

# Towards a better understanding of the e-health user: comparing USE IT and Requirements study for an Electronic Patient Record.

Ton AM Spil [a.a.m.spil@utwente.nl](mailto:a.a.m.spil@utwente.nl)

Roel W. Schuring [r.w.schuring@utwente.nl](mailto:r.w.schuring@utwente.nl)

Robert A. Stegwee [r.a.stegwee@utwente.nl](mailto:r.a.stegwee@utwente.nl)

Margreet B. Michel-Verkerke [M.B.Michel@utwente.nl](mailto:M.B.Michel@utwente.nl)

School of Business, Public Administration and Technology  
University of Twente  
P.O. Box 217  
7500 AE Enschede  
The Netherlands

## **Abstract**

*This paper compares a traditional requirements study with 22 interviews for the design of an electronic patient record (EPR) and a USE IT analysis with 17 interviews trying to understand the end-user of an EPR. Developing, implementing and using information technology in organizations is a complex social activity. It is often characterized by ill-defined problems or vague goals, conflicts and disruptions that result from organizational change. Successfully implementing information systems in healthcare organizations appears to be a difficult task. Information Technology is regarded as an enabler of change in healthcare organizations but (information) technology adoption decisions in healthcare are complex, because of the uncertainty of benefits and the rate of change of technology. (Job) Relevance is recognized as an important determinant for IS success but still does not find its way into a systems design process.*

*In this study we compare different ways of assessing the needs of the healthcare professional: traditional requirements analysis as employed by the IS professional and the USE IT method to analyze the key determinants of IT adoption by healthcare professionals. This comparison is carried out both at a theoretical and an empirical level. At the theoretical level it becomes clear that meeting user requirements is only one of four key determinants of IT adoption. At an empirical level we applied both methods to the introduction of an Electronic Patient Record in different organizations. It turns out that there is only a small overlap in terms of requirements from both analyses. The differences in outcome can only partially be explained by the different organizational settings. Apparently the gap in expectations between IS professionals, using requirements analysis, and healthcare professionals, elicited by USE IT analysis, remains rather wide. The only common characteristic for an Electronic Patient Record, shared by designers and users, is a focus on communication with other parties involved in the patient care process. The USE IT analysis is a worthwhile addition to classic approaches as it helps to embed the requirements analysis in the organizational setting. I.e. it places problems and goals that are related to the introduction of IT between other problems and goals. It relates the IT introduction*

*to current working practice and the resources available. It helps to distinguish these aspects in various groups of users, depending on their adopter category. On the other hand the USE IT analysis does not lead to specific detailed design. We conclude that there is need for a combination of both methods.*

## **Introduction**

The ability to determine how well a system meets the information needs is a critical component of any system (Miller, 1999). He calls it bridging the information transfer gap. This information gap is clearly visible in healthcare. "What features and functions of computer systems are currently acceptable for clinical use, and what improvements are needed to increase the value of these systems?" (Drazen et al., 1995). "In many cases, physician use of clinical functions is voluntary and, unless they conclude that the system is a reasonable tool, they simply will not use it." (Metzger and Teich, 1995).

The adoption of information technology in healthcare has increased which underlines the importance of user requirements (Beuscart-Zephir et al, 1997). In later work she links the adoption to the activities of the healthcare professionals (Beuscart-Zephir et al, 2001). From practice point of view, Brender and McNair (2001) describe a case study in which detailed functional requirements are seen as a curse for contract management because too many deviations arise. The use of the system seemed to be a product of customization and standardization. Fleisner and Hofkircher (1998) refer to the same problem when they conclude that relevant information will not be improved unless additional requirements are met.

Saiedian and Dale (2000) typify the situation well when they state: "without a well written requirements specification, developers do not know what to build, users do not know what to expect, and there is no way to validate that the created system actually meets the original needs of the user". It is even more difficult to assess the quality of an integrated system and to derive integration requirements (Toussaint et al, 2001).

Symon (et al, 1992) conducted a requirement study where they encounter cross-departmental problems, the impact of resource shortages, a lack of strategic thinking and an enthusiasm for an integrated information system from hospital staff. Specific hurdles for a computerized patient record are according to van Ginneken (2002), the lack of integration and flexibility.

We see that "modern" systems design is making a big effort to make the requirements analysis more dynamic and iterative (Harmsen & Brinkkemper, 2001) but lacks a relevance study. We also observe that the resources are often taken for granted which especially in healthcare can be a serious mistake. The developments in method engineering (Schalken et al., 2004) promise a better participation of the user and we hope to contribute to that with this paper.

In this paper we compare a "normal" requirements study for an electronic patient record (EPR) in a hospital with a USE IT analysis for an EPR in several healthcare institutes. First a comparison is made theoretically and then both studies are compared empirically, also explaining the research method. Finally we find a ground for discussion.

## **Comparison requirements analysis and USE IT analysis theoretically**

### **Requirements analysis**

At the semantic level (Shannon & Weaver, 1949; Stamper, 1973; DeLone & McLean, 1993) we are concerned how pattern-types relate to what happens in the world. On this level we deal with the meaning of the system but this term brings along a lot of different meanings about its definition (Cohen, 1962). The meaning of a sign relates to the response the sign elicits in a given social setting (Liu, 1993). It is situational of nature since we have a range of pattern-types that signify a certain meaning and a user (group) that interprets the expression (Spil, 1993). Therefore it is necessary to establish requirements as thorough as possible. Wieringa (1996) defines requirements as *desired properties needed to achieve the desired composite system properties*. Pressman (1982) makes a distinction between normal requirements, expected requirements and exiting requirements. Before defining requirements ourselves we want to study the problem at a deeper level.

“Many system designers do not appear to realize that with their present approach they are designing only partial systems” (Mumford, 1995). She argues that all needs of the end users should be identified. The notion of variance emerged from some early socio-technical work design experiments in Norway (Mumford, 1995). A variance is defined as *a tendency for a system or subsystem to deviate from some desired or expected norm or standard*. Key variances are the deviations on goals and functions, operational variances stem from the organizational problems. Together they get close to the main problem that we are addressing, the information gap between designer and user.

