Four Tactics of Establishing and Preserving Data Stability

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Abstract

This article focuses on core ideas behind an information centric approach concerning stability in databases. We investigate if and how data stability is obtained when an information centric approach is implemented in practice. The results of our two case studies reveal four tactics focusing on actions conducted in order to obtain and maintain stability in databases: (1) change avoidance, (2) anticipated generalization, (3) constructive standardization, and (4) expansion to new application areas. Based on our empirical findings, we argue that data stability is a result of social construction in organizations rather than just an effect of structured information systems planning. The contributions in this paper can be used to explain IS design effects in organizations and analyze organizational situations from a data stability perspective.

Keywords: Information centric approach, data stability, data modeling, data integration, organizational language.

Introduction

There have been many articles focusing on the theme of information centric approaches, resulting in integrated databases. The notions 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, Griffiths, & Whitmore, 1990). Other scholars have been more negative towards the ideas and expressed major criticism against such approaches (e.g., Davenport, 1997; Lyytinen, 1987). This article questions what the results might be when setting these theories into practice. The article focuses on describing what we would regard as "theory of the empirical", in contrast to the many descriptions of "theory of the ideal," which have been written during the last three decades.

When focusing on information centric approaches, the relation between data and information is important to sort out. The difference between data and information can be explained and defined as following; data about different phenomena in an organization (e.g., about products, customers, prices, etc.) might be stored on paper or in information systems (IS), but it is only when these data are placed in a context and interpreted by someone that data become meaningful information. We define data stability as an ambition to keep the database structure as constant as possible. Data stability implies that the conceptual structure can be kept unchanged once the database is developed. Conceptual structure is here defined as the structuring of linguistic categories used in the database. Necessary changes in user in-

terface or reports might occur, but changes that affect the database structure should preferably be avoided. A main reason for trying to reach data stability is to achieve efficient information management, which implies that information is made accessible, no redundancy occurs, and maintenance is facilitated (Ward et al., 1990).

The kind of approaches that we intend to study in this paper has been given many names; e.g., information resource management (IRM), data-driven IS structuring, and information engineering approaches. We have chosen to use the label information centric approaches, as we are not focusing on any particular strategy or method among these similar ones. Common to information centric approaches is the notion of information as being one of the main resources in an organization. In order to make the most out of this resource, organizations need to manage their data in an integrated and stable way (March & Kim, 1992). This means that data 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 organization. By separating user interfaces, reports, etc. from the database, a high degree of data and program independence is reached (Zachman, 1978), which is another goal behind these approaches. Changes should, as mentioned above, be easy to conduct in the interfaces but the database should be kept stable. In practice, need for changes in database structures due to evolving information needs of employees may of course occur. In an information centric approach it is not desirable to continuing change the database structure but to keep it stable. Data modelling is a key activity when designing a stable database 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 information systems (IS) design projects and is a component in many IS development methods. Such methods can be process-oriented or functional, and they can use data modelling to design a database in a late phase of the development process. Or IS development methods may emphasise that the development process should be initially guided by a modelled conceptual structure. In the first case, the data models often represent limited models created for a specific IS or part of an IS. 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 an organizational perspective versus a database perspective on data modelling.

The purpose of this article is to examine and question the idea of data stability and its consequences when put into practice. As far as we know there are only few previous studies that focus practical consequences of an information centric approach (Davenport, 1997; Goodhue, Wybo, & Kirsch, 1992; Iivari & Hirschheim, 1996). None of these studies, however, inductively identify and structure consequences in the same broad sense as we aim to. We focus on core ideas behind the information centric approach concerning stability in databases. We are interested in if and how data stability is obtained when such an approach is implemented in practice. In order to characterise our empirical findings regarding data stability, we use the notion of social construction of data stability. (The notion of social construction was originally used by Berger and Luckmann (1979) in sociological inquiry.) 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 organizations adopting an information centric approach have revealed examples of different tactics focusing on actions conducted to obtain and maintain stability in databases. In this article, we discuss these tactics in order to explain some of their consequences. The main purpose of the article is to reveal different organizational effects (e.g., dysfunctions) arising from adopting an information centric approach.

We claim that, even though there are many research articles written about pros and cons of information centric approaches in theory (e.g., Davenport, 1997; Goodhue et al., 1992; March & Kim, 1992; Ward et al., 1990), there are still very few contributions focusing on problems con-

cerning consequences of their practical implementation. Information centric strategies were intensively discussed in literature during the eighties (e.g., King & Kraemer, 1988; Lyytinen, 1987), 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, recent IT innovations, such as data warehousing, data mining, and, not the least, enterprise resource planning (ERP) systems (e.g., Davenport, 2000), all rely on the very same ideas of information integration. Research in the field of ontology engineering (e.g., Jarrar, Demey, & Meersman, 2003; Spyns, Meersman, & Jarrar, 2002) and service oriented architecture (SOA) (e.g., Bieberstein, Bose, Walker, & Lynch, 2005) has also 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 article is organized in the following way: In the next section we review literature on data modelling and information centric strategies. The research design is then reported. The empirical findings are analyzed in the following section, resulting in four tactics for establishing and preserving data stability. The social construction of data stability is discussed in the next section. The article is finally concluded in the last section, where we also make some statements about the need for further research efforts in this area.

