Appeared in Wakayame, Toshiro, Srikanth Kannapan, Chan Meng Khoong, Shamkant Navathe, and JoAnne Yates. 1998. "Information and Process Integration in Enterprises – Rethinking Documents." Kluwer Academic Publishers. Norwell, MA.

17 DOCUMENT AND PROCESS TRANSFORMATION DURING THE PRODUCT LIFE CYCLE

Abraham Bernstein[1], Christian Schucan[2]

Abstract

Based on our experiences[3] in the corporate banking department of the Union Bank of Switzerland we are convinced that business, IT and organizational aspects have to be considered in an integrated way while developing IT-strategies. IT-strategies are crucial for an effective (business) development because they identify the constant and the changing parts of an IT infrastructure during product life cycle. In order to achieve this, we state three design invariants: the deep structure of the process, the dependencies within the process, and the information handled. We believe that identifying these invariants will lead to a deeper understanding of product-life-cycles.

1. Introduction

Our field of experience is the information technology support for the corporate banking division of a bank. We believe that this area of studies offers some generizability to other service providing industries, due to the significance of

[1] MIT-Sloan School of Management, email: avi@mit.edu
[2] ETH Zürich (Eidgenössische Technische Hochschule), email: schucan@inf.ethz.ch
[3] Both authors worked as project managers for Union Bank of Switzerland

information (as a facilitator and as a product in itself) in this business. Some insight from our observations should be applicable to the management of production-oriented business, since it is the nature of management as a task to be closely coupled to information flows and processes and therefore to information management. The statements made in this paper, are based on our experiences as project managers in several projects at Union Bank of Switzerland. They are observations made during our daily work and are not based on a specific empirical study or on a theoretical approach.

We differentiate between data and information. Information represented in a physical structure becomes data. With this view, data is information which is coupled to a physical structure. But data is not in every case information. Whether data represents information or not depends on the use of data. Only a meaningful context can turn data into information. As an example we offer the number 1996. This number is data when stored in a physical structure, but without context it is meaningless to the user. The number does not represent information. In addition to the context specification (e.g. the number represents the current year) the number has to add additional knowledge to the user, otherwise it does not represent information to him. For example, we observed systems that hold huge amounts of data. But since the users chose other information systems (especially paper-based document archives) or knew the facts in advance, the system had no value to them. Thus, it did not add any information to their work. A consequence of this view is that information can be represented in an unstructured document in the file system as well as in a strongly structured relational form in a database. The information does not change by this fact.

We also see a difference between process maps, which represent the surface structure of a particular process, and the 'deep structure'[4] of a process. A process map describes the elementary details of a particular process, and only describes one way to achieve the goal. It does not describe the action of achieving a goal without actually offering a special solution. We refer to the 'deep structure' of a process, an expression from linguistics, for the more abstract description.[5]

2. The Relation between Business, IT-Support and Organizations

When we are speaking about business support with information technology, we think about any piece of software, tool or method that is needed to provide, handle and manage information that is used to keep the business running or even more as a product of the business itself. This also includes aspects which only appear over time, i.e. within different levels of product development in the product life cycle.

---

[4] see Malone 1996

[5] 'John hit the ball' and 'The ball got hit by John' represent different surface structures for the same deep structure. (see Malone 1996)

This is important for the design of document and process management systems. They have to be designed to support structural changes in documents and classes of documents. We observed this in our environment and recognized several problems:

- people work with different versions of software
- information of different structured documents is no longer comparable, because of the different data structure
- data can not be aggregated to provide the overall information about the state of the product and its selling because the data comes from different sources according to the level of development of the product and with that in different structures.

For example loan-granting in a bank: When a customer wants to build a house, he often gets mortgage from a bank. This business is handled via documents containing many pieces of information about the house and its value. The structures and contents of the documents change over time and differ from region to region. However the management needs the information of the total value of all mortgages over all regions and wants to compare this result with former results. Because the documents are stored in different places with different structures[6] (but with the same information represented) it is difficult to find and add the single values in order to calculate the total value.

We are convinced that only this global view on information management, that includes aspects of technology, economics and organizations, allows IT to become a strategic issue within the businesses. This overall view is necessary for IT projects to focus on the needs and to become an asset rather then an obstacle.