The functional uncertainty is often described in information systems literature. It occurs in the task domain of Leavitt (1965). In each situation, the interpretation and the meaning can be different. Therefore, it is necessary to establish a functional specification with users and providers of the information systems. Henry & Stone (1999) state this to be information quality. Larsen (1998, p.413) notes however "the quality of the IS/IT product is a necessary but not sufficient prerequisite for IS innovation success. The *people* within the organizations determine the outcome." Within the healthcare sector, 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.

Iivari and Koskela (1987) include three quality constructs on the semantic level, which they call the input/output requirements: informativeness, accessibility and adaptability. Informativeness describes the potentiality of the information systems, accessibility the quality of the user-IS interaction and adaptability points to the ability of the systems to change.

DeLone and McLean (1992) enumerate the criteria from nine earlier studies. They declare themselves that there is not “one” measure of IS success but there are many dependent variables. They call their taxonomy on the semantic level a taxonomy of information quality. Usefulness or relevance is mentioned eight times in the nine studies. Schuring and Spil (2002) have studied the importance of relevance and made it a separate determinant on the pragmatic level. Timeliness is empirically used five times and adopted in our model. We keep using the term accessibility as a broader term including convenience of access. Accuracy is studied four times and adopted under

informativeness. We do not understand why there is no notion of adaptability or ability to integrate in the DeLone & McLean study. We adopt the ability to integrate as the degree in which the new system is embedded in the organization.

Brender and McNair (2001) use the ISO 900x structure and use the strategic, tactical and operational level to perform their user requirements specification. Larsen (1999) also makes this distinction. The strategic level is concerned with the problem definition, including objectives and global task description. The tactical level is interpreted as a preferred approach and the operational level includes a set of functional, performance and capacity criteria.

How to derive these criteria is described in numerous textbooks. We have chosen Hoffer et al (2002) and Romney and Steinbart (2004), which leads to the following deliverables:

- Business objectives
- The processes
- Information needs
- The data handled
- Movement, transformation and storage of data
- The sequence and the dependencies and the rules governing them
- Key events

Within an empirical setting this leads to the interview protocol as presented in appendix 1.

### USE IT Analysis

We can use a wide range of sources that discuss user-perspectives in IT-introduction. This section gives a short overview of intriguing literature. The aim is to demonstrate that requirements are not *the only* determinant of user-adoption. Rather, it is an important determinant among other factors. One of the ultimate goals of our research project in this field is to propose a model that neatly balances the role of such factors.

First, we present the dimensions of the USE IT-model to predict and evaluate innovation and diffusion of information systems: the innovation-dimension and the domain-dimension, which results in four determinants for success: relevance, requirements, resistance and resources.

| <b>USE IT-model</b> | <i>User Domain</i> | <i>Information Technology Domain</i> |
|---------------------|--------------------|--------------------------------------|
| <i>Product</i>      | Relevance          | Requirements                         |
| <i>Process</i>      | Resistance         | Resources                            |

Table 1. The USE IT-model (Schuring & Spil, 2002)

The process in the innovation dimension refers to the innovation process, similar to the process defined by Saarinen and Sääksjärvi (1992) and the innovation process structure of Larsen (1998). The product is the result of this innovation process. This corresponds with the definition of the product by Saarinen and Sääksjärvi and the artifact structure in the framework of Larsen. Also the IT domain is part of the artifact structure; the user domain represents the organizational

structure in Larsen’s framework. The time horizon structure can be part of the requirements and the knowledge structure can be considered as an element of the resources.

Table 2 shows the determinants with their sub-determinants. Every determinant comprises two levels: the macro-level and the micro-level. The macro-level represents a general perspective, e.g. the organizational level. The micro-level refers to the individual user.

| <b>Determinant</b> | <b>Sub-determinants</b>   |
|--------------------|---|
| Relevance          | Macro-relevance: <ul style="list-style-type: none"> <li>• Economic improvements,</li> <li>• Social improvements,</li> <li>• Functional improvements,</li> <li>• Saving time and effort.</li> </ul> Micro-relevance: <ul style="list-style-type: none"> <li>• Solve here-and-now problems</li> <li>• Compatibility with working process</li> </ul> |
| Resistance         | Macro-resistance: <ul style="list-style-type: none"> <li>• Lack of opportunity to change</li> </ul> Micro-resistance: <ul style="list-style-type: none"> <li>• Inability to change,</li> <li>• Bad attitude</li> </ul>  |
| Requirements       | Macro-requirements: <ul style="list-style-type: none"> <li>• Strategic general requirements,</li> <li>• Tactical approach.</li> </ul> Micro-requirements: <ul style="list-style-type: none"> <li>• Functional,</li> <li>• Performance requirements.</li> </ul>  |
| Resources          | Material: <ul style="list-style-type: none"> <li>• Hardware &amp; Software,</li> <li>• Time,</li> <li>• Money.</li> </ul> Immaterial: <ul style="list-style-type: none"> <li>• Adaptability,</li> <li>• Capabilities,</li> <li>• Reliability.</li> </ul>  |

Table 2. The USE IT-determinants (Spil, Schuring & Michel-Verkerke, 2004)

The *relevance* determinant is defined by Schuring & Spil (2003) as: “*the degree to which the user expects that the IT-system will solve his problems or help to realize his actually relevant goals*”. The word “expects” expresses that relevance is a factor that is important in the course of the adoption process, not only in evaluation. The word “actually” is crucial in their 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 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, 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".

Relevance defined in this way comprises relative advantage (Rogers, 1995), net benefits (DeLone and McLean, 2002), perceived usefulness (Davis, 1989) and job relevance (Chismar and Wiley-Patton, 2003), and results in task support satisfaction, which is a criterion for user satisfaction (Garrity and Sanders, 1998).

