Innovation and creativity versus control (assessing the paradox in IT organizations)

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INNOVATION AND CREATIVITY VERSUS CONTROL[1]
Assessing the paradox in IT organizations

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As a result of the increasingly more turbulent environment of today IT organizations face an important problem: on the one hand they have to control their activities, which requires a certain stability, on the other hand, they need to be creative and innovative, requiring a certain amount of autonomy, which in turn may result in instability. In this paper it is shown that control and creativity/innovation do not necessarily oppose each other. A model is presented that shows how the need for control and the need for creativity/innovation can be matched. Results from empirical research on the diffusion of CASE-technology are used to support and flesh out the model.

1. Introduction

Due to changing environmental conditions, organizations have to act in other ways than they used to act. In a description of the change in strategic issues, Ansoff shows that the critical issue for organizations has changed from control to managing 'weak signals' emerging from the environment [3]. In order to survive and gain strategic advantage over other companies in the turbulent environment of today, organizations can respond to these weak signals by way of innovation. Viewed from this perspective, its seems as though organizations have moved from 'control' to 'innovation' as a guiding principle.

This change in emphasis from control to innovation has an important impact on the management of (IT) organizations [1]. Technology, especially IT, plays an important role in achieving innovations in organizations. For example, IT is often regarded as an important facilitator for business reengineering, which results in large scale innovations [11]. The pressure for organizations to innovate thus forces its IT organization to act innovative as well. This IT organization can act as a prime stimulus for innovation towards the whole organization by acting innovative itself.

However, IT organizations can not be innovative at all costs. Given the competitive environment, a high burden is placed on control as well in order for organizations to be cost efficient and to increase the predictability with which their goals and objectives can be met. When focusing on innovation, the predictability of the objectives to be attained will decrease. It is not uncommon for IT organizations to favor control over innovation. For example, the still continuing software crisis [27], and the interest in downsizing show the need for control instead of the need for innovation.

The discussion above suggests that control and innovation exclude each other, and thus form a dilemma. This paper will demonstrate that this would however be a wrong conclusion. We will show that IT organizations are not dealing with a dilemma but with a *paradox*. In case of a dilemma, an explicit choice has to be made for one of the opposite sides, in case of a paradox such a choice does not have to be made, because the two opposing sites can exist simultaneously [29]. The question is not so much 'either or', but 'to what extent': control and innovation are not excluding each other, but are different ends on the same continuum. One side of the continuum favors routinization or 'exploitation', the other side favors innovation or 'exploration' [17]. Walsham speaks of a *autonomy/control balance* [30], stressing on the one hand the need for freedom of IT personnel, which is one of the most important determinants for creativity, and thus for innovation [2], and on the other hand the need for control. The increasing need for innovation thus forces the IT organization to find a solution for the situation expressed by the innovation/control balance.

Van de Ven and Poole describe four generic methods for solving a paradox, which can be applied to the innovation/control paradox [28]: (1). live with paradox and make the best of it, (2). clarify connections between organizational levels, (3). take the role of time into account, that is, one horn of the paradox is assumed to hold at one time, and the other at a different time, and (4). advance a new conception. The first and the third method are rather straightfoward and will not be discussed. The solution for the paradox discussed in this paper is a combination of the second and the fourth method. The paper primarily uses the second method to

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solve the innovation/control paradox.

Although the paradox is visible in numerous publications in organization theory, especially such publications that relate organizations to their external environment [8,26], few attempts have been made to describe this paradox in detail. In this article a model is presented that describes the innovation/control paradox in detail, using additional concepts such as autonomy and creativity. The discussion focuses on IT organizations, although it may also be applied to organizations in general.

First, in section 2 the concepts used to describe the paradox are discussed and defined. Subsequently, the resulting model is discussed using two levels of analysis, corresponding to the second generic method to solve paradoxes. With the help of this model, we will show that the paradox is not unsolvable, because it can be broken down to an issue of matching different types of innovation/control issues at different levels of analysis. This process of matching is discussed in section 3. In section 4, based on an operationalization of the model, empirical results from a field study on implementation of CASE-technology are used to flesh out and support the model. Finally, section 5 discusses why the model that describes the innovation/control paradox can be an interesting starting point for both strategic positioning and for describing the diffusion of technology in organizations.

