Assessing Relevance and Micro-Relevance to the Professional's Working Process as a Determinants of IT-Diffusion and IT-Use in Healthcare

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ABSTRACT

User-adoption of new IT-applications is the proof-of-the-pudding when it comes to IT-success in Healthcare. As a consequence, many studies are made of the role of the users in the introduction of new IT in both theory and practice. This paper introduces relevance and micro-relevance as key determinants of IT-diffusion and IT-use respectively. Relevance is the degree to which the user expects that the IT-system will solve his problems or help to realize his actually relevant goals. Micro-relevance is the degree to which IT-use helps to solve the here-and-now problem of the user in his working process. Central to both concepts is the degree to which goals or problems that IT is related to are actually pressing in nature. Goals and problems that are less pressing do not result in relevance. Goals that are pressing may still not be micro-relevant on the level of executing work. A study amongst 56 general practitioners (GP's) on the introduction of an Electronic Prescription System (EPS) demonstrated the importance of relevance and micro-relevance. To these GP's time-pressure, and communication with pharmacy and hospitals were highest on the agenda. In that light, the innovation EPS was not relevant. Lack of micro-relevance level obstructed intensive use of EPD by those who had introduced the innovation. As a consequence, those who adopted the EPD only used it sparsely. Every improvement is a change but not every change is an improvement (Heraclitus)

INTRODUCTION

Healthcare is changing (Tange, 97) and Information and Communication Technology is a driving force for many of these changes (Suomi, 2001). At the same time many authors report cases of failure of ICT innovations (Southon et al., 1999, Gelderman, 1998). The cause of these failures is often searched in resistance and user participation (Ballantine et al, 2000, Offenbeek & Koopman, 1996). Professionals in healthcare organization get the blame for opposing changes in their working processes. But Pare and Elam (1999) state that they are positive about using information systems to access up to date knowledge, for continual medical education, for access to healthcare in rural and remote areas, for the quality of patient care and for the interaction within a healthcare team. Also, Timpka (1989) demonstrated the fundamentally positive attitude of physicians towards the use of IT. So, there is no resistance to change, there is only resistance to bad change (Barlow, 2001). Therefore the assumption is made that there is more to IS success than resistance alone. While resistance is still important, there is an increasing awareness that there is a wide range of more complex organizational and people-related factors to be taken into consideration (Lorenzi & Riley, 1994). Southon (et al, 1999) concludes that the capability to bring IS benefits is severely compromised by our inability to adequately address the problems of the healthcare working process. This is exactly what we observe in 56 cases of GP practices where an Electronic Prescription System (EPS) is implemented. To explain this problem we focus on the relevance factor as an important success factor for ICT implementation in healthcare and probably beyond healthcare. Or as Whyte *et al* (1997) sharply observes, "we must understand the attributes of information systems that users perceive to be important".

BACKGROUND

The central perspective of our approach is that user-adoption of new IT-applications is the proof-of-the-pudding when it comes to IT-success in Healthcare. User-perspectives are by no means new to IT-evaluation. We can use a wide range of sources. In the balance model of

organizational change risks, Leavitt (1965) introduced four domains in which these risks will occur: tasks, structure, technology and people. People, at that time, were not the most important domain. Offenbeek & Koopman (1996) connect people with resistance potential because they can feel that the quality of their working life will be decreased. Mumford (1983) observed that user participation contributes to effective organizational change. Wissema (1987) defines resistance as willingness to change and the difference between results and expectations.

Thong and Yap (1995) discuss the user-satisfaction approach to IT effectiveness. They mention the debatable operationalization, poor theoretical construct and misapplication as critics to the approach. On the basis or their review they conclude that attitude is the construct that lies on the root of user-satisfaction and suggest ways to improve operationalization and measurement of attitude.

Paré & Elam (1999) studied attitudes, expectations and skills in relation to physicians' acceptance of IT systems. Physicians with formal training on computers were more knowledgeable about informatics concepts and reported that computers would be more beneficial to health care, although it is not clear whether the training causes this attitude. Also, it becomes clear that user-priorities regarding IT-innovations vary strongly.

The functional uncertainty is often described in information systems literature. It occurs in the task domain of Leavitt. In each situation the interpretation and the meaning can be different. Therefore it is necessary to establish a functional specification with user and providers of the information systems. Henry and Stone (1999) state this to be information quality.

Walley & Davies (2001) conducted a study to the internal barriers to technological IT-advancement in the healthcare sector. The involvement of stakeholders is arguably one of the most distinctive characteristics of IT projects. There are instruments to identify user-needs, but they question whether they are actually used.

Van der Pijl (1994) shows that there is more to say about people than just resistance or user participation. Both users and providers of information systems have their own targets, not necessarily going hand in hand. A central question is whether the provider intention is

the same as the user interpretation (Sperber & Wilson, 1986). We will re-define relevance in the next section.

