

Serie Research Memoranda

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Organizational aspects of implementing CASE-technology

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FACULTEIT DER ECONOMISCHE WETENSCHAPPEN EN ECONOMETRIE

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Abstract

A lot of research on Computer Aided Systems Engineering, CASE, is oriented toward technical solutions. In contrast, this paper discusses not technical, but organizational aspects of CASE-technology: how this technology is embedded in organizations. Based on interviews with key players in 18 companies in the Netherlands, the change management process of introducing CASE-technology is discussed from the perspectives of culture, structure and control process. It is concluded that in order to implement CASE-technology successfully, CASE should be regarded as a process of organization development (OD), i.e. a cultural change process. Aspects of structure, culture, and control all seem to influence the success of implementation of CASE-technology.

1. Introduction

CASE-technology has been the latest silver bullet in the Information Technology (IT) market. For a lot of people, it provides the barrels of gold at the end of the rainbow (see the descriptions of CASE in, for example, McClure 1989, Gane 1990, Parkinson 1991). This may explain the attention CASE-technology receives in the academic world. Most of this research is oriented towards comparison and development of tools (see Wynekoop and Conger 1991). But the market for this technology is very dynamic, and the concepts of systems development are still evolving. And just because of this dynamism and instability, issues of power and culture tend to heavily influence the success of implementing CASE; some use the potentials of CASE to promote and introduce the technology, whereas others use the instability and fact that the technology is nonproven to fight against it. In this respect, implementation of CASE-technology may be a useful indicator for implementation of Information Technology (IT) in general.

In order to fill the gap between practical experience and theory, and add to the knowledge in the area of CASE-technology, implementation aspects of CASE-

technology have been researched. The research is based on interviews at 18 organizations in the Netherlands that have implemented CASE-technology. Key figures in these organizations were asked about the state of software technology in their company, issues of culture, internal environment, external environment, traditions and implementation of CASE. For a detailed discussion we refer to Fischer (1992).

This paper is organized as follows. Section 2 discusses three concepts that may be of importance when introducing CASE-technology: culture, structure and the process of control, which is presented as a link between structure and culture. Based on these three concepts, interview research was carried out. In section 3 the results of the interview research are discussed. An overview is presented of the organizations that participated in the research, and two aspects are described that are useful to discuss the results: the *process* of the change, and the *success* of the change. Based on these aspects, the results of the interview research are discussed from the perspectives of culture, structure, and the process of control. Section 4 summarizes the results.

2. Innovation and organizational change due to information technology

In order to assess which organizational aspects play a role, if any, when implementing CASE-technology, concepts of organizational change and innovation have to be known. If CASE-technology is regarded as innovation, as is done by for example Rockart and Hofman (1992), the success of implementation of CASE-technology will depend on the extent to which an IT department is capable of introducing innovations. In this section, an overview is presented of three concepts that were used for the research: structure, culture, and control. The relation of each of these concepts to innovation in general, and to introduction of CASE-technology in specific, is discussed.

2.1. Structure and innovation

The framework of Henry Mintzberg is the most popular for describing the type of structure of an organization. In his book *The Structuring of Organizations* (Mintzberg 1979), he proposes five types of organizations. Based on the concept of power, he added two other configurations in his book *Power In and Around Organizations* (Mintzberg 1983). What results are seven types of organizations - entrepreneurial, machine, diversified, professional, innovative, missionary and political - that are described in terms of several coordinating mechanisms.

The concept of structure as described by Henry Mintzberg can be applied to IT/EDP departments. The EDP department has its own structure, its own environment and its own coordinating mechanisms, and thus can be described as a smaller organization within a larger one. In order to apply the framework of Mintzberg to the EDP department, we have to go back to the concepts that define the various structures: the characteristics of the environment and of the tasks. This leaves us with four of the seven structures: professional and machine bureaucracy, adhocracy and simple structure. Depending on the task - the technology used - and the environment, a

different structure is appropriate. For example, an environment and a technology that are both dynamic and complex should be met with ad hoc organizational responses and constant mutual adjustments, i.e. an adhocracy.

What have these structures to do with innovation? Every configuration may be characterized by a certain type of technology (Cusumano 1991). Depending on the type of technology, e.g. routine or nonroutine, an organization is capable of adopting new technologies in a fast way or not. Perrow uses four classifications of technologies (Cusumano 1991): routine, engineering, nonroutine and unit (see table 1). Organizations dealing with routine technologies encounter few exceptions and therefore face problems that, over time, become easier to analyze and solve through formal procedures and tools. Firms dealing with engineering technologies have more exceptions, but still are relatively defined and managed systematically. Craft technologies and nonroutine technologies on the other hand are very difficult to define and manage systematically.