In their study on the implementation of an Electronic Prescription System, Schuring and Spil found that lack of relevance was the major determinant that explained the failure of the implementation (Schuring and Spil, 2002).

*Resistance is the personal attitude of all stakeholder groups towards the introduction of an information system* (Spil et al, 2002). The main IS-quality aspect of resistance is the attitude and the willingness to change. Pare and Elam (1999) also focus on the attitude of the professional when they assess clinical information systems. The end users have an important role because their norms and values determine the effectiveness of the information system. Resistance was found to be the cumulative effect of the other three determinants (Spil et al, 2002).

Expectance of reduced quality of work life satisfaction, high complexity and the lack of trialability can result in resistance (Rogers, 1995; Garrity and Sanders, 1998). Observability reduces resistance (Rogers, 1995). Offenbeek & Koopman (1996) connect people with resistance potential because they can feel that the quality of their working life will be decreased. Mumford (1995) observed that user participation contributes to effective organizational change. Wissema (1987) defines resistance as willingness to change and the difference between results and expectations.

*Resources are defined as the degree to which material and immaterial goods are available to design, operate and maintain the information system* (Spil and Schuring, 2004, Salmela, 1997).

The main focus of the determinant resources will be on the people and on the costs these people cause. Next to that, the reliability of the information technology and the information systems are considered. Resources defined in this way refer to service and system quality (DeLone and McLean, 2002), management support and mature IS function (Saarinen and Sääksjärvi, 1992). 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.

The *requirements* determinant evaluates the meaning of the information system. *Requirements are defined as the degree to which the user needs are satisfied with the product quality of the innovation* (Spil and Schuring, 2003). This includes such aspects as the functional capability, the ease of start-up and the ease of use.

Meeting the end-user's requirements results in high information quality, system quality (DeLone and McLean, 2002), high interface satisfaction (Garrity and Sanders, 1998), and high compatibility (Rogers, 1995).

To measure the determinants the USE IT-tool consists of structured interviews. In this way a more precise insight can be obtained in the nature and relevance of problems and solutions, before implementation and this insight can be tested with the same tool during the evaluation of the implementation. The interview protocol is given in appendix 2.

## ***Empirical comparison***

### **Requirements study hospital EPR**

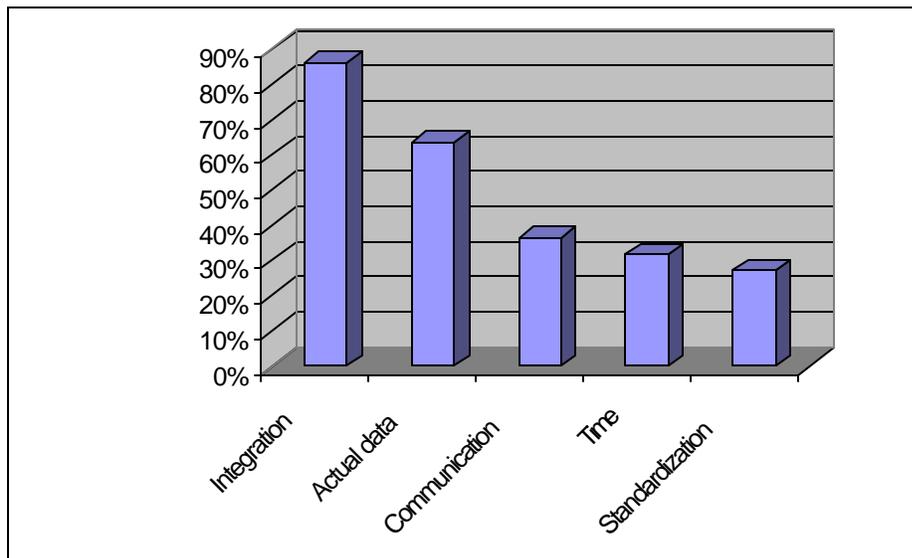
#### *Case Study Method*

In this study we got permission from a hospital in the Netherlands to use their material for the requirements study for an electronic patient record. The interview protocol is given in appendix 1. In total 22 interviews were conducted, documented and analyzed. The protocol reflects the theory above with as main subjects:

- The working process
- Document analysis
- Information needs
- Data handling and movement
- Current (EPR) initiatives
- Planning/future

#### *Case Study results*

**Figure 1: Requirements %**



#### *Empirical Requirements analysis medical specialists*

Below the main factors are listed:

- Integration
- Most recent data

- Communication
- Time
- Standardization

The vast majority of medical specialists (86%) reports in the interviews the frequent use of data of other departments and organizations, as well as the stored patient data. The medical specialists require a certain degree of integration of the system, meaning that all data must be available. Partial implementation of systems only leads to more disturbances and inefficiency.

Connected to this is the emphasis put on reliability of the system by 64% of the medical specialists. It was reported that much work was repeated because it was not clear whether the collected information was the most recent and whether it was reliable.

Thirty six percent of the respondents asks for a good communication facility within the hospital, i.e. consulting colleagues and asking them for information and the communication with clients.

Saving time is one of the most important objectives of using an EPR for 32% of the medical specialists. The advantage of saving time for themselves is mentioned as the main possible advantages. This means that this will be one of the most important acceptance-criteria. The EPR will hardly be used if it is not faster than the present way of working.

In many cases (27%) the specialists reported spontaneously the standardization of many processes in their department and the importance of central tuning of certain issues, like central coding.

## **USE IT analysis EPR**

### Analysis of information needs

What must be kept in mind is that medical specialists always see patients who are referred to them by other physicians, GP's or fellow medical specialists. This means that these patients all have a medical history that is documented in a patient record elsewhere. The medical specialists reported to need to know the content of this patient record. Especially lab-results, medical history and use of medication in the past and present are required. Medical specialists in hospital require the availability of up-to-date medical and diagnostic data.

In addition to the information of the referring physician medical specialists and providers of psychiatric care require to gain information from their own observation.