The use of IT support requires a major financial involvement. In order to justify the commitment of financial resources to IT projects, they have to be focused on areas where a major return on investment is to be expected. If this selection is accurately applied, IT appears no longer as a cost factor (as it does today in our domain) but as a business opportunity.

In the following, we explain this relationship and its consequence with the example of the corporate banking market in Europe. Over the last few years the corporate banking market in Europe; which has been mainly focusing on loans, has transformed into a highly saturated and competitive market. Loans have transformed into a commodity product, which differ mainly in pricing. In order to ensure survival in this market, financial institutions face a major transformation of their market appearance in terms of communication channels to their customers, products, product innovation, pricing and distribution. This transformation from a highly administrative loan-'granting' company to a cooperative customer-focused

[6] location and structures for mortgage documents are defined bank-externally by law

organization with a broad variety of products, can only be achieved by business process reengineering projects.

At the first glance the problem as we encountered it, showed two main problem areas. On one hand, existing loan-products had changed to a commodity product, which have to be produced cost efficient; in other words a major area for rationalization. On the other hand, new approaches to the business demanded support for customer focused product innovation and a new way to look at the relationship between financial institutions and their customers; in other words, a major area for invention.

A more profound examination of those two problem areas unveiled that they actually represent two different views on the same problem: the complexity of managing and coordinating a variety of parallel product life cycles. Since the managing process bases highly on information, i.e. gathering and distributing information, we have to manage the coordination of the processes and the respective information over time. The main information flow within an enterprise is document centered. Therefore, the coordination of processes and information over time largely incorporates the problem of managing the transformation from unstructured document centered information processing to highly structured database held information and its handling.

3. Product Life Cycles: Two Examples

Looking at money transfers, as an example, might help us to understand this transformation. The traditional way of money transfer was predominantly paper based. The customer produced a document to order and authentified the transfer. Following that, he handed over this transfer order to the bank. The bank checked the authenticity of the document, entered the transfer into their records, produced a charge notice for the originating account and a credit voucher for the beneficiary.

A more sophisticated approach was given by the introduction of forms for the documents mentioned. In this way, transfers could be processed faster because they could be handled by standard procedures with well-established processes. The next level of sophistication is the introduction of electronic forms processing. Money order forms are scanned upon arrival to the bank, important information as account numbers and amount of transfer are either entered manually or even extracted by OCR-methods. The introduction of an EDI-interface between the bank and its customers even allows an automated handling of the whole process.

If we focus on the documents throughout this 'evolution' of the money transfer process, we conclude that the representation of the data held in the documents involved gets more and more structured. Finally, it is even transformed into an electronic record. Parallel to this change, the processes get more structured and at last translated into computer programs.

Another example with a much shorter product life cycle are derivatives. Derivatives are usually constructed and calculated supported by spreadsheet calculations in order to estimate their value. This is a manual process handling highly unstructured documents. If they seem profitable, they are exposed to the market. Their handling is constantly improved (e.g. introduction of spreadsheet macros, short programs) and the documents involved are getting more structured with every refinement cycle.

At the beginning of this life cycle, production costs for this product are very high. This does not matter because customers are willing to pay the appropriate charges since there is no competition for this product. After a period of about three months, the derivatives start to become a commodity product. Therefore, their production has to be organized in a highly cost efficient way. Therefore, within the period of three months we have gone from product invention to cost efficient (rationalized) production.

It is important to notice that in both life cycles, the product remains the same, but the organization, the steps for the transactions, and the data structures changed. In addition to, this the second example shows a business opportunity that is only feasible by IT means, because the calculations for derivatives are rather complex.

4. Implications of the Close Link between Business and IT

The statements about the relationship between business, IT, and organizations as well as the two examples illustrate, that the use of IT has impacts on business **and** conversely. In consideration of this link between business and IT, we noticed two major consequences:

- IT has to fulfill the strategic business needs, and not only small isolated problem areas as it is today; i.e. it is not enough to support one version of a product and restart the development for the IT support for the next step in the product life cycle from scratch. Support for products has to be developed in a flexible way to assist the product life cycle and thus constantly improve. This is a long-term goal. In order to achieve this, IT has to be flexible enough to support the changes of the short-term business needs in the areas of organizations, processes and information and provide a coordinated information and process support.
- Business-strategies have to enclose IT strategies and to consider the business opportunities created by the availability of IT; e.g. availability of new products, speeding up product life cycles, or allow faster settlement of deals. IT is not just an add-on to the business strategy, but more likely part of the business strategy. With the use of IT, business and organizations are changed.