Table I. Organizational structure and technology (Source: Cusumano, 1991)

Structure	Technology	Tasks & problems	Characteristics
Machine Bureaucracy	Routine, mass production	Few exceptions, well defined	Standardized and deskilled work, centralization, division of labour, high formalization of rules and procedures
Professional Bureaucracy	Engineering	Many exceptions, well defined	Standardized and specialized skills, decentralization, low formalization
Adhocracy	Non routine	Many exceptions, ill defined	Specialized skills but few or no organization standards, decentralization, low formalization
Simple Structure	Unit or craft	Few exceptions, ill defined	Few standardized skills, centralized authority but low formalization

Since software technology commonly has to deal with many exceptions, but relatively well defined problems, why then is not every EDP department organized as a professional bureaucracy? There are at least two reasons for this:

- sometimes one perceives the technology as having few exceptions and well defined problems, instead of many exceptions and relatively well defined problems. So, one regards the technology as routine, not as engineering. And the IT department is structured accordingly.
- as Mintzberg argues (1983) the structure is determined by task, i.e. technology, as well as environment. So, technology is not the only determinant. The environment may also determine the structure of the IT department. For the IT department, the environment is not only the outside environment of the whole organization, but the organization itself as well.

This leaves us with all except one possible structure for the IT department: the diversified form, which is typical for large multinationals, not for single departments. As discussed above, some of the remaining structures are more innovative than other structures. According to Mintzberg, the adhocracy is the most innovative structure. It is organized to be innovative, relying on teams of experts, and having a flat hierarchy. The professional bureaucracy is also innovative, but to a lesser extent because the organization is not quite flat. Not very innovative are the machine bureaucracy and the ideology. Finally, the innovativeness of the politicized organization and of the simple structure depends on the power of management. In order to successfully introduce CASE-technology, the structure of the IT organization should allow for such an innovation.

2.2. Culture and innovation

Structure seems to be an important determinant for innovativeness. But the culture of an organization might be important as well. A definition of culture is not easy to give. There is a wide variety of definitions, most of which stem from either anthropology, sociology, or psychology (Von Grumbkow 1990). From the perspective of the IT department, definitions that stem from sociology tend to be the most suitable, since these definitions view culture from the perspective of groups. For the purpose of this research the definition of Edgar Schein is chosen. Schein describes the culture of an organization - or another group - as consisting of three layers (Schein 1985):

- fundamental assumptions, which are the basic values by which every person in the group carries out its tasks;
- beliefs, which are practices that are not yet fundamental beliefs, but do some to be the correct way of performing tasks in the group;
- expressions of culture, such as stories, heros, and the way the office is organized.

As Schein argues, it is very difficult to arrive at the fundamental assumptions of a culture. One has to pass the other layers in order to arrive at them. As a consequence, research on culture is often directed at expressions of culture. For the purpose of the research on CASE-technology this is not very suitable, because expressions do not seem to give any justification whether culture has any influence on the success of implementing CASE. Therefore, a different approach is taken, in which we base ourselves on research of Sanders and Neuijen (1989). Sanders and Neuijen investigated cultures of organizations in the Netherlands and Denmark. Instead of focusing on any of the three layers of Schein, they tried to identify dimensions on which culture could be described. These dimensions describe the *type* of expressions of culture, the *type* of beliefs, as well as the *type* of basic assumptions.

Based on in-depth interviews and questionnaires, Sanders and Neuijen identified six dimensions of culture:

- process-orientation versus result-orientation;
- people-centered versus task-orientation;
- organizational-bound versus professional, i.e. bound to profession;
- open versus closed;
- tight control versus loose control;
- pragmatic versus normative.

Based on these six dimensions, it is possible to describe how the culture of an IT department influences the success of innovations as CASE-technology. For example, process-oriented companies or departments rely very much on formalization. People in this type of culture are usually risk-averse, and thus are likely to resist change, in contrast to the result-oriented culture. Task-oriented companies apply pressure to finish jobs within the required time and budget. In contrast to a people-centered culture, the task-oriented culture is not very interested in personal problems of individuals. When task-oriented companies introduce CASE-technology, the pressure will be high to complete the project within the required time, whereas people-centered companies are likely to pay attention to the impact of the technology on individual work.