2. Modelling the innovation/control paradox

In order to describe the innovation/control problem as a paradox in more detail, it is necessary to define various concepts that seem to be related to this issue. These concepts are: innovation, control, autonomy and creativity. Similar to the argument of Couger and Higgins [6,7,12],we can argue that it is difficult to define these concepts in a single way. The definition of each of these concepts will usually depend on the focus of the research. In addition, some concepts, like control and autonomy, seem to have a specific meaning at different levels of analysis - micro, meso and macro level [18] - whereas other concepts seem to be more valid for one specific level of analysis - innovation focusing on macro or meso level, creativity on the individual level [2].

Thus, before defining the various concepts, we have to describe the focus of our research. The focus of our research is the IT organization or IT function, which we will define as carrying out three missions [24]: a development and maintenance mission, a services mission, and a consultation mission which links the former two missions. Based on this definition, we can discuss the set of concepts mentioned above and relate them to the levels of analysis.

Defining control

Following the second method of solving paradoxes [28], two relevant levels of analysis exist when assessing the innovation/control paradox: the level of individuals, that is, the level of IT personnel, for example systems developers, and the level of group or organization, that is, the level of the IT organization. At both these levels, control has a different focus. At the level of IT organization control can be defined as the level of certainty with which organizational objectives can be realized [20]. From this point of view, most IT organizations want to increase the level of certainty with which organizational objectives can be realized. Increasing the certainty with which objectives are realized means that tight control will have to be exercised. Consequently, at organizational level the issue is not whether control should be tight or loose, but which type of control should be used to ensure tight control.

At the individual level, control has a different focus. Following various definitions from sociology, control at this level can be defined as the degree to which the behavior of individuals, in our case IT personnel, and the activities they perform are enforced [25]. So, the focus of control at this level is on *behavior*, rather than focusing on goal realization, which is the case at the organizational level. The distinction between organizational and individual level is not enough to clearly distinguish between aspects of innovation and control. The reason for this is that at the organizational level, the focus of control is on activities, not individuals. Since activities in organizations are of various types, control, and consequently innovation can have a different impact for different types of activities. With respect to control, there often is a distinction between the management aspect and the operational aspect [4]. Although these different activities are related, several authors [13,14,25]argue that different types of control can exist at different levels in the organization.

Defining creativity, autonomy, and innovation

Given the two levels of analysis, it is easier to define the remaining concepts, that is, the concepts of creativity, autonomy, and innovation. Following Amabile [2], we restrict creativity to the individual level, and innovation to the organizational level. Note that creativity will always have a relation to some organizational activity,so although it is defined at the individual level, it can be linked to the organizational level of analysis as well. We will define creativity in a pragmatic way which means that in order for something to be creative it should be

Level/Aspect	Focus	Concepts
Organizational level Management aspect	management activities, i.e. the certainty with which objectives of the organization can be defined	innovation, control
Organizational level Operational aspect	operational activities, i.e. the certainty with which operational activities, such as systems development and information services can be realized	innovation, control
Individual level	individual behavior	creativity, control, autonomy

Table 1. Levels of analysis and their related concepts

new or unique, have value, and the task responded to should not be algorithmic, but heuristic [1] and innovation is considered as the implementation of creative idea [2].

The role of the concepts of innovation and creativity compared to the concept of control is not difficult to explain. Creativity, which emerges at the individual level, is a necessity for innovation, which emerges at the organizational level. As discussed, an important stimulus for creativity is freedom [2], that is, autonomy. Therefore, innovation usually is best suitable organizations that make use of indirect control types [21]. Consequently, innovation and creativity are not directly related to the two levels of analysis, but indirectly. At the individual level, autonomy is one of the important determinants for creativity, whereas at the organizational level, indirect control types [2,21] are important determinants for innovation.

So, there seem to be two relations, one emerging from the individual level, starting at autonomy, which may result in creativity, which in turn may result in innovation. The other relation emerges on the organizational level, starting with indirect control such as mutual adjustment. These two seem to be important determinants for innovation [21]. Combining these two relations, indirect control at the organizational level and autonomy at the individual level seemingly leads to innovation. However, this is conditional, because of two reasons: there are different types of innovations, and autonomy, creativity and innovation can be different for different types of activities.

