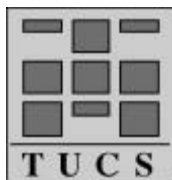# Linking Personalization of Information System to Managerial Productivity

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Abstract

The paper studies the relationship between information technology (IT) and managerial productivity. Temporal dimensions constitute an important part of the individual perception of productivity. To study the impact of IT on the temporal dimensions of managerial work we conduct a descriptive study. An analysis of the obtained results indicated a significant difference between the impact of IT on the productivity of senior and middle managers. This observation confirmed the fact that the IT support of ill-structured tasks – tasks that constitute a significant part of senior managers' work – has yet to be improved. While the work of middle managers is greatly influenced by organizational processes, the work of senior managers is influenced by such a factor as their personality. Personal preferences are neglected in current practice of IS development – a fact that weakens the positive impact of IT on the productivity of managers. In our paper we propose an approach to the development of IS that takes into account a manager's personality type and preferences. The approach is based on an understanding and modeling of managerial activities and an elicitation of requirements imposed by different personality types on the support systems for managers.

Keywords : productivity, information technology, personalization

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1. Introduction

The rapid introduction of information technology (IT) in the business environment has raised the question of its impact on managerial productivity. The understanding of the notion of productivity differs depending on the knowledge domain: it varies from "hard", quantitative measures expressed in monetary units aggregated on a national and organizational level (Barua et al., 1995; Mahmood and Mann, 1993; Brynjolfsson, 1993) to "soft", subjective judgments expressed on an individual and group level (Sheffield and Gallupe, 1995). We base our analysis on the subjective judgments of managerial productivity since considering productivity only from an investment perspective brings a good understanding of economic trends, but relatively few insights into how IT affects the nature of managerial work.

As an alternative to traditional methods of evaluation the impact of IT on the productivity of managerial work, we propose to study the relationships between IT and the productivity of managerial work by using temporal dimensions. The temporal dimensions have been validated and used as research instruments in other research fields, i.e. in behavioral research (Schriber and Gutek, 1987), managerial psychology (Benabou, 1999) and anthropology (Hall, 1976).

Speed and reduced delays are among the main tangible benefits that we try to achieve through implementation of IT. Also, recent management concepts such as Business Process Reengineering (BPR) and Knowledge Management (KM) promote the use of IT as an enabler to speed up processes, to allow multi-tasking, and to share information and knowledge much faster. There is numerous evidence of increasing productivity due to IT implementation, particularly in well-structured operational processes (see e.g. Jelassi, 1994). However, while operational efficiency benefits straightforwardly from time reduction, more complex tasks, such as knowledge-intensive activities, require a more systematic study and a more sophisticated analysis (Drucker, 1999).

This observation has been confirmed by descriptive study conducted among 32 Finnish companies (Kvassov and Tétard, 2001). In this study time and temporal dimensions were used as representations of organizational processes and managerial activities. The study showed that middle managers perceive IT as a significant leverage of their productivity. At the same time, senior managers estimate the impact of IT on their work rather pessimistically. The work of senior managers is influenced by intangible factors, such as their personalities (Cotté and Rathneshwar, 1999). There are numerous examples in the field of management to demonstrate the impact of a manager's personality type on various aspects of managerial work (cf. Maccoby, 1999, Mintzberg, 1994). Therefore, to increase productivity of senior managers IT support should be built to take into account their personality.

In our paper we make an attempt to work out an approach to the development of information systems (IS) that takes into account a manager's personality type and preferences. The approach is based on the understanding and modeling of managerial activities and an elicitation of requirements, which the different personality types of managers impose on support systems. We use Mintzberg's taxonomy of managerial

roles (Mintzberg, 1973) to define actions to be supported by a system. According to Jung's theory (Jung, 1971), the way an individual performs actions depends on his/her personality type. We want to establish a connection between categories of personal preferences and actions, which are implied by managerial roles. Such a connection allows us to identify requirements imposed by different personality types and preferences on the design of information systems.

Traditionally, personal preferences are taken into account when designing human-computer interfaces. We go beyond the surface issues of the human-computer interface and explore the advances in IT, which are able to meet a manager's personal requirements. A lot of discussion has been devoted to the role of perceptual and intellectual characteristics in the field of information systems, more specifically decision support systems (e.g., Huber, 1983, Robey, 1983). More recent research on this topic established a relationship between the usage of IS, time pressure, personality and the performance of managers (van Bruggen et al., 1998). We continue the study of this topic and argue that by applying our approach it is possible to design an IS, which has the potential to improve managerial productivity.