What can be concluded from the discussion above is that several dimensions of culture seem to determine the degree to which an organization or department is innovative, whereas other dimensions not seem to do so. Thus, several characteristics of culture may be taken into account when implementing CASE-technology. We might even go one step further and argue that implementing CASE-technology is nothing but a process of changing the culture of the EDP department. In that case, by definition it is a form of *organization development* (OD, see for example, Burke 1982 and 1987, Bennis et. al. 1970, French and Bell 1984), a process of unfreezing, changing and freezing the IT department.

2.3. A link between culture and structure: the process of control

Structure and culture are two concepts that are not totally orthogonal. Clearly there is a relationship between these two concepts. For example, machine bureaucracies are characterized by high formalization of rules and procedures, and thus by tight control, one of the dimensions of culture. Also, because a machine bureaucracy is rather formal, it tends to be process-oriented, whereas informal organizations as adhocracies tend to be result-oriented. So, several dimensions of culture tend to reflect themselves in the structure of organizations. The relationship between culture and structure is best described by the characteristics of control that culture and structure represent. Structure describes control in terms of degree of standardization and formalization of rules and procedures. Culture describes control in terms of process-orientation, tight or loose control, pragmatic versus normative, and people-centered versus task-orientation.

In this paper, the focus of control is on internal control. Various descriptions exist of types of internal control (see, for example, Orlikowski 1991). We will rely on Hofstede (1978) to describe various types of control processes. According to Hofstede, a cybernetic philosophy is used for most management control processes. He argues that the cybernetic philosophy is based on several basic assumptions, e.g. actual accomplishment can be measured in a formal way. These assumptions subject the philosophy to severe limitations, since in most organizations one or more of these assumptions will not hold. In addition, even relatively machine-like processes, for which the assumptions are most justified, are in reality social. Hofstede arrives at two alternative philosophies. A distinction is made between routine industrial-type processes, for which a homeostatic approach seems more suitable, and non-routine, non-industrial-type processes, for which a political paradigm is recommended. In a later publication, Hofstede also identifies an 'intuitive' control process, in which objectives and outputs of processes are known, but effects of interventions are not (Hofstede 1981).

The cybernetic philosophy is comparable to the models O-I and O-II processes that Argyris and Schön (1978) identify. Model O-II can be described as a homeostatic learning process based on cybernetic principles. The homeostatic process is similar to the informal control process that Peters and Waterman (1982) identify.

To summarize, at management level a distinction can be made between:

- departments that have a formal control process, characterized by model O-I of Argyris and Schön;
- departments that have a homeostatic learning process, characterized by model O-II of Argyris and Schön;
- departments that rely on an informal, political control process;
- departments that rely on an informal, intuitive process.

Departments using an informal control process are likely to be the most innovative. These departments rely on the process of trial and error. New technology is introduced in the organization with little financial justification, but the culture will be result-oriented. Thus, a powerful pressure exists to try out new technology and achieve results with the technology. IT departments with a formal control process might not be eager to introduce new technologies as CASE, because detailed financial justification will be required.

3. Implementation of CASE-technology in the Netherlands

Based on the concepts discussed in the former section, research was carried out to assess the relevance of each of these concepts for the implementation process of CASE-technology. In this section the results of the empirical research are discussed. The results are discussed from two perspectives, the *process* of implementation and the *success* or *result* of the implementation. We start with an overview of the organizations that participated in the research.

3.1. Overview of organizations

In order to assess to what extent the aspects discussed above are important when introducing CASE-technology, over 30 interviews were carried out with key persons of 18 organizations in the Netherlands that have implemented CASE-technology. To get a representative view of implementation of CASE in the Netherlands, both large and small companies were contacted, both governmental and business organizations, in various sectors of the economy, such as banking, industry and transport. Also, different types of CASE were selected: Upper CASE as well as Lower CASE and Integrated CASE-technology¹.

Because CASE-technology is a rather new technology, the level of experience in managing and using this technology is low. Even mature or sophisticated EDP departments have very little experience with CASE. Of the companies that took part in the research, most of them had more than three years of experience with CASE-technology. Seven of them implemented Integrated CASE, two a sophisticated type of Lower CASE environment, and nine Upper CASE-technology.