Various authors not only describe innovations, but do make distinctions between different types of innovation as well. For example, Gluck [10] makes a distinction between incremental innovation and big-bang innovation, because he wants to trace back the determinants for what he considers the most important innovations, that is, the big-bang innovations. Speaking in terms of the organizational learning theory of Argyris and Schön [5],incremental innovations can be considered a result of single-loop learning, whereas big-bang or discontinuous innovations can be considered a result of double-loop learning [19]. The fact that authors differentiate between innovations suggests that under some conditions, one type of innovation is more likely than other types of innovations. Applying this reasoning to the innovation/control paradox, suggests that under both ends of the continuum at organizational level, that is, under both indirect and direct control, innovations may be possible. The innovations that emerge under indirect control are likely to be stronger, like a big-bang innovation. Innovation under direct control will be less strong, but not impossible, such as incremental innovation.

The second reason why the two levels can not be mapped directly 1:1 is the fact that innovations can occur for different types of activities. Earlier in this section, we made a distinction between management activities and operational activities. Since innovations can focus on different activities, innovations may focus on only one of the types of activities, for example only on the management activities or only on the operational activities. Thus, direct control may occur at one of these aspects of activities, whereas innovation may occur at the other aspect.

Given the discussion of the concepts in this section, it is possible to define a model that can be used as a starting point for operationalization of the innovation/control paradox. Figure 1 shows the resulting model, consisting of the three continua. The use of two types of activities and a distinction between either a low degree or a high degree of use of direct control results in 'pulls' or 'forces' in the organization. When there is a high degree of use of direct control, both for the management type of activities as for the operational type of activities, there is a high incentive to make use of direct supervision and standards. Consequently, there will be a pull towards 'bureaucratization', or the 'consolidation' of existing practices, resulting in incremental innovation. The opposite situation occurs when an organization has a very low degree of use of direct control for both management and operational type of activities. In this situation, the organization will make use of indirect control such as culture and mutual adjustment. Indirect control is commonly used for activities that are not routine, and in environments that are very dynamic [21]. So, this type of control is typically suited for organizations that strive for big-bang innovations, the adhocracies in the theory of Mintzberg [21].