We proceed as follows: in section 2 we present Mintzberg's taxonomy of managerial roles together with some temporal dimensions of managerial work. In section 3 we elaborate on the definitions of productivity and present our descriptive study of the impact of IT on managerial productivity. In section 4 we discuss the theory of personality types theory and its connection to managerial work, and motivate a personalization of IS to enhance the productivity of managers. Finally, we conclude by discussing the proposed ideas in concluding remarks.

2. Managerial work

Mintzberg proposes to remove the role of management from rational actions in a predictive environment and identifies a set of roles, which are common to the work of all managers. In this taxonomy the managerial roles are divided in three categories:

- informational roles, which encompass activities related to gathering, transmitting and dissemination of information;
- interpersonal roles, which refer to activities that requires personal communication;
- decisional roles, which address such issues as the allocation of resources, initiating the change and other forms of decision-making.

The taxonomy has proven its worth in studies of managerial work in general (Kotter 1999; Kurke and Aldrich 1983). Recently, it was also applied to study the impact of information technology on the nature of managerial work (Pinsonneault and Rivard, 1998). Revisiting the premises of the taxonomy demonstrated that the nature of managerial work did not change over time (Mintzberg, 1991).

The extent and the content of the roles played by a manager depend both on the level and function of management and the specific organizational context. As the next step, we will consider temporal dimensions of managerial work—norms about time, that are important in evaluating the performance of managerial roles and also helps in identifying the requirements to design an effective IT support.

2.1. Temporal dimensions of managerial work

The role of the temporal dimensions of work has attracted growing attention in the last decade. An extensive study by Schriber and Gutek (1987) has shown an intrinsic presence of the temporal dimensions in organizational culture. The dimensions that constitute the set vary depending on the perspective and the level of elaboration (compare for instance Zerubavel (1981), Schriber and Gutek (1987) and Benabou (1999)). In our study we investigate the following dimensions of managerial work:

- *schedules and deadlines* are the time limits by which work has to be done. A more detailed level of analysis of this dimension includes studies of how the deadlines are met and the *pace* of work (Lee and Liebenau, 2000);
- *work overload* is the inability to achieve goals within a defined time frame. This dimension can be investigated in depth by considering (i) work constraints defining the number of activities that have to be completed within a certain amount of time, and (ii) allocation of time – the amount of time, whether planned or actually expended on an activity;
- *autonomy of time use* represents the degree to which people have control over their own time planning and its actual use;
- *co-ordination and synchronization* assume a specific ordering of activities, in particular when several people are involved;

Time and temporal dimensions are essential factors for the concept of productivity. In the next section, we will discuss the concept of productivity and more specifically, the personal productivity of managers.

3. Personal productivity and information technology

In the contemporary economy, information technology is viewed as a key leverage to improve productivity. There has been a lot of effort made to deliver evidence of the relationship between IT and productivity. The studies of the impact of IT typically focus on an industry or organization level. Most of them have concentrated on quantitative measures, such as investments, aiming to provide "hard" empirical evidence of the economic impact of IT on productivity (Banker and Kauffman, 1988).

Such an approach provides us with a comprehensive view of the general trends in the economy and the influence of IT. However, it brings relatively few insights in how information technology affects productivity through the change of work processes. In attempts to resolve the productivity paradox (which states that investments in IT do not improve productivity) researchers provide different explanations such as possible mismeasurements of inputs and outputs, lags due to learning and adjustment, the redistribution and dissipation of profits, IT mismanagement (Brynjolfsson, 1993) and a lack of adequate productivity metrics (Due, 1994). Organizations pursue their goals by means of processes, which are conducted by motivated people. IT support provided to employees is intended to increase overall organizational productivity by improving the performance of individuals. Information technology can be used to change and improve business processes, to enhance psychological contracts of employees, expectations, and to develop motivation and productivity. According to Chan (2000), to understand the value of IT on an individual or a group level, qualitative, subjective measures are required.

