Value, Participation and Quality of Electronic Health Records in the Netherlands.

Ton AM Spil (corresponding author - a.a.m.spil@utwente.nl)  
Christiaan P Katsma; Robert A Stegwee; Ernst F Albers; Arne Freriks; Edwin Ligt  
University of Twente  
The Netherlands

Abstract

Growing cost of health care, the gradual reorganization of health care on a free-market basis and patients evolving into health care consumers all prompt hospitals to gain competitive advantage by improving efficiency, quality of care, and customer-friendliness. An electronic health record system (EHR) is one of the tools to achieve these goals. Hospitals are nevertheless lagging behind industry in implementing IT systems to support their core business processes.

Eighteen case studies were conducted among Dutch hospitals to examine the EHR system implementation. Through seventy three interviews with key stakeholders, the relation between perceived value of the EHR, the degree of participation in the implementation process, and the resulting quality of EHR systems was investigated.

The value that end users expect is not achieved within Dutch hospitals. It was found that no hospital had so far reached third generation EHR functionality, even though several hospitals are actively pursuing it. Innovation with respect to EHR systems in hospitals is limited because of a lack of capabilities, not because of a lack of participation. Extensive and ill-targeted end user involvement tends to delay decision making and exacerbates the mismatch between implementation goals and results. Quality issues focus on information quality in terms of completeness and system quality in terms of reliability.

This study contributes in combining participation models with the technology acceptance model and the IS success models. Electronic Health Records can be evaluated with this combination and a prescriptive analysis has lead to practical advice to the Dutch Ministry of Health.

Keywords: adoption; health care; electronic health record; participation; relevance; technology acceptance; information system success.

1. Introduction

The public and political pressure for a more efficient health care provision is rising in all developed nations, including the Netherlands. An ageing population and increasing number of patients with chronic illnesses are causing a growing demand and thereby growing health care expenditures [1]. Increased living standards and the development of consumerism in health care are putting additional pressure on the health care system [2]. Essential elements of 21st century health care, emphasizing the potential gains of an Electronic Health Record (EHR), are: widespread use of evidence-based medicine (including adaptive evidence-based decision support systems), robust information infrastructure, aligned reimbursement incentives, regulatory requirements, and a workforce skilled in evidence-based medicine [3][4].

The expression EHR is one out of many for computer-based systems in health care. The definition of an EHR used in this research is based on the definition of a computer-based patient record of the Institute of Medicine[5]:

“An EHR is a patient record that resides in a computer system specifically designed to support care providers by providing accessibility to complete and accurate patient data, medical alerts, reminders, clinical decision support systems, links to medical knowledge and other aids”.

Expectations of the ultimate benefits of an EHR, untangling all problems in healthcare, have been discussed and published for at least twenty years. The frequently delayed promise of a national interoperable EHR strengthens these expectations. The current Dutch government expected the national interoperable EHR in September 2009, whereas the previous government commissioned it to be operational by 2006. Neither deadline has been met. And only very few of the 110 general and academic hospitals in the Netherlands are ready to participate in such an interoperable EHR.
infrastructure, given the state of their own EHR implementation.
The implementation of an EHR has proven to be a path ridden with risks and dangers [6]. In this study we combine the (lack of) value achieved through EHR implementation with measures of participation and quality to determine possibilities to improve EHR implementation success. Studies [7][8] show that (top management) participation is the most important dimension for software implementation success. We use Poole and DeSanctis [9] and Katsma [10] to define and operationalize participation. Davis [11] and Rogers [12] show that perceived usefulness and relative advantage are the main drivers for people to accept technology. The problem of adoption by physicians of an EHR is described by Schuring and Spil [13] as a gap between expected and perceived performance and effort expectancy [14]. The quality of an information system in general [15] and EHR specifically influences both participation of end-users and value for end-users, while participation and value influence the success of an EHR.

