

# The Relevance of Telehealth across the Digital Divide: The transfer of knowledge over distance.

Ton AM Spil<sup>a</sup>, Roel W. Schuring<sup>a</sup>, Rueben Mugisha<sup>c</sup>  
Margreet B Michel-Verkerke<sup>a</sup>, Peter JB Lagendijk<sup>b</sup>

a) University of Twente, The Netherlands

Corresponding address [a.a.m.spil@utwente.nl](mailto:a.a.m.spil@utwente.nl)

b) HAN University of applied sciences

c) Country Manager African Regional Centre for Computing, Rwanda

## ABSTRACT

*This paper explores the concept of Relevance as an explanatory factor to the diffusion of IT-use, or, in this paper particularly, the use of Telehealth. Relevance is the net value of performance expectancy and effort expectancy and contains both micro-relevance (i.e. here-and-now) and macro-relevance (i.e. actual goals) Following the case-study approach, two Telehealth situations were studied in Rwanda and The Netherlands. In the comparison, two more existing studies in Canada and Tanzania were included. The conclusion is that Relevance is the explanatory factor, whereas particularly micro-relevance is crucial. Without the micro-relevant occasions that initiate use, there will be no use on longer term In the cases studied the micro-relevance of knowledge-transfer was crucial. Furthermore distance determined Telehealth relevance. Practical conclusions to cases were drawn.*

**Key Words:** Telehealth, e-health, developing countries, relevance, diffusion, use, micro-relevance, Rwanda, Netherlands, rheumatism

## INTRODUCTION

The Information Technology (IT) based Innovations of Telehealth have the potential to support and enhance physicians' patient care as well as to improve healthcare organizations' competitiveness (Hu et al. 1999). Relevance is seen as the main determinant of Information Systems (IS) success (Dhillon & Forducey, 2006) and especially job relevance, that is the value of the information system for the working process has a significant relation with the use of the information system (Chismar et al. 2003) (Venkatesh et al. 2003).

To promote the diffusion of Telehealth, campaigns should focus on the relevance of such systems for physicians of different regions and specialties (Gagnon et al. 2003). The key motivation for adopting Telehealth technology is the ability to access healthcare expertise that has already been developed at another institution (Robinson et al. 2003). Telehealth can increase access to care by allowing physicians to remotely examine patients or to consult with specialists. It can improve quality of care by enabling physicians to collaborate on complex clinical problems of patients whose disorders cannot be diagnosed or treated at referring sites. It can also reduce costs by enabling in-home monitoring of patients, eliminating the need for on-call expertise, maintenance of expensive facilities, and transportation of physicians to patients or vice versa (Higa et al. 1997; Tanriverdi et al. 1999). Although physicians get the most attention in Telehealth research, the nurses are often the front-line healthcare professionals and therefore central to successful Telehealth implementation (Effken and Abbott, 2009).

This paper seeks to explain differences in diffusion of Telehealth in various sections of the world by comparing a case study in Rwanda and The Netherlands. First, the digital divide between Northern countries and Southern countries is introduced. Then the concepts of Telehealth and relevance are defined and elaborated. Finally, the relevance of Telehealth in Rwanda and in The Netherlands is described and the empirical data is analyzed and compared with two literature and demographic studies in Tanzania (Katzenstein & Chrispin, 2005) and Canada (Watanabe, 2000). This allows conclusions on the relevance of the Telehealth divide. Miscione (2007) studied Telehealth in the Upper Amazon and concluded that the knowledge transfer should be embedded in the local culture. Avgerou (2008) reminds us in more general terms, bringing Telehealth across the Digital Divide is not a technological issue.

## THE NORTH – SOUTH (DIGITAL) DIVIDE

In 2007, according to the UNDP World Human Report 2009, Rwanda scored very low on the Human Development Index (HDI) in the Southern African Developing Community (SADC) countries, with 0.460. *Table 1* shows some basic indicators of the dramatic state in which the majority of the population, especially those in rural areas, find themselves. However, the country's macro-economic indicators show positive signs of growth. For example, in 2007 the Gross Domestic Product (GDP) increased.

In the UNDP World Report 2009, Canada and the Netherlands nearly tie for 4<sup>th</sup> highest position with a Human Development Index (HDI) <sup>1</sup> of 0.966 and 0.964 respectively, and Rwanda at the 19<sup>th</sup> lowest one with a HDI of 0.460 and Tanzania a little higher with 0.407 (UNDP. 2009). Tanzania is one of the world's less developed countries (Katzenstein et al. 2005). The ICT infrastructure even though is undergoing rapid modernization. Telehealth might be able to help lever the HDI while more people can use the scarce resources. Another

---

<sup>1</sup> The UNDP Human Development Index measures three variables of a country population: life expectancy at birth, degree of education and income per capita.

benefit from Telehealth is bridging distances. Canada presents a strong case for Telehealth development (Jennett et al. 2001). The population (29 million people) averages to just under three people per square kilometer. The density in Tanzania is nearly 20 people per square kilometer. In the Netherlands (16 million people), Telehealth struggles for survival since the average density is 477 people per square kilometer. The question is how Telehealth will prosper in Rwanda (254 people per square kilometer)?

	Human Development Index (HDI)	Life expectancy (years)	Education enrollment (%)	Gross Domestic Product per capita (PPC dollars)
	2007	2007	2007	2007
<b>Canada</b>	0.966	80.6	99.3	35.812
<b>Netherlands</b>	0.964	79.8	97.5	38.694
<b>Tanzania</b>	0.530	55.0	57.3	1.208
<b>Rwanda</b>	0.460	49.7	52.2	866

Table 1 - demographic comparison (UNDP. 2009)

The *digital divide* is not a new phenomenon. On the contrary, it reflects and accentuates the existing technological gap between rich and poor countries. In fact, most evidence of the digital divide revolves around Internet access but also in the infrastructure (table 2) across the country (Kun 2001). “In those areas where the infrastructure is underdeveloped, unreliable, or non-existent, the cost of upgrading the infrastructure can be prohibitive. Yet these same areas would most likely benefit the most from Telehealth services.” The early Telehealth endeavors failed because of primitive Information and Communication Technology (ICT) infrastructures, immature technology, inefficient use and premature funding termination (Bashur et al. 1997). These conditions are still present in the Southern countries studied.

The import of ICT into poor countries is quite problematic (Piotti et al. 2005). However, whatever ICT development strategy the poor countries intend to choose, the relationship with globalization and market worldwide is not avoidable. The countries and regions, which are integrated into the global network, have a potential to develop themselves according to the present technological system. Those without this access are condemned to marginalization (Castells 1996). Castells and van Dijk showed that structural inequality is the main cause of the digital divide (Fuchs & Horak, 2008). ICTs enable the pervasive expansion of networking throughout the social structure but global diversity should be a key focus when developing and using ICT (Walsham 2002).