There are several approaches to measure productivity on the individual level:
- *efficiency*: find out if and how IT speeds up processes and activities, and if IT saves efforts spent on them;
- *effectiveness:* find out if and how IT may alter the means of achieving desired goals by extending the scope, depth and quality of performed activities and/or by providing the means for carrying out activities, which would be impossible without IT (Zeleny, 1997);
- *expansion of limits:* find out how IT allows us to expand or conserve the limited time and attention that an individual can devote to activities (Davis et al. 1999).

Some authors argue that it is more appropriate to examine the relationship between IT and the nature of work (Pinsonneault and Rivard, 1998). The reason for such a view is that productivity improvement can be one of several objectives pursued by IT investments: other complementary goals include quality, the increase of flexibility, responsiveness, and/or operational efficiency. To our knowledge, there is no single theory that would encompasses all the concepts – information technology, the temporal dimensions of managerial work and productivity all together To get a better insight into the relationship between these concepts we carry out a descriptive study, which we present in more detail in the next section.

3.1 Empirical study of impact of IT on productivity

In this paper we focus on managerial work and the impact of IT on managerial productivity. To evaluate the impact we have conducted a descriptive study. The survey covered 32 Finnish organizations of different sizes belonging to both private and public sectors.

By using temporal dimensions as a common "denominator" in our study, we assess how (i) IT impacts on the temporal dimensions of managerial work, and in their turn, (ii) how temporal dimensions impact on subjectively perceived productivity. We also explore how temporal dimensions mediate between IT and perceived productivity and make an attempt to identify a direct relationship between the impacts of IT and productivity.

Data collection was operated through a mail questionnaire. The questionnaire consists of the following parts: demographics, the use of office and advanced IT, impact of IT on temporal dimensions of managerial work and the impact of temporal dimensions on productivity of managers.

In this study design IT includes technologies that are available to managers when carrying out their daily activities. These technologies include communications systems and desktop information systems. The more advanced systems include decision support systems and enterprise resource planning systems.

The impact of IT on temporal dimensions of managerial work is assessed as how the respondent perceived impact of IT on five temporal dimensions within three managerial roles (as defined in Mintzberg's taxonomy). Originally Schriber and Gutek (1987) presented 14 temporal dimensions. In our study we have used only five dimensions (schedules and deadlines, autonomy of time use, coordination, allocation of time, and pace), which are essential to managerial work and probably the easiest to handle by the respondents of our questionnaire. This also allows us to reduce the complexity of the analysis. In a similar manner we assess the impact of temporal dimensions on the

productivity of managerial work. Questions are answered on a 5-point Likert-scale ranging from "Never" (1) to "Always" (5).

Results of the study

The response rate for the questionnaire was 18.6%. Such a relatively low rate can be explained by the way of distribution of the questionnaire—10 per company, independently of the company size. The responses are distributed between senior (34%) and middle (66%) managers. The respondents belong respectively to small (33%), medium (42%) and large (25%) companies.

Demographics

From the demographics section of the questionnaire we can compare the results with age, *education, level in the organizational hierarchy and IT usage*. The responses are distributed between senior (34%) and middle (66%) managers. The respondents belonged to small (33%), medium (42%) and large (25%) companies respectively.

Education vs. Position

The majority of managers have M.Sc. (63%) and Ph.D. (17%) degrees. Some 90% of managers who have a Ph.D. are in a senior management position, while 80% of M.Sc. managers belong to middle management.

Position vs. IT usage

Middle managers made greater (40%) use of IT than senior ones (12%). This is consistent with the rest of our data: 76% of senior and 55% of middle managers showed *moderate or low* IT usage. A similar relation exists between the level of education and IT usage. From these results, we can reasonably assume that the role of IT in the work of middle managers is more significant. We can also suggest that senior managers are low IT users because their support staff carries out IT-based tasks.

We disaggregated IT usage for further analysis. Within the unit of analysis "IT usage" we found that the vast majority of managers use applications such as email: over 55% of managers exchange over 10 emails per day. However, more sophisticated tools do not enjoy the high usage. Only a half of the respondents use DSS, and only 34% of them DSS use it. The similar situation with ERP: only one third of overall population has it and less than half of them use it regularly. These data can be interpreted in the light of the fact that over 70% of respondents belong to small and medium-sized organizations, where using ERP is inappropriate. Typically ERP systems (such as e.g. SAP R/3, BAAN) operate with large amounts of data and require substantial financial resources for system deployment and consultancy. Compared with ERP, web-based systems that are quite compact, flexible and affordable are used more intensively – over 65% of respondents use web-based systems more than five times a day for communications.