Information is provided by letter, fax or – occasionally – by e-mail. Usually the existing paper medical record is used. Often questions remain and the referring care provider must be called or the patient is asked for the missing information. But the information of the patient can differ from the information provided by the referring physician. All respondents prefer to have better access to existing patient data.

In psychiatry a lot of information is needed by care providers in order to diagnose and advise the patient. The historical patient data are split in (medical) history and biography. Both have often been retrieved in previous treatments also. Retrieving this information from previous consulted care providers is possible, but takes a week in average. Sometimes the care provider only hears from previous treatments during the first meeting with the patient. This means that the intake is obstructed until the old patient record is provided.

The internist and urologist report the existence of two versions of the paper record: the inpatient record and the outpatient record. This distinction sometimes causes the failing of certain data in one of the records. The outpatient medical patient records are kept by the secretary of the outpatient clinic of the specific medical specialty.

The "Electronic Patient Record" can only be used for retrieval of data of the outpatient clinic. Entering data is not possible.

The care providers in psychiatry do have a bad experience with ICT-innovations. They were not involved in the preparations of the introduction of the DBC-system (DBC stands for Diagnosis Treatment Combination, a system of fixed care products with fixed prices, comparable to a DRG system). As being one of the first to implement the system, they experienced many omissions, resulting in irritation and resistance. This bad experience contrasts with the feelings of medical specialists of another hospital who were informed extensively before the introduction of the DBC-system.

Nevertheless these medical specialists also have their doubts about the feasibility of using DBC's, regarding the complexity of the system and the large number of possible DBC's per specialty.

### 1.3 Analysis of relevance

The answers to the question what respondents consider important in their job, were very diverse. Good working conditions like a consulting room, which does not have to be shared with others, up-to-date patient records available during consulting hours and are mentioned most. The diversity in answers seems to follow from the diversity of ways care is provided. Although the answer to the next question seems to contradict this. The prerequisites are needed to appear quiet and professional to the patient. The conclusion can be drawn that prerequisites like a correct and available patient record raise the trust of a patient in the care provider and that quietness contributes to a good contact with the patient. The reported bottlenecks confirm this. Another bottleneck is the administrative burden is reported. Improvement is especially needed to stop the filling in of the same data over and over again in paper forms, the manual recording of production activities and the legibility of hand-written notes.

The difference between the psychiatric clinic and the general hospital becomes evident in this part of the interview. In the psychiatric clinic no ICT-innovations are implemented yet in contrast to the general hospital where all aspects are implemented. The providers of psychiatric care express the importance of improvement with ICT. The expected advantages are: saving time, less boring administrative tasks and accurate patient records. Improvements they want to fight for comprise the electronic calendar, electronic forms and in the future even an Electronic Patient Record.

The medical specialists are familiar with the automated environment and experience the advantages, but are also confronted with the limitations.

### 1.4 Resistance (attitude)

The attitude towards ICT-innovation in the psychiatric clinic is positive. No doubts exists about the added value. ICT is considered to be a means to get rid of experienced bottlenecks. An electronic calendar and EPR are expected to save a lot of time. People expect to be freed of boring jobs and expect to have fast and good access to required information. Expectations are high.

In the general hospital the most of the high expectations of the EPR-project came out. But the medical specialist not only experience the added value, but also feel extra time investment. The added value and experience differs per physician and per fellowship of specialists, because of the difference in attitude to patient care on the one hand and the attitude to developments in ICT in the hospital and in society.

It is appealing that the providers of psychiatric care do not mention disadvantages of ICT. This is probably the result of the high level of frustration with the present paper records. But it should be questioned how realistic the expectations regarding the EPR are. The EPR will doubtlessly also create irritations. Even the psychiatrist who used an EPR before in another clinic only sees advantages.

Obstructions experienced when implementing innovations are money and time-pressure. Innovations seem to be implemented as cheap as possible, despite management-support. The high working-pressure makes it hard for care providers to spend enough time on implementing innovations.

One can conclude that the EPR is seen as an important innovation, solving many irritations, but also as a project that should not cost much time to be implemented. The care providers have no confidence that they will given enough time by the management to learn to use the EPR. But they think they have enough knowledge and experience to learn to use the EPR. The urologist, who considers himself as an 'old doctor', is stimulated by his younger colleagues to use the computer, but on the same time it is accepted that he isn't that enthusiastic and often works in the old way.

All respondents are stimulated to deal with innovations. They can all name other innovation-projects that occur in the organization, but which are considered less important than the EPR-project.

### 1.5 Resources

The providers of psychiatric care do have many ICT-facilities. Communications by e-mail with colleagues present at other locations within the organization occur daily. All consulting rooms are provide with a network-computer. All employees are given an e-mail-account and a computer to work at home, which is used daily also.

This is the same for the urologist and internist. Both consider the available soft- and hardware as sufficient, but the unwieldiness of the organization obstructs the fast response on specific questions with high priority.

The providers of psychiatric care can use electronic forms when providing care. Some care providers hand over hand-written or dictated reports to the secretary. It seems that making digital reports is stimulated, but not obliged

The internist reports to spend more time on entering data, which would previously be entered by a secretary.

The urologist on the other hand, does not take the initiative to use the ICT-facilities, despite the fact that everything is at hand. He uses paper to make notes during patient encounters.

A helpdesk is available in the psychiatric clinic. The support is sufficient, but doubts exist about the reliability and protection of privacy of the system. Too many people can access too much information.

The urologist and internist think that in the general hospital enough time and money can be generated for the EPR. They call it a capital deepening with returns on the short and long term, but the present budgetary measures in health care may be an obstruction to the implementation of all ICT innovations.

The care providers in the psychiatric clinic are much more pessimistic. They expect that little money and no time will be allocated.

## **Discussion**

How to merge USE IT with normal systems design?

## **Conclusions**

As discussed in the introduction there is a big gap between IS designers and IS users. We see that the traditional requirements study only partially determines the information needs of the users. It answers the question “what do you want?”, in general. The results from the 22 interviews show many lists of requirements. The relevance determinant however shows what they “really” need at this moment, in this case time and communication. Communication overlaps in both studies. Key issue therefore is how to create good communication in healthcare through use of an EPR without losing time. Or even better, winning time.