This paper first defines the main research question and then develops the research model in terms of value, participation and quality in section 2. Then in section 3 the research method is shown followed by a concise description of all eighteen cases in section 4. Section 5 presents an analysis and discussion and in Section 6 we return to our main research question and discuss the overall results.

2. Value, Participation and Quality

Figure 1 shows the research model derived from many models as handled in this section. The relations between quality, participation and value are best explained by Barki and Hartwick [16]. We consider value as most important as shown by many applications of the TAM model [11] and in the UTAUT model [14]. Schmidt [8] showed in his Delphi study that (top management) participation is very important for IS success. Finally, Delone and McLean [15] showed the many applications of their model where the net benefits are dependent on three quality dimensions.

The main research question this research aims to answer, is: How to increase the value, optimize participation and leverage the quality of Electronic Health Records in Dutch hospitals?

2.1 Value

Benefits of an EHR are reported in literature as incentives like positive financial returns on investments to health care organizations and time saving incentives [17]. The EHR is helping clinicians in making better decisions [18], making healthcare safer for the patient and more satisfying for the clinician [19]. The EHR has the potential for annual savings for the overall healthcare system, by improving healthcare quality and efficiency [20].

Thus far the focus of value of EHRs is on the availability of information at any time and any place, which does not meet the end-users’ expectations [10]. Promises for better quality of care should prompt a call for the adoption of an EHR [21].

The perspectives of value and participation [22] are based on innovation diffusion theories. Value is derived from Rogers’ relative advantage [12], Davis’s perceived usefulness [11], job-fit and usefulness and outcome expectations [23]. Spil and Schuring [22] distinguish between Macro-relevance and Micro-relevance. Macro-relevance defined as: “the degree to which the user expects that the IT system will solve problems or help to realize his actual goals”. Micro-relevance defined as: “the degree to which IT-use helps to solve the here-and-now problem of the user in his working process”.

Looking at the Dutch situation we see that the adoption decision of Second generation EHRs took place in (almost) all hospitals. Since 2005 hospitals started with implementing Third generation EHRs, but most hospitals are not up to it yet. We will therefore focus further on the individual adoption process.

Gallivan [24] describes three factors that mediate between primary and secondary (individual) adoption: managerial interventions, subjective norms and facilitating conditions. Managerial interventions describe the actions taken and resources made available by managers to expedite secondary adoption. We will elaborate further on managerial interventions in the participation section. Subjective norms are best described by Micro-Relevance and Macro-relevance. Schuring and Spil [25] found micro-relevance as a key factor.
factor in explaining IT-use in their case studies. The third construct, facilitating conditions is described by Gallivan as factors that can make implementation more- or less-likely to occur [24]. Katsma [10] describes this factor more extensively as participation, which should increase micro-relevance perception of the involved user.

Even if an EHR is able to solve the here-and-now problem of the end-user in his work process, it might still not come to actual use of the system, even years later. Fichman and Kemerer [26] call this an assimilation gap, which is common for technologies with a high implementation complexity. In the Dutch situation any time that a doctor devotes to EHR use does not lead to increased income potential and for hospitals it is not clear if they will benefit [27]. We assume financial and time saving incentives to have positive effects on EHR use, as it is widely recognized in literature [17][19]. The identified value dimensions from Table 1 are used to analyze their effect on EHR adoption.

Table 1: Value dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Items identified in this research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expectations</td>
<td>Performance expectation [14], organizational impact [15] or macro-relevance [22]</td>
</tr>
<tr>
<td>Subjective norm</td>
<td>relative advantage [12], perceived usefulness [11], micro-relevance [22], involvement [16][28][29]</td>
</tr>
</tbody>
</table>

2.2 Participation

It is argued that extensive participation by different care professionals during the implementation is significantly contributing to the acceptance of an EHR [29][30]. Although end-user participation is of paramount importance to foster ownership of the system by future users [6], still many organizations fail to take this aspect of the change process into account during their implementation [10].

