

**Technology based welfare innovations:
The implementation of remote patient monitoring, mobile health,
and healthcare networking information systems**

Work-in-progress paper

Per Andersson
Center for Information and Communication Research
Stockholm School of Economics
Holländargatan 32, floor 8, Stockholm, Sweden
per.andersson@hhs.se

Jan Markendahl
Wireless@KTH
KTH - The Royal Institute of Technology
Electrum 229, 164 40 Kista, Sweden
janmar@kth.se

1 Introduction

New technology is one of the most powerful drivers of renewal of welfare systems and public sector innovations in general (Bason 2010). In healthcare as part of welfare systems, the implementation of internal administrative IT systems for increased productivity has been the dominating way in which technology has been employed to develop and innovate in systems and operations. At least two major technology changes have created new prerequisites for technology driven innovations in healthcare. Firstly, today more technology can provide outcome-based data online to citizens (e.g. patients) so they can make informed choices about the quality etc. of public, welfare services, including healthcare. It is sometimes summed up in terms of new interactive web 2.0 technologies, harnessing the power of networks through which citizens and professionals are mobilized into dialogue and interaction. The second technology shift and improvement in technology is connected to the growing need in society in general to have access to real-time information. This involves the extended use of communications beyond the exchange of information between human users. The Internet of Things (IoT) refers to networks of sensors and devices used for many applications in order to optimize resources and services. Both these technology shifts have an impact on the development of welfare sectors and operations. This paper puts in focus innovations in the healthcare sector, resulting from the application of these new information and communication technologies.

When the future of welfare systems is discussed more and more attention is directed towards the public sector's increasing need to be innovative (Bason 2010). However, to strengthen the public sector's innovation capacity is also to expand that capacity with relevant skills and resources of other sectors and industries, i.e. powering innovation through the combination of multiple disciplines and capabilities (ibid). Procurement and collaboration by the public sector in relation to private companies is not new. But as stated by Bason, "what might be new, and increasingly necessary, is the focus on creating products or services in a way that generates new solutions to complex, societal problems, and at the same time helps foster revenue, growth, .." (p.94). This paper focuses on a technology shift in one part of the welfare system, healthcare, but shifts attention to the perspective of a major, private supplier of information and telecommunication system solutions.

Against, the background of many challenges facing many countries' healthcare systems - increased patient needs, escalating treatment and therapy costs, shortage of medical professionals, increasing demand for specialized, interactive treatment, adults becoming overweight, increasing number of chronic and long-term patients, and steadily increasing elderly populations – companies in the global information and telecommunication industries (ICT) have seen the emergence of interesting new markets for their ICT systems and solutions. In parallel to this, the development of new mobile telecommunication infrastructures adapted to the needs for increased machine-to-machine (M2M) and Internet of Things (IoT) related telecom traffic, involving many other industrial sectors. This requires improved knowledge by the telecom and ICT suppliers about the core business of e.g., public transport, power distribution and facility management industries, healthcare sectors, and more.

Of particular interest for this paper is the fact that more and more industries are beginning to share the same or strongly interconnected parts of the emerging new generation of fixed and mobile telecommunication systems, more or less forcing the ICT suppliers into closer interactions and relationships with industrial sectors that used to be on an arms-length distance. ICT suppliers and telecom operators are coming closer to industrial sectors, creating a need to develop new relationships and create new knowledge that telecom companies usually do not have. In addition, these suppliers need to use the same resources in and share knowledge from customer relationships in different usage and application areas.

At the same time, telecom and broadband operators for example, face a business challenges in this development, since their traditional revenue streams are based on high amount of traffic per users. But M2M and IoT devices usually generate very low traffic and telecom operators can no longer base the charging on the traffic volumes, hence alternative revenue models needs to be considered. Technical solutions for these services represent only part of the overall service and business context. M2M and IoT services cannot be offered as a standalone service, but increasingly need to be integrated into a broader service context. This development also involve and concern the ICT technology and system suppliers moving their business into more and more service solution business, sometimes requiring a closer cooperation with the end customers, irrespective if they are in the transportation, energy and utilities industries, healthcare or any other industries applying the new generation of ICT infrastructures and services.

This study summarizes data now being gathered from a set of cases in the telecom sectors. The technology supplier is a global company supplying telecom and ICT systems and services with a long experience as large supplier to the world's telecom operators. The case (introduced below) describes the supplier's development of different customer solutions in its group of healthcare customer. Different customer relationship situations are described. For example, one relationship in which a regular customer, a telecom operator, is the main customer, and where the technology supplier has a more limited, direct relationship with the end customer in the healthcare sector. Another example describes a case where the supplier develops a much broader and deeper direct end customer relationship with the public actor(s) involved in developing the new technology based healthcare operations.