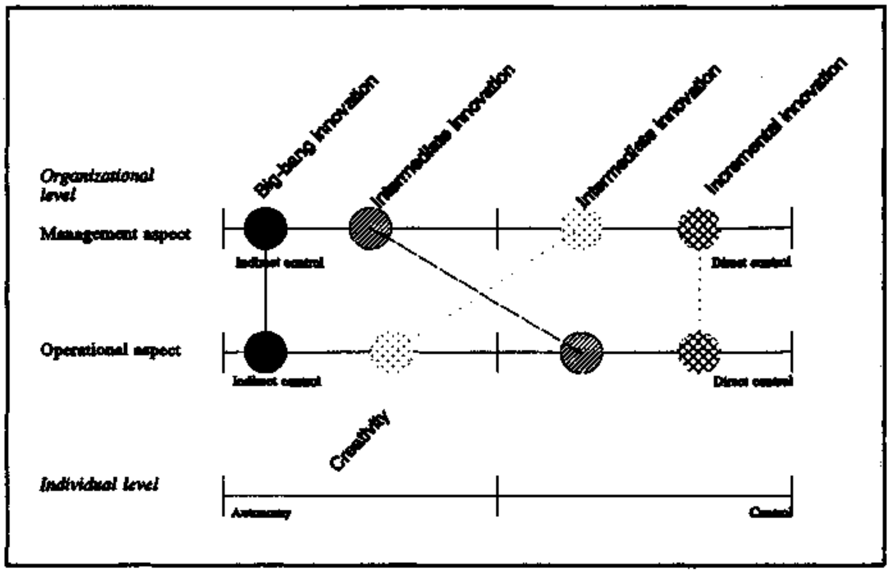

Figure 1. A model describing the paradox of innovation, creativity, and control

The two control situations discussed so far are situations in which there is a high emphasis on either one of the control types: direct or indirect control. There are however intermediate situations in which there is some use of direct control and some use of indirect control. These situations can be of two types. The first situation is characterized by a high degree of use of direct control for operational types of activities and a high degree of *in*direct control for the management types of activities. So, standardization and direct supervision are used for activities such as systems development and information services, whereas culture or mutual adjustment is used for defining the objectives of the IT organization. As Mintzberg argues [21], this situation is typical for environments that are both dynamic, where objectives are difficult to define, and simple, where activities are relatively routine. Consequently, in these situations there is a pull toward improvement in specific operational activities, for example the development of on-line information systems, and where objectives usually emerge external to the organization, similar to a softwarehouse. With respect to these specific operational activities, the IT organization will strive for routinization, thus, for incremental innovation. At the management level however, activities will be less routine, which offers the opportunity for big-bang type innovations.

The remaining intermediate situation is where there is a high degree of use of direct control for the management type of activities, for the setting of objectives and broad plans, and a high degree of use of *in*direct control for the operational activities. Again following Mintzberg, it can be argued that this situation is typical for environments that are both simple and complex [21]. The complexity of the environment, that is the complexity of the activities to be carried out, results in the use of indirect control such as culture and mutual adjustment to attain control over systems development. Because the environment is complex and rather stable, the setting of objectives and the development of long-term plans can be structured in a rather routine fashion, for example by use of direct supervision and standards. We will call this intermediate situation, as well as the former intermediate situation, both *intermediate innovation*.

3. Solving the paradox

The central notion of this article is that innovation and control do not necessarily oppose each other. In the former sections, we already reviewed some of the reasons for this notion. For example, one of the elements of the model presented in figure 1 was that the continua of direct/indirect control and autonomy/control occur at different levels and occur for different types of activities. For each of these separate continua, autonomy/control and indirect/direct control are two opposite sides. But when the different continua are combined, such a conclusion cannot be made. For some of the continua the focus may be on (direct) control, whereas for other continua the focus will be more on autonomy/indirect control.

Figure 2 provides a simple example on how the innovation/control paradox can be solved by matching different types of control. For each of the three continua, a separate decision can be made as to the level of control used. Example A shows the combination of indirect control at the management level and more direct control at the operations levels. Thus, the organization using these types of control is focusing on improvement in some specific type of IT activities. Direct control at the operational level does however not mean that control at the individual level will be strict. For example, by using software productivity tools such as CASE-technology, direct control at the operational level may be attained through the technology, leaving systems developers more time, and more autonomy, to focus on the 'creative' part of the systems development process, that is analysis and design.

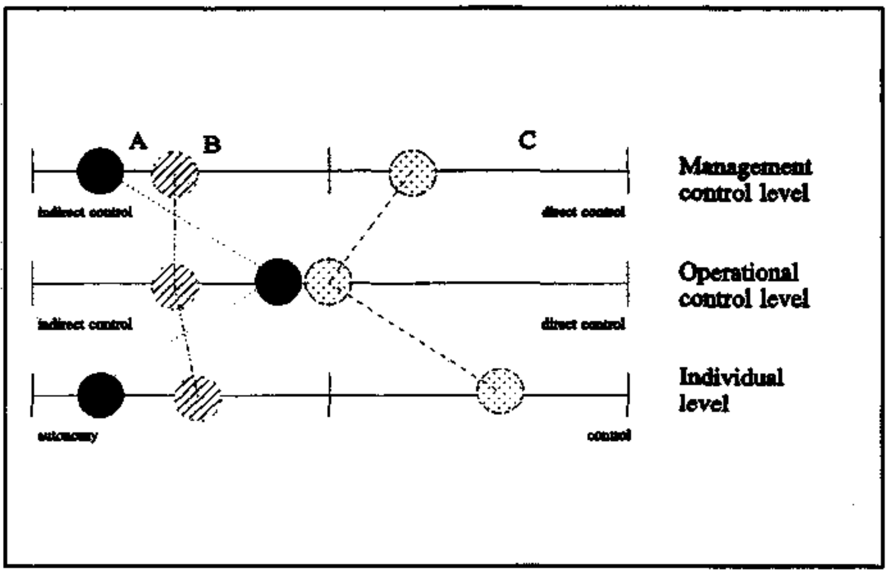

Figure 2. An example of matching control at different levels

Example A is not likely to be the most straightforward use of control, considering traditional literature on control such as [13,14,20,25]The authors do not make explicit distinctions between the individual level and the other two levels. They apparently assume that control, at least at the individual and operational level, is more or less 1:1 related, like in example B. If control at individual level is direct, there will be strict control at the individual level, and if control at the operational level is mainly indirect, at the individual level autonomy is likely to exist.