Participation is an extensively investigated item [9,10,16,29,30] and Barki & Hartwick [28] elegantly bridge the explanation of participation with value as discussed in the prior section. During the change process willingness to change is an important factor in adopting new technologies [9]. Barki & Hartwick [28] explain this intention is a subjective psychological state reflecting the importance and personal relevance of a system to the user and call this involvement. They argue for a separation of the constructs of user participation and involvement. Participation in their and others perspective is defined as a set of behaviors or activities performed by users in the implementation process. User involvement on the other hand reflects the care professionals subjective norm (table 1).

This distinction between involvement and participation recently is confirmed in another study by McGill and Klobas [29]. We therefore continue this line of reasoning and separate between involvement (included under the value dimensions as subjective norm, table 1) and participation as process in which the different actors act. One way to achieve user involvement is through user participation [16][28][29], but as McGill & Klobas correctly state both participation and involvement influence application success, but little is known about the mechanisms by which their influence operates.

The extent to which people are willing to participate and change not only depends on their subjective norm, but also very much on the management of the change process [31]. The management is able to demote and create barriers when end-users are disempowered [32]. Empowering and facilitation of the change process stimulate the interplay between involvement and the participation process.

Top management support, organizational change -and project management approach are found to be critical factors for successful implementation of information systems [33][24]. Berg [6] argues for presence of upper management from a practical point of view: without the presence of upper management the processes tends to loose direction and thus agreement among end-users. In respective to the various contributions and theories of participation and involvement we ground our research lens on the basics of the Barki & Hartwick [28] model.

The latter is shown in Table 2, which includes the items that have been used for this research in the Dutch academic hospitals. We discern three dimensions that specify participation as a process and enable to specify the relationship with value as presented in the prior section.

Responsibility by Barki & Hartwick originally is focused around the responsibilities of the IS implementation. This dimension recently is adjusted by extending the participation scope from the mere IS perspective towards the more holistic perspective on IS implementation [34] and encompasses the system introduction, but also the organizational change process. It specifies the content [29] of the participation initiatives, but also the level [36] or the degree [29] of the participants actions during the process. In other words this dimension specifies the
topics and the amount of detail the participating members discuss and work on during the implementation process.

The second dimension, influence, is unanimously derived by the various authors in this school of thought. It specifies the influence on the decision making process [34] or the power or control over the outcomes of the process. Either on the IS solution itself [30] or the entire change and implementation process [30]. This dimension continues the first one of our framework. Responsibility characterizes scope in the participation process, whereas influence specifies how much authority the participating members have over the chosen alternatives.

The third dimension is often called hands-on activity [28] and describes the different aspects of the participation process itself. We call this the process dimension that specifies how the participation is deployed in format, activities, timing, but also efficiency of the participation efforts.

From our interview findings we value participation both from a perceptive norm as well as by specifying the three dimensions. This means we asked the interviewees if they were satisfied with their responsibilities, influence and how they could deploy their actions, but also asked to label, specify and if possible quantify these actions, influence and responsibilities.

We coded the combined findings towards high, moderate and low. Our coding scheme uses the following setting. We value the participation dimension as high when the interviewee responded a high perception on at least two of the dimensions and also was satisfied with at least two of the participation dimensions. E.g.: The respondent indicated to be actively deployed in the process and have and extensive influence on the outcomes, but also when he/she was satisfied with the participation efforts and influence. In our opinion a mere score on influence alone is not an indication for high participation as this exactly illustrates, the often criticized lack of top management presence during the process, but their mere interference in the decision making process.

We value participation as moderate when interviewees report moderate actions and responsibilities or only satisfied on one of the three dimensions. We value participation as low when the interviewees respond they were not satisfied with any of the three dimensions and also perceive their activities (process) as low or negligible and respond to have no or low influence.