Table II. Summary of characteristics of participating companies

Company	Branch	Structure	Major cultural characteristic	Type of control process	Type of CASE
A	Public	bureaucratic	tight	model I	ICASE
B	Banking	political	open	political	ICASE
C	Industry	bureaucratic	tight	intuitive	Upper
D	Banking	professional	open	model II	ICASE
E	Banking	professional	professional	model II	ICASE
F	Energy	bureaucratic	risk-avers	model I	Upper
G	Energy	bureaucratic	risk-avers	model I	Upper
H	Banking	political	professional	political	Lower
I	Banking	political	professional	model I	Lower
J	Transp.	bureaucratic	risk-avers	model I	Upper
K	Transp.	political	tight	model I	ICASE
L	Public	professional	tight	model I	Upper
M	Industry	political	professional	intuitive	ICASE
N	Industry	political	professional	intuitive	Upper
O	Transp.	professional	open	model I	Upper
P	Agricul.	professional	tight	model I	Upper
Q	Public	professional	open	model I	ICASE
R	Banking	political	tight	political	Upper

¹ Upper CASE-tools are tools that support one or two of the initial phases of development of information systems: usually analysis and design, sometimes planning. Lower CASE-tools typically support one or two of the later, 'lower' or technical, phases of information systems development: design, coding and testing. When most of the tasks of systems development, i.e. upper as well as lower, are supported by a tool, it is typically called an Integrated CASE environment. In this research, a tool is called an Integrated environment when three or more phases of systems development are supported.

The companies that participated in the research did not only differ in size and sector of economy. They also differed in characteristics of culture and structure. The concepts of culture (Sanders and Neuijen) and structure (Mintzberg, Cusumano) were used to characterize the EDP department. Of the six structures of Mintzberg three were appropriate to characterize the EDP departments: politicized environment, machine bureaucracy and professional bureaucracy. Characteristics of simple structure, adhocracy and ideology were visible, but not dominating. Seven IT departments proved themselves to be heavily politicized, five could best be described as machine bureaucracy, whereas six could be described as professional bureaucracy.

There was a wide variety of cultural characteristics of EDP departments, but most of them tended to be open, oriented towards tasks, and - what would be expected - had a strong identification with profession, not with the company itself. Of the 18 IT departments, three did have an intuitive control process. Most of the departments, ten, had a formal process, a process comparable to model O-I.

3.2. Two perspectives: process of change and result of the change

An approach to implementing change, such as introduction of CASE-technology, can at least be characterized in two ways: the *direction* of the change, and the *strategy* for change. The direction of change represents which level in the organization initiates the change, and which level the change aims at. When higher management initiates the change and directs its efforts at the system developers, we speak of a *top-down* approach to change. When system developers initiate the change, and want to convince higher management of the usefulness of change, a *bottom-up* approach takes place. A combination of directions may also take place, e.g. when management pushes the system developers to change their way of working, to use CASE-technology, but leaves it to the system developers to work out the total change process.

The other aspect of implementing changes is the *strategy*. Literature on change management strategies is numerous (see, for example, Vrakking and Cozijnsen 1986). For our research, we rely on the work of Zaltman, and Bennis (see Zaltman and Duncan 1977, Bennis et. al. 1970). Based on their work, the following strategies for change were identified:

- reeducative strategy: the effort is to 'teach' people that the required change is necessary. Usually rational arguments are used, sometimes normative.
- persuasive strategy: the effort is to persuade people to use the new technology. So not only rational or normative arguments are used, but also some force or power.
- power strategy: this strategy consists only of the use of power. Rational and normative arguments are scarcely used.

Of the three types of strategies, the reeducative and persuasive strategies were used most often by the organizations investigated (see table III). The strategies were used with different directions, although for persuasive strategies the top-down approach did seem to dominate. All power strategies did have a top-down direction of change.

Apart from characteristics of change, the research also had the objective to identify key factors for the success of the implementation process of CASE. In order to identify these factors, a measure of success of the implementation process has to be defined. Based on the interview results, it was possible to use various measures of success of implementation. One obvious measure was to relate management objectives to the actual achievements of these objectives. But such a measure is an indication of the *overall success* of CASE-technology. For our research, a measure of success of the *change management process* due to CASE was needed. Therefore, success of implementation was measured by the number of system developers that started using all the features of the CASE-environment during the time frame specified in the projectplan. If more than 50% used the tool, the process of implementation was regarded as a success.

Based on this measure of success, half of the companies were successful in introducing CASE-technology, and half of the companies were not. Other measures were applied to check differences between overall success of CASE and the success of the implementation process, but no significant differences were found.