The North-South divide not only shows on technical issues. More cutting are the figures on the life expectancy in table 1 or the number of physicians in the African countries (table 2). The latter figures play an important role when interpreting the interview results.

	Phone mainlines per 1000 people	Cellular subscribers per 1000 people	Internet users per 1000 people	Physicians per 100000 people	Health expenditure Public % of GDP
	2005	2005	2005	2004	2004
<b>Canada</b>	566	514	520	214	6.8
<b>Netherlands</b>	466	970	739	315	5.7
<b>Tanzania</b>	4	52	9	2	1.7
<b>Rwanda</b>	3	32	6	5	4.3

Table 2 - comparison on telecommunication and number of physicians (UNDP. 2007/2008)

A "knowledge gap" currently exists between the developing countries and most of the rest of the world. The distribution of skilled professionals and access to knowledge and information is highly skewed in favor of developed countries. For example, scientific and technological capabilities are distributed highly unequally in the world. Developing countries account for only 13 percent of the world's scientists and engineers, and only 4 to 5 percent of global spending on research and development, and most of this small share is concentrated in a few countries (Baranshamaje 1995). The problem of the knowledge gap is twofold: (1) the developing countries are unable to access and use the latest knowledge and information that is currently available in the world; and (2) they have been unable to produce knowledge for their own use and even less able to contribute to and influence the creation of the base of knowledge and information being produced around the world.

## TELEHEALTH

The organizing vision of Telehealth has developed differently in different countries. It depends on the countries geographical and socio-economic situation, national policies, telecommunications and information technology saturation, the history of adoption of innovations and specific local circumstances (Klecun-Dabrowska 2002). In the Northern countries a renewed interest is seen caused by increased pressure on the healthcare provision and technological advances, coupled with cheaper telecommunication services. In the Southern countries there is a first interest in Telehealth and hopefully they can learn from the Telehealth programs failure in the Northern countries caused by telecommunication costs, technology problems, lack of stability and difficult use (Darkins et al. 2000). Especially the inability to interface Telehealth with mainstream healthcare provision and the inability to justify them on cost-benefit basis (Field 1996; Perednia et al. 1995).

Telehealth is defined as:

The use of advanced telecommunications technologies to exchange health information and provide healthcare services across geographic, time, social, and cultural barriers (Reid 1996).

The goals of Telehealth applications are stated as (Ratzan 2002): "Staying healthy, getting better, and living with disease". The physicians also perceive the patients' benefits as very important with regard to equity in access, quality and continuity of care (Gagnon et al. 2003). Heinzelmann (et al, 2005) see the added value of Telehealth as enabling effectiveness, quality, cost savings and accessibility. Suleiman (2001) takes an ICT perspective with four applications on the Telehealth flagship (figure 1):

1. Teleconsultation or reducing the distance
2. Empowerment for patients and reducing inequities
3. Knowledge for professionals (broader than Suleiman)
4. Life time health

Teleconsultation will allow for interaction between hospitals and healthcare centers,

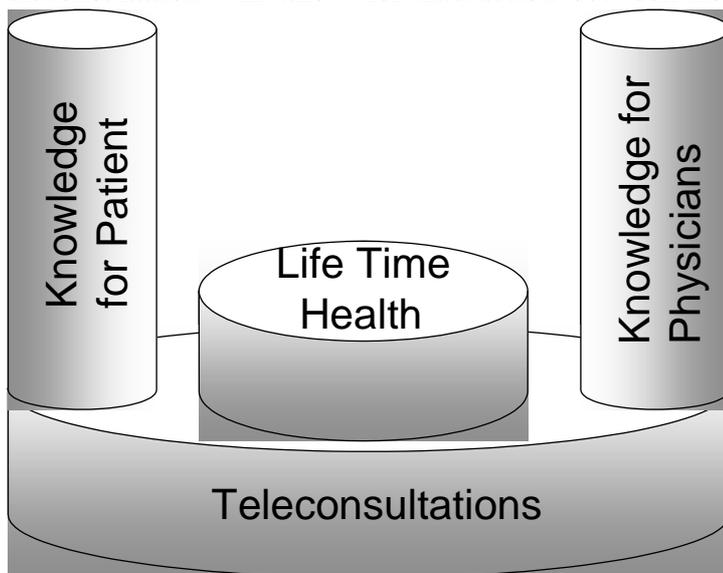


Figure 1 - Flagship Telehealth (Suleiman 2001)

especially in rural areas. It will enhance the capabilities of the rural health centers and extend

the reach of specialized healthcare (Suleiman 2001). Furthermore it can optimize the utilization of physicians and reduce patient transfers.

Empowerment provides up to date knowledge for patients and improves the decision capability (Morris et al. 1997). With the promise of information brought to rural areas, Telehealth can bring more equity in the healthcare system (Klecun-Dabrowska 2002).

Knowledge for professionals will come from passive sources but also through active computer links. Mann and Chaytor(1992) increasingly regard assessing educational needs as a critical component of program planning, design, and evaluation, particularly in adult and continuing medical education (CME). Dialogue (telephone, email, video or audio conferencing)(May 2002), is essential for the telelearning design(Anderson et al. 1995)amongst other tenets of success (Klecun-Dabrowska 2002) like keeping the end-user in mind and having champions on every side(Watanabe 2000).

Lifetime health can be seen as the main integrating factor of health services (Suleiman 2001) and refers to prevention (Ratzan 2002), effective support for treatment and enhancing coping (Jennett et al. 2001).

### **RELEVANCE: MACRO- AND MICRO**

Many researchers of diffusion have sought to explain difference in diffusion patterns. Venkatesh (et al. 2003) proposes a synthesized model of user acceptance, which they call the UTAUT (Unified Theory of Acceptance and Use of Technology). In this model, they propose four constructs that play a significant role as determinants of user acceptance and usage behavior. Of these four, the performance expectancy construct is the strongest predictor of use intention. Performance expectancy is a concept that evolved over time. It resembles Rogers' (1962, 2003) *Relative Advantage*, Davis' (1989) *perceived usefulness*, Thompsons' (1991) *Job-fit, usefulness and outcome expectations* (Compeau et al. 1995). Schuring & Spil (2003) used to call the factor relevance, which is in fact the net value of performance expectancy and effort expectancy.

