An E-healthcare Mobile Application: A Stakeholders' Analysis[1]

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Abstract

This chapter presents a longitudinal study on the implementation of an e-health mobile application, DITIS, which supports network collaboration for home healthcare. By adopting the stakeholders' analysis the study explores the various groups that have directly or indirectly supported the system during its implementation. The system was originally developed with a view to address the difficulties of communication and continuity of care between the members of a home health care multidisciplinary team and between the team and oncologists often hundreds of kilometres away. DITIS evolved to be much more than that and even though it has been introduced five years ago it is considered as a novel application. Despite this, its implementation has been slow and several challenges, including the system's sustainability, have to be faced. This chapter aims to understand these challenges and the results of the study point to a diversity of interests and different degrees of support.

Keywords: e-health, mobile technology, stakeholders, implementation

INTRODUCTION

Health care is an environment that has been experiencing dramatic progress in computing technology in order to process and distribute all relevant patient information electronically and overall to improve the quality of care. In particular, mobile e-health involves a spectrum of information and telecommunication technologies to provide health care services to patients who are at some distance from the provider and also provide supporting tools for the mobile healthcare professional. The benefits of such applications are numerous with the main one being improvements in access to medical resources and care.

Recently, the health care and related sectors have been found to embrace mobile technology in e-healthcare applications. Though there have also been cases of mobile workstations being implemented at small medical units to facilitate easier access to specialist medical advice (e.g. Salmon et al, 2000), most of the applications have been introduced to support patients at home. These could either be patient-centred where patients and/or caretakers are given direct access to a mobile phone for communicating with the provider (e.g. nurse, doctor, counsellor etc), or nurse-centred where nurses who visit and care patients at home have direct access to mobile applications and for communicating with other medical staff.

It follows that the practice of e-health projects is often a collaborative activity requiring extensive and interactive communication within and between members of specialized occupational groups to coordinate patient care services. This becomes necessary when dealing with patients requiring a multidisciplinary team approach to their care, and who are treated outside the hospital environment. In such a case, the team is mostly geographically dispersed and rarely see the patient together. This requires the creation of virtual multidisciplinary teams of care whose management and coordination can be supported by technology. In the study, we aim to explore the role of diverse stakeholders in an e-health application involving virtual multidisciplinary teams of care. Diverse stakeholders get involved at different stages of the project implementation and may experience different degrees of knowledge about the system itself, its significance and novelty. These along with their different backgrounds, interests and expectations may contribute to different meanings and understanding about the system, its role and significance which will ultimately affect system implementation.

BACKGROUND

Stakeholders' Analysis

The role of stakeholders in information systems (IS) implementation has long been recognised in the literature though it has only been during the last few years that the identification of different stakeholders as well as the roles and inter-relationships between them was found to be important for uncovering some of the complexity in system implementation (Pouloudi and Whitley, 1997).

Despite this, researchers have given different definitions to stakeholders. Sauer (1993) for example, makes reference to stakeholders as supporters, those who provide funding, information, and influence, whilst Beynon-Davies (1999) argues that there is a need to broaden up this definition. As he puts it: "…not all groups with an interest in the development of an information system necessarily support that development. Some stakeholder groups may have a definite negative interest in the success of a given project" (p.710). Following from these, in this chapter, in an attempt to keep a broad definition, stakeholders are defined as those with a direct or an indirect interest in a project.

According to Mitchell et al (1997), stakeholders can be distinguished in terms of three relationship attributes: power, legitimacy and urgency. Power is the ability to impose influence on the relationship; legitimacy is "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman, 1995: 574 in Mitchell et al). Urgency is based on time sensitivity and criticality" (Mitchell et al 1997 in Howard et al, 2003). A combination of these three attributes contributes ton different types of stakeholders who have different roles and expectations.

EMPIRICAL STUDY

In this section, we present the case of an e-health mobile application and adopt a stakeholders' analysis to understand its implementation process and the challenges faced.

Mobile applications are an increasingly important technology for improving the quality of health services especially at the point of care. They enable the formation of virtual teams of care, and timely, effective and quality patient management are the expected outcomes. The role of stakeholders in supporting such innovative applications is vital.

The System

DITIS (http://www.ditis.ucy.ac.cy) is an Internet (web) based Group Collaboration system with secure fixed and mobile (GPRS/GSM/WAP) connectivity (see Figure 1). It enables the effective management and coordination of virtual collaborative healthcare teams. It provides a secure access to e-records from anyplace and anytime via desktop computers (at work) or a variety of mobile devices (when on the go). It includes a set of tools for effective scheduling and coordination of team members, with features including automatic notification and alerting. It makes use of supportive tools relevant to home care that improve efficiency and minimize errors. The collaboration platform is based on identified roles and scenarios of collaboration, analysed using the Unified Modelling Language (UML).

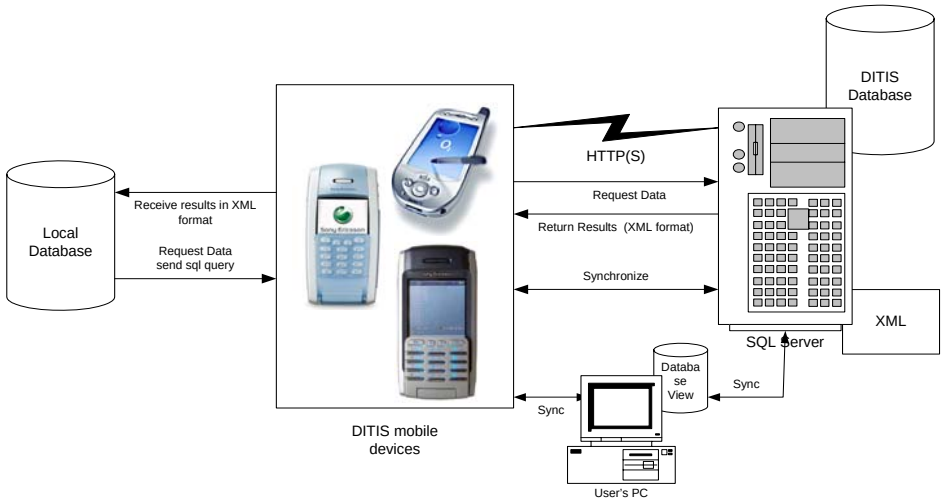

Figure 1 DITIS System architecture

The DITIS project was initiated in 1999 to support the activities of the home healthcare service of the Cyprus Association of Cancer Patients and Friends (Pasykaf). DITIS goal is to deliver a product that can improve the quality of the citizen's life. Contrary to today's health processing structure which is, in all practical terms facility-based care, this project aims to shift the focus onto home-based care, where everything is moving around the patient, supported by a team of multidisciplinary healthcare professionals. Given that the team cannot be by the side of the patient at all times, DITIS developed a collaborative software system to support dynamic virtual health care teams, customised for the differing needs of each patient, at different times. The virtual healthcare team is supported in its provision of dedicated, personalized and private service to the home residing patient on a need based and timely fashion, under the direction of the treating specialist. Thus it is expected that chronic and severe patients, such as cancer patients, can enjoy 'optimum' health service in the comfort of their home (i.e. a focus on wellness),

feeling safe and secure that in case of a change in their condition the health care team will be (virtually) present to support them. The present users of the system include the Health-Care professionals treating cancer patients (Home-Care nurse, Oncologist, Treating doctor, Psychologist, Physiotherapist, Social worker etc…), and the Pasykaf administration. It is expected that the system will be extended to other paramedical professionals, as for example the 'Pharmacist and the Cancer Registry', currently located at the Ministry of Health. Furthermore, the system can be adapted to cater for other home health care needs, as for example cardiac, renal or diabetic patients.

DITIS deploys a novel networked system for Tele-collaboration in the area of patient care at the home by a virtual team of medical and paramedical professionals, implemented using existing networking and computing components (the novelty of the system and competing approaches are briefly discussed in (Pitsillides et al 2004, Pitsillides et al 2005)[i].) The system was originally developed with a view to address the difficulties of communication and continuity of care between the home health care multidisciplinary team (Pasykaf) and between the team and the oncologist often many miles apart. DITIS has through its database and possibility of access via mobile or wire line computers offered much more than improved communication. Its flexibility of communication and access to the patient's history and daily record at all times, anywhere (home, outpatients or in the event of an emergency hospital admission), has offered the team an overall assessment and history of each symptom. DITIS has thus offered improved quality of life to the patient, for example by offering the nurse's the possibility of immediate authorisation to change prescription via mobile devices and the oncologist the possibility of assessment and symptom control without having to see the patient. It has also offered the home care service the opportunity to plan future

services and lobby for funding by offering audit, statistics, and performance evaluation and with these in place, the possibility for research.

The User Organization

Pasykaf, the user organization, was founded in 1986 to provide support to cancer patients and their families during their period of rehabilitation and is manned with highly qualified medical, paramedical and nursing staff. In 1992 it started a home care service for cancer patients. Specially trained palliative care nurses in close co-operation with doctors (general practitioners and oncologists), physiotherapists and psychologists, attend and care for patients at home, focusing on maintaining the best possible quality of life, including medical care and psychological support.

In the context of home care, home care professionals visit patients at home. Traditionally, the team of professionals was (loosely) coordinated by weekly meetings, or in case of some urgent event information was exchanged by telephone calls, or face-to-face meetings. Often the same information is requested from the patient, so as each professional can build their own medical and psychosocial history and treatment notes (handwritten). Traditionally, these handwritten notes were filed at the Pasykaf offices, once the health-care professional returned to the office. On a scheduled visit, the file had to be removed from the office and taken with the health-care professional to the patient's house. This was inflexible and restrictive, as there was no possibility of access by another health-care professional at the same time. After hours on call professionals had to make a special visit to the office to collect the patient file (even if there was no other business with the office). For a patient visit to

the hospital, especially in emergency, there was no possibility of immediate access to the patient file from the attending home care nurse. Therefore there was limited possibility for continuity of care.

As with every manual system, there was limited possibility for audits and statistics, research was difficult, evidence-based medicine was not supported, dynamic coordination of the team was almost impossible, and communication overheads were very high and extremely costly in human and monetary terms. DITIS aims to address these problems in the provision of home-care services by a team of professionals.

Generally, given the limitations of the existing home-care delivery models, the need for improved ICT supported practices emerged. Even though the context of health reform may vary across countries, major objectives are similar and include:

- a move towards *people-centred* services;
- a commitment to *healthy public policy* and a desire to improve the health status and quality of life of individuals and communities;
- increased emphasis on *knowledge/evidence-based decision making* and *efficiency and effectiveness* in service delivery;
- a shift from facility-based health services and a focus on illness, to *community-based health services* and a focus on *wellness*;
- the *integration* of agencies, programs and services to achieve a seamless continuum of health and health-related services; and
- greater *community involvement* in priority setting and decision-making.

DITIS aims to support the above healthcare reform objectives. We focus our analysis on home health care of cancer patients, but expect our results to be applicable to home healthcare in general as well as cross cultural and cross border interoperability. Thus through DITIS we expect to assist in the delivery of better home-care, by offering the health-care team services that are aimed in achieving a seamless continuum of health and health-related services, despite the structural problems of home-care, as compared to facility based care.

The system was initially deployed in one district, District A, and was gradually implemented in another three districts. The study has adopted the longitudinal approach in data collection for the first five years of the system, 1999-2004.

Methods and Data Collection

The fieldwork has taken place in various district sites of Pasykaf. Each site is served by a number of palliative care nurses who visit patients regularly in their house offering support. Data on DITIS were collected on different stages of the implementation process:

Phase 1: The preliminary part of the research has studied the use of mobile telephones by a group of palliative care nurses during the period August to September 2000. Interviews with three nurses and one doctor in District A have enabled the study of nurse-to-nurse interactions and nurses-doctors interactions via the use of mobile telephones, whilst also contributed to gathering information on their level of awareness about DITIS and its potential use in palliative care.

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Phase 2: This part of the study took place in May 2001 and involved the use of a structured questionnaire that was sent to DITIS developers and potential users. It aimed to explore stakeholders' expectations regarding DITIS. A copy of this questionnaired appears in Appendix.

Phase 3: The third phase of data collection took place in April 2003. By this time DITIS was implemented in four district sites. During this phase, current users of the system in three district Pasykaf offices were interviewed: 1 psychologist and 3 nurses. The main issues explored during interviews included the Participants' actual use of DITIS, their own explanation of why they use DITIS the way they do, and their understanding of what users' and others stakeholders' role should be for achieving effective DITIS use.

Phase 4: This final part of the study took place in April 2004. Interviews included users (nurses and psychologist) as well as members of other stakeholders' teams. During this phase, it was found that even though DITIS has been implemented effectively with the right support from the project team, anxiety was identified at different levels with regard to its future.

Results

Overall, the data reveal that DITIS offers innumerable opportunities for palliative care nurses and other cancer-care practitioners. DITIS is currently widely accepted as an invaluable tool in palliative care. Nurses, psychologists and doctors acknowledge that DITIS has numerous advantages and that they are willing to incorporate it in their work activities. DITIS can improve communication, coordination and collaboration among members. Due to the huge amount of data regarding new and old patient

records that need to be handled on a daily basis, DITIS enables users to access data quickly either from their office or remotely. Furthermore, it can be used as a statistical tool, for producing internal reports for the district offices and the head office as well as external reports required by the Ministry of Health and other government departments.

"Pasykaf will be able to extract more information and statistics about cancer symptoms. Information about cancers and their occurrence by region will help to detect possible reasons that may be responsible about cancer (e.g. factories in the areas, etc)" (Developer, Phase 2).

"...Life will be so much easier with DITIS to fill in the gaps from unknown to known" (District B, Nurse).

Interestingly, even though technology phobia was identified in Phase 1 of this study as a possible negative factor in the effective implementation of the system, it was later expressed by nurses across different district sites that participated in Phase 3 that users are generally willing to adapt the system in their day to day work because they expect that their tasks will be executed faster and easier, saving time and effort.

It was agreed among all participants in the study that the project was a novel one and was a radical departure from what existed previously and was designed to be at the core of Pasykaf's activities (i.e. the provision of health care to home-based cancer patients).

Implementation Problems

During the first three phases of the study, there was a general feeling that DITIS had not yet been sufficiently incorporated in the daily work activities of the health care workers and that this would be a slow process. The main problems identified were with regard to the implementation process. A nurse in District B clearly said that this process *"has been slow from all points of view"* (Phase 3).

It has been widely recognised that the effectiveness of this system implementation was jeopardised due to financial resources being constrained or at times becoming unavailable. The limited budget that the project development team had to work with mainly had two major implications. Firstly, only a small number of mobile handsets could have been acquired. As a result, only nurses in one district office (District A) were given a mobile device with DITIS application whilst other district offices have to rely only on PC-based applications. This restricts the use and the potentials of DITIS which has been developed as a wireless application to promote virtual collaboration in cancer care. Secondly, limited financial resources have influenced staff availability on the project implementation team. The project has been experiencing staff discontinuities since the early stages of DITIS development. In the main, graduate students have been used for this project under the guidance of two computer-science academics, both members of the DITIS project team. Even though the latter remained the main drivers of the project, DITIS was only one of several projects that they were involved in and therefore could not give their full attention as

required by the criticality of the project nature. To quote a nurse: "*The system was done on borrow time"* (District A, Phase 3), indicating that for most of the implementation period, there were no full-time project members; rather even though the system had gained the enthusiasm of several people who committed themselves in the system, none of them could make a full-time commitment on the project. Instead, there were several temporary project members throughout the duration of the implementation process leading to staff-turnover. The high staff turnover and the lack of full-time staff brought inconsistencies and delays in the project development.

As the psychologist who participated in the study (phase 3) put it: *"There is no person in charge and this leads to communication problems"*. The same person suggested that there was a need for frequent meetings to keep users informed about the state of the implementation process, to alleviate doubts and improve coordination among cross-groups (e.g. nurses, doctors, psychologists).

Based on the results of the longitudinal assessment corrective measures were taken, including a more stable team due to the commitment of all relevant actors and availability of funding. These corrective action were acknowledged by all the users interviewed in phase 4 of the study. During this phase, there was a general feeling of satisfaction about the use of DITIS in the day to day work practices as users have by now begun seeing the benefits of the system:

“The system is more reliable”; “It is 100% better”.

Despite these positive results, there appears to be some anxiety among some users about the sustainability of the system. DITIS was successful in attaining the initial goals set. However, several difficulties, some non-technical in nature, were encountered during the development and deployment of DITIS in phase I. These are outlined below:

- Underestimation of the workload involved in order to populate the DITIS database, and misjudgement of effort for encouraging users who are used to a paper-based system to switch to a new system, which was in essence still incomplete and under-construction.
- Network technology limitations (e.g. WAP over GSM). The migration to new technologies (GPRS/UMTS and ADSL) is resolving many of the original technical problems i.e. service is always available and bandwidth is much higher.
- Deployment with mobile devices has been limited mainly due to the cost related with having each member of the home care team have his/her own mobile device, and the pace of new device launches with enhanced functionality. Recently 30 mobile devices were acquired and are being deployed. This will allow a number of multidisciplinary teams to operate.
- Sustainability of DITIS due to uncertain financial support. Potential funding may derive from the government through its spin-off company initiative. Another one is the Ministry of Health for its planned Community Care service.

Stakeholders: Relationships and Roles

The main stakeholders of DITIS derive from inside as well as outside the user organization. A key stakeholder group are the nurses and other members of the medical team in the district offices e.g. psychologists who directly use the system. Gradually the nursing team has begun to embrace DITIS and overcome the initial resistance that was mainly caused due to the delays in implementing the system.

A second group is the university computer scientists who designed the original system and currently manage the project development and implementation. They have the intellectual property of the system and they are the ones who actively promote the system to national and international organizations in order to attract funding that would enable them to continue developing and improving the system. Their interest is in *"The expansion of the collaborative system for usage in other fields (e.g. cardiac home-care, insurance sales, etc…) and its eventual commercialisation"* (interview with project leader). The cost of setting up such an infrastructure and supporting it, versus the benefits such as quality of life and time saved, are difficult to justify in monetary terms. Also the potential benefit of using GPRS and ADSL (always connected, higher speeds) versus the earlier GSM/WAP mobile telephone device and ISDN for the fixed computer lines (dial-up, low bandwidth) and costs of maintaining such a telecom infrastructure (currently supported by CYTA, Telecom Operator in Cyprus). Another barrier is the high cost of hand held devices and rapid change of technology, which have hindered the projects development Cyprus wide.

An independent commercial software organization that supported the initial idea and design of DITIS has also been a key stakeholder until recently. This organization has recently withdrawn from the project after the first stage of its implementation, as they

could not see the financial viability and profitability of the project and were no longer interested in investing in mobile - based applications. Another commercial software organisation with a focus on mobile e-services has recently joined the project.

Finally, an important stakeholder is Pasykaf, as the user-organization that hosts the system in its district offices as well as in the headquarters. Pasykaf, a charity organization is interested in the project as they can see that the system can predominantly enable them to produce national and regional statistical information on cancer and cancer patients which are required by the government. Our study however has shown that the involvement of Pasykaf management in this project has remained limited. Several users recognised that Pasykaf in particular should undertake a more active role in the implementation of the project by investing more time and administrative support.

Accordingly, the stakeholders derive from diverse sectors and even though they all want DITIS to succeed their expectations are different. From our data, it was found that all stakeholders agree on the important role that the system could play in cancer-support.

In what follows, we describe these different types of stakeholders and identify their relevance to the DITIS project. Figure 2 depicts the stakeholders' relationship attributes and the different types of stakeholders.

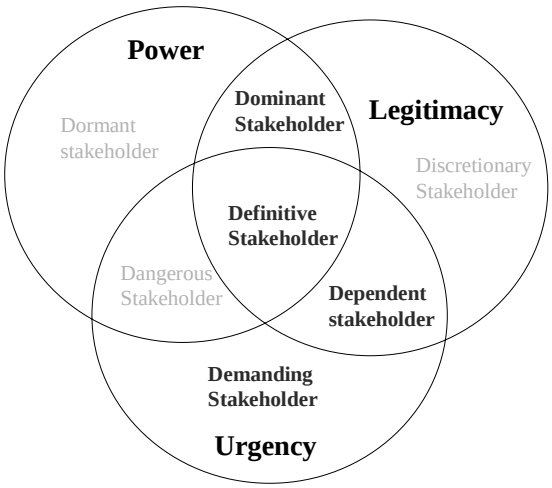

Figure 2. Stakeholder typology (Mitchell et al, 1997: p. 874)

Definitive stakeholders possess power, legitimacy and urgency. The project initiators at the University fall part of this group. Due to their active involvement in the design and promotion of the system they possess both power and legitimacy whilst simultaneously they are aware of the risks involved if no funding is secured. For this, they have a clear and immediate mandate to give priority to the project and have considered several options, one of which is commercialisation.

Demanding stakeholders exist where there is urgency but no other relationship attribute. Within this category, we place the commercial organization that became involve in the initial design of the system. It did so for commercial interests. Due to the financial difficulties that the project face the company decided to withdraw as their demands for commercialization and thus profitability have not been met.

Dormant stakeholders. These stakeholders possess power to impose their will on a firm, but "by not having a legitimate relationship or an urgent claim, their power remains unused…Dormant stakeholders have little or no interaction with the firm. However, because of their potential to acquire a second attribute, management should remain cognizant of such stakeholders, for the dynamic nature of the stakeholder-manager relationship suggests that dormant stakeholders will become more salient to managers if they acquire either urgency or legitimacy." (Mitchell et al, 1997: 874-5) In the case of DITIS, the dormant stakeholder is the government and other funding bodies that have shown an interest in the system. Because of their potential role in the future of the system, the project management team (University) should remain cognizant of such stakeholders. It is expected that the government's power will be exercised when there is a better recognition of the potentials of the system not only in cancer care but in the other health areas.

Dependent stakeholders are those "who lack power but who have urgent legitimate claims as 'dependent', because these stakeholders depend upon others [e.g. other stakeholders] for the power necessary to carry out their will" (Mitchell et al, 1997, 874-5: 877). Nurses represent this type of stakeholders. Their voice has mainly been represented through Pasykaf (management) itself which however as it was found in the study their interest in the system is predominantly for efficiency and accuracy in statistical analysis.

Dominant stakeholders are both powerful and legitimate. Their influence in the relationship is assured, since by possessing power and legitimacy they form the dominant coalition. In our case, we find that Pasykaf itself belongs to this group of

stakeholders as they represent the only host of the system. However, as a charity organization it has been unable to fund the project itself and therefore their position has remained weak and the management team needs to look elsewhere for financial support. It is expected that when other funders are found, e.g. the government, or with the commercialization of the system, the power of Pasykaf will be reduced as other host organizations will emerge e.g. cardio-care support.

Other stakeholder groups which were identified in Mitchell et al framework and shown in figure 1 but not found in our own study are:

- Discretionary stakeholders possess legitimacy, but have no power for influencing the firm and no urgent claims.
- Dangerous stakeholders possess urgency and power but no legitimacy; this may result in the use of coercive power.
- Non-stakeholders possess none of the attributes and thus do not have any type of relationship with the rest of the group.

Accordingly, it is found that in the case of DITIS there were five different distinct types of stakeholders. The diversity in their views which is expressed in the reasons they give to the legitimacy of the system as well as the perceived urgency and their ability to influence the system have all contributed to different degrees of support. In this study, apart from the commercial organization, all the other stakeholders have been positively supportive of the implementation process. They have been doing so differently however with some such as the University team taking a more active role in securing funding and hosting the project team whilst others such as Pasykaf

remaining more passive. This passiveness is not however due to a lack of interest but rather due to other priorities.

FUTURE TRENDS

The potentials of mobile applications in e-health are tremendous. They could be used for supporting health professionals in offering care through improved e-tools (e.g. for improved access to patient record by all health professionals, improved collaboration and streamlined workflow), which are especially useful for the community care environment. However, even though mobile technology is a key factor for enabling the formation of geographically-proximate medical teams at the point of care, their effective implementation would depend not only on the level of support provided to users but also by the extend to which there is a shared understanding and support among diverse groups of stakeholders.

An important contribution of this study is an examination of the role of diverse stakeholders on the implementation of such a novel, e-health initiative. With a growing recognition that e-health can make an impact on the provision of health care as well as the fact that e-health applications are becoming even more global, investigating the diversity that may exist among the various stakeholders is becoming vital for their success.

CONCLUSION

This chapter presents a longitudinal study on the implementation of an e-health mobile application, DITIS, that supports network collaboration for home healthcare.

Our study has found that users' support has gradually improved over the last years as they have been increasingly exposed to the system capabilities and have recognised the advantages of the system in their day to day work for both administrative and consultation purposes. Another reason for this is that the nurses have gained participation in the project team with periodical meetings with the project manager and developers. Yet, the future of the system is uncertain as future funding to gain sustainability may not be available. Such complex and novel system has not gained shared support by all parties concerned, with one company dropping out (but another one joined) and others not taking an active role. The long term solution is commercialisation, which is currently pursued, but as with any new ideas and products there is considerable risk involved. The study has adopted the stakeholders' analysis (Mitchell et al, 1997) and found that there are different relationship characteristics among the key stakeholders showing diversity in interests, expectations and level of involvement in the system implementation.

DITIS has appeared to act as a useful fuel for improving patient-records and promoting an integrated approach that has a direct impact on the quality of treatment and health care support to home-based cancer patients. However, even though this is a novel application and despite the fact that it has been introduced five years ago, the implementation has remained slow and the system has not yet been able to secure its place and its future in the health sector; though it has been making an impact on the health care support provided by some nurses and medical staff. Lack of organization ownership makes the future of the system uncertain. What has enabled it however to survive was the enthusiasm of some key individuals, mainly the university team and those users who could see the direct benefits of the system on the quality of cancer

care. Speedy commercialisation of the system seems to be the solution for its long term survivability, and this is the current focus. In the meantime, DITIS is at present being deployed, for its healthcare collaboration and patient management aspects, in the context of two EU funded e-TEN market validation projects (HealthService24 and LinkCare), involving trials for cardiac patient monitoring.

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DITIS IMPLEMENTATION PROJECT

MAY 2001

Please take a few minutes to answer the following questions. I would appreciate if you return the completed questionnaire to me by email: …

Thank you very much for your contribution.

Please tick the one that most identifies your involvement in the DITIS project:

Designer/Developer: ----------
User (Nurse): ----------
User (Doctor): ----------
Other (please specify): ----------

What do you think, would the main benefits be for implementing DITIS within Pasykaf?

After implementation, how do you expect DITIS to be used on a day-day to basis?

What would you expect the results of the pilot study to be? Please identify in your answer those factors that you think might enable or constrain the success of this pilot.