So what is the value of each of the approaches? The USE IT analysis is particularly worthwhile since it helps to embed the requirements analysis in the organizational setting. I.e. it places problems and goals that are related to the introduction of IT between other problems and goals. It relates the IT introduction to current working practice and the resources available. It helps to distinguish these aspects in various groups of users, depending on their adopter category. On the other hand the USE IT analysis does not lead to specific detailed design, as a more “classic” requirements analysis does. We conclude that there is need to apply both methods, probably in sequence, starting with USE IT. On the basis of the outcomes it could be discussed which particular application area of IT could help to make the organization “work”, taking into account the peculiarities of working processes, resources, and, above all, various problems and goals of which many could be unrelated to the introduction of IT. Then, as a next stage, a more classic requirements analysis would be needed to the particular application areas that are selected. By following this approach, the IT design specifications will be clear and will fit to the particular situation.

## **References**

- Berg, M (2001) “Implementing information systems in healthcare organizations: myths and challenges” *International Journal of Medical Informatics*, 64, pp143-156.
- Beuscart-Zephir, MC, Brender, J, Beuscart, R & Menager-Depriester, I (1997) “Cognitive evaluation: How to assess the usability of information technology in healthcare”, *Computer Methods and Programs in Biomedicine*, 54, pp 19-28.
- Beuscart-Zephir, MC, Anceaux, F, Crinquette, V & renard, JM (2001) “Integrating users’ activity modeling in the design and assessment of hospital electronic patient records: the example of anesthesia”, *International Journal of Medical Informatics*, 64, pp157-171.
- Bogucki, DN (1995) “Capturing flexibility of information technology infrastructure: a study of resource characteristics and their measure”, *Journal of MIS*, 12, 2, pp37-57.
- Brender, J (1999) “Methodology for constructive assessment of IT-based systems in

- an organisational context”, *International Journal of Medical Informatics*, 56, 67-86.
- Brender, J & McNair, P (2001) ‘User requirements specifications: a hierarchical structure covering strategical, tactical and operational requirements’, *International Journal of Medical Informatics*, 64, pp 83-98.
- Cohen, LJ (1962) *The diversity of meaning*, Methuen, London.
- Damian, DMH, Eberlein, A & Woodward, B, Shaw and Gaines, B (2001) ‘An empirical study of facilitation of computer-mediated distributed requirements negotiations’, In *Fifth International Symposium on Requirements Engineering (RE '01)*, pages 128–135, Washington, DC, USA, Aug. 2001. IEEE Computer Society Press.
- Davis, F D (1989) ‘Perceived Usefulness, perceived ease of use, and User Acceptance of Information Technology’, *MIS Quarterly*, September.
- Delaney, B C, Fitzmaurice, D A, Riaz, A & Hobbs, F D R (1999) ‘Can computerized DSS deliver improved quality in primary care?’, *British Medical Journal*, 312, pp 1008-1012
- DeLone, W H & McLean (1992) ‘Information Systems Success: The Quest for the Dependent Variable’, *Information Systems Research*, 3, 1, pp60-95.
- Drazen, E.L. (1995). Physicians' and Nurses' Satisfaction with Patient Care Information Systems: Two Case Studies. *Patient care information systems*. E.L. Drazen, J.B. Metzger, J.L. Ritter and M.K. Schneider. New York, Springer-Verlag New York, Inc.
- Feeny, DF & Willcocks, LP (1998) ‘Core IS capabilities for exploiting IT’ *Sloan Management Review*, Spring, pp 9-21.
- Fleisner, P & Hofkircher, W (1998) ‘The making of the information society: driving forces, ‘Leitbilder’ and the imperative of survival’, *Biosystems*, 46, pp 201-207.
- Garrity, & Sanders, (1999) *Information Systems Success Measurement*, Idea Group Publishing.
- Ginneken, A M van (2002) ‘The computerized patient record: balancing effort and benefit’ *International Journal of Medical Informatics*, 65, pp97-119.
- Hakkinen, H, Turunen, P & Spil, TAM (2003) ‘Information in healthcare process –evaluation toolkit development’ *Proceedings of HICSS 36*, <http://www.hicss.hawaii.edu/diglib.htm>
- Harmsen, F & Brinkkemper, S (2001) *Method engineering, webenabling van methoden voor systeemontwikkeling (in Dutch)*, Ten Hagen Stam.
- Henry, J W & Stone, R W (1999) ‘End user perception of the impacts of computer self-efficacy and outcome expectancy on job performance and patient care when using a medical information system’ *IJHTM, Special issue on advances in the management of technology in Healthcare*, Vol.1, Nos1/2, pp 103-124.
- Hoffer, JA, George, JF & Valacich, JS (2002) *Systems analysis & design*, Prentice Hall.
- Iivari, J & Koskela, E (1987) ‘The PICO model for IS design’ *MIS Quarterly*, September, pp400-417.
- Lapointe, L, Lamothe, L & Fortin, J P (2002) ‘The dynamics of IT adoption in a major change process in healthcare delivery’, *Proceedings of the 35<sup>th</sup> HICSS conference*, Big Island, Hawaii.
- Larsen, T J (1998) ‘Information Systems Innovation: A Framework for Research and Practice’ In Tor J. Larsen and Eugene McGuire (1998). *Information Systems Innovation and Diffusion*. Idea Group Publishing. Hershey, USA