3.3. Culture and the implementation of CASE-technology

Does implementation of CASE-technology result in a change in culture? In other words, is it a form of organization development, in which the IT department progresses from one type of culture to another? To determine if a change in culture has occurred, a comparison based on the six dimensions of culture is not enough. A change in culture can take place, but still the organization can remain in the same type of dimensions as before the change. For example, due to CASE-technology, developers may create the assumption that 'there is no way to develop information systems except by rigidly using the tool'. If the former assumption was that 'the best way to develop information systems is what everyone thinks is the best, as long as management controls it', a fundamental change in culture has taken place, but it has not changed any of the dimensions of culture. The dimensions of culture are continuums. Thus, a culture can become more open, i.e. less closed, or more closed, i.e. less open. As a consequence, these dimensions can only be used to identify dramatic changes in culture, not fundamental but subtle changes.

To assess whether a change in culture has taken place, it is better to investigate the *forces* that are used when unfreezing and freezing a culture. When these forces are apparent, a cultural change has taken place, be it with or without any awareness of it. Seven forces exist when changing a culture (for an in-depth discussion, see Sanders and Neuijen 1989, Berenschot projectteam cultuur 1988):

- *shock*, the realization that some things that are taken for granted have to be changed;
- *spirit*, there has to be a leader who acts with charisma, and who pulls everybody towards the change;
- *vision*, everybody, management as well as system developers, have a clear message what are the objectives and goals to be achieved;
- *structure*, the way in which people work, interact and communicate has to

- change;
- *success*, the change process should have some short term results, so the motivation will remain to stay along the path that was set out;
- *balance*, create confidence of the people in the required change, so that everybody feels stronger during the process of change;
- *empowerment*, visualize the results of the change process, in order to stabilize the change.

Table III. The change process due to CASE in each participating company

Company	Strategy	Direction	Number of unfreeze forces	Number of freeze forces	Success of change
A	persuasive	top-down	two	none	no
B	reeducative	bottom-up	none	none	no
C	persuasive	combined	one	none	no
D	persuasive	top-down	two	three	yes
E	persuasive	top-down	four	three	yes
F	reeducative	combined	none	none	no
G	reeducative	combined	none	none	no
H	power	top-down	three	three	yes
I	power	top-down	three	three	yes
J	reeducative	bottom-up	one	none	no
K	persuasive	top-down	three	two	yes
L	power	top-down	two	three	yes
M	reeducative	top-down	two	none	no
N	reeducative	bottom-up	one	none	no
O	persuasive	top-down	three	three	yes
P	persuasive	top-down	four	three	yes
Q	reeducative	bottom-up	two	two	yes
R	reeducative	combined	one	none	no

The first three forces occur during the stage of unfreezing, the other four forces occur during the stage of refreezing. The more forces of change exist, the more it is possible to speak of a change in culture. Normally, for a change in culture all forces mentioned above should be used at a certain point in time during the change process.

With respect to dimensions of cultures, closed cultures, as well as people-centered and risk-averse cultures, tended to be less successful in implementing CASE-technology than other cultures. The other dimensions of culture did not seem to influence the success of implementation. One very important conclusion was that the more forces of cultural change existed, the more successful the implementation of CASE-technology would be. One may conclude from this that in order to be successful, CASE-implementation should be regarded as a process of organization development, a cultural change process.

3.4. Structure of the IT organization and implementation of CASE-technology

Most professionalised organizations were successful in implementing CASE-technology, whereas most bureaucratic organizations were unsuccessful in implementation of CASE-technology. Because bureaucratic organizations usually apply a reeducative strategy, these strategies are often the least successful. In addition, since bureaucratic

IT departments are often the large IT departments, there is a negative correlation between size and success of implementation. Large projects are just more difficult to manage than small ones.

A political environment tended to successfully introduce CASE when a persuasive or power strategy was used. The explanation for this might be that in political IT departments, the success of implementation depends on the power of the initiator of change. When the initiator is very powerful, the strategy for change will often be persuasive or even a power strategy, and such a strategy is often tolerated.

3.5. Control characteristics and implementation of CASE-technology

In the former section four different types of control processes were identified: the intuitive process, the political process, the model O-I process and the model O-II process. The organizations having an intuitive control process were not successful, the ones having a double-loop learning process, model O-II, were. The success of the implementation process of CASE for the two other control processes seems to be determined by other variables than control. For these control processes, some implementations were successful, but others were not.