We have argued that such a rather strong 1:1 relation does however not necessarily have to exist, like example A suggested. Example C is similar to A, and shows a possible combination of types of control, in which the most direct or strict control is at the management level and at the individual level. This may for example occur in organizations that have a very strong culture, which enforces a specific kind of behavior of individuals. Such a strong culture may make the necessity for direct control at the operational level obsolete. Thus, like in example C, control at that level may be more indirect, for example through mutual adjustment.

4. Diffusion of CASE-technology as an innovation

We will use results from one part of the project, a detailed case-study research among 18 different companies in The Netherlands, to flesh out the model describing the innovation/control paradox. The case-study research made use of the structured interview technique to describe: (1) the type of IT activities carried out in the organization (based on the innovation/control model), (2) the type of culture, structure, internal environment, external environment, and history, and (3) the introduction of CASE-technology in the organization (a detailed description of the research from the perspective of CASE-technology can be found in [9]). The interviews carried out were structured according to frameworks provided in the works of [21,15,16,23,31]. These frameworks were used to operationalize the characteristics of the organizations, typically characteristics of culture and structure. Reliability of the research results was ensured by interviewing an average of two persons per organization, and by feedback of the interview results. Feedback was allowed at the end of each structured interview, after receipt of a comprehensive description of the research results, and at a feedback session two months after completion of the project. Interviews with individuals lasted typically between two and three and a half hours.

The results from the case-study research can be used both to describe that there are various ways in which control types can be matched at the different levels in the organizations, and to show how different types of innovation can take place for different combinations of control types. This is shown in tables 2 and 3. Table 2 describes the various IT organizations that participated in the research (coded from 'A' to 'R')

Company	Branch	Organizational level: control for Mgt activities	Organizational level: control for operational activities	Individual level: autonomy/control
A	Public	direct	indirect	(strong) control
B	Banking	indirect	direct	(weak) autonomy
C	Industry	indirect	indirect	(strong) control
D	Banking	direct	direct	(strong) autonomy
E	Banking	direct	direct	(strong) control
F	Energy	direct	indirect	(strong) control
G	Energy	direct	indirect	(strong) control
H	Banking	indirect	direct	(weak) autonomy
I	Banking	direct	indirect	(weak) control
J	Transport	indirect	indirect	(weak) control
K	Transport	direct	indirect	(strong) control
L	Public	direct	indirect	(strong) control
M	Industry	indirect	indirect	(strong) autonomy
N	Industry	indirect	indirect	(strong) autonomy
O	Transport	indirect	direct	(weak) autonomy
P	Agriculture	direct	indirect	(strong) control
Q	Public	direct	indirect	(strong) autonomy
R	Banking	indirect	indirect	---

Table 2. Characteristics of organizations investigated

and the types of control that were used at the organizational and individual level. Table 3 describes characteristics of the CASE-technology these IT organizations started using, along with the innovativeness of the use of CASE-technology.

In table 2 the degree of control is described for each of the levels of analysis. The autonomy/control dimension at the individual level describes the degree of standardization of individual activity, and whether individuals are capable of ignoring standards or not. The description can be made for organizational activities, resulting in a measure of control at the organizational level. From table 2 we can conclude, similar to what is concluded from theory, that it is possible to have control at individual level and have indirect control at the organizational level, for example, company C. The opposite situation is also possible, for example, company D shows a case in which direct control exists at the operational level, and autonomy at the individual level. The reasons for the existence of these situations has only partly to do with the effectiveness of the type of control chosen. The major reason is that the types of control used at the operational level, that is, the means of control used for systems development, such as standards and procedures, only partly focus on the *behavior* of systems developers. Most standards and procedures are generic, allowing much discretion for the systems developers.