---

Table 2: determinants of participation (based on: Barki & Hartwick [28], McGill & Klobas, [29], Cavaye [30]; DeSanctis and Poole [9])

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Items identified in this research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsibility</td>
<td>Degree and content [30], level [46], Overall responsibility [28]</td>
</tr>
<tr>
<td>Influence</td>
<td>Decision process [9], User IS relationship [32], Influence [30]</td>
</tr>
<tr>
<td>Process</td>
<td>Extent and format [30], Hands-on activity [28], efficiency &amp; atmosphere [9]</td>
</tr>
</tbody>
</table>

---

2.3 Quality

The evolutionary process of the development of the EHR has changed software packages from translating existing paper based data into passive systems, towards active systems ‘fed’ with the input of the caregivers. The most recent EHRs are more advanced and are supporting clinical episodes and participating clinicians. They are known as Third Generation EHRs, or ‘The Helper’ [35].

To be able to propose incentives and mandates for EHR suppliers we first analyze the interplay between end-users and EHR suppliers via the EHR system. Success of the interplay can be divided into three categories according to the revisited approach of Delone and McLean [15]: (1) information quality, (2) system quality and (3) service quality. In their model the three categories influence both the intention to use, as well as the user satisfaction. In our study the intention to use is best compared with macro-value, whereas user satisfaction is best compared with micro-relevance. Van der Meijden [36] conducted a literature study on patient care information systems and identified attributes per dimension. The attributes are supplemented with literature findings, as can be found in Table 3. The “Ease of use” component in the model of Collis [37] is related to availability and usability aspects of the system. To indicate the system quality in this research we use the three system success categories according to the revisited approach of Delone and McLean [15].

System quality, as described in Table 3, has a direct link to Gartner’s definition of different generations of EHR systems [35], as these generations are differentiated (in part) in terms of workflow support, customization possibilities and expression power. A simplified description should suffice to interpret our references to EHR generations in this study:
• The first generation EHR systems combine data from different ancillary systems into a single integrated view;
• The second generation adds clinical documentation capabilities;
• The third generation adds order management, limited workflow capabilities, alerts and reminders;
• Fourth generation EHRs include full clinical workflow with decision support and knowledge management to develop an evidence-based care pathway;
• Fifth generation adds to this advanced interoperability, to take into account the capabilities and certifications of all resources involved in the provision of care.

Fully capable third generation EHRs have been available on the market since 2005 and the first Dutch implementations have commenced in 2007. Fourth generation EHRs are expected to become available in the next few years.

Table 3: Success dimensions and their attributes (based on Delone and McLean [15]; Van der Meijden [36])

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Items identified in this research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Quality</td>
<td>completeness, Data accuracy, legibility</td>
</tr>
<tr>
<td>System Quality</td>
<td>ease of use[11][42], time savings, reliability, workflow support, interoperability, customization possibilities, expression power</td>
</tr>
<tr>
<td>Service Quality</td>
<td>availability, support, responsiveness</td>
</tr>
</tbody>
</table>

3. Research Method

In order to apply our model as presented in figure 1, we decided to conduct case studies. Yin [38] and Stoop and Berg [39] have argued in favor of case studies for theory development. Data about hospitals and software vendors are collected in 73 qualitative interviews. Qualitative studies are capable of generating insights that can explain the effects of healthcare specific peculiarities [39].

With the help of purposive or judgmental sampling [40] eighteen hospitals (out of hundred) in the Netherlands were selected according to a specific set of criteria. These criteria include homogeneity of the hospitals, maturity of the EHR and the stage of the implementation progress. The implementation process should have progressed beyond ‘go live’ to be able to investigate the degree of adoption.

Table 4: Hospital selection criteria

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Realization in the research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homogeneity of hospitals</td>
<td>Each case is a Dutch hospital.</td>
</tr>
<tr>
<td>Maturity of solution</td>
<td>Multidisciplinary Implementation of the EHR Beyond first generation[35]</td>
</tr>
<tr>
<td>Progress of the EHR implementation</td>
<td>The process is progressed past going live for at least two specialties.</td>
</tr>
</tbody>
</table>

The hospitals are homogeneous but differ in size and in status. The empirical data is collected with help of extensive interviewing. The used interview model is based on the USE-IT model [22], the Delone & Mclean [41] model, the TAM model [11] and the 4E-model [37]. The interview is structured according to the components of Figure 1. The value, participation and quality questions are based on the identified success dimensions as can be found in Table 1, Table 2 and Table 3 respectively. In total, seventy three interviews of more than an hour were conducted.