In the IT-diffusion literature, relevance was originally defined by Saracevic (1975) as a measure of the effectiveness of a contact between a source and a destination in a communication process. This is a somewhat abstract wording of what we would call the degree to which the user expects that the IT-system will solve his problems or help to realize his actually relevant goals. There are three dimensions in this explanation that are kept implicit in Saracevic' definition that we want to explain. As many authors, we use the word "expects" since we want to make more explicit that relevance is a factor that is important in the course of the adoption process, not only in evaluation. Second, instead of effectiveness we use "solve problems and goals". By doing so, we imply that effectiveness has two dimensions: to take away existing negative consequences (problems) and, to reward with positive consequences (reach goals). Third, the word "*actual*" is crucial in our view of relevance. Relevance is not to be confused with the degree to which the user considers outcomes as being positive. The set of outcome-dimensions that someone considers "positive" is larger than the set of outcome-dimensions that are relevant. Imagine a physician, who basically considers IT-outcomes of a computer decision support system, such as, assistance in diagnosis, disease prevention, or more appropriate dosing of drugs (Thornett 2001) as "positive". This does not automatically imply that the IT-adoption is relevant to him. It is only relevant if these outcomes are high on his goal agenda. That is why we use the word actual. Relevance as discussed in this paragraph can be divided into macro relevance and micro relevance as shown in the next paragraphs.

**Macro relevance**, is defined by Spil et al. (2004) as: “the degree to which the user expects that the ICT system will solve problems or help to realize her actual goals”. Some goals or problems may be entirely unrelated to the use of IT or Telehealth, but still may dominate the agenda of the “user”. This is, however, the yardstick to determine the (potential) relevance of the application that is being studied. Although the list of problems and goals is personal and may contain odd issues, we dare to state on the basis of previous work, that it is very likely that one or more of the following items may have a role on the problem list, and thus frame the macro relevance to the user.

- ▶ Economic improvements
- ▶ Social improvements
- ▶ Functional improvements
- ▶ Saving of time and effort.

**Micro-relevance** is defined as “the degree to which IT-use helps to solve the here-and-now problem of the user in his working process” (Spil et al. 2004). Even if an innovation is relevant in the way discussed in the paragraph above, it might never come to actual use of the innovation, simply because the “right moment” is never there. Let’s presume that the use of new equipment or new IT-procedures is a conscious activity. In every conscious activity that is goal-oriented to a specific goal, there is a reason why that course of action is being chosen, *on every very moment*. So, a course of action that a user basically considers as “positive” may not have any particular moment in which the use of the innovation is “micro-relevant”. The effect is that the innovation is never actually being used. Again, let’s illustrate this with an example. Imagine a patient with a viral infection visits a physician. The physician might notice the similarity to a number of other patients he has met that week and decide on diagnosis and treatment fairly quickly. To this doctor, the use of a decision support system to determine diagnosis is not micro-relevant. However, a colleague of his may not feel so confident on that very moment and thus use the system. Schuring & Spil (2003) discovered that micro-relevance is a key factor in explaining IT-use in their case studies. The following items can be used to measure this:

- ▶ Absolute value of innovation in terms of macro relevance
- ▶ “Here and now” value (performance expectancy on micro level)
- ▶ Low initial costs: it is well possible to use the innovation “here and now” (effort expectancy on micro level)
- ▶ Immediacy of the reward: does it help to solve the “here and now” problem within the time-frame that is acceptable on that very moment?

The distinction of macro-relevance and micro-relevance is a notable refinement of the way the role of the user is being discussed in the existing literature. Thornett (2001) implicitly refers to relevance and micro-relevance when he discusses limited adoption and use of DSS by primary physicians where “consultation time is lengthened by their use and there is no appreciable impact on patient satisfaction”. It is an example where other outcomes that are basically considered as positive (as mentioned above: better diagnosis, more appropriate dosing of drugs, and other) are overruled by limited relevance and micro-relevance. In other sources, we also found reason to reconsider the general relevance-construct. Cooper (1971) stated that “Relevance is simply a cover term of whatever the user finds to be of value about the system output, whatever its usefulness, its entertainment, or aesthetic value, or anything else”. Wilson (Wilson 1973) adds to this that relevance is situational. Ballantine et al. (1998) put it in the following way: “Depending on the type of task, the information generated by the system may be more or less appropriate, which will affect its success or failure”.

However, most other sources do not distinguish between the “general” role that relevance plays and the situational “here and now” conditions. In addition, by definition, without micro-relevance, a high value of macro relevance may never lead to actual use. There needs to be a time and condition to actually adopt the innovation and there might be series of moments needed in which the innovation is micro-relevant in order to “grow” to full use.

It is most notable that the organizational factors (Barnard 1938) or social influence (Venkatesh et al. 2003) are not explicitly included in our user-relevance framework. It should be kept in mind that the user’s agenda of problems and goals depends on his role in society (Barnard 1938). The influence of the organization on this agenda depends on many aspects, including the involvement with other organizations, on time and on place. As a consequence, our framework reflects the actual impact that organizational goals and preferences have had on the user in the sense that it has changed the relevance of the innovation to him.

## **CASE STUDY METHOD**

The assessment of Telehealth is often limited to feasibility, clinical performance and safety instead of questioning whether the innovation may fit in the process of healthcare delivery (Wallace 1998). Evaluation of Telehealth should first consider whether it is safe, second whether it is practical and third whether it is worthwhile (Taylor 1999).

According to the stakeholder-based perspective, all actions are not always rational, aiming at one mutual goal, and therefore the criteria should be collected from several stakeholders’ view (Nykänen 2000). The perspective has many qualitative characteristics and it can be a quite laborious framework for a study design (Hakkinen et al. 2003).

The current case-study-protocol was originally set up to assess the situation regarding the electronic prescription system (EPS) in the Netherlands. The practical aim was to unravel the unsatisfying diffusion-situation of the EPS. The protocol builds on the above mentioned literature and also sought to bridge the gap to the actual work of professionals as it came to IT-use. This resulted in a case-study protocol that covers all the topics that are mentioned in the framework in open-ended questions. Afterwards, the interview model was verified and used in more than 150 interviews on different e-health systems (Spil et al. 2004). The kernel point of Telehealth assessment is that of understanding the healthcare process (Brender 1999). All interviews started with ten questions on the primary process of the end users.

The main result of the EPS study (Spil et al. 2004) was that relevance is the main determinant of IS diffusion. This was in line with similar quantitative studies on job relevance (Chismar et al. 2003) and performance expectancy (Venkatesh et al. 2003). In accordance with that we studied if we could predict IS diffusion with small scale qualitative case studies. In line with the case-study approach by Yin (2003) we discerned different case-situations on the basis of our theoretical framework. Particularly, the homogeneity of the end-users was studied. Each professional and potential end-user was visited in his/her own working situation and interviewed for over an hour. Only the primary process and relevance questions of the standardized interview schedule (Spil et al. 2004) were used.