We also found that managers with a higher education tend to prioritize task completion and longer working hours over following strict schedules and meeting deadlines. Analysis of the temporal dimensions against the position of the managers indicate that

senior managers have more organized work settings that allow them to stick to schedules and meet deadlines (31% of senior managers vs. 15% of middle managers), maintain autonomy (37% vs. 16%) and allocate their time better (70% vs. 45%). Middle managers are more pressured to stick to schedules, meet deadlines and have less autonomy; therefore they demonstrate a higher capability to do several activities at once.

Temporal profile vs. position of managers
The temporal profile defines individual preferences either for carrying out several activities at once (polychronicity) or for sticking to one activity at a time (monochronicity). Analysis of this dimension has a certain limitation, i.e. the temporal profile of a manager is influenced not only by individual preferences in carrying out the work but also by organizational processes and organizational structure. Therefore it is rather difficult to draw definitive conclusions result and to point out the cause of managers' behavior. However, cross tabulation of polychronic/monochromic behavior against the level of the manager in a company hierarchy brings additional insight into the nature of managerial work. Both senior managers and middle managers reported having to cope with many things at once (88.2%) and (90.9%) correspondingly. Even though most managers claim to have their working day planned (70.6% of seniors and 45.5 of middle managers) the overwhelming majority of managers report disruptions in their work by some unexpected event – (93.8%) for senior managers and (93.9%) for middle managers. In that sense these results are consistent with the view of managerial work as a process that is characterized by hectic pace and interruptions that interfere with deliberately selected goals and objectives. From this analysis we come to the conclusion that managerial work is neither a completely planned set of actions that is followed rigidly nor a pure reaction on external events. Managers do have plans but they have to cope with various events that prevent completion of their plans.
We used time and temporal dimensions as the denominator for organizational processes and managerial activities. The study showed that middle managers perceive IT as a significant leverage of their productivity. At the same time, senior managers estimate the impact of IT on their work rather pessimistically. This fact can be explained by comparing the nature of work of middle level and senior managers. The work of middle managers is to a great extent defined by the requirements of organizational processes. Hence the temporal dimensions of their work are predefined by the structure of organizational processes. In contrast, the work of senior managers is ill structured and is influenced by such intangible factors as their personal preferences. Therefore, to increase the productivity of senior managers, the development and building of IT support should take into account their personality. In the next section we will discuss an approach to the personalization of IS.

4. Personality in IS

4.1. Motivation of personalization

Managerial roles imply a variety of activities. Obviously, there are only a few managers that are equally good at performing all of them. Therefore, IS support should help managers to take advantage of their strong capabilities and to mitigate their weak

points. The strong and weak points of managers are the reflections of their personal preferences. Activities, which are not personally preferred, tend to be delayed or even ignored. This will potentially cause the overall managerial productivity to deteriorate. Therefore, while identifying manager's personality type we also define a set of activities, which tend to be poorly performed. An IS, which is adjusted to support that particular manager, would potentially improve or enable the performance of those activities, which would increase a manager's effectiveness. On the other hand, by augmenting a manager's preferred activities we improve the manager's performance and increase his/her efficiency.

Usually requirements imposed on an IS are derived from the organizational processes, which the system is intended to support. Such an approach implies discarding the influence of a manager's personality type from the system requirements. The consequences of such an approach are obvious: the managers who get a system, which corresponds to their personal preferences are likely to benefit from using that system; the others, whose personality mismatch the way the system provides support, get annoyed and distracted. As a result, they tend to disregard the system and the support they can get or will use it ineffectively. Therefore, the same IS can enhance the performance of one type of managers and have little or no impact on the performance of others.