In Section 4 the qualitative data is related to the components value, participation and quality. The cases are judged by comparing their empirical data with the identified success dimensions as can be found in Section 2. In Section 5 the case results are turned around to possible solutions with a prescriptive analysis. Section 6 presents the conclusions.

4. Results

**Hospital 1** is an academic hospital with 7000 employees. The value is potentially high but the most mentioned incentive is time saving so the real value is low. The hospital as a whole is mentioned as “innovative” but there are many initiatives on operational level leading to sub optimization but with a moderate participation level. The quality of the overall EHR system is low according to the interviewee.

**Hospital 2** is an academic hospital with 8500 employees. In hospital 2 the EHR consists of a hospital wide EHR and specific EHRs for most of the departments. The quality is lacking in all three identified dimensions, as can be found in Table 5. The system is slow, it is not easy to use, the data is not legible, the system is not always available and the
support is lacking. The negative evaluation of the system and the absence of customization possibilities make the value moderate.

**Hospital 3** is a big academic hospital with nearly 10,000 employees. The expectations for both management and professionals are high. The participation is coordinated by the executive board and can be considered as high. The lack of reliability of the EHR prevents a high score on quality.

**Hospital 4** is an academic hospital with 6000 employees. Time saving is the most valuable character of the EHR. The lack of conflict management decreases the score on participation. The quality is sufficient but not high.

**Hospital 5** is a general hospital with 2000 employees. It can be typified as an IT leader. The value of the EHR is one of the highest in the Netherlands but still one employee said “the new EHR will lead to a happier administration”, and not much more than that. The approach involves many employees but the quality of the system is still not high.

**Hospital 6** is a cooperation of three hospitals that together have about 6000 employees. The joint implementation of their EHR is “on track”. Given the statement of one of the interviewees: “give them a my First Sony and they want more”, all three dimensions can be categorized as moderate and growing.

**Hospital 7** is a small hospital with 1350 employees and the information manager is clear about their ambitions: “we wish to be trendsetter in the Netherlands, and even in Europe”. But although the expectations (value) are high, the quality that is reached is still low. The participation level is high but does not help to improve the quality of the EHR system.

**Hospital 8** is an academic hospital with 7100 employees. The expected value of the EHR is not high. One hospital respondent stated “the software made a best fit with the hospital”. The quality can therefore be seen as moderate and the participation level is moderate with many consultants helping to implement the EHR.

**Hospital 9** is a small general hospital with 2100 employees. One of the interviewees started by stating that: “the previous implementation was a failure”. The learning process increases the participation level, but lowers the expectations a little. The interviewees are satisfied with the functionalities of the new EHR.

**Hospital 10** is a small general hospital with 1400 employees. The value expectations are low illustrated by a statement of an employee “we take it easy”. The participation level surpasses the expectations, because a good plan was drawn. The quality of the system is reasonable because of the cooperation with two other hospitals.

**Hospital 11** has 5000 employees. The self made system has a high quality but the expected value does not go beyond availability of the EHR. Despite that one respondent said that “the quality of care was most important”. The participation level is consistent with their ambition, moderate.

**Hospital 12** is a general hospital with 2300 employees. The project manager stated: “if there is no attention for the process you end up with the wrong thing”. The value expectation is “no nonsense” low but the participation is high and the system reliable.

**Hospital 13** is a small hospital with 2100 employees. The EHR started out in the departments and spread through the hospital with a high expectancy. This bottom up approach led to a high participation but the overall quality is due to sub optimization a bit lower than expected.

“We were sure of the benefits and that kept us going” shows their confidence in the future.