As to the current case studies, there were two. In the Netherlands, the Electronic Rheumatism Care Guide case was a small project in which we were asked to study the relevance of the electronic version. The testing of the paper-based Rheumatism Care Guide had started, when we interviewed the future professional users of the proposed system using the USE IT model, with the emphasis on relevance.

The Telehealth system in Rwanda is a big project in which we were asked to participate. Before we jumped into the project, we exercised this relevance test with good results.

Although both cases are small, the homogeneous end user groups give us validity for these specific Telehealth systems. Both quantitative studies and the qualitative EPS study described in this section confirm these results in general.

This study does not describe cases in Tanzania and Canada but the demographic information from UNDP and the literature available helped us to compare our cases to the situation in these countries and get a broader view.

## **TELEHEALTH IN RWANDA**

### **Government Strategy and Past Telemedicine Experience**

Telehealth fits into Rwanda's strategic vision 2020, which is to transform the country into a middle income society based on knowledge and information. Telehealth (2000) in general would satisfy the following key strategies:

- ▶ Assist the transformation of Rwanda into an IT literate nation
- ▶ Promote the deployment and use of ICT in society
- ▶ Contribute to the modernization of health services
- ▶ Act as a catalyst for the improvement of both information and communications infrastructure
- ▶ Contribute to the educational resource pool and hence in the development of the human resource pool in Rwanda
- ▶ Provide a platform upon which some aspects of national reconciliation and reintegration can be performed.

The Government of Rwanda is conscious of the role of ICT in the rapid development process of Rwanda to become a medium income society, and knowledge based society, therefore, support for the implementation of telemedicine fits within Government priority areas.

In Rwanda there are currently 4 major hospitals, 34 regional hospitals and 385 smaller health centers/ clinics. The vast majority of incidents handled by all of these institutions require some form of communication to another for successful case management/resolution.

The reality today is that this communication takes inordinate periods of time or it does not happen at all due to a variety of reasons:

- ▶ Simple logistics – takes too long to process (e.g. up to 1 month to get an X-ray evaluated by a radiologist)
- ▶ Absence of appropriate skills on a local or even national level
- ▶ A patient's inability to travel
- ▶ A patient's inability to pay

Rwanda's current infrastructure is not on the leading edge – It is known that Internet bandwidth is NOT high between major internal urban centers. The commissioning of the new fiber linking Kigali and Butare is imminent. In Kigali or Butare, the medical operational environment is relatively excellent, with good consulting facilities, treatment rooms, power, lighting, security, etc. In the more remote regions things are harsh at best and primitive at worst.

Telehealth systems, by definition, require significant computer skills by supporting staff as a base upon which to work. The skill level of the medical teams in Kigali and the other towns and cities with hospitals around the country, is not in doubt. However, the operational

skill sets in the field is at a lower level. This would be addressed over time with focused training and education.

**Empirical Relevance of Telehealth in Rwanda**

Under the header Relevance seven questions were asked about the perceived macro and micro relevance of the Telehealth system. The professional were very positive in general or as one of the interviewees’ said: ”Telehealth is a necessity for sharing information in difficult cases”. It needs no arguing that many difficult cases pass his desk each day.

Figure 2 shows the main seven relevance factors mentioned in the interviews. These will be elaborated below:

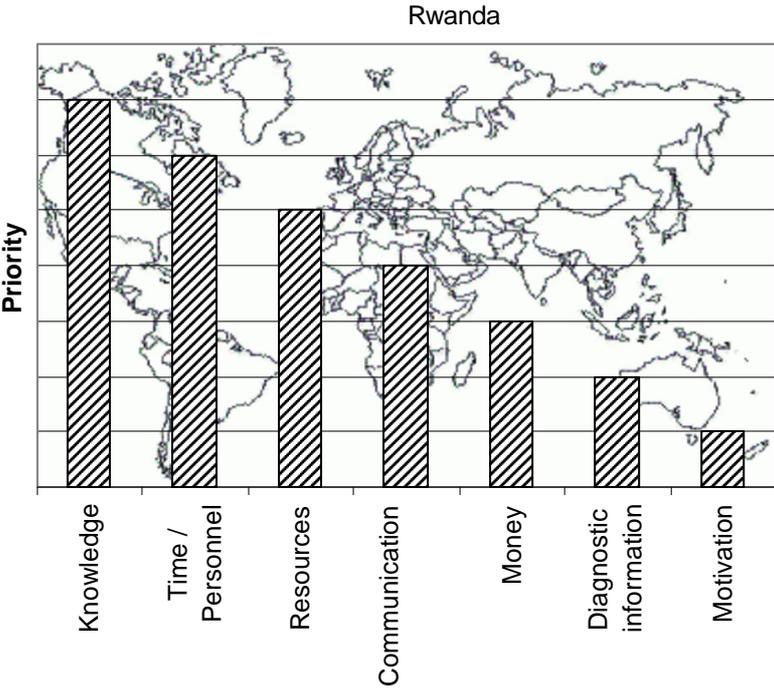


Figure 2 – Relevance priority count in Rwanda

1. Training (education) and Knowledge

Hundred percent of the interviewees mention training and knowledge as very relevant for their working process at this moment. “Care is inadequate”, one of them said, “and only proper knowledge and training can solve part of that”. As earlier indicated in Table 1, Rwanda has very poor Human Development Index of 0.460, the country lacks sufficient well trained human resource capital in all sectors. Similarly, the country lacks sufficient doctors and other qualified health care experts to meet the current demand in the health care sector. If sub-Saharan Africa wishes to participate in the knowledge-intensive, global economy, it must be able to produce large numbers of scientifically and technologically literate, innovation receptive, highly adaptable, and problem solving minded people with predisposition to lifelong learning. And, it must be able to do this with an accelerated timeframe (Baranshamaje 1995). In order to produce successful Telehealth solutions in Rwanda, the issue of training and education has got to be given utmost attention.

2. Number of patients and lack of personnel.

Due to lack of enough trained health care professionals in Rwanda, the number of patients is often bigger than the number of caregivers, it is clear that the doctor to patient ration in Rwanda is 1:20, which calls for delay in healthcare service delivery. Most complicated cases in all clinics and hospitals are referred to the two referral hospitals in Kigali or to the Butare University Hospital while ambulance facilities are also limited. Telemedicine, when implemented, will immediately facilitate a quantum leap in service and hence quality of life to all sectors of Rwandan society in the rural and urban areas alike.

### 3. Medical resources

According to information provided by medical doctors in Rwanda, there is need for medical resources and diagnostic literature sharing. Building knowledge driven and dynamically adaptive networked communities of Rwanda healthcare systems coupled to the western improved systems of advanced medical specialists would create improved knowledge dissemination and better health care provision.