These observations lead us to the following conclusion: the way in which a manager performs his work is influenced by the manager's personality type and the degree of support an IS can provide for carrying out managerial activities. In our previous work (Kvassov, 2001) we proposed to work out the impact of personality in the system requirements as shown in Fig 1. The personality preferences define the design alternatives of system components. Such an approach gives the manager the possibility to choose the implementation alternative, which is best suited to his personality type.
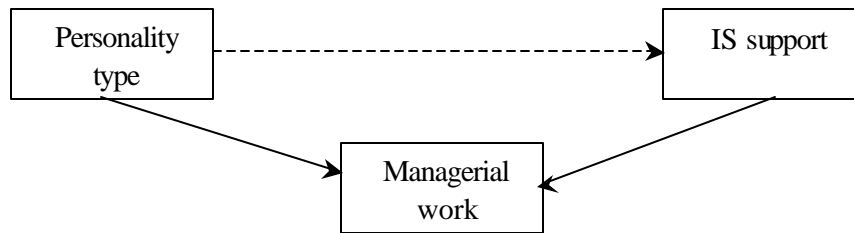

Figure 1. The design of a personalized IS

The use of a personalized IS should start from an identification of the user's personality type. By establishing a "psychological profile" of its potential user the system would be configured to meet the user's preferences. A similar approach has been taken by Naas et. al (1995). It was established that the social psychological rule called the "law of attraction" (Byrne and Nelson, 1965) also applies to computers. It means that people prefer to interact with computers that share their personality type (Nass et.al 1995). Nass et. al conducted a set of experiments during which they identified the personality preference (domination/submission) of IS users and implemented a dominating/submissive behavior in the design of the IS interface. They discovered that even the simplest implementation of personality type behavior had a significant impact on the effectiveness of human-computer interaction. In a later study (Moon and Nass,

1996) the concept of system adaptivity has been studied. It was established that individuals are more attracted to systems that change from being dissimilar to being similar in personality type over time.

Since the tasks to be solved by managers are complex and ill-structured it might be insufficient to consider only one category of preferences, i.e. domination/submission when implementing the approach by Nass et.al. We argue that for the effective support of managerial work through personalization a more elaborate approach to personal preferences is required.

Therefore, to develop such an approach to the personalization of IS we need to solve two tasks: 1) to find a taxonomy of personal preferences that on one hand is sophisticated enough to identify adequately a manager's personal preferences, and on the other hand can be computerized, i.e., it will allow an identification of personality type through a well-structured questionnaire; 2) to define the requirements on the IS based on personal preferences and to describe corresponding design and implementation alternatives.

To solve the first task – designing the introductory session during which the manager's preferences are classified – we will next discuss the theory of personality types by Jung and its operationalized counterpart – the Myers-Briggs Type Indicator.

4.2 Personality theory and MBTI for Information System Development

The personality type theory is founded upon the work of Jung (Jung, 1971). Jung proposed a theory of psychological types in 1921, asserting that any individual is either extraverted or introverted in orientation, and prefers one way of perceiving (sensing or intuition) and one way of judging or deciding on actions (thinking or feeling). According to the theory, the ways by which a person interacts internally and externally — his or her personal preferences – are limited. Jung established three major pairs of categories of the preferences that constitute a personality:

- sensing/intuition – what *information* a person perceives;
- thinking/feeling – how a person makes a *decision*;
- extroversion/introversion –preferences in *interaction,* a person may concentrate either on an inner or an external world;

To these pairs Myers and Briggs added the fourth pair (Myers, 1980)

- perceiving/judging – how a person prefers to rule his/her life *(life style)*

The last category was added by Briggs and Myers-Briggs (Myers, 1980). Of the four categories of preferences, the sensing-intuition preference reveals the differences in the basic learning style while the thinking-feeling dimension shows a pattern of commitments and values and the judging-perceiving dimension shows work habits (Schultz, 1985). Briggs and Myers-Briggs have developed an instrument that would reveal individual types, the Myers-Briggs Type Indicator (MBTI). This is an operational instrument to identify personal preferences within four categories. It has also been tested in the organizational context (Hirsh, 1985, Hirsh and Kummerow, 1987). Recently, there has been an increasing interest in using personality factors as predictors of job performance (Barrick and Mount 1993, Bradley and Herbert, 1997). Bradley and Herbert, for example, applied personality theory to predict the performance of a team based on the personality types of the team members.

A careful examination of individual preferences and Mintzberg's taxonomy of managerial roles shows that the preference dimension, which is essential in personality

type definitions, is also essential for specific types of managerial activities. This correspondence is illustrated in Table 1.