Finally resources, (Human, physical and monetary components, Ansoff 1965) are needed to implement the new information system into the organization. The human resources can both be insufficient in time and in experience (risk of technology). Insufficient material resources (Offenbeek & Koopman, 1996) will have a limiting influence on the other three risk domains.

In this paper we will focus on a single determinant to user-adoption of IT in healthcare, i.e. relevance. We keep in mind that, although relevance plays a major role in determining IS success on user-level, it only plays its role within the context of other factors that were briefly mentioned in this section (Schuring & Spil, 2001). It is most important to elaborate the construction of a framework that brings these factors together. Saarinen and Sääksjärvi (1995) point out that different factors act as critical success factors under different circumstances. This will also apply when a framework of success factors is limited to user-related factors. However, in this paper we will concentrate on relevance and the empirical findings in this area.

RELEVANCE AND MICRO-RELEVANCE: DEFINITION

Saracevic (1975) defines relevance is a measure of the effectiveness of a contact between a source and a destination in a communication process. This is a somewhat abstract wording of what we would call the degree to which the user expects that the IT-system will solve his problems or help to realize his actually relevant goals. There are three dimensions that are kept implicit in Saracevic' definition that we wish to stress. We use the word "expects" since we want to stress that relevance is a factor that is important in the course of the adoption process, not only in evaluation. Second, instead of effectiveness we use "solve problems and goals". By doing so, we imply that effectiveness has two dimensions: to take away existing negative consequences (problems) and, to reward with positive consequences (reach goals). Third, the word *actual* is crucial in our view of relevance. Relevance is not to be confused with the degree to which the user considers outcomes as being positive. The set of outcome-dimensions that someone considers "positive" is larger bigger than the set of outcome-dimensions that are relevant. Imagine a physician, who basically considers IT-outcomes of a computer decision support system, such as, assistance in diagnosis, disease prevention, or more appropriate dosing of drugs (Thornett, 2001), as " positive". This does not automatically imply that the IT-adoption is relevant to him. It is only relevant if these dimensions are high on his goal agenda. That is why we use the word actual. Again, this is a more explicit wording of a dimension that is implicitly included where Saracevic' uses the word effectiveness in his definition. The actually relevant goals may be a mix of short-term goals and long-term goals. If, for example, smooth communication with hospitals or pharmacy is his prime actual problem or goal, he will only consider the IT-innovation as relevant when it actually helps to improve that communication, notwithstanding the fact that he might have a positive attitude towards that innovation as long as the innovation helps to solve other problems or other goals that are on the lower positions in his agenda-ranking. We discovered in our case-studies that it is not sufficient for an innovation to effectuate a positive attitude amongst users. The IT-innovation should be relevant.

Micro-relevance is a related concept that can be used to describe a similar phenomenon once the new IT is installed. Micro-relevance is defined as "the degree to which IT-use helps to solve the here-and-now problem of the user in his working process". The use of new equipment or new IT-procedures is a conscious activity. In every conscious activity that is goal-oriented to a specific goal, there is a reason why that course of action is being chosen. Similar to what was discussed above on "relevance", not every course of action that a user basically considers as "positive" is "micro-relevant". Again, let's illustrate this with an example. Imagine a patient with virus infection visits a physi-

cian. The physician might notice the similarity to a number of other patients he has met that week and decide on diagnosis and treatment fairly quickly. To this doctor, the use of a decision support system to determine diagnosis is not micro-relevant. However, a colleague of his may not feel so confident and thus use the system. We discovered that micro-relevance is a key factor in explaining IT-use in our case-studies. Box 1 gives an overview of relevance as we propose to use it.

Relevance and micro-relevance are notable refinements of the way the role of the user is being discussed in the existing literature. Thornett (2001) implicitly refers to relevance and micro-relevance when he states discusses limited adoption and use of DSS by primary physicians where "consultation time is lengthened by their use and there is no appreciable impact on patient satisfaction". It is an example where other outcomes that are basically considered as positive (as mentioned above: better diagnosis, more appropriate dosing of drugs, and other) are overruled by limited relevance and micro-relevance.