Literature Review

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

Enterprise-wide Data Modelling and Organizational Languages

Ever since the relational database technology was invented in the early seventies (Codd, 1970), there has been a movement towards centralization 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 utilization of organizational information (March and Kim, 1992; Ward et al., 1990).

Oppenheim, Stenson, and Wilson (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 discussed above) as a vital asset for the entire organization, i.e., as a common resource, information should be made accessible to all users within the organization (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 IS design is conceptual data modelling. The result of this activity is a view and a structure of vital organizational concepts, i.e., a data model. The data model often covers an enterprise-wide view of data content. This is necessary in order to design integrated databases as the common information resource of the organization. Such enterprise-wide data models are sometimes called corporate data models. Shanks and Darke (1999) suggest that corporate data models are required when designing cross-functional IS that integrate information from different sources. They argue that corporate data models have met a renewed interest as the use of data warehousing and IS supporting re-engineered business processes increase.

Organizations have a set of partly overlapping organizational languages. These professional languages consist of vocabulary (terminology and concepts) and rules for communicative actions (Lyytinen, 1981). A professional or organizational language is developed and used by human beings in the organization in order to perform a professional task and communicate about this (Goldkuhl & Lyytinen, 1982). Consequently, there exist sub-languages for different actor groups within an organization, 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 organization, while others are used by a certain group of actors. Organizational concepts are socially constructed and inter-subjectively meaningful to people (Berger & Luckmann, 1979). During data modelling, the organizational languages are formalised.

Shanks and Darke (1999) 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 organizational 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 (Shanks & Darke, 1999).

Information Centric Approach Put into Practice

Information centric strategies have been criticised for being difficult to successfully implement in practice. Davenport (1997) argues that such approaches are much more impressive in theory than in practice. Iivari and Hirschheim (1996) state that information centric approaches view IS in organizations in a technical, mechanistic way. The information needs of users are analyzed in an objective sense relating functions and data to each other. This is made in an impersonal way that makes human beings invisible in the analysis (Iivari & Hirschheim, 1996). Davenport (1997) also maintains that an information centric approach assumes that organizations work as systems rather than as individuals and communities with diverse interests. The result of these approaches is that it is difficult to motivate organization members to follow information centric guidelines. There are also forces within in an organization that, for various reasons, do not want to make information accessible throughout the entire organization. Similar findings are reported in a study on beliefs and attitudes that affect the willingness to share information within organizations (Kolekofski & Heminger, 2003). In order to make an information centric approach work, it is necessary for information managers to become “information czars” (Davenport, 1997) with total control of all information. Studies also claim that data integration benefits, such as organization-wide coordination and decision making, should be compared to possible disadvantages, like losses in local autonomy and flexibility and changes in IS design and implementation costs (Goodhue et al., 1992).

Mutch (1996) 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. We agree that there is an important conceptual difference between data and information, as discussed in the introduction of the paper. We discuss data modelling and information centric approaches as means to reach data stability, but the consequences of this will relate to information access and information use, as discussed further in the empirical analysis.

King and Kraemer (1988) have studied information centralization through information resource management in government organizations and found the following:

> 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. (p. 10)

Despite the mentioned problems that might occur when information centric strategies are put into practice, benefits from this approach are also reported. To summarise the ideas behind an information centric approach, the following possible advantages could occur in an organization that acknowledges a centralized view of information management:

1) Data modelling facilitates a proper analysis of organizational concepts, which may result in a feasible database structure.
2) An aim of data modelling is to achieve inter-subjectivity concerning organizational languages and concepts.
3) Adopting an information centric approach means a total solution for information management in an organization, from data provision to data presentation and utilization.
4) Centralised management of information resources facilitates a proper overview and administration of information.
5) The organization 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 organization, which could be seen as a democratic issue.

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.

Research Context

The findings reported in this article are results from a research project that focused on effects of practical implementation of architectural approaches for IS planning and design. One of the studied approaches was an information centric approach. The main purpose of the research project was to answer two research questions: (1) Is it possible to practically apply the theoretical ideas behind an architectural approach; and (2) What effects and consequences can be identified in organizations adopting an architectural approach? An empirical finding from the research project was that the information centric approach could be realised in practice in the organizations studied, but there were many effects, both of intended and unintended nature. 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 the present article.

We are focusing on practical implications of information centric strategies and we are using two case studies in order to show our empirical findings. The case studies were interpretive and qualitative (Walsham, 2006). They were conducted in two Swedish organizations: a construction firm and a municipality office. Both these organizations had been adopting an information centric approach for several years and each possessed a distinct information centric IS solution. These organizations were chosen because they had deep practical experience from using an information centric approach.