MBTI dimension	Managerial role
Extroversion/introversion: Preference in communications and interactions	*Interpersonal:* Represents the organization legally and socially outside the organization Maintains a personal network in order to gain information Responsible for directing, encouraging and motivating employees
Sensing/intuition: Preference in the way of collecting information	*Informational:* Scans and collects information to identify trends within and outside the organization Diffuses information, both factual and interpretative, into the organization Transmits information about the organization to outside people in order to keep them informed
Thinking/Feeling: Preference in making judgments and taking decisions	*Decisional:* Plans and initiates changes and tries to improve work by adjusting it to the work environment Manages external pressure, resolves conflicts, handles interruptions Makes decisions on where the organization will use its resources (money, manpower, material etc.) Negotiates both within (with peers) and outside an organization
Perceiving/Judging Preference in working style and habits, particularly with respect to time planning	Temporal dimensions of managerial work

Table 1. The personality preferences and managerial work.

In the next paragraphs we will justify and elaborate on the links established between the activities of managerial role and personal preferences.

- The sensing/intuition category and the role of information in management:

The sensing/intuition category defines the collection of personal information. Sensing individuals have better capabilities to work with detailed, precise and factual data. In contrast, intuition-driven individuals have a better vision of the whole picture, concepts or frameworks and constantly bring new hypothetical possibilities into consideration.
The cognitive limitations imposed by the sensing/intuition category of preferences influence the managerial work in the part, which is focused on gathering, monitoring and dissemination of the information. The preferences in perceiving the information define how effectively a manager processes information.

- The thinking/feeling category and the role of managerial decision making:

According to Jung's theory an individual is predisposed to make decisions according to a dominating preference: either thinking or feeling. Thinking individuals tend to use a logical, analytical process that leads them to rational judgments or decisions. The process of making decisions is impersonal and includes a logical evaluation of several alternatives. The opposite type - feeling individuals- focus on making decisions based on social and subjective values. The personal beliefs are the driving force in making a decision, which can be illogical and inconsistent.

Decision-making constitutes an essential part of the decisional roles of a manager. The managers that are driven by specific preferences (impersonal vs. subjective judgment) perform the decisional roles in a different manner and they are, therefore, likely to come up with quite different decisions.

- The extroversion/introversion category and the role of managing people:

This category identifies how a person is directed toward the outside world: introverts direct their interest inwards, towards their own thoughts, concepts and ideas. Extroverts prefer the outside world of people and events.

Obviously, the extroversion/introversion category of personal preferences is related to the communicating capabilities of an individual. Therefore, the managers' orientation influences how effectively he/she performs interpersonal roles, i.e. communicating and maintaining personal networks. An introvert manager needs some reflection time to react on external events and to communicate. In contrast, an extrovert manager reacts on events promptly and willingly initiates communication. We can, with some reason, assume that an extrovert individual is more communicative in such things as conflict resolution, and the bringing existing problems to the attention of people.

- The perceiving/judging category and the temporal dimensions of managerial work

This category is related to the three previous categories and depicts how a person prefers to rule his/her life (life style). In the social context of an organization life style becomes essentially a *working style* (Schultz, 1985). The judging preference relates to the inclination of individuals to have the most of their activities planned. In contrast, perceiving individuals prefer a spontaneous and adaptable life. The distinctive preference of perceivers is that while making a judgment they prefer to stay open minded to several alternatives rather than to stick to one of them.

In the organizational context the individual's preferences regarding the life style are reflected in his/her working style. In our paper we relate the perceiving/judging category of personality preferences to the temporal dimensions of managerial work described in section 1. Therefore, from personal perceiving/judging preferences we can identify the manager's type of temporal behavior as presented in Table 2.

Temporal dimension	Judging	Perceiving
schedules and deadlines	- the activity is always planned according to the long- and short-term deadlines - deadlines are firm - time is under control and is managed as a resource	- the activity is not planned in advance, spontaneous - flexible deadlines - focus on achieving the goal rather than on the time use
work overload	- coping with work overload by accurate planning and setting deadlines - managing work constraints by maximizing control over the timing of activities	- work overload is dealt with by quick adaptability to changes - managing work constraints by adapting, solving problems ad hoc and rushing to satisfy unavoidable deadlines
autonomy of time use	- successfully restricting external influence on one's own planning	- the autonomy of planning is influenced by others
co-ordination and synchronization	- prefers to be scheduled	- prefers to be spontaneous