- Leavitt, H J (1965) "Applied organisational change in industry: structural technological and humanistic approaches. IN March JG(ed)*Handbook of Organisations*, Chigaco, Rand-McNally, pp1144-1170
- Liu, K (1993)*Semiotics applied to information systems development*, PhD thesis, University of Twente, Enschede.
- Markus, ML (1983) "Power, Politics and MIS Implementation", *Communications of the ACM*, 26, 6, pp430-444.
- Mata, FJ, Fuerst, WL & Barney, JB (1995) "Information Technology and sustained competitive advantage: a resource based analysis", *MIS Quarterly*, 19, 4, December, pp487-505.
- Metzger, J.B. (1995). The Potential Contributions of Patient Care Information Systems. *Patient Care Information Systems: Successful Design and Implementation*. E.L. Drazen, J.B. Metzger, J.L. Ritter and M.K. Schneider. New York, Springer-Verlag New York, Inc.
- Michel-Verkerke, M.B., R.W. Schuring and T.A.M. Spil (2003). Use IT or Leave IT: A Model To Reveal User Satisfaction of ICT-support in Health Care Processes Ex Ante and Ex Post, Proceedings Hospital of the Future conference 3, Warwick, UK.
- Miller, C A (1999) "Bridging the Information Transfer Gap: Measuring goodness of information fit", *Journal of Visual Language and Computing*, 10, pp523-558.
- Mitchell, E & Sullivan, F (2001) "A descriptive feast but an evaluative famine: systematic review of published articles on primary care computing during 1980-97" *British Medical Journal*, 322, pp 279-282.
- Mumford, E (1995)*Effective Systems Design and Requirements Analysis*, MacMillan, London.
- Newton, J, Graham, J, McLoughlin, K, Moore, A & McTavish, D (2000) "Change in primary health care: new wine in old bottles?", *Journal of Management in Medicine*, 14, 1, 2000, pp 37-47.
- Nykänen P (2000) *Decision support systems from a health informatics perspective*. Academic dissertation. Department of computer and information sciences, University of Tampere. Tampere, Finland.
- Offenbeek, M van & Koopman, P (1996) "Interaction and decision making in project teams", IN West, MA ed (1996)*Handbook of Work Group Psychology*, John Wiley & Sons Ltd.
- Pare, G & Elam, J J (1999) "Physicians' acceptance of clinical information systems: an empirical look at attitudes expectations and skills", *International journal of Healthcare Technology and Management*, 1,1, pp46-61.
- Pressman, R S (1982)*Software engineering, a practitioner's approach*, McGraw-Hill.
- Romney, M B & Steinbart, P J (2004)*Accounting information systems*, Pearson.
- Rogers, E M (1983) "*Diffusion of innovations*", The free press, New York.
- Saarinen, T & Saaksjarvi (1992) "Process and product success in information system development", *Journal of Strategic Information Systems*, 1, 5, pp266-277.
- Saiedian, H & Dale, R (2000) "Requirements engineering: making the connection between the software developer and customer", *Information and Software Technology*, 42, pp419-428.
- Salmela, H (1997) "From information systems quality to sustainable business quality", *Information and Software Technology*, 39, pp819-825.
- Schalken, J, Brinkkemper, S & Vliet, H van (2004) "Assessing the Effects of Facilitated Workshops in Requirements Engineering", *EASE 04*.

- Schmidt, R, Lyytinen, K, Keil, M & Cule, P (2001), "Identifying Software Project Risks: An International Delphi Study" *Journal of Management Information Systems*, Spring, 17, 4, pp5-36.
- Schuring, R W & Spil, T A M (2002) "Explaining plateaued diffusion by combining the user-IT-success factors (USIT) and adopter categories: the case of electronic prescription systems for general practitioners", *International Journal of Healthcare Technology & Management*, 4, 3, pp.303-318.
- Schuring, R W & Spil, T A M (2003), "Relevance and micro-relevance for the professional as determinants of IT-diffusion and IT-use in healthcare", IN Grant, G(ed)(2003), *ERP & Data Warehousing in Organizations: Issues and Challenges*, pp 219-232, Idea Group Publishing, Hershey.
- Shannon, CE & Weaver, W (1949) *The mathematical theory of communication*, University of Illinois press, Chicago.
- Spil, TAM (1993) "The evaluation of SISP; From a quality undergrowth to a semiotic clearing, proceedings of the first ECITE conference, Henley on Thames.
- Spil, T A M, Schuring, R W & Katsma, C (2002) "Assessing resistance of professionals as a determinant of IT-diffusion and IT-use in healthcare", *Proceedings of the ninth ECITE conference*, Paris.
- Spil, TAM, Schuring, RW & Michel-Verkerke, MB(2004) "Electronic Prescription System: do the professionals USE IT?" *Int. J. Healthcare Technology Management*, V6, 1, pp32-55.
- Stamper, RK (1973) *Information in Business and Administrative Systems*, John Wiley & sons, New York.
- Sullivan, F & Mitchell, E (1995) "Has general practitioner computing made a difference to patient care?" *British Medical Journal*, 311, 848-852.
- Suomi, R (2001) "Streamlining Operations in Healthcare with ICT" IN Stegwee, R A & Spil T A M eds *Strategies for Healthcare Information Systems*, Idea Group Publishing, Hershey
- Symon, G, Fitter, M, Radstone, C, Kunkler, I & Hancock, B (1992) "The process of deriving requirements for a hospital information system" *Behaviour & Information Technology*, 11, 3, pp131-140.
- Thong, J Y L & Yap, CS (1995) "CEO characteristics, organizational characteristics and IT adoption in small businesses", *Omega*, 23,4, pp429-442.
- Thornett, A M (2001) "Computer decision support systems in general practice, *International journal of Information Management*, 21, pp39-47.
- Toussaint, PJ, Bakker AR & Groenewegen, LPJ (2001) "Integration of information systems: assessing its quality", *Computer Methods and Programs in Biomedicine*, 64, pp9-35.
- Walley & Davies (2001) "Implementation IT in NHS Hospitals – internal barriers to Technological Advancement" paper presented on the 1<sup>st</sup> Hospital of the Future Conference, Enschede, The Netherlands
- Wieringa, R J (2001) *Requirements Engineering: Frameworks for Understanding*, Wiley, Chichester.
- Wissema, J. G. (1987). *Angst om te veranderen? Een mythe!* Assen: Van Gorcum.
- Yin, R.K., (1984) *Case study research, design and methods*, Sage Publications, London
- Zowghi, D., Gervasi, V. (2002) "The Three Cs of Requirements: Consistency,

Completeness and Correctness", in the proceedings of 8th International Workshop on Requirements Engineering: Foundation for Software Quality, (REFSQ'02), Essen, Germany, September.