The construction firm has approximately 150 employees and its organization 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 clients 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 standardized 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 IS, 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 IS covers all stages within a project and all staff categories use one or several system modules. The IS development started with enterprise-wide data modelling, where consultants modelled organizational 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 their own initiative. The inspections are conducted as projects with one or several inspectors involved, depending on which competence is needed. All employees are highly specialized in different areas. The IS, 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 organization. The IS is used for entering information in the diary, handling different cases, and invoicing. The IS 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 IS is used for library information as well. This makes the IS very central for this organizational unit.

Data Collection and Data Analysis

We conducted in total five individual, semi-structured interviews with managers, system developers, and users at the construction firm. Each interview lasted for approximately two hours. The interviews were conducted by two researchers, who documented and transcribed the result soon after each interview. The interviewees were chosen so that they represented different organizational groups and units. While studying the IS, we interviewed users and managers responsible for organizational activities that were supported by the IS, as well as system developers responsible for the IS. Interviewing was combined with observation, so that the user could exemplify from his or her work the relevant tasks while answering our questions.

The case study at the municipality was conducted as an action research project where we conducted organizational analysis and actively participated during modelling seminars together with several representatives from the organization. These seminars resulted in documentation on business processes, organizational problems, strengths, and goals. Participation in these analysis activities and seminars resulted in deep understanding of the municipality. Data was also collected from observations of users interacting with their IS, and from document studies, i.e., data models. We also conducted two interviews with participants in the action research project after the project was finished.

In analysing data we have used a multi-grounded theory approach (Axelsson & Goldkuhl, 2004; Goldkuhl, 2004; Goldkuhl & Cronholm, 2010; Lind & Goldkuhl, 2006), which is inspired by grounded theory (GT) of 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. In contrast to the initial GT of Glaser and Strauss (1967), the Strauss and Corbin version is

less doctrinaire and more open to the use of other theories and pre-categories than the original. Goldkuhl and Cronholm (2010) 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: (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. This MGT approach resembles also the "iterative grounded theory approach" of Orton (1997). Both approaches acknowledge the mixing of inductive and deductive thinking in theory development.

In our analysis, we found four tactics focusing on actions to establish and preserve data stability. Different categorised phenomena (empirical data identified in, e.g., interview statements or observations) have been related to each other as causal-pragmatic relations during the analysis (i.e., internal grounding). These relations are illustrated in theory diagrams of the four revealed tactics and its motives and other pre-conditions, actions, results, and effects. Pre-existing theories on information centricity have guided our data collection and analysis. 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 generalization, according to Yin's (1989) definition. The result we have created so far can be characterised as an evolving mid range theory (e.g. Weick, 1989). We are not aiming for a very abstract and formal theory. Glaser and Strauss (1967) contrast formal theory and substantive theory. Formal theory is aimed to be on a high abstract level covering phenomena across several domains. A substantive theory (i.e., a mid range theory) covers some substantive area. Our emergent theory is concerned with a demarcated problem area; in this case the establishment and preservation of data stability in information systems.

Discovered 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 generalization; (3) Constructive standardization; and (4) Expansion to new application areas. These four tactics are discussed below.

Data Stability Obtained through Change Avoidance

The two studied organizations had both adopted a strict information centric approach in developing the IS. This implies that the design process began with data modelling activities, which had important effects on the resulting IS. 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 conceptual structure that later occurred to be infeasible. The conceptual structure was not equal to the users' habitual organizational 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 IS was implemented, the users felt very unfamiliar with these two new concepts. After a while, users requested a change in the IS back to the old concept of "Contract by tender". However, this was not any easy change from a technical perspective. Since the requested change affected many

tables in the database, the IT department decided not to implement this change immediately. An extensive IS change was planned for a later occasion, when the IT infrastructure whould 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 conceptual 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, though, had several effects. The users had to conceptually adapt themselves to the new concepts, which decreased the user