Com-pany	Type of CASE	Change in IS deve-lopment (newness)	Productiv ity or quality increase (value)	Is direct control used for the activities the CASE supports (algorithmic)	Grade of creativi-ty	Major type of change for innovative use of CASE
A	ICASE	strong	no	no	+	
B	ICASE	strong	no	yes	0	
C	Upper CASE	no	no	no	0	
D	ICASE	strong	yes	yes	+	
E	ICASE	strong	yes	yes	+	
F	Upper CASE	no	no	no	0	
G	Upper CASE	no	no	no	0	
H	Lower CASE	strong	yes	no	++	design and coding
I	Lower CASE	strong	yes	no	++	design and coding
J	Upper CASE	no	no	no	0	
K	ICASE	strong	yes	no	++	planning, analysis, design
L	Upper CASE	strong	yes	no	++	analysis and design
M	ICASE	strong	yes	no	++	analysis, design and coding
N	Upper CASE	strong	no	no	+	
O	ICASE	strong	yes	yes	+	
P	Upper CASE	strong	yes	no	++	analysis and design
Q	ICASE	strong	yes	no	++	analysis and design
R	Upper CASE	no	no	no	0	

Table 3. Characteristics and 'creativeness' of use of CASE-technology

Table 3 describes various characteristics of CASE-technology that the organizations have introduced [2]. Amabile [1] gives three requirements with respect to creativity: new or uniqueness, value, and heuristic instead of algorithmic. In order for the introduction of CASE-technology to be creative, it should be a new way of carrying out systems development activities, it should be of value, and the tasks that are supported by the CASE-technology should not be heuristic. Table 3 shows how each of these three requirements is operationalized. The new or uniqueness is operationalized as whether the introduction of CASE-technology resulted in a new way of developing information systems. The introduction of CASE-technology is regarded as having a value if either the productivity or quality of systems development has been improved. In addition, in order for CASE-technology to be regarded as creative, it should not automate an algorithmic task. These three characteristics can be used to classify creativity. If CASE is new and of value, a '+'is added to the score. But if the tasks to be supported is algorithmic, a '+'is deleted from the score. The resulting scores will range from 0 to ++.

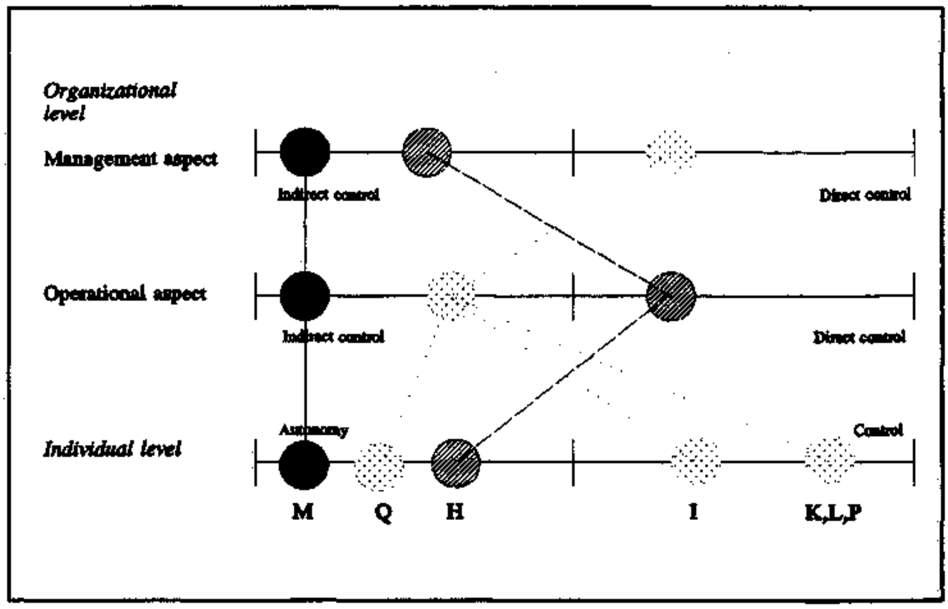

Figure 3. Matching different types of control for the most creative implementations of CASE-technology

In figure 3 the most creative implementations of CASE-technology are described based on the three continua of innovation/control, that is, the double-plus companies H, I, K, L, M, P, and Q. From this figure, and from tables 2 and 3 we can make four important conclusions that support the theory described.