Saracevic (1975) provides a historic positioning of relevance. The roots lay in the 1930's and 40' where the distinction between information and relevant information is made by Bradford (Saracevic 1975:324). In order to make the distinction between relevant and non-relevant information, he discusses the nature of communication. By doing so, he recognizes that relevance to a subject depends on specific dimensions, like for example, the subject's knowledge, representation and values. He discusses a number of (philosophical) approaches to relevance. The elaboration we propose above builds on the radical pragmatism-perspective or, more specifically, Cooper (1971)'s utility function "Relevance is simply a cover term of whatever the user finds to be of value about the system output, whatever its usefulness, its entertainment, or aesthetic value, or anything else". Wilson (1973) adds to this that relevance is situational. Ballantine (et al.,1999) put it in the following way: "Depending on the type of task, the information generated by the system may be more or less appropriate, which will affect its success or failure". Saracevic (1975) distinguishes various other approaches to relevance, of which a number focus on the basic source of relevance, like, logical relevance, the nature of interference and the pertinence view of relevance. We are very much aware of the fact that our elaboration of relevance does not in full retain the differences between those point of views. It is merely a practical elaboration that we use to predict user-adoption.

The pragmatic perspective of relevance that we choose resembles the notion of "relative advantage" as discussed in the Innovation Diffusion literature by Rogers. Rogers (1983, 1997) reserves a central role for "relative advantage", which is the user's view of "the degree to which an innovation is better than the idea it supersedes". Relative advantage can be economic or social. Rogers: "The nature of the innovation largely determines what specific type of relative advantage is important to adopters, although the characteristics of the potential adopter also affect which dimensions of relative advantage are most important. Based on a review of hundreds of empirical studies, Rogers concludes that relative advantage explains 49% of the rate of adoption of innovations.

It is most notable that the organizational factors are not explicitly included in our user-relevance framework. It should be kept in mind that user's agenda of problems and goals depend of his role in the society (Barnard, 1938) The influence of the organization on this agenda depends on many aspects, including the involvement with other organizations, on time and on place. As a consequence, our framework reflects the actual impact that organizational goals and preferences have on the user, and thus, on organizational behavior.

MULTIPLE CASE-STUDY RESULTS
Case Study Method

Our research was set up to both assess the situation regarding the electronic prescription system "EVS" in the Netherlands and the theory that is described above, that was set up to provide an instrument that could be used to unravel the diffusion-situation of the prescription

Box 1: Relevance

FRAMEWORK OF IT RELEVANCE TO USERS

User Relevance
- Definition: degree to which the user expects the that the IT-system will solve his problems or help to realize his actually relevant goals
- (Co)determines: IT-diffusion
- Generic sub-dimensions
  - Reward:
    1) Positive dimensions: e.g. economic, social or functional improvement that is high on the actual agenda of the user
    2) Negative dimensions: decrease of discomfort, savings of time or effort,
  - Start-up barrier:
    1) low initial cost
    2) immediacy of the reward
- Point of confusion: many things that a user finds positive need not necessarily be relevant

Micro relevance
- Definition: the degree to which IT-use helps to solve the here-and-now problem of the user in his working process
- (Co)determines: IT-use
- Generic sub-dimensions
  - Absolute value of relevance

Figure 1: Case study results

system. This resulted in a case-study protocol that covers all the topics that are mentioned in the framework in open-ended questions. In line with the case-study approach by Yin (1984) we discerned different case-situations on the basis of our theoretical framework. Particularly, the network-situation of general practitioners and the degree of adoption of previous ideas served as a basis to make categories of general practitioners. A total of 56 case-studies were conducted. Each general practitioner was visited in his/her own working situation and interviewed for over an hour. We had data available on the size of each category, which enabled us to quantify the qualitative data that we gathered.

Empirical Relevance to the GP

Under the header relevance for the GP, questions were asked about problems or wishes that the GP experienced as important at the moment of asking, during implementation of the Electronic Prescription System. Figure 1 gives an overview of all the situational relevance factors mentioned. Here we will summarize the results of the main seven:
1. Communication
2. Time
3. Money
4. Software
5. Free Choice
6. International Code Primary Care (ICPC)
7. Formulary

In more than half of the cases that improvements have to be made to communication with colleagues, pharmacists and hospitals. They state that a standard way of working is very important to reach such a communication. The EPS system does not deliver these features. Saarinen and Saaksjarvi (1992) measured the improved internal communication and improved inter-organizational communication under the header "impact of the IS on the organization" None of these success factors was satisfied in our cases.

In 55% of the cases and independently of each other (the term was not mentioned by the interviewee) the GP's stated that there should be a diminishing of the time pressure. Both in the description of the EPS, as in international literature it is made assumable that EPS will not diminish the time of consult (Mitchell and Sullivan, 2001, Thornett, 2001).