4. Conclusions: implications for implementation of CASE-technology

This article discussed interview research that was carried out at 18 companies to identify organizational aspects of implementation of CASE-technology. The research was carried out based on three concepts: culture, structure and the process of control. After a detailed discussion of each of these three concepts, the results of the research were presented from the perspective of these concepts. Although the sample of organizations is small, the sample is representative for the use of CASE-technology in the Netherlands. Based on the research, several conclusions could be derived with respect to the type of approach to CASE-technology used, and the success of the various approaches:

- there is a relation between the structure of the IT department and the implementation of CASE-technology. Most professional departments were successful, most bureaucratic ones were not.
- the strategy chosen for implementation is tightly linked to the structure of the IT department. Thus, there is also a relation between the strategy of change and the success of implementation of CASE. Because most bureaucratic departments used a reeducative strategy, these strategies were not successful, whereas most persuasive and power strategies were successful because they were used by either professional or political departments.
- the direction of change is mostly influenced by the type of structure of the IT department and thus to the strategy of change. Most top-down approaches do seem to be successful. There is no relation between the type of control process and the direction of the change process due to CASE.
- several characteristics of culture tend to have a negative impact on the success of implementation of CASE. Especially people-centered, risk-averse and closed

cultures have difficulty in implementing CASE-technology.

- regarding control processes on a continuum from intuitive, to political, to model O-I, to model O-II, the more the control process resembles a model O-II control process, the more successful the implementation of CASE will be.
- all three concepts of culture, structure and process of control do seem to influence the success of implementation, but no single concept totally explains the success.

Apart from the conclusions presented above, the most important conclusion of the research was that *implementation of CASE-technology was only successful when it is regarded as a process of changing the culture of the IT department, or when it is regarded as a process of organization development*. Thus, the approach and strategy of change should have taken into account several aspects of culture and structure. Note that this is something different than saying that the concept of culture is influencing the success of implementation of CASE.

The consequences of these findings are threefold:

- **implementation of CASE is not different from other technologies concerning the type of factors that play a role.** Like 3GL and 4GL technology, it is very fundamental, directly affecting the way of working in the organization. But whereas the way of working with 3GL and 4GL is in handbooks, with CASE it is in the technology itself. Thus, the impact of CASE is much more dramatic (see Orlikowski 1991).

It would be too easy to argue that CASE-technology is just another technology. CASE-technology is very different in at least one important respect: the way of working with the technology is controlled by the technology itself. And in most cases, CASE-technology even forces a way of working. Because of this, the impact of CASE-technology on the IT department is much more dramatic and fundamental than other technologies. CASE-technology has a direct effect on the way of working, on control, and thus on the culture and structure of the organization. Based on this viewpoint, it is best to compare CASE-technology to CAM, CAD and CAE, not to 3GL and 4GL. DeLisi argues that culture is the most important factor for managing IT in the '90s (see DeLisi 1991), but for some technologies it does seem more obvious than for other technologies.

To implement CASE successfully, it looks like a process of business reengineering for the IT department has to take place. CASE-technology is not just automation of the existing process; a new business process for the IT department has to be designed, just like for other business functions (see, for example, Davenport and Short 1990, Hammer 1990).

- **political and cultural aspects cannot be ignored by management when implementing CASE**

Although using power or secretly changing culture by introducing technology-toys is regarded as 'dirty', it does seem to be the only way to introduce the technology successfully. For the past few decades, system developers have relied on their expertise, and slowly developed a position of power. By automating the systems development process, CASE-technology is undermining this basis of power. So, implementation of this technology in most cases will result in a struggle for power,

the system developers not wanting to use the new technology, the management does.

The consequence is that not only the aspect of *management* is important, but as Schein describes, also the aspect of *leadership*. Leadership is different from management in that management is constantly aware of the cultural and political environment, and that the major task of management is the creating of the appropriate culture. So, leaders have to create the proper cultural environment for change. Thus, it cannot be denied that sometimes subtle management strategies are important. Examples of these strategies are technological seduction - what we will call 'seducing the fox' - and implementation in very small steps - what is often called 'boiling the frog' (see Schein 1985). Technological seduction is an approach in which management introduces technology not because the technology should make work more effective or efficient, but for a completely other reason. Boiling the frog is a strategy in which a change is carried out in small steps. Each step is of little impact on the organization, but as a whole the total change is. The same occurs when boiling a frog: if the increase in temperature is very slight, the frog will not be aware of the increase, whereas the total increase will result in a temperature increase of 100 degrees. When CASE is implemented in very small steps, resistance to it may be diminished. But this contradicts the force of 'shock' which is one of the forces of unfreezing. So, implementation of CASE might be done in small steps to reduce the initial resistance to change. After the resistance is reduced, a 'shock' may be used to allow for the necessary change in culture. If the shock does not occur, a new philosophy of development might not be realised.