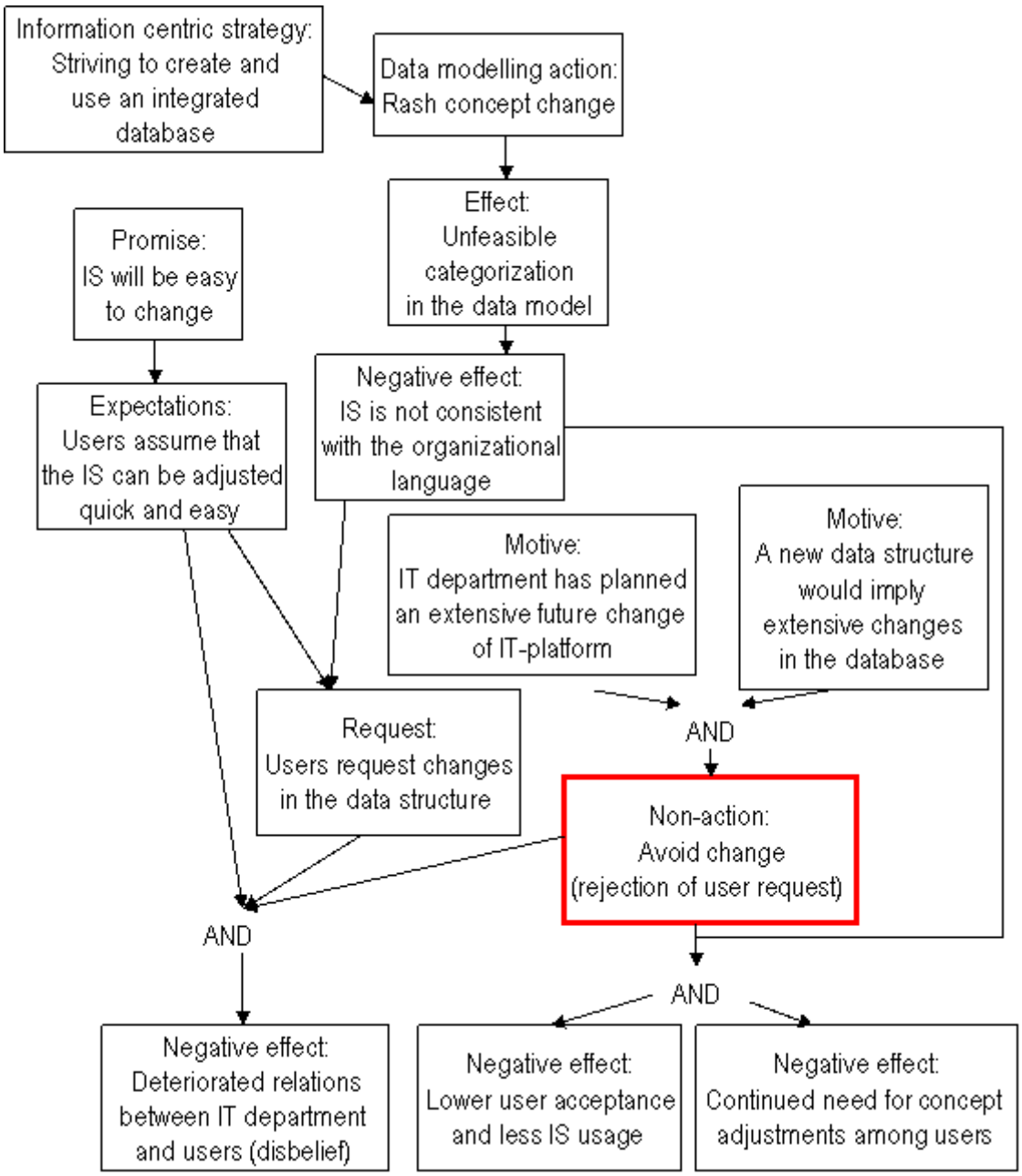

Figure 1: Change avoidance tactic.

acceptance of the IS. Some users refused to use the IS, 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 advertised the IS as "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 change. Not all changes, however, are easy to accomplish. If a fundamental conceptual mistake is made during data modelling, this might lead to implementation of an unfeasible conceptual 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 very 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 the circumstances under which this non-action occurs, what the motives are, and what the effects are. To perceive an unchanged precondition as a non-action is only justified when there is 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. In Figure 1 this tactic's vital statements in terms of motives and other pre-conditions, actions, results, and effects are illustrated.

Data Stability Obtained through Anticipated Generalization

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 generalize 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 organization we studied, but there were also many differences.

A possible future integration of these two organizations' databases affected the data modelling at the construction firm. Parts of the resulting data model were made too abstract to really fit the existing organization at the construction firm. Instead, the construction firm was seen as a "special case" of the data model, due to this anticipated generalization of concepts. Creating a data model based on *anticipated generalization* 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 generalized conceptual structure. This tactic implies the striving for generalization of data (i.e., creating abstract categories) with the intention to make the existing organization a special case of the data model.

This discovered tactic means that future organizational changes do not have to result in database changes. The tactic may, though, have consequences for users of the IS. As was the case in our first tactic described above, this tactic might also result in a gap between the conceptualization of objects in the database and the users' organizational 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 approach 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 generalization of concepts is made

because data are not stable. This tactic builds on the apprehension that future organizational changes might lead to changes in organizational concepts; i.e., an apprehension about data *in*stability! This is obviously a practical contradiction according to the theoretical information centric ideas. In Figure 2 this tactic's vital statements in terms of motives and other pre-conditions, actions, results, and effects are illustrated.