### 4. Communication

Internal communication in Rwanda is generally not poor; mobile phones usage dominates over other forms of telecommunication. Using text, images, audio and video data would connect remote areas using existing communications infrastructure and state-of-the-art telemedicine software, computers and portable imaging devices to global medical resources. In short, there is need for ICT penetration in the healthcare systems in order to improve service delivery, while considering the time and quality, and accessibility factors.

### 5. Money, both provider and patient.

There is need for sufficient money from both sides of the caregiver and the patient. Medical equipment is significantly costly to purchase and to maintain; most equipment is donated and in most cases is not of common brand type, which makes it difficult or expensive to maintain in case of technical breakdown. According to table 1.0, Rwanda's per capita income is still low and the number of patients who manage good medical care is still very low. Medical supplies are also costly for care providers and patients are often not able to pay for certain drugs. In cases when the issue is complicated and requires traveling, the patient has no choice but to wait for death.

### 6. Diagnostic information

There is need for up-to-date diagnostic information and new information. Most of the literature used by Rwandese health care providers is old fashion and inefficient. This calls for seminars and research in order to support health care professionals in reducing risk in their daily practices and also to provide awareness in all medial activities.

### 7. Motivation

According to all the respondents interviewed, there is significant need for better motivation for the health care givers in Rwanda. It is also proven that most highly qualified medical workers are absorbed by other jobs which are better paying hence this creates a gap in the health care system.

## **TELEHEALTH IN THE NETHERLANDS: THE ELECTRONIC RHEUMATISM CARE GUIDE CASE**

The Rheumatism Care Guide is a tool to reveal the needs of rheumatism patients and the needs of the relatives who look after them. Four groups of users are identified: 1) nurses specialized in rheumatism care, 2) indication-advisers<sup>2</sup>, who advise the government about facilities that should be granted to the patients, 3) patients, and 4) patients' relatives. The purpose of the introduction of the Rheumatism Care Guide was to supply both groups of professional users with better information about the patient in order to improve the quality and the efficiency of the indication process, and the quality of care provided. The electronic version of the Rheumatism Care Guide complies with the definition of a Telehealth system (Reid 1996), since the patients and their relatives can fill it out at home, using a web-form, which will be sent to the office of the nurse or indication-adviser. The next step would be to integrate the provided information automatically in the electronic patient record. The electronic Rheumatism Care Guide empowers the patients and their relatives, since they can decide to express their needs and requests for facilities without the intervention of care providers. Also relatives and patients can act independently, which empowers them both. By filling out the Rheumatism Care Guide at regular intervals progress and change in the care process and needs, can be detected.

### **Expected relevance in the Netherlands-case study**

In this section the expected relevance is discussed according to the dimensions of macro-relevance: economic, social, and functional improvements and saving time and effort, and according to the dimensions of micro-relevance: absolute value, "here and now"-value, low initial costs, and immediacy of reward.

Whether the electronic Rheumatism Care Guide provides economic improvements depends on how it is used. Since filling out the forms by patients reduces the amount of home-visits, immediate out-of-pocket costs are reduced. Moreover home-visits enable patients to show and express their needs, the demand for care could raise. Also, the investments to develop and implement the system must be taken in account. Social improvements can be expected because being able to express their needs, empowers the patients and their relatives, since explicitly asking information about relatives is new. Reducing the number of home-visits on the other hand, enhances the isolation of chronically ill patients.

The Rheumatism Care Guide brings functional improvement in standardizing information retrieval: information becomes comparable in time, less dependent on individual care providers, and more complete.

The micro-relevance depends on the here-and-now problems in the working process as experienced by the future users. The absolute value of the innovation is high, due to the availability of a tool to retrieve information from and about the relatives of the patients. Also the standardization of information retrieval can be expected to be of value for the individual care provider. Since time pressure is high in healthcare, saving time is micro-relevant to professional users.

---

<sup>2</sup> To receive a facility or remedy, like a wheelchair or homecare, a patient needs to be "indicated" for this kind of care. Indication-advisers of a governmental institute decide what kind of facility is indicated and in what amount (e.g. how many hours homecare per week). The indication-adviser calls or visits the patient to gather information and also retrieves information from care providers involved.

Initial costs seem low to the professional users: it takes little time to learn to use the Rheumatism Care Guide. Other costs are “invisible” for these employees of care-institutions. Using the Rheumatism Care Guide is immediately rewarded, because the information generated, is immediately available.

It can be concluded that the Rheumatism Care Guide is expected to be macro- and micro-relevant to the users.

### Empirical Relevance of Telehealth in the Netherlands

Under the header “relevance from a users perspective” fourteen questions were asked about problems and wishes the medical professionals encountered. In this section we summarize the main seven that are elaborated below:

1. Home visits; The nurses visit the patients at home and all of them state that this could not be replaced by IT.
2. Eliciting care needs;The structural information helps the nurses to understand the real needs.
3. Evaluation and feedback; It is important not just to give an indication but also to evaluate that.
4. Time; Many interviewees complained about not having enough time for the patient.
5. Reach ability and accessibility;The care providers are difficult to reach.
6. Communication and interpretation of information;The several care providers do not communicate with each other.
7. Knowledge standardization; Uniformity can help to treat all patients the same way.

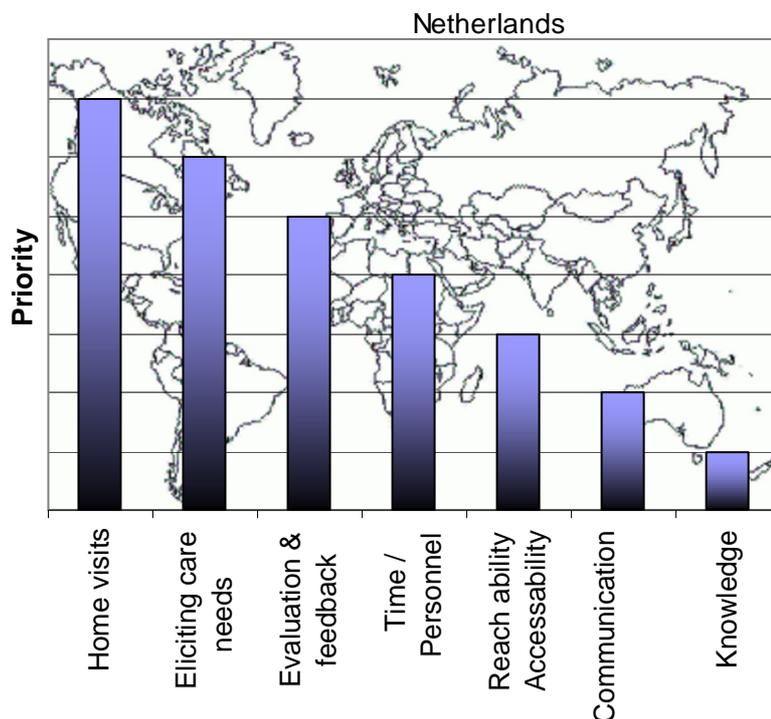


Figure 3 - Relevance priority count in The Netherlands

Four healthcare professionals, representing all potential professional future users, were interviewed. All interviewed users saw no usefulness in the (paper-based) Rheumatism Care Guide. It does not solve their general problems, i.e. shortage of capacity and high time-pressure. The objectives of the users, indicating and lessen care needs of patients, are not

supported by the system. An electronic form would not alter this. Some users indicate that some other users might use the system but those other users deny that.