Next, related work related to the empirical phenomenon in focus is briefly described. The (planned) data collection process and suggested analysis approach are explained in the next section. Then we give a short note on the analytical framework. This is followed by our case examples related to the implementation of ICT solutions and innovations among healthcare customers. Finally, some suggested points of analysis and discussion are suggested. (As the study is in an early phase yet, most of the discussions will be of an explorative character.)

2 Problem area and research questions

2.1 Implementing New Technologies in Healthcare

The suppliers of these new ICT systems and services are facing many, new challenges as they become involved in supplying their solutions to new industries involving new application areas, like the healthcare sector which is in focus here. This paper takes the starting-point in two major, both practical and strategic issues facing the suppliers of infrastructures, systems and services upon which future welfare systems, like the health care sector will be based.

Firstly, in a short-term perspective, the ICT suppliers are facing a new marketing and networking challenge. The supplier in focus of this paper called it “a way to market problem”. How do we build new relationships to a new set of customers for our technology platforms, in particular, how do we build relationships to new customers in the healthcare sector? And as a consequence of this, to what extent should our regular customers, the telecom operators, be involved in this process of building new relationships? In what markets should the telecom operators continue to be the “middleman” between us as technology supplier and the healthcare organizations? And, subsequently, how do we need to adapt our marketing organization, capabilities, resources and operations when these new customers are approached, given that healthcare customers in the public (and private) sector can differ widely in different national markets?

Secondly, in a more long-term perspective, the technology suppliers are also facing the problem that some of the marketing resources need to be shared and used when dealing with customers in different application areas. In short, the same technology platform and some of the internal resources need to be used when dealing with customer relationships using the technology for very different purposes. The technology supplier named it “the problem of scalability”. Customer solutions are initially highly adapted to the needs of the specific customers. With this comes the need for *both standardisation* based on successive learning in order to be able to create an efficient use of resources from the growing business, *and for increased specialization of resources*. This long-term learning process and challenge to efficiently use internal resources comes from two sources; the need for learning *between customer relationships* within *the same* industrial sector, and the need for learning *between customer relations* in *different* sectors and application areas.

Both business challenges can be viewed as network problems. The first draws attention to a classical distribution network and channel relations issue, including also the issue of adaptation of internal organizational structures to match the new customer relationships. The second business challenge entails networking problems with wider implications and issues to handle, involving the relationships and connection between customers within and between different industries and fields where the technologies, systems and services are applied.

2.2 Research questions

In order to analyse these two business challenges a supplier of new technologies to customers in a sector new to the company, in this case the healthcare sector, two broad research questions will guide our work. The first issue concerns the fact that the supplier needs to handle *the interactions and relationships* to new and existing customers in new ways. The second issues concerns the fact that *resources* (of different kinds) need to be handled both efficiently and effectively in this process.

1. How does a technology supplier build new relationships to new customers in the healthcare sector? And as a consequence, how are the supplier's regular customers involved in and affected by this process of building new customer relationships in the public sector?
2. In this process, how does the supplier handle the need for both resource standardisation based on successive learning in order to be able to create an efficient use of resources from the growing business, and for increased specialization of resources? In addition, how does it manage the need for learning *between customer relationships* within *the same* industrial sector, and the need for learning *between customer relations* in *different* sectors and application areas?

3 Related Work

At the centre of our case study is the implementation of new mobile systems for use in healthcare operations. Several previous studies have focused on similar implementation and innovation processes. The International Journal of Electronic Healthcare, for example, presents several studies on related topics. Specifically using actor network theory to understand network centric healthcare operations, Wickramasinghe et al (2007), discussed similar implementation issues. von Lubitz & Wickramasinghe (2006) and Tamburis (2006) are example of similar studies. Journals, specifically focusing on mobile communications report on similar studies, eg. in Wickramasinghe, N. & Goldberg, S. (2004; 2007)

A core conceptual framework in business network studies is the ARA analytical scheme (Håkansson and Snehota 1995). Three levels (company, relationship and network) and three layers (activities, resources and actors) are distinguished. Interdependence between resources, between activities, between actors is a major attribute of business networks. Some of the propositions in Håkansson et al. (2009) are central to the approach: The value of a resource is dependent on its connection to other resources. The outcome of any activity is dependent on other activities.

Griffiths et al (2006) presents a literature review of how Internet can be used for seeking and delivering health care including different types of service like; health information seeking, Internet-based peer support groups, online health consultations and delivery of health interventions.

4 Methodology

4.1 Data collection

A number of pre-study interviews were conducted 2013-2014 with R&D and marketing people at Ericsson. In total we have performed around 10 interviews with persons involved in the development and marketing of ICT solutions for health care, energy and transport services. The questions have been focused on:

- how