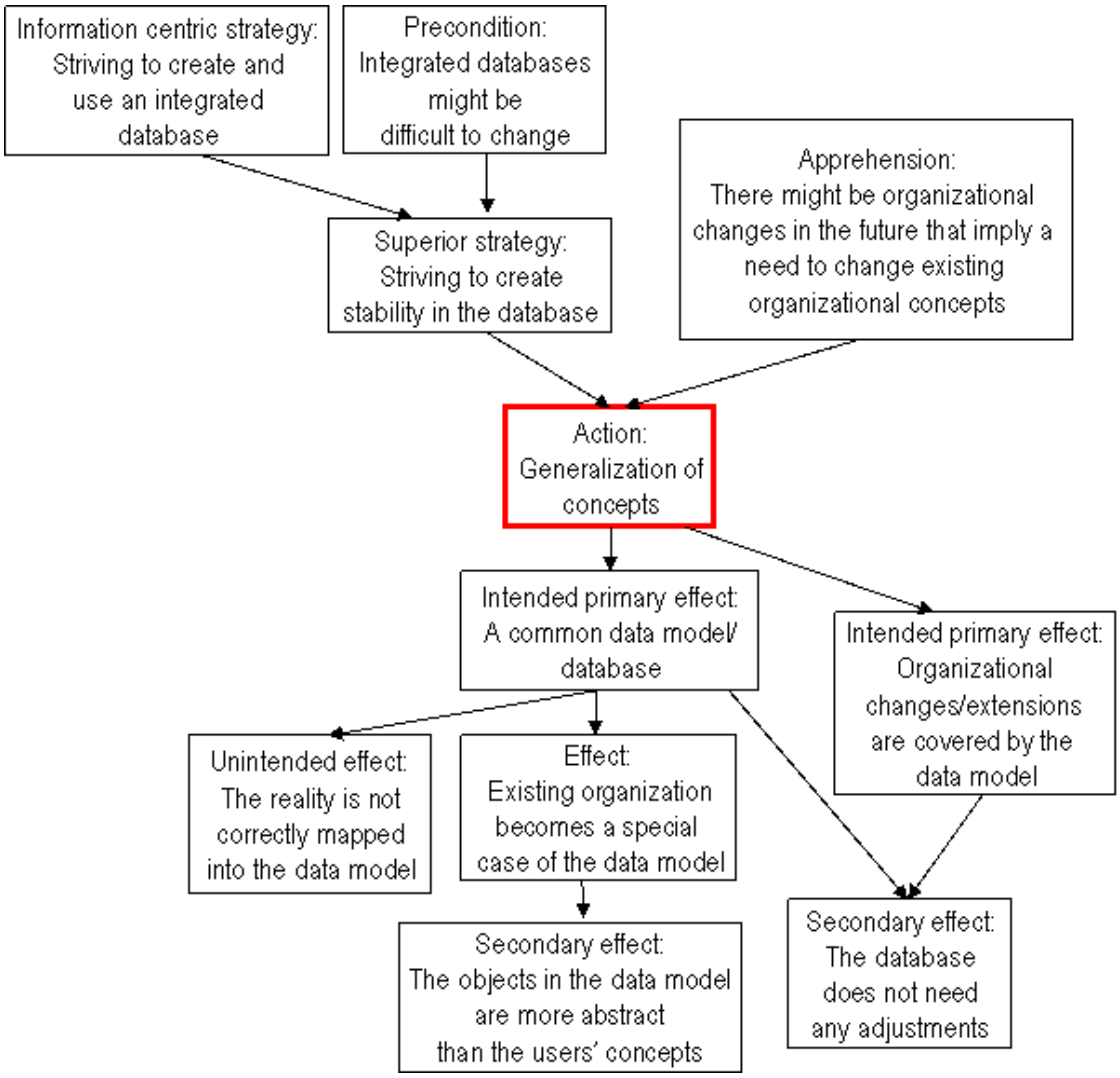

Figure 2: Anticipated generalization tactic.

Data Stability Obtained through Constructive Standardization

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

process was that the new concepts should be used by everyone in the organization; i.e., a new concept standard was introduced.

The introduced conceptual structure had four levels: object, business, commission, and document. The object level corresponds, for example, to a building or a lake where the inspection should be performed. Due to this constructive standardization, a structure was developed that could be used by all actors regardless of their specialization. This also meant that all user groups had to adjust themselves to these new and, to some extent, more abstract concepts. This conceptual structure implied some problems. The different inspection tasks were not fully supported by the new structure. Since the aim was to develop a general standardized conceptualization for all user groups, some specified concepts for different user groups were left outside the data model. As an effect of