**Hospital 14** is a big general hospital with 4000 employees. The hospital lags a little bit behind but is selecting a new system as we interviewed. The doctor that we interviewed was not too optimistic”. the EHR is like writing your own verdict”. The whole project organization has to be developed yet.

**Hospital 15** is a hospital with 2000 employees. It is the first and only hospital in the Netherlands that stopped the use of paper records. Therefore the trust in the EHR quality is high. Despite this digitalization the hospital is thinking of changing its supplier. The participation level matches the expected value, moderate.

**Hospital 16** has 3500 employees. One of the interviewees stated that an EHR is “not necessary at all”. Despite that, the EHR quality is not bad just like the participation of the employees.

**Hospital 17** is a big general hospital with nearly 6000 employees. They lowered their ambition level when implementing an EHR. Although one of the employees complained about the quality of the system, the good
participation of the doctors should increase the quality and value soon.

**Hospital 18** is a general hospital with 3300 employees. “Better information means better decisions”, said one of the doctors that were interviewed. Although the expectations in an information strategy are fairly high and the participation seems to be accordingly, the overall quality is still low.

Table 5 – Overview results

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Participation</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>5</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>6</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>7</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>8</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>9</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>10</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>11</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>12</td>
<td>Low</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>13</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>14</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>15</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>16</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>17</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>18</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
</tr>
</tbody>
</table>

5 Descriptive and Prescriptive Cross case Analysis

5.1 Value Analysis

Resuming the results below we can state that for nearly all the hospitals the subjective norm is too low to create enough incentives for professionals to invest time in a new EHR system. This confirms earlier studies from Chismar and Wiley [42] and Spil [43]. What makes hospitals 3, 7 and 13 different? The first one is an academic hospital where they created their own EHR. Hospitals 7 and 13 are both small and have a bottom up approach that is acknowledged by top management. The hospitals where the expectations are high all have a kind of strategic plan or a group of doctors that are very enthusiastic. This leads to the following question:

*What should happen to improve the value of EHR for the healthcare professional and the hospitals?*

Up till now the hospitals have not been able to include active support to care planning, work flow and clinical decision support that shows more value to the user that could convince the professionals to participate.

Flexibility of the EHR or creating a mother and daughter EHR [44] in a way that professionals can choose what to use. With this extra responsibility, the relevance or performance expectancy is dependent of what they do themselves.

To accommodate the implementation of a third grade EHR the ministry should force all the Dutch hospitals to use certain standards. On national level not too much data has to be exchanged but on hospital level all relevant medical data should be in the record. The professional himself has the most detailed information and room for specific notes. In this way a layered record can evolve.

Last but not least the professionals have to be convinced of the net benefits of the EHR focussing on the improvement of the quality of care.

5.2 Participation analysis

Our investigations show participation is applied extensively in almost all cases. In only one case (No. 14) the participation process is graded low, as both top Mgt and care professionals do not participate in activities and the participation content is very limited. In all other cases participation is rated either moderate (eleven) or high (six). In 14 from our 18 case studies we observe low to lacking top management participation. More concrete: Top Mgt is invisible, does not manage or guide the implementation process, or fails to communicate a clear vision and goal behind the implementation. There are no significant differences in these participation activities and content between the smaller and the larger hospitals comparing the relative number of participants and the project’s duration and scope. Inspecting these results leads to the following question:

*How can hospitals balance the participation in EHR projects?*

Our findings on the participation determinant confirm the difficulties found in earlier research [45][29]. Participation is way more complex than the often heard phrase: “Participation increases the successful adoption of IT systems”. Participation is a “catch-all term” and requires a more precise specification. It is especially this perception by practitioners that may lead to several problems we observed in our empirical studies.
Participation quickly becomes a “holy grail”, but in our investigations more turns into an inefficient way of working that delays the decision making process and fails to guide the requirements definition process into relevant contributions for the care providers. We do not say participation should be banned, but it requires a careful balance between who, at what moment in time will participate about what different topics. Applying this rather plain “Sesame street” like approach to our problem domain shows that first during the implementation it is important that both the management and the doctors are involved. The management should keep track of the whole process of implementation. They need to formulate a well-established implementation approach, with their responsibility to give feedback and stimulate the doctors/nurses to use the EHR. The doctors should also be involved with the implementation of the system, because from other studies can be concluded that in hospitals with self-made EHR’s the participation was much higher. Finally a deliberate attention is necessary from EHR suppliers. Still one of the existing problems in the implementation of EHR is the information quality: suppliers fail to deliver information systems that really contribute to the aspects care providers care about. Relating this to the participation domain we cannot conclude a direct relationship between participation efforts and system quality (see table). On the contrary our investigations confirm Barki & Hartwicks and McGill & Klobas observations that involvement is a different kettle of fish than the mere participation process itself. The participation efforts in the majority of our case studies is moderate to high, whereas the quality on the other hand in most of these cases is low to moderate.

5.3 Quality Analysis

Only two hospitals (11 and 15) consider the quality of their EHR as high. The first has a self made system that over ten years evolved to a steady functional system. The second hospital even dared to stop creating paper records. The other hospitals have a double system because the reliability and completeness of the digital system is too low.

The functional quality does not seem to be the problem for the end users although we had some question marks about the user friendliness of the systems.

Finally, the service quality, especially the availability is the key argument for the hospital to continue with the EHR effort. Up till now this was not enough to convince the end users. This leads to the following question:

**How can hospitals and suppliers improve the quality of the EHR?**

In two hospitals (6 and 10) collaboration with other hospitals lead to an improvement of the quality. Networks of collaborating hospitals could therefore be a successful path.

In the improvement of information quality an important point is the completeness of information. The system must involve all the different parts involved in health care process, in that way the innovation can represent a simplification of the exiting procedure and not something more complicate. New systems are complex to use, so extensive training is needed. Physicians need to make time to follow the necessary trainings.

To fit the EHR in the working process availability is important. There should be access anywhere and anytime to analyze and add data so this cannot withhold the physician from using it. The system quality of future HER should therefore support mobile equipment.

For a successful implementation of the EHR a uniform working method of the different health care providers is required in order to make data share in one system possible. For some professionals this means they have to change their way of working, this can cause some resistance to work with the system. Therefore it is important that the end users are closely involved in the ‘design’ process of the system to see what works and what not and to come to a consensus between different methods of information sharing and analysis.

6 Conclusions

The contributions from this study are both practical and scientific. Practically it has lead to a letter to the Ministry of Health with a plea for change on all three dimensions:

- The value of the EHR on micro level should be improved both for the professional and the patient. On macro level the expectations are high but the implementation is still disappointing. From the eighteen hospitals studied only one did not use a paper record anymore.
- The participation is not balanced with the value and the quality of the systems used. In general there is not a lack of participation but an overload of participation causing delay in the implementation process. In
contrast with that high participation level, the implementation capabilities are too low.

The quality of the systems is still limited. No hospital has so far reached third generation EHR functionality, even though several hospitals are actively pursuing it. The suppliers lack innovation due to time and money shortage for research and development.

The scientific contribution focuses on the operationalizations and relationships in the value, participation and quality model. Within the value dimension, the subjective norm turns out to be a crucial determinant for success. This confirms quantitative studies where they call it perceived usefulness and qualitative studies of other healthcare systems where they call it relevance. This study shows that the participation dimension should be balanced with the value dimension as shown in the practical contributions. This means that increasing just one of the dimensions does not directly have a positive impact on overall success. Combining the three dimensions in one research model has provided a rich pool of data in this large qualitative study.

Future research should elaborate on the relationships, especially with respect to the quality dimension, and quantitatively generalize the findings. An international comparison would also enrich our findings, although we expect the results for the Netherlands to be indicative of other western developed countries.

7. References