## **Appendix 1 – Interview protocol requirements study**

### **Guideline for EPR-questions during interviews ESP's**

The development of digital recording of patient data in Electronic Patient Records (EPR) will increase the next years. The first experiments started 10 years ago and nowadays more usable products that comply the needs, are entering the market. Because of the new building at one location and the strategy to develop the organization and information- and communication-technology at both locations in an equivalent way, the EPR-project is set up hospital wide. In the next months interested staff of both locations will write a project-plan. In order to let this project-plan comply with the needs of the end-users and adhere to the initiatives of both location it is necessary to perform a requirements analysis.

We defined an EPR in the following way:

*“An Electronic Patient Record is a digital record, which can be consulted or in which data can be added by any authorized care provider and in which all medical, paramedical and nursing data, i.e. medical history, diagnosis, results, images, treatment-plan, course of a patient are recorded. A mini-EPR is an EPR developed for one specialty /ESP/EZ. Eventually all mini-EPR's make the EPR for the entire hospital.*

The objective of this survey is to measure the degree of interest and activities concerning the (development of) mini-EPR's and EPR and to estimate the urgency of the development of an EPR.

The present participants in the project-team EPR selected the following starting-points:

- automated systems to support the direct patient-contacts of care providers
- stay as close to the users, current way of record-keeping and organization
- flexible system: making the options for entering or retrieving data dependent on the situation (e.g. speech recognition, mobile devices)
- finding nice and handy applications.

As said before, the development of the EPR intervenes with the way care providers work. That is why it is important to know whether we work from the same view on the ESP/ZE. For that reason we like to take a short look at the organization structure of the ESP/ZE and the automated systems in use at the moment.

- What automated systems are used in each organizational unit of the ESP/ZE?

The development of the EPR is connected to the present way of record keeping and the forms in use. We like to take a short look at the standard forms for the medical patient record and the nursing patient record within the ESP/ZE and the additional forms made by care providers themselves.

- Can you indicate how much time you spend – at the moment – on record keeping? (Make a distinction in physician, nurse and secretary, distinguish in outpatient clinic and inpatient clinic)
- What five most important forms should be part of the EPR?

One of the starting-points of the EPR-project is that we want to develop the EPR starting out of the needs of the users.

- How could the EPR for your ESP/ZE look like?
- What is part of it, what not?

The EPR facilitates the exchange of patient data between organizational units and the integration of patient data.

- With what organizational parts should agreements be made to make the EPR complete?
- What connections do you see in the EPR? (E.g. digital EEG, digital ultrasound, etc.)

We know that at this moment many EPR-(like)initiatives in the hospital exist. To prevent double work we like to know what these initiatives are and how you feel about them.

- What developments concerning EPR's do you see in your field?
- With what products did you get acquainted with?

- What are your experiences with these products?

The EPR for the hospital should be realized in 6 years. To allocate the capacity for development and implementation well, it is necessary to prioritize.

- Does an EPR-development at this moment fit in the present developments of the ESP/ZE? If not, when will be a convenient moment?

## Appendix 2 – Interview protocol USE IT

|                   |  |
|-------------------|--|
| Date interview:   |  |
| Name interviewer: |  |
| Name interviewee: |  |
| Job interviewee:  |  |
| Organization:     |  |

| <b>P</b> | <b>Primary process</b>  |
|----------|---|
| P1       | <p>What care do you provide?<br/>Most care providers contribute to different care processes.<br/>In our research we make the following distinction:</p> <ul style="list-style-type: none"> <li>• Diagnosis %</li> <li>• Investigations outside the consulting room %</li> <li>• Treatment %</li> <li>• Nursing %</li> <li>• Acute incidents occur: the whole day through / several times a day / several times a week</li> <li>• Acute incidents dominate my work very much / somehow / a little / not</li> </ul> <p>The categorization may be adjusted to the investigated care process as long as it is clear to what % of patients or tasks the innovations applies (see Rel. 7).</p> <p>How do you act at each of the above-mentioned tasks?</p> <ul style="list-style-type: none"> <li>• Do you follow a fixed pattern?</li> <li>• How long does a patient contact take?</li> <li>• Do you use equipment?</li> <li>• Do you use (human) support? If so, for whom else does this supporter work?</li> <li>• Where do you perform your tasks? Could they be performed elsewhere?</li> <li>• Do you always sit or stand in the same position towards the patient? (Make a sketch)</li> <li>• Do you have to look up or ask after things?</li> <li>• Do you have to prepare anything?</li> </ul> |
| P 2      | <p>What other tasks do you have apart from providing care?</p> <p>How much time or energy do these tasks take from you?</p> <p>time %<br/>energy %</p>  |
| P 3      | <p>What exceptions or disturbances make that this kind of care or the coordination of this care fails?</p>  |
| P 4      | <p>Do you use a care protocol or medical guideline for the care you provide?</p> <ul style="list-style-type: none"> <li>• Do you comply with this protocol entirely or partially?</li> <li>• What parts do you use, what parts don't you use?</li> <li>• Does using the protocol fit with your way of working?</li> </ul>   |
| P 5      | <p>Who refers patients to you?</p>  |
| P 6      | <p>To whom do you refer patients?</p>   |
| P 7      | <p>What other care providers or institutions are simultaneously involved with the care for your patients?</p> <ul style="list-style-type: none"> <li>• Do you work together?</li> <li>• Or do you work "in parallel"?</li> </ul>  |
| P 8      | <p>How do you experience the cooperation with other care providers in respect to the</p>  |