This has to be clarified in the business strategy by defining the role and the respective long-term goals for the IT support. If this is not done, IT can hardly fulfill the business needs.

Considering this, IT development within an enterprise is not a set of uncoordinated projects but a set of projects derived from an IT strategy which links IT with business and therefore helps to differentiate between long-term base-level development and short-term application development. When we are thinking of a better integration of documents and processes, this last point becomes crucial because otherwise uncoordinated projects create structural clashes. Therefore document and process technology are part of the long-term development. In our banking environment it is a declared goal that document and process management have to be part of the base-level architecture of IT. We think that the following problems are the major problems when trying to establish this base-level architecture:

- existing information bases (databases and document usually just handled by the file system)
- existing monolithic applications
- heterogeneous structures - changing technology
- changing business and thus, continuous development of products (product life-cycle)

Considering these impacts and the findings explained in the examples, we need a way to design a document and process support that makes a distinction between constant and variable structures. We therefore have to find the invariants of this change.

5. The Three Design Invariants

We observed that most product life cycles have invariants which are partly defined by the product. The first invariant is the deep-structure of the production process. A loan application consists of an application (or some kind of contact, in which information is exchanged, be it directly or indirectly), an approval process, and a third process in which the funds are made available to the customer. These processes are invariant to the changes of the loan product. This structure does not define when the customer and the bank actually meet the first time (if ever), or whether a formal loan application has to be filled.

We found dependencies (see Malone & Crowston 1991) to be an other invariant. Coming back to the loan granting process as an example, no corporate loan is being

paid without some kind of approval. So the approval process is a prerequisite on the third sub-process of loan granting[7].

Reconsidering the money-transfer example, helps us to identify the third invariant. The actual information (as opposed to data) never changed. A money transfer always contained information about the originator, the receiver and the amount to transfer. The physical representation changed from-free form text to EDI-records, but its information stayed the same. So information is the third invariant. It is important to know which information is relevant for the business, which information is created by the business, how the management of information has to be implemented from the business point of view and what influence time has on information.

We by no means claim that this list of invariants is exhaustive, but our experience in several projects showed, that it helped us to think about the product life cycle in this manner.

6. Conclusion

Reviewing a number of examples within our institution, we discovered that the structure of the data (the data model[8] spoken in IT terms) changed, but not the information passed throughout the process. In addition, we could see that the detailed process map changed, but not the deep structure and the dependencies within the overall process. Furthermore, we discovered a very strong dependency between the data model and the processes.

These discoveries lead us to the conclusion that the following points are central for managing the change:

- We have to find the invariants of this change, i.e. the deep structure of the process and the dependencies within the process, as well as the information handled.
- We have to build a data model and a process map according to the invariants which supports a design for change.
- These two models can not be constructed independently from each other. They are strongly coupled.

In order to ensure these points, we need a tool which not only helps us to create data models and process maps but also supports the identification of the invariants.

---

[7] For a more detailed explanation on processes and dependencies please refer to (Malone & Crowston 1991)

[8] We do not speak here about a physical data model, where the storing strategy (e.g. file system, relational database, text documents, etc.) has to be taken into account.

In addition it has to actively support change. This means it has to be capable of handling different versions of models and the transition process between them.

We also need a technology which allows a smooth transition from unstructured documents to structured data and processes. In the case of documents, this could be achieved by active documents and the use of technology similar to the Web and Java. In the case of processes we have to integrate unstructured processes, supported by groupware products, workflow management, and database-like nested-transaction management.

Literature

Malone, T. W. and Crowston, K. (1991). *Toward an interdisciplinary theory of coordination* (Technical report #120). Cambridge, MA: Massachusetts Institute of Technology, Center for Coordination Science.

Malone, T. W. *How Will You Manage in the 21st Century? From Command and Control to Cultivate and Coordinate.* MIT Center for Coordination Science, Unpublished discussion paper, May 1996