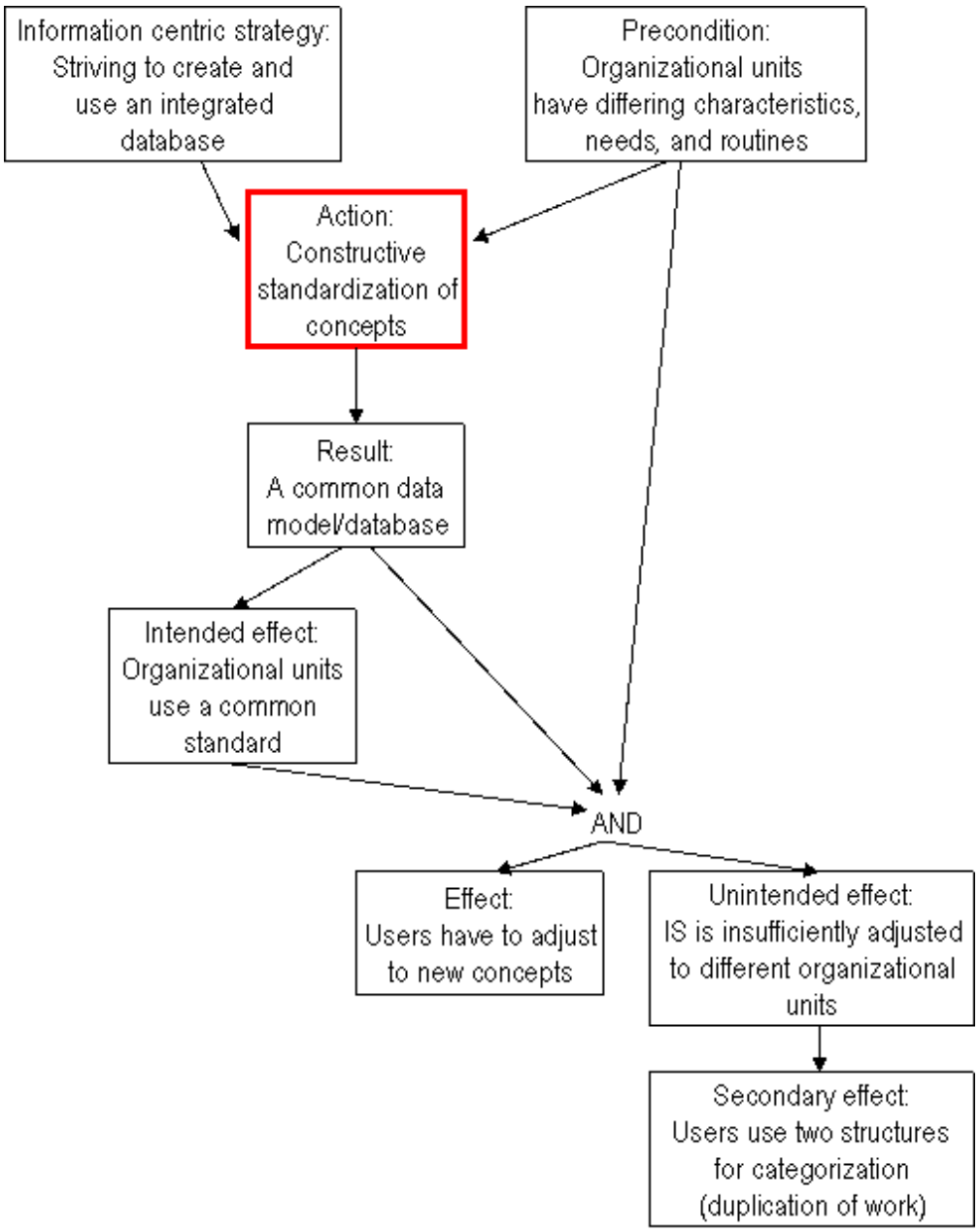

Figure 3: Constructive standardization tactic.

this, some users had to use manual register files beside the IS. Users were forced to do extra work when translating between manual and computerized structures. This way of action also resulted in some redundant information storage, which is in contradiction to the theoretical ideas of an information centric approach.

There are other examples of how this standardization led to insufficient organizational support. Actors still had to do work tasks manually, which should have been conducted by the IS instead. It is obvious that this *constructive standardization*, aiming at finding a least common denominator, resulted in an IS that did not support all users in an optimal 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 standardization 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. In Figure 3 this tactic's vital statements in terms of motives and other pre-conditions, actions, results, and effects are illustrated.

Data Stability Obtained through Expansion to New Application Areas

At the municipality office, a data model of high generalization and standardization was developed, as described above. This situation also helped us discover the 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 conceptual 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 conceptual structure mentioned above. This resulted in not only a distinct deviation from the organizational language, but also in less usage of the IS. The IS was optimised to support registration of health and environmental inspection errands at the office. When using the IS 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 model was avoided. A negative effect was, however, that this way of action forced the users to make, sometimes extensive, adjustments in their organizational languages. It is, though, not only in information centric approaches that an already implemented data model is re-used. Still, an information centric approach seems to create exaggerated expectations in the organization, 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 conceptual structure. In Figure 4, this tactic's vital statements in terms of motives and other pre-conditions, actions, results, and effects are illustrated.

