention two examples, are making these problems even more legitimate in inter-organisational settings from now on. In the research field of enterprise engineering, for example, focusing on changing enterprises, it is important to consider these results in order to develop future enterprise architectures in a direction that forms sound relationships between business strategy, organisational structure, business processes, and IT systems. Such relationships should support the organisation without forcing it to use any certain tactic to establish and preserve data stability.

Empirically researched effects of information centric strategies and data stability are very rare, as we understand. Therefore, we claim that this is an area that needs to be further investigated in order to generate knowledge about relationships between data stability in theory and practice. If the tactics to establish and preserve data stability, discovered in our research, are found to be common in organisations using an information centric approach, this would imply an important question to focus in the beginning of every design process. Further research must of course be conducted before the findings reported in this paper are to be seen as completed. Further case studies might also reveal other tactics than the ones reported here.

References

Axelsson, K. and Goldkuhl, G. (2004) Theory Modelling – Action Focus when Building a Multi-Grounded Theory. In Brown, A. and Remenyi, D. (Eds.) Proceedings of the 3rd European Conference on Research Methods in Business and Management (ECRM2004), Reading University UK, 29-30 May 2004, pp 25-33.

Bieberstein, N., Bose, S., Walker, L. and Lynch, A. (2005) Impact of service-oriented architecture on enterprise systems, organizational structures, and individuals. IBM Systems Journal, 44(4), pp. 691-708.

Berger, P. L. and Luckmann, T. (1979) A Social Construction of Reality. Penguin Books, Harmondsworth.

Codd, E. F. (1970) A Relational Model of Data for Large Shared Data Banks. Communication of the ACM, 13(6), 377-387.

Davenport, T.H. (1997) Information Ecology – Mastering the Information and Knowledge Environment. Oxford University Press, New York.

Davenport, T.H. (1998) Putting the Enterprise into the Enterprise System. Harvard Business Review, 76(4), 121-131.

Glaser, B. and Strauss, A. L. (1967) The Discovery of Grounded Theory: Strategies for Qualitative Research. Aldine, Chicago.

Goldkuhl, G. and Cronholm, S. (2003) Multi-grounded Theory – Adding Theoretical Grounding to Grounded Theory. in Proceedings of the 2nd European Conference on Research Methods in Business and Management (ECRM 2003), Reading, UK, 20-21 March 2003.

Goldkuhl, G. and Lyytinen, K. (1982) A language action view of information systems. In Proceedings of the Third International Conference on Information Systems. Ginzberg and Ross, eds., Ann Arbor.

Goodhue, D.L., Wybo, M.D. and Kirsch, L.J. (1992) The Impact of Data Integration on the Costs and Benefits of Information Systems. MIS Quarterly, September, 293-311.

Hamilton, D. (1999) Linking strategic information systems concepts to practice: systems integration at the portfolio level. Journal of Information Technology, 14, 69-82.

Iivari, J. and Hirschheim, R. (1996) Analyzing Information Systems Development: A Comparison and Analysis of Eight IS Development Approaches. Information Systems, 21(7), 551-575.

Jarrar, M., Demey, J. and Meersman, R. (2003) On Using Conceptual Data Modeling for Ontology Engineering. In Spaccapietra, S., March, S. and Aberer, K. (Eds.) Journal on Data Semantics (Special issue on Best papers from the ER, ODBASE, and COOPIS 2002 Conferences). LNCS, vol. 2800, Springer, pp. 185-207, October 2003.

King, J. L. and Kraemer, K. L. (1988) Information Resource Management: Is It Sensible and Can It Work? Information & Management, 15, 7-14.

Kolekofski, K.E. Jr. and Heminger, A.R. (2003) Beliefs and attitudes affecting intentions to share information in an organizational setting. Information & Management, 40, 521-532.

Lyytinen, K. (1981) Language oriented development of information systems – methodological and theoretical foundations. Licentiate Thesis, University of Jyväskylä.

Lyytinen, K. (1987) Two Views of Information Modelling. Information & Management, 12, 9-19.

March, S. T. and Kim, Y. (1992) Information Resource Management: Integrating the Pieces. Data Base, Summer 1992, 27-38.

Martin, J. (1990) Information Engineering – Planning and Analysis. Prentice Hall, New Jersey.

Mintzberg, H. (1991) Five Ps for Strategy. In Mintzberg, H. and Quinn, J.B. (Eds.) The Strategy Process – Concepts, Contexts, Cases. Second Edition, Prentice Hall, New Jersey, 12-19.

Mutch, A. (1996) No such thing as… information resource management. Management Decision, 34/7, 58-62.

Nolan, R. L. (1979) Managing the crises in data processing. Harvard Business Review, March-April, 115-126.

Oppenheim, C., Stenson, J. and Wilson, R. M. S. (2001) The attributes of information as an asset. New Library World, 102(1170/1171), 458-463.

Shanks, G. and Darke, P. (1999) Understanding Corporate Data Models. Information & Management, 35, 19-30.

Spyns, P., Meersman, R and Jarrar, M. (2002) Data Modelling versus Ontology engineering. SIGMOD Record, 31(4), 12-17.

Strauss, A. and Corbin, J. (1998) Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. 2nd edition, Sage Publications, Thousand Oaks, CA.

Walsham, G. (2006) Doing interpretive research. European Journal of Information Systems, 15, 320-330.

Ward, J., Griffiths, P. and Whitmore, P. (1990) Strategic Planning for Information Systems. John Wiley & Sons Ltd., Chichester.

Wernerfelt, B. (1997) A Resource-Based View of the Firm. In Foss, N.J. (Ed.) Resources, Firms and Strategies – A Reader in the Resource-Based Perspective. Oxford Management Readers, 117-130.

Yin, R. K. (1989) Case study research. Design and methods. Sage, Newbury Park.