First, creativity does not only occur when an IT organization relies on indirect control and autonomy. It may also occur in other situations when a 'matching' of direct control and indirect control takes place. However, when an organization completely relies on direct control at the organizational level, implementation of CASE-technology tends not to be creative.

Second, depending on the type of matching of direct and indirect control, the innovation that results from the implementation of CASE-technology tends to have a different character. When an organization relies on indirect control for both the management aspect and the operational aspect, the innovation tends to have the greatest impact, like a big-bang innovation, having an impact on most of the phases of the systems development process.

Third, in situations where the amount of innovations is very high - the combination of indirect control for the management aspect and operational aspect, and the combination of direct control for the management aspect and indirect control for the operational aspect - there is a large difference in the degree of creativity of individual implementations. This suggests that these situations are very volatile.

Finally, based on different combinations of indirect and direct control, three broad clusters of companies can be identified, <I,K,L,P,Q>, <M>and <H>.Companies I, K, L, P, and Q all focus mainly on analysis and design aspects, whereas M focuses on all phases of systems development and H mainly design and coding aspects. Not only does this suggest that different combinations of control result in different types of innovation, there is also a bias in the innovations on the 'earlier' phases of systems development, that is, analysis and design. The technical features of CASE-technology may be a reason for this. The design and implementation phases are often less supported in CASE-technology than the analysis phase.

5. Conclusions

This paper discussed one of the critical choices that organizations, specifically IT organizations, face due to the rapidly changing environment: the choice between control on the one hand and innovation and creativity on the other hand. The choice between these issues suggests a dilemma. However, this paper argued that organizations do not need to make an explicit choice for either control or either innovation and creativity. It was shown that the need for control, innovation and creativity can be matched, by taking into account different levels of analysis, that is, organizational level and individual level, and different types of activities,that is, management activities and operational activities. The process of matching was illustrated using empirical data on the implementation of CASE-technology in IT organizations.

Three major conclusions can be derived. Firstly, up till now, control, creativity, and innovation have been relatively separate camps, both in academics and practice. Each of these concepts is the focus in different fields of research. However, with the increasing importance of matching of control, innovation, and creativity, the need for a synthesis of these different research fields is high.

Secondly, there is a need for thoroughly describing the process of matching, in other words, to arrive at some operationalization of the process of matching. One possible starting point for operationalization is through *control mechanisms*, a concept which was not discussed in this article. A control mechanism describes the type of control exercised by an organization, and can be either direct or indirect - whether the type of control is specifically meant for control - and internal or external to the organization. So, culture, technology, standards and direct supervision are all control mechanisms. A classification of control mechanisms would be one of the first requirements to arrive at a proper operationalization of the process of matching.

Thirdly, it is important to note the role that technology and culture may play in the future. Both culture and technology are control mechanisms, and are very well suited for the process of matching because they allow the continua at organizational and individual level to be reversed. Culture or technology can attain direct control at the organizational level and, at the same time, autonomy at the individual level.

Based on the conclusions, two interesting implications of the model described in this paper come to mind. One implication is the use of the model to arrive at a strategic positioning of the IT organizations. The model allows management to become aware of the role IT should play for the organization, that is, to what extend the IT organization should be innovative, and to what extend it should strive for control or routinization. The second possible implication of the model is to describe the diffusion of IT in the IT organization, especially the impact it will have on the organization in terms of control and innovation. Since IT can be regarded as a control mechanism, it is likely to have an impact on the continua at both the individual and organizational level. Thus, with the help of the model it is possible to describe the impact IT has on control, creativity, and innovation, and thus whether IT is in line with the strategic positioning of the IT organization.

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Endnotes

1. In this paper the focus is on IT organizations. However, the discussion in this paper is also applicable to organizations in general. IT organization in this paper is defined as any information systems functional area in an organization. It typically performs three functions [24]: systems development and maintenance, resource administration, and information services.
2. A distinction is made between Upper CASE, Lower CASE and ICASE. Upper CASE-tools are tools that support one or two 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, such a tool is typically called an integrated CASE environment (ICASE). In this research, a tool is called ICASE when three or more phases of systems development are supported.

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