Forty five percent of the case studies reported that the GP expected a fee in return for going through the trouble of implementing and using EPS. At the moment of interviewing it was not clear what
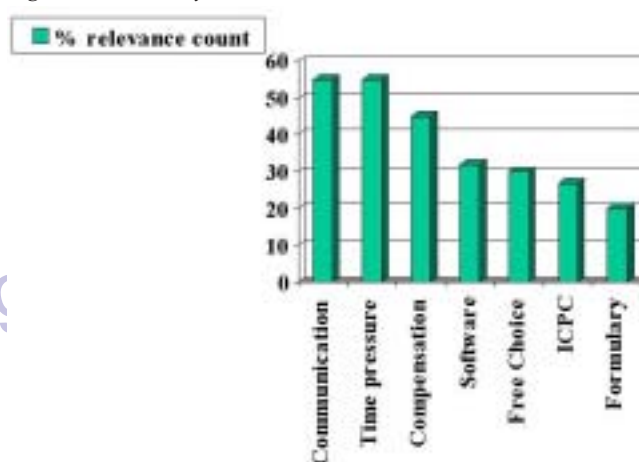
financial profit the new system would deliver for the GP. What was known was that it would deliver government a large amount of money on costs of medicine.

In about twenty case studies lack of trust in the existing software and in the software supplier were mentioned as a barrier for (wanting to) use the new EPS. They said that first things had to change in the GP-IS market and in the GP-IS itself before EPS could be a success.

About the same amount of GP's want to remain freedom of choice for medication of the patient. Although this seems to be a resistance matter it is also a relevance matter because the EPS does not comprehend new ideas and new treatments which are already known in the general practice.

Although the use of ICPC seems useful to many GP's (in structuring and communicating) the time that it will cost to find the right code and the omissions of some codes will form a barrier for EPS use.

Twenty percent of the GP's make use of a personal or regional formulary The EPS makes use of a formulary of the Dutch council for GP's and often does not have the possibility to keep the own formulary when an update of the software is installed.

Finally, once the computer-system was installed, use of the system was mostly sparse. The way of working was relatively complicated and added relatively little value in most patient-doctor contacts.

Analyzed Relevance to the GP

We analyze the empirical results of the previous section with the characteristics of relevance as described in box 1. User relevance tells us more about the adoption of the system and micro relevance shows improvements on the working process. The relevance of the EPS to general practitioners was on the average very low. The economic and social benefits were scarce, as the main problems on the agenda of general practitioners were (1) communication between practitioners, with the hospital and with the pharmacy and (2) time pressure. The EPS did not help to solve these problems. Also the initial cost was high to many practitioners, as the IT-use in their starting-situation was by far not sufficient to be able to use the EPS system. About 27% of the general practitioners make sufficient professional use of the computer to be able to start right away with the EPS-use. The remainder first would have to further structure there electronic patient records, or would even have to start using the computer professionally at all.

The economic benefits of the system are potentially substantial but they do not appear for the user but for the ministry and for the healthcare insurance companies. The costs involved with updating the system are higher than the benefits. A promise is made on practice support but not for every practice such service becomes available. The immediacy of the reward is therefore not recognizable.

Socially, the new system is more seen as a threat than a benefit. The patient-GP interaction changes as also noticed for micro rel-

evance and this change is not for the good. The quality of the GP service can improve as Sullivan and Mitchell (2001) pointed out. Saving in time and effort is not to be expected as the same authors point out which is seen as most wanted by the GP's. This characteristic is most critical in our opinion.

Beside the general relevance of the new system we want to know if the system improves the working process of the user, the micro relevance.

The EPS system is clearly capable of improving the GP decision making but that assumes that the current decisions are not sufficient. This assumption has a political nature and comparison of the prescription behavior put Dutch GP's in a very good position (pharma, 1997). For the doctor it is more micro-relevant to stay in personal touch with his patient during the visit, than to double-check if the intended prescription can be further optimized. The Start-up barrier on activity level was generally high, as ICPC codings were not sufficiently clear and sufficiently accessible. This study showed that in many cases the system was used after the consult. It can be concluded that the micro-relevance after the patients' consult is higher than during the consult. This would mean that the decision making satisfaction during the consult is not improved.

CONCLUSIONS

Relevance has long since been a central notion to IT-theory. The elaborated approach that we proposed in this paper was used in 56 case studies. These cases provided us with enough evidence that for this particular (electronic prescription) system in this particular (healthcare) branch, relevance and micro-relevance were by far the most important determinant for failure of diffusion and use of the system.

We tend to conclude that many theories on IT-introduction indeed focus on the role of the user. Our approach makes it possible to study the change that the user goes through once he starts using the system.

We agree with Wilson (1973) that "relevance is not a single notion but many". We feel that the distinction between user relevance and micro relevance follows the more philosophical thoughts of Schutz (1970) when he introduced motivational relevance (course of action to be adopted) and topical relevance (perception of something being problematic). Those types will influence the pragmatic relevance to the user in dynamic interaction.

With use of the relevance characteristics we were able to explain that new ICT innovations will not diffuse without relevance and micro-relevance to the user. To measure relevance and micro-relevance is not straightforward process.

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