In addition to political and cultural awareness, leadership requires management commitment and the careful selection of a pilot project. When a pilot project is used, it should not be too ambitious. An ambitious pilot project will make the pilot more important than the implementation of CASE, and applies pressure on the time frame of the project. Implementation of CASE takes time, and when a pilot requires a longer time frame than expected, this should not have negative impact on the efforts to implement CASE.

● **implementation of CASE-technology is often a matter of timing. By creating a very unstable situation, time not uncommonly solves a lot of resistance and problems of choice**

As described in this paper, bureaucratic organizations were all unsuccessful in implementing CASE-technology. This is not too surprising, because these organizations usually have to rely on reeducative strategies instead of on persuasive or power strategies. But reeducative strategies are not very successful, partly because system developers want to protect their basis of power, partly because groups of system developers exist that each have their own preference for specific types of technology. What remains is either to implement CASE-technology separately in each group and create interfaces between each environment, or fundamentally change the organization. A bureaucratic environment is not the most obvious environment to introduce an innovation.

But a bureaucratic organization is not the only type of organization in which CASE-implementation will be difficult. Closed cultures, risk-averse cultures and people-

centered cultures face difficulties as well. CASE-technology might be used to change these cultures, but it will take a subtle strategy, such as seducing the fox or boiling the frog.

When comparing successful and unsuccessful cases, remarkable is that successful organization often combine reorganizations with the implementation of CASE-technology, or are in such a bad situation that things have to change in order to survive. What happens is that, either deliberately or not, an unstable environment is created. As Zuiderhoudt says, a chaos should be created before a change process is started (see Zuiderhoudt 1990). Referring to the framework of Mintzberg, this results in an ad hoc organization, i.e. in a more innovative organization. By creating such instability, a need for change is created, which reduces or totally diminishes the resistance to the new technology.

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References

- Argyris, C., and Schön D.A., *Organizational Learning: A Theory Of Action Perspective*, Addison-Wesley Publishing Company, Reading, Massachusetts, 1978.
- Bennis, W.G.; Benne K.D.; and R. Chin, *The planning of change*, 2nd edition, Holt, Rinehart & Winston, London, 1970.
- Berenschot Projectteam cultuur, "Het zevenkrachten model van Berenschot", (the sevenforces model of Berenschot; in dutch), *ELAN, magazine voor directeuren en commissarissen*, December 1988.
- Bouldin, B.M., *Agents of change: managing the introduction of automated tools*, Yourdon Press, Englewood Cliffs, 1990.
- Burke, W.W., *Organization development: Principles and Practices*, Brown and Company, Boston, 1982.
- Burke, W.W., *Organization development: A Normative View*, Addison Wesley OD Series, Addison Wesley Publishing Company, Reading, Massachusetts, 1987.
- Cusumano, M., *Japan's Software Factories: A Challenge for US Management*, Oxford University Press, New York, Oxford, 1991.
- Davenport, T.H., and Short J.E., "The New Industrial Engineering: Information Technology and Business Process Redesign", *Sloan Management Review*, Summer 1990, pp. 11-27.
- DeLisi, P.S., "Lessons from Steel Axe: Culture, Technology, and Organizational Change", *Sloan Management Review*, Fall 1991, pp. 83-93.
- Fischer, S.J., and Doodeman M.P.J., *Organisatorische inbedding van CASE-technology* (Embedding CASE into organizations; in Dutch), CASE Research Group, rapport 9210, June, 1992.
- French, J.W., and C.H. Bell Jr., *Organization Development. Behavioral Science Interventions for Organization Improvement*, Prentice Hall, 1984.
- Gane, C., *Computer Aided Software Engineering*, Yourdon Press, 1990.
- Grombkow, J. von, (ed.), *Cultuur in organisaties*, (Culture in organizations; in dutch), Van Gorcum, Heerlen, 1990.
- Hammer, M., "Reengineering work don't automate, obliterate", *Harvard Business Review*, July-August 1990, pp. 104-112.
- Hofstede, G., "The poverty of the current management control philosophy", *Acadamy*

of Management Review, July 1978, pp. 450-461.