The care professionals stated that, the economic improvements achieved by reduction of the amount of home-visits would inevitably lead to a reduction in quality of information. Visiting a patient at home and observing the patients and their relatives in their social situation was considered necessary by all interviewees, because actually meeting the patients and their relatives in their social environment supplies the indication-adviser and the nurse with invaluable information. Therefore, replacement of the home-visits by filling out a paper or electronic form by the patients and their relatives was not considered acceptable, because the professionals believed that this would reduce the quality of the information gathered.

The only contributed value of the Rheumatism Care Guide mentioned was the explicit attention it pays to the relatives of the patient. But this social improvement does not compensate for the social loss reduction of home-visits would cause.

A potential benefit of the Rheumatism Care Guide is the enhancement of uniformity of the working processes, but on the same time the interviewees expressed their satisfaction with the forms in use now. Furthermore, forms were just an aid to elicit information, and a way to structure reporting. More important than forms, are the skills and experience of the professional. This means that the Rheumatism Care Guide will not accomplish the functional improvements. On the contrary: all future users state that they do not want a system for rheumatism only. A new system should be much broader for all chronic patients and have more functionality than only intake information. The here-and-now problems are accessibility of the care providers, random character of the disease, waiting lists and objective indication of the patient. All these problems are not addressed by the new system. The quality of the indication was not a problem, according to the indication-advisers. Electronic forms in general would be appreciated, but not this one. The nurse specialist was not satisfied about the quality of the indication process, it takes too long and the outcome differed in similar cases. Still, she agreed that using the Rheumatism Care Guide would not solve this problem.

### **Conclusions Rheumatism Care Guide**

The main conclusion of this study was that an electronic version of the care guide for Rheumatism was not micro-relevant nor macro-relevant to the professional users. The interviews also show that the Rheumatism Care Guide does not enhance the empowerment of the patients, when this means that an electronic form replaces home-visits in which patients and their relatives have more opportunity to express and show their needs. Therefore we recommended abandoning the project.

### **ANALYSIS**

A big step forward is to be expected on the social improvements in Rwanda. Telehealth crosses distances of care and brings healthcare closer to the people. The lack of resources and the lack of money will remain a big (macro) relevance problem that cannot easily be solved with a Telehealth system. In the Dutch situation Telehealth will be a step back in social perspective since in the present situation the healthcare professional makes home visits if necessary. In the future this will decrease because of Telehealth. Also on the functional improvements this specific Telehealth system has a negative score. The Telehealth systems should be aimed at eliciting care needs of the patient.

The relative short distances and relative high initial costs lower the expectations for the micro relevance of Telehealth in Rwanda. The actual relevance and immediacy of the reward can lever the score because the professionals state that without good education and

knowledge it will not be possible to provide good care in Rwanda. The here and now value of knowledge and communication is high.

The here and now value in the Netherlands is low. When pressure on time and effort increase because of tighter budgets for healthcare and the shortage of healthcare professionals, the higher efficiency achieved by replacing home-visits by the Telehealth system might be considered acceptable in spite of the expected reduction in quality of the indication process. Although the standardization of the indication process is not considered micro relevant by the end-users, the healthcare organizations might consider this macro relevant, because standardization enhances the evaluation process and by that the improvement of quality.

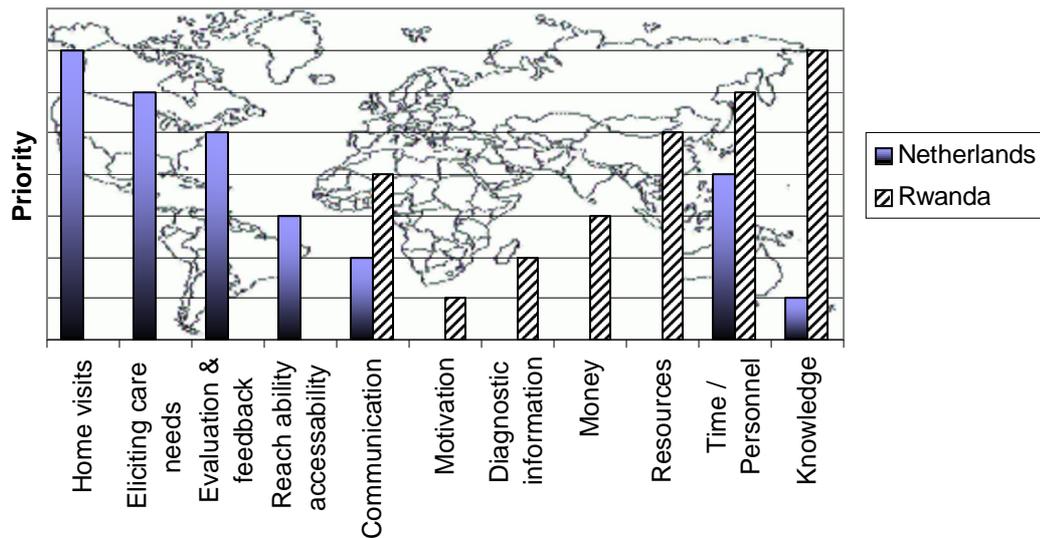


Figure 4 - Comparison Relevance between Rwanda and The Netherlands

Resuming, the north-south divide provides a total different relevance analysis for the Northern countries and the Southern countries. In the Northern case the knowledge relevance is indirect with the need for evaluation and feedback. In the Southern case the knowledge relevance is much more direct, having information to be able to diagnose a patient. Another big difference is the lack of personnel. In Rwanda, and we think in Africa in general, the number of patients per professional is very high. In the Netherlands, time is an important relevance factor, related to the need to control healthcare costs and the forthcoming shortage of healthcare professionals due to the double effect of ageing.

Now, we add the cases in Canada and Tanzania to the analysis. The relevance of Telehealth in Canada is high as already mentioned (Jennett et al. 2001) and slightly less in Tanzania because of the initial costs involved and the relative benefits in time and effort of the healthcare organizations. The acute need for integration (Braa et al. 2003) between regional health centers and hospitals will compensate these initial costs.