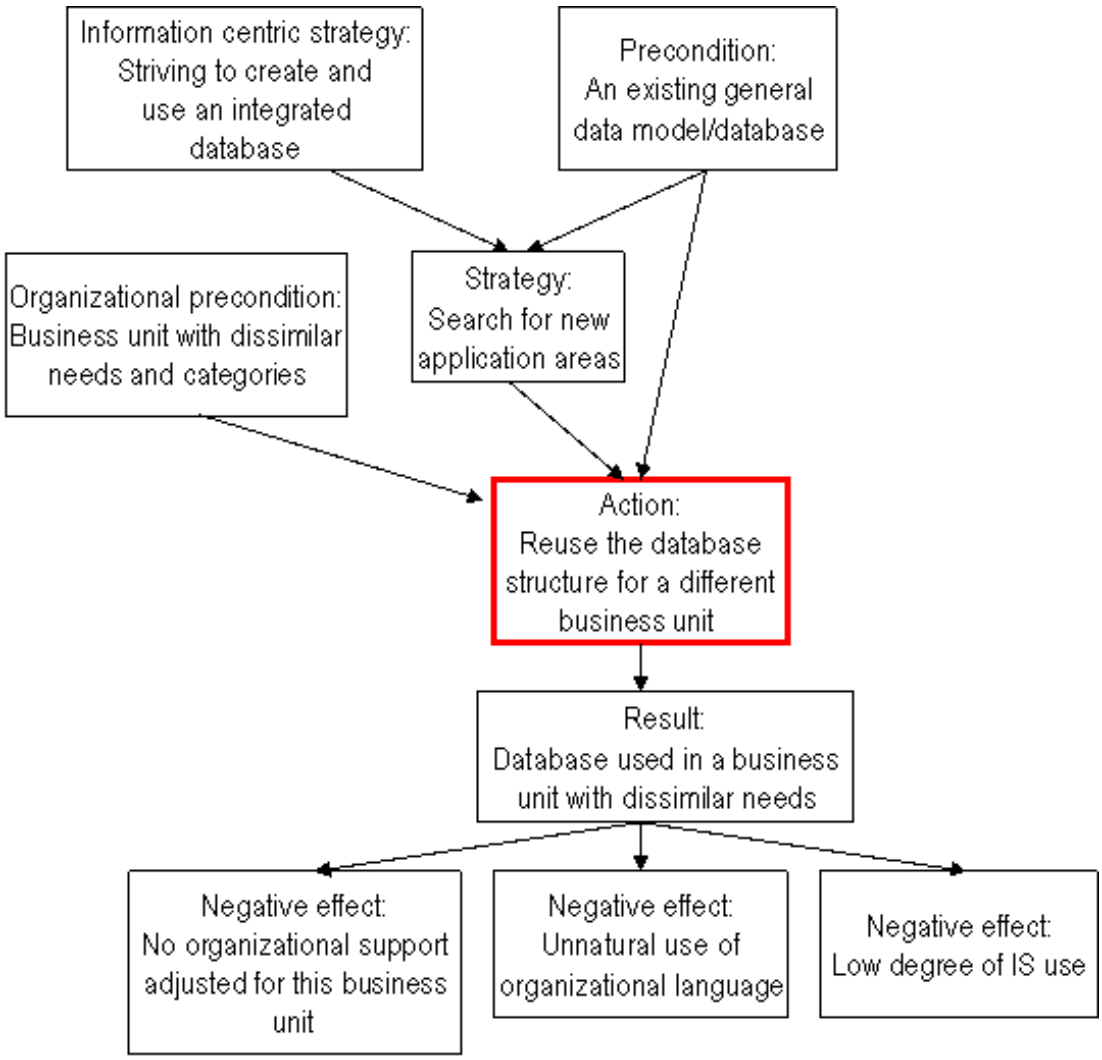

Figure 4: Expansion to new application areas tactic.

Discussion

All the discovered tactics cover problems about conformity in the organizational languages, although identified within different work settings. There is an obvious need to create common concepts in organizations in order to develop usable IS. 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 organizational language can be agreed upon in the data model is commendable as far as it concerns the aim of making a thorough conceptual analysis. On the other hand, this proposition neglects the existence of several overlapping organizational languages and supposes that only one common language is enough for an entire organization. This is an idea that our case studies have proven to be wrong. A conclusion from this is that the benefits of an information centric approach 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 is that core organizational data, information, and associated process structures are sufficiently stable in the long-term for an integrated IS structure to be implemented, managed and maintained (Martin, 1990). The assumption of stability is required from the change management perspective, since volatility is incompatible with a project that requires years to complete (Hamilton, 1999). Hamilton's 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 are driven by business needs and it is not possible to keep them totally stable over time. Even if data do not change rapidly, they are not static, and changes will cause problems when the conceptual structures are embedded in the databases (Hamilton, 1999, p. 78).

The tactics can be related to Mintzberg's (1991) way of distinguishing between intended and realized 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 to New Application Areas) have emerged without or despite organizational 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 generalization. In the tactic of Anticipated Generalization, the data model is made more abstract than the originally organizational concepts are. In the tactic of Constructive Standardization, a new, generalised conceptual standard is developed. The tactic of Expansion to New Application Areas is in line with the same idea of generalization, 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 database structure is used as long as possible. The database structure becomes more stable than what is requested from an organizational point of view.

A question that might be asked is whether our findings do not reflect 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 such mistakes 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 Generalization) 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 notion of importance in keeping the database structure stable. Thus, we find it vital to relate our empirical findings to the main goal of an information centric approach; i.e., to make correct, useful, and non-redundant data accessible to all users that request it. Our four tactics indicate that, although a database might be developed in accordance with these ideas, the users are not fully supported by their IS. The data 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 organizational languages familiar to the users, then different translation problems and user dissatisfaction will occur.

In information centric approaches there is a strong striving for data integration; i.e. to see similarities and (as our cases have indicated) to extend bounds for what these similarities are. The striving for data generalization, to make data objects general and more abstract in order to reduce

differences, implies an increased level of data stability. Such data generalization might, on the other hand, lead to decreased organizational support, which reveals an identified goal conflict between data stability and organizational support, illustrated in Figure 5.

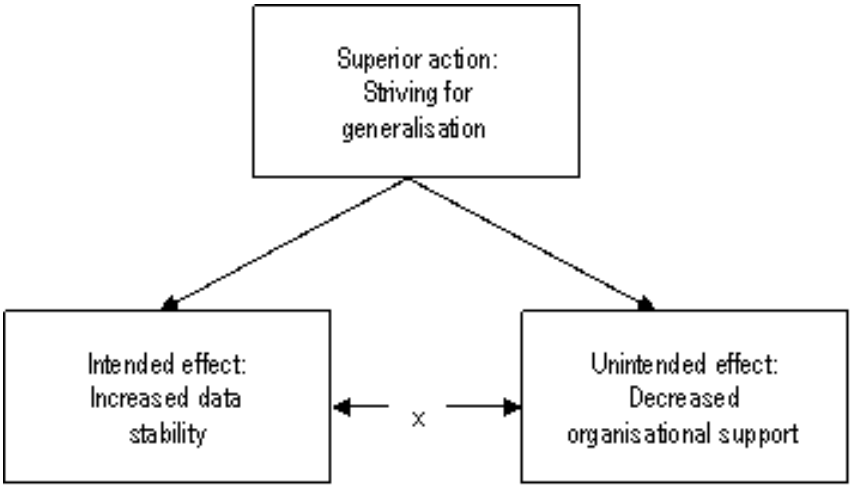

Figure 5: Goal conflict between data stability and organizational support.

Conclusion

Many advocates of an information centric approach state that data are stable once the "true" database structure is captured through conceptual data modelling. This statement includes a notion of the relationship between the IS and the organization. This notion has been called the reality mapping view by 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 (Lyytinen, 1987). However, our empirical study has 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 organizations adopt different action patterns in order to create and sustain stability in databases. From this general finding 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 realization discovered that 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 organization is not reached when users are not supported by the IS in their work tasks. *Anticipated Generalization* – if data modellers really thought stability was reachable in the long run, there should not be any need for abstractions and generalizations. *Constructive Standardization* – 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 emphasizing 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 approach and its practical realization. These four tactics may be useful both for researchers and practitioners. Researchers interested in, e.g., practical IS design effects in organizations can use our tactics to explain and analyze organizational situations from a data stability perspective. Practitioners might use the tactics as lessons about data stability when trying to avoid negative organizational consequences of IS design. These lessons are equally

important for responsible managers who need to understand the implied risks with an extensive and unfounded striving for data stability in their strategic IS/IT management.

In this article we have discussed problems that might occur when realising an information centric approach in practice. These problems are possible effects; they should not be seen as necessary consequences of an information centric approach. They might occur in some organizational contexts but not in other. 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 regardless of specific technology, IS, or period of time. The findings are important to take into consideration during IS design in any organization. We have only studied this phenomenon in an intra-organizational setting so far. However, initiatives such as e-government and e-commerce, which involve several organizations, are making these problems even more legitimate in inter-organizational settings. For example, in the research field of enterprise engineering, which focuses on enterprise change, it is important to consider these results in order to develop future enterprise architectures in a direction that forms sound relationships between business strategy, organizational structure, business processes, and IS. Such relationships should support the organization without forcing it to use any tactic to establish and preserve data stability.

Empirically researched effects of information centric approaches and data stability are very rare. 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 our tactics to establish and preserve data stability are found to be common in organizations using an information centric approach, this would imply an important question to focus on in the beginning of every design process. Further research must of course be conducted before our understanding of data stability is to be deemed conclusive. Further case studies might also reveal additional tactics.

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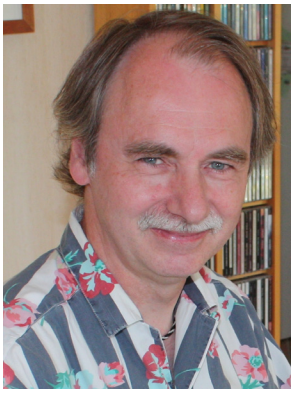

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