Hofstede, G., "Management control of public and not-for-profit activities", *Accounting, Organizations, and Society*, Vol. 6, No. 3, 1981, pp. 193-211.

Kusters, R.J.; Wijers G.M.; Boterenbrood, F.; Dort, E. van; Fischer, S.J.; Groenland, W. van; and Pauw, J.W., *Het gebruik van CASE-tools in Nederlands* (The use of CASE-tools in the Netherlands; in Dutch), Kluwer Bedrijfswetenschappen, 1992.

McClure, C., *CASE is software automation*, Prentice-Hall, Englewood Cliffs, NJ, 1989.

Mintzberg, H., *The Structuring of Organizations: A Synthesis of the Research*, Prentice-Hall International, Englewood Cliffs NJ, 1979.

Mintzberg, H., *Power In and Around Organization*, Prentice-Hall International, Englewood Cliffs NJ, 1983.

Orlikowski, W.J., Integrated Information Environment or Matrix of Control? The Contradictory Implications of Information Technology, *Accounting, Management and Information Technology*, Vol.1, No.1, 1991, pp. 9-42.

Parkinson, J., *Making CASE work*, Blackwell Limited Oxford, 1991.

Peters, T.J., and Waterman R.H., *In Search of Excellence: Lessons from America's Best-Run Companies*, New York, Harper & Row, 1982.

Rockart, J.F., and Hofman J.D., "Systems Delivery: Evolving New Strategies", *Sloan Management Review*, 1992, pp. 21-31.

Sanders, G., and Neuijen B., *Bedrijfscultuur: diagnose en beïnvloeding* (Corporate culture: diagnosing and influencing; in dutch), Van Gorcum/Stichting Management Studies, Assen/Maastricht, 1989.

Schein, E.H., *Organizational Culture and Leadership: A Dynamic View*, Jossey-Bass Publishers, San Francisco, Oxford, 1985.

Vrakking, W.J., and Cozijnsen A.J., *Handboek voor strategisch innoveren: een internationale balans*, (hanbook for strategic innovation: an international overview; in dutch), Kluwer, Deventer, 1986.

Wynekoop, J.L. and Conger S.A., "A Review of CASE research Methods in Information Systems Research", *The Information Systems Research Arena of the '90s*, Nissen et al ed., 1991, pp. 301-325.

Zaltman, G., and Duncan R., *Strategies for planned change*, John Wiley & sons, New York, 1977.

Zuiderhoudt, R.W.L., "Chaos and the dynamics of self-organization", *Human Systems Management*, No. 9, 1990, pp. 225-238.

Appendix A

There were several options for the research approach: case study, questionnaire, structured interview and unstructured interview. Because the problem area was relatively clear, an approach was chosen which consisted of five phases:

- conduct several unstructured interviews.
- based on the results of the unstructured interviews, define a framework that can be used for structured interviews.
- select organizations that form a representative sample of implementations of CASE in the Netherlands.
- conduct structured interviews (see table A-I).
- feedback to the interviewed persons.

The third phase, the selection process, was based on a large survey research in the Netherlands conducted by the Vrije University, SERC (Software Engineering Research Center) and the NGGO (Dutch Association of Users of Structured Methods). A detailed discussion of the results can be found in Kusters et. al. (1992). The survey was sent to 1800 companies, with a response rate of about 17%. The results provided us with characteristics of companies that had implemented CASE, such as branch, size, and type of CASE-technology. Based on these results, companies were selected and asked to participate in the interview research.

Table A-1. Framework for the structured interviews

Structured interview on organizational aspects of implementation of CASE-technology	
Section	Comments
1. General	In this section, several general characteristics of the organization were asked for, such as organizational scheme, number of employee, and function of the person interviewed.
2. IT facility	In this section, several characteristics were asked with respect to developing, maintaining, planning for and implementation of information systems were asked. This allowed us to assess the 'maturity' of the EDP department.
3. Organizational Characteristics	In this section several organizational characteristics of the EDP department were asked for:
3.1. Culture	○ the culture of the IT organization
3.2. Structure	○ the organizational structure
3.3. Internal environment	○ leadership style, power characteristics
3.4. External environment	○ characteristics of the external environment (passive, dominated, etc)
3.5. History, traditions	○ important historical issues and traditions
3.6. Technology	○ importance of technology for the company
4. Implementation of CASE-technology	specific questions regarding the way CASE was implemented, who participated in the implementation process, the type of CASE-technology, the impact on the organization, etc.