The physicians density (table 2) can confirm the added value of bridging distances of telehealth. In Canada, Tanzania as well as in Rwanda every physicians has a district larger than 150 square kilometer. In the Netherlands every physician has a district smaller than 1 square kilometer.

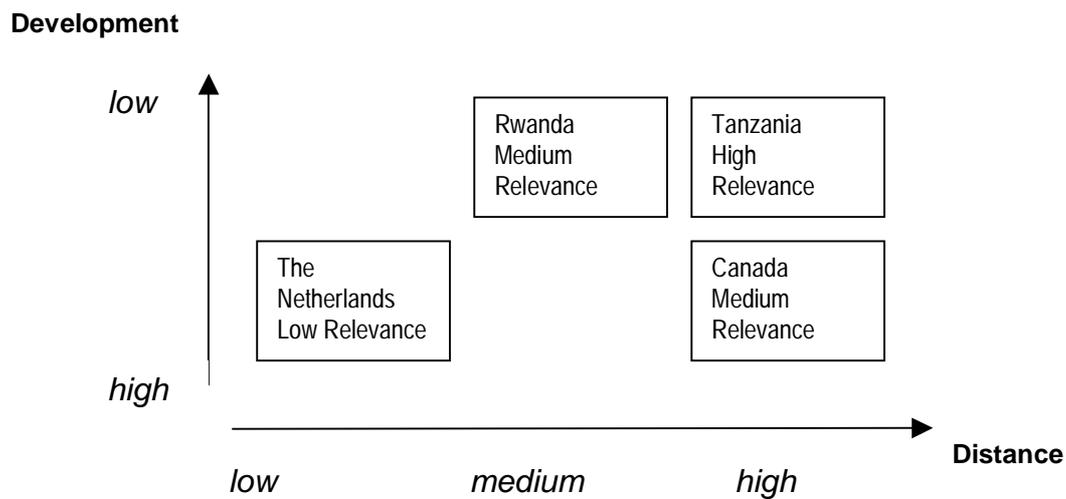


Figure 5 – Relevance of the Telehealth as a function of distance and development

In all four case-study countries compared, the strength of Telehealth is confirmed: it is a relatively inexpensive way to share knowledge across long distances. In the southern country where knowledge is scarce and distances are long (Tanzania), the relevance is high, as is the case in the northern country where knowledge is available, but distance is an issue (Canada). In Rwanda distance is not the real problem, but scarcity of professional knowledge is, so Telehealth is relevant. In the Netherlands, the country, where neither distance, nor lack of knowledge are a big issue, healthcare professionals can afford to reject the more efficient Telehealth system.

To achieve the benefits of Telehealth the southern countries have to find a way to overcome the digital divide.

## CONCLUSIONS

This paper used the concept of macro- and micro-relevance (Schuring & Spil, 2003) to explore the relevance of Telehealth in various countries. Relevance is seen as the major determinant of differences in diffusion. Notable differences in relevance were found related to distance and knowledge need. Also, it was recognized that micro-relevance has a particularly interesting role. Without micro-relevant occasions on which initial use is started, there will be no use on the longer term. In the cases of the least developed countries there clearly was such micro-relevance, i.e. the need for knowledge-sharing on a given patient.

The study yields clear conclusions to the individual cases: First, in the Netherlands, the advice was to stop the further design of the electronic care guide because it lacked relevance to the end user. For Rwanda the macro relevance was analyzed as very problematic and these factors have to be seriously considered in the next phase of the project. The micro relevance factors nevertheless show the necessity of the Telehealth system.

Finally, there is not only a North-South divide but also a big country-small country divide as to what Telehealth is concerned. When the Telehealth factors are ranked on importance, crossing the distance with Teleconsultation will be the first priority followed by knowledge and training. The empowerment of patients and the lifetime health concept are very trendy but are lagging behind in this study. Broadening the scope of the Telehealth initiative in Rwanda to neighboring countries like Tanzania will lever the relevance directly.

## REFERENCES

- Anderson, T.D., and Garrison, D.R. "Transactional issues in distance education: The impact of design in audio conferencing," *American Journal of Distance Education* (9:2) 1995, pp 27-45.
- Avgerou, C (2008)"Information systems in Developing Countries: a critical research review"*Journal of Information Technology*, 23, pp 133-146.
- Ballantine, J., Bonner, M., Levy, M., Martin, A., Munro, I., and Powell, P.L. "Developing a 3-D model of information systems success," in: *Information Systems Success Measurement*, E.J. Garrity and G.L. Sanders (eds.), Idea Group Publishing, 1998, pp. 46-59.
- Baranshamaje, E. "The African Virtual University Concept Paper," 1995.
- Barnard, C.I. *The functions of the executive* Harvard University Press, Cambridge (Mass.), 1938.
- Bashur, R.L., Sander, J.H., and Shannon, G.W. (eds.) *Telemedicine: Theory and Practice*. Charles Thomas, Springfield, 1997.
- Braa, J., and Shaw, V. "Strategies to prioritise the fight against HIV/AIDS in national routine health information systems," Helina, Johannesburg, 2003.
- Brender, J. "Methodology for constructive assessment of IT-based systems in an organisational context," *International Journal of Medical Informatics* (56:1-3) 1999, pp 67-86.
- Castells, M. *The rise of the network society, the information age, economy, society and culture* Blackwell, Oxford, 1996.
- Chismar, W.G., and Wiley-Patton, S. "Does the Extended Technology Acceptance Model Apply to Physicians," 36th Hawaii International Conference on System Sciences, Hawaii, 2003.
- Compeau, D.R., and Higgins, C.A. "Application of Social Cognitive Theory to Training for Computer Skills," *Information Systems Research* (6:2) 1995, pp 118-143.
- Cooper, W.S. "A definition of Relevance for Information Retrieval," *Information Storage and Retrieval* (7:1) 1971, pp 19-37.
- Darkins, A.W., and Cary, M.A. *Telemedicine and telehealth: principles, policies, performance, and pitfalls*. Free Association Books, London, 2000.
- Davis, F.D. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*:September) 1989, pp 319-340.
- Dhillon, H and Forducey, P.G. (2006)"Implementation and Evaluation of Information Technology in Telemedicine", *HICSS proceedings*, Kuauai.
- Effken, J.A. and Abbott, P (2009)"Health IT-enabled Care for Underserved Rural Populations: The Role of Nursing", *JAMIA*, 16, pp439-445.
- Field, M.J. (ed.) *Telemedicine: A guide to assessing telecommunications in healthcare*. National Academy Press, Washington DC, 1996.
- Fuchs, C and Horak, E (2008)"Africa and the Digital Divide", *Telematics and Informatics*, 25, pp 99-116.
- Gagnon, M., Godin, G., Gagné, C., Fortin, J., Lamothe, L., Reinharz, D., and Cloutier, A. "An adaptation of the theory of interpersonal behaviour to the study of telemedicine adoption by physicians," *International Journal of Medical Informatics* (71) 2003, pp 103-115.
- Hakkinen, H., Turunen, P., and Spil, T.A.M. "Information in healthcare process - evaluation toolkit development," in: *Proceedings of HICSS 36*, 2003.