Table 2. Working style and temporal dimensions

For an IS to be used effectively by managers there must be a cognitive fit between technology and task, and between individual characteristics and the technology (Hubona and Geitz, 1997). By choosing the extroversion/introversion category of personal preferences, we will illustrate possible alternatives for implementing support for interpersonal roles. A personalized IS would increase the efficiency of extravert managers by providing new ways of communication and increases the effectiveness of introvert managers by enabling them to maintain personal networks. From this description we can derive a number of requirements for an IS as follows:
Introvert:
- support for reflection on ideas rather than communicating with others;
- eliminating or assigning a low priority to social contacts, which are perceived as destructive interruptions of purposeful actions;
- supporting of the communication that allows the user to contemplate (e.g., off-line communication, that gives time for reflection, rather than online, which requires to reactions prompt);
- while communicating the introvert individuals tend to suppress their comments, hence there is a need to support impersonal forms of expression.

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Extrovert:
- supporting interaction with people (e.g., groupware);
- supporting brainstorming activities in meetings;
- supporting and maintaining multiple personal contacts;
- supporting forms of communication that target a broader audience by means of new media (e.g., video conferencing, instant messaging)

There are many technologies that can implement the requirements identified above. In general, for an introvert manager the system would "protect" its user from prompt reactions by employing an "off-line" style of communication (e.g., e-mail). As an opposite, for an extravert manager the system would simulate interpersonal, prompt communication by using an "on-line" style of communication (e.g., groupware, video conferencing). The design alternative for the other categories of personal preferences and the corresponding managerial roles can be defined in a similar manner (Kvassov, 2001).

Conclusions

In this paper we have analyzed the relation between the productivity of managerial work and IT. The analysis is based on a descriptive study conducted in 32 Finnish companies. The results of the study stimulated our interest to find additional ways to improve managerial productivity. The descriptive study attempted to explore the relationships between the use of office information technology, managerial work and temporal dimensions. This study had several limitations: i) the size of the sample was insufficient for generalization and substantial conclusions ii) we used perceptual rather than objective measures of the impact of IT on managerial productivity. However, our results give us some insight in the perception of the role of IT in managerial work, and, more specifically, the change in the temporal settings of work influenced by IT.

The study identified the following problem: while middle managers estimate that the impact of IT on their productivity is positive, senior managers find that impact significantly lower. We explained that fact by considering the nature of managerial work. The work of middle managers is to a great extent influenced by predefined organizational processes and hence is more routine. A standard, commercially available office IT provides a good support of their work.

As an opposite, the work of senior managers is more complex and ill-structured, and as a result it is also influenced by personal preferences. The current practice of information system development is based on the premise, that information should support a manager in performing a number of roles. Therefore, the requirements imposed on the system are derived from the description of actions, which are implied by the managerial role. However, the way of carrying out these actions, and the actions themselves, are strongly influenced by the personality type of the manager.

To increase the productivity of managers we propose that it would be useful to build on personality preferences when we develop an IS to support managerial work. We described the nature of managerial work as a set of roles (Mintzberg, 1973), which define the actions performed by a manager and a set of temporal dimensions (Schriber and Gutek, 1987, Benabou, 1999). We established a correspondence between the dominating activity of a role and a personal preference, which has the most significant influence on performing that activity. Such a correspondence allowed us to formulate

the requirements imposed by different types of managers on the design of IS support. The use of a personalized IS should start from the identification of the user's personality type, which serves as a basis for a further configuration of the system.

We argue that the preferences may force us to use different technologies to provide different implementation alternatives and to support different kinds of temporal behavior. The proposed approach gives the system developers guidance on how to design an IS that would provide managers with a systems support to match his/her personal preferences.

A personalized IS would have a greater potential to improve the productivity of managerial work, i.e., to increase efficiency, effectiveness and expand the limits. While identifying the personality type a personalized IS at the same time defines the manager's strengths and weaknesses. A personalized IS would allow a manager to re-enforce the strong points and mitigate the weaknesses.

Carrying out the managerial activities in the most preferred way enhances the efficiency via saving time and efforts. A personalized IS improves the effectiveness by enabling or improving performance of the activities carried out weakly. It is also reasonable to expect an expansion of the depth and the scope of managerial activities, if the requirements of a manager in IS support are met more precisely.

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