|      |  |
|------|--|
|      | providing of the care?   |
| P 9  | With what care providers should you cooperate (more)? <ul style="list-style-type: none"> <li>• Why?</li> <li>• With whom should you exchange more information?</li> <li>• What information?</li> </ul> |
| P 10 | What do you find important in the contact with other care providers?   |

| <b>INF</b> | <b>Information quality</b>  |
|------------|---|
| I 1        | <p>What information about the patient do you need to perform your job properly?<br/>(Distinguish according to the separate tasks, mentioned in P 1 and P 2)</p> <p>What information do you receive from</p> <ul style="list-style-type: none"> <li>• The patient?</li> <li>• The patient's surrounding?</li> <li>• Other care providers?</li> <li>• With what purpose?</li> <li>• In what frequency?</li> </ul> <p>What form does this information have?</p> <ul style="list-style-type: none"> <li>• Letter (sent by post or handed over personally)</li> <li>• Fax</li> <li>• E-mail</li> <li>• In paper record</li> <li>• In electronic record</li> </ul>  |
| I 2        | <p>Does this information suffice?</p> <ul style="list-style-type: none"> <li>• Do you experience problems?</li> <li>• Do you miss information?</li> </ul>   |
| I 3        | <p>What information do you generate yourself when providing care?</p> <p>What information do you give to:</p> <ul style="list-style-type: none"> <li>• The patient?</li> <li>• The patient's surrounding?</li> <li>• Other care providers?</li> <li>• Managers?</li> <li>• External parties (e.g., insurance company, government)?</li> </ul> <p>What form does this information have?</p> <ul style="list-style-type: none"> <li>• Letter (sent by post or handed over personally)</li> <li>• Fax</li> <li>• E-mail</li> <li>• In paper record</li> <li>• In electronic record</li> <li>• Record only used for this patient group or this type of care</li> <li>• Record only used by your own discipline</li> <li>• Record only used in your institution</li> </ul> |
| I 4        | <p>How do you appreciate the quality of the proposed (or implemented) innovation?<br/>Regarding the:</p> <ul style="list-style-type: none"> <li>• Content</li> <li>• Objectives</li> <li>• Method</li> <li>• Possibility to integrate it in the present situation</li> <li>• Timeliness</li> </ul>  |

|     |  |
|-----|--|
|     | <ul style="list-style-type: none"><li>• Correctness</li></ul>                |
| I 5 | Where the right end-users involved with making or selecting this innovation? |

| <b>REL</b> | <b>Relevance</b>  |
|------------|---|
| R 1        | What do you experience, <b>for you personally</b> , as important in your daily work when you look at the care you provide?  |
| R 2        | <p>What aspects in the ability to provide care, do you experience as a bottleneck or problem?</p> <ul style="list-style-type: none"> <li>Concerning the providing of care</li> <li>Other aspects</li> </ul> <p>Are there any specific actions in the previously discussed processes that cause bottlenecks or problems?</p>                             |
| R 3        | Do you know proposals for improvement, concerning these patients, for which you would do your utmost?   |
| R 4        | <p>How important are these proposed improvements in the chain of care in relation to other possibilities to improve aspects of your job?</p> <ul style="list-style-type: none"> <li>Can you name other proposals for improvement, which are more important?</li> <li>Can you name other proposals for improvement, which are less important?</li> </ul> |
| R 5        | <p>In what way could the use of ICT matter to you?</p> <ul style="list-style-type: none"> <li>What application are you thinking of?</li> <li>For what purpose or for what situation?</li> </ul>   |
| R 6        | What aspect of your job would you miss, if it would be removed?   |
| R 7        | <p>How important are your tasks for these patients, <b>for you</b>, in comparison with your tasks for other patients?</p> <ul style="list-style-type: none"> <li>Why are these patients so important or of so little importance for you?</li> </ul>   |

| <b>A</b> | <b>Attitude</b>   |
|----------|---|
| A 1      | <p>To what extent are you convinced that the use of ICT is necessary to improve the providing of care?</p> <ul style="list-style-type: none"> <li>What experience do you have with ICT?</li> <li>How much time are you prepared to spend?</li> <li>Do you use ICT to communicate?</li> <li>How often do you use the Internet?</li> <li>How often do you use specific systems yourself?</li> </ul> |
| A 2      | <p>Do you experience obstacles when implementing innovations?</p> <ul style="list-style-type: none"> <li>Workload</li> <li>Management support</li> <li>ICT support</li> <li>Money</li> <li>Your skills</li> </ul>   |
| A 3      | How much time and energy do you think you can find to implement the changes that will occur when introducing innovations and ICT in this kind of care?  |
| A 4      | Do your colleagues or managers stimulate you to participate in changes?   |
| A 5      | <p>Can you name other innovation-projects this organization is working on?</p> <ul style="list-style-type: none"> <li>Are these projects equally important (or more or less important)?</li> </ul>  |

| <b>M</b> | <b>Means</b>   |
|----------|--|
| M 1      | <p>What ICT-facilities do you have at your disposal at your workplace?</p> <ul style="list-style-type: none"> <li>Hardware</li> <li>Software</li> <li>For communication</li> <li>Data</li> </ul> |
| M 2      | What of these ICT-facilities do you use when providing care?   |

|     |   |
|-----|---|
|     | <ul style="list-style-type: none"> <li>• Hardware</li> <li>• Software</li> <li>• For communication</li> <li>• Data</li> </ul>   |
| M 3 | <p>Is the technical support sufficient to guarantee the quality of the system?</p> <ul style="list-style-type: none"> <li>• Reliability</li> <li>• Availability</li> <li>• Security</li> <li>• Privacy</li> </ul> |
| M 4 | <p>Do you think you will have support to implement changes?</p> <ul style="list-style-type: none"> <li>• Time</li> <li>• Money</li> <li>• Training</li> <li>• Management support</li> </ul>                       |

|          |  |
|----------|--|
| <b>C</b> | <b><i>Concluding questions</i></b>   |
| C 1      | Is there anything you would like to add?                                     |
| C 2      | May we contact you to think with us in the development of a ICT-application? |