- Heinzelmann, P.J., Lugn, N.E. and Kvedar, J.C. (2005) "Telemedicine in the future" *Journal of Telemedicine and Telecare*, 11, pp 384-390.
- Higa, K., Shin, B., and Au, G. "Suggesting a diffusion model of telemedicine - Focus on Hong Kong's case," HICSS 30, Maui, Hawaii, 1997.
- Hu, P.J., Chau, P.Y., Sheng, O.L., and Tam, K.Y. "Examining the technology acceptance model using physician acceptance of telemedicine technology," *Journal of Management Information Systems* ( 16) 1999, p 91—112.
- Jennett, P.A., and Andruchuk, K. "Telehealth: 'real life' implementation issues," *Computer Methods and Programs in Biomedicine* (64:3), 2001/3/1 2001, pp 169-174.
- Katzenstein, J., and Chrispin, B.R. "Designing a telemedicine system in tanzania: a sociotechnical systems approach," in: *Human and Organizational Dynamics in e-Health*, D.C. Bangert and R. Doktor (eds.), Radcliffe Publishing, Oxford, 2005.
- Klecun-Dabrowska, E. "Telehealth and Information Society: a critical study of emerging concepts in policy and practice," in: *Department of IS*, London School of Economics, London, 2002, p. 322.
- Kun, L.G. "Telehealth and the global health network in the 21st century. From homecare to public health informatics," *Computer Methods and Programs in Biomedicine* (64) 2001, pp 155-167.
- Mann, K.V., and Chaytor, K.M. "Help! Is anyone listening? An assessment of learning needs of practicing physicians," *Academic Medicine* (67) 1992, pp 54-56.
- May, J.A. "An evaluation of the British Columbia rural health video network link," Athabasca University, Athabasca, p. 159.
- Miscione, G (2007) "Telemedicine in the Upper Amazon: Interplay with Local Health Care Practices" *MIS Quarterly*, 31, 2, pp 403-425.
- Morris, T.A., Guard, J.R., Marine, S.A., Schick, L., Haag, D., Tsipis, G., Kaya, B., and Shoemaker, S. "Approaching equity in consumer health information delivery: Net Wellness," *Journal of the American Medical Association* (4:1) 1997, pp 6-12.
- Nykänen, P. "Decision support systems from a health informatics perspective," in: *Department of computer and information sciences*, University of Tampere, Tampere, Finland, 2000.
- Perednia, D.A., and Allen, A. "Telemedicine technology and clinical applications," *Journal of the American Medical Association* (273:6) 1995, pp 483-488.
- Piotti, B., and Macome, E. "Public healthcare in Mozambique: strategic issues in the ICT development during managerial changes and public reforms," *International Journal of Medical Informatics* (forthcoming) 2005.
- Ratzan, R.C. "Telehealth - Promise or Peril?," *journal of health communications* (7) 2002, pp 257-258.
- Reid, J. *A telemedicine primer, Understanding the issues* Artcraft, Billings MT, 1996.
- Robinson, D.F., Savage, G.T., and Campbell, K.S. "Organizational learning, Diffusion of Innovational Collaboration in Telemedicine," *Health Care Management Review* (28:1) 2003, pp 68-78.
- Rogers, E.M. *Diffusions of innovations* The Free Press, New York, 1962 (1<sup>st</sup> ed.) 2003 (5<sup>th</sup> ed.)
- Saracevic, T. "Relevance: A review of and framework for the thinking on the notion in information science.," *Journal of the American Society for Information Science* (26:6) 1975, pp 321-343.
- Schuring, R.W., and Spil, T.A.M. "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 and Management* (4) 2002, pp 303-318.

- Schuring, R.W., and Spil, T.A.M. "Relevance and Micro-Relevance for the professionals as determinants of IT diffusion and IT-use in healthcare," in: *ERP & Datawarehousing in organizations: issues and challenges*, G. Grant (ed.), IRM Press, Hershey, 2003.
- Spil, T.A.M., Schuring, R.W., and Michel-Verkerke, M.B. "Electronic prescription system: do the professionals use it?," *International Journal of Healthcare Technology and Management* (6:1) 2004, pp 32-55.
- Suleiman, A.B. "The untapped potential of Telehealth," *International Journal of Medical Informatics* (61) 2001, pp 103-112.
- Tanriverdi, H., and Venkatraman, N. "Creation of Professional Networks: An Emergent Model Using Telemedicine as a Case," HICSS 32, Maui, Hawaii, 1999.
- Taylor, P. "Evaluating telemedicine systems and services," in: *Introduction to Telemedicine*, J. Craig and R. Wootton (eds.), Royal Society of Medicine Press, London, 1999.
- Telehealth (2000) "An integrated socio-economic and ICT policy and strategies for accelerated development," Rwanda Government, 2000.
- Thompson, J.D., Higgins, C.A., and Howell, J.M. "Personal Computing: Toward a Conceptual Model of Utilization," *MIS Quarterly* (15:1) 1991, pp 124-143.
- Thornett, A.M. "Computer decision support systems in general practice," *International Journal of Information Management* (21) 2001, pp 39-47.
- UNDP (2007/2008) *Development Report 2007/2008*, , <http://hdr.undp.org>, data extracted on 13<sup>th</sup> of January 2010.
- UNDP (2009) *Development Report 2009*, <http://hdr.undp.org>, data extracted on 13<sup>th</sup> of January 2010.
- Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. "User acceptance of information technology: toward a unified view," *MIS Quarterly* (27:3) 2003, pp 425-478.
- Wallace, S. "Telemedicine in the NHS for the millennium and beyond," in: *Rethinking IT and health*, J. Lenaghan (ed.), Institute for Public Policy Research, London, 1998.
- Walsham, G. "Cross-Cultural Software Production and Use: A Structural Analysis," *MIS Quarterly* (26:4), December 2002, pp 359-380.
- Watanabe, M. "A Telehealth Report," International Conference on the Medical Aspects of Telemedicine, Canadian Society of Telehealth, Montreal, 2000.
- Wilson, P. "Situational relevance," *Information Storage and Retrieval* (9:8) 1973, pp 457-471.
- Yin, R.K. "Case Study Research: Design and Methods," *Applied Social Research Methods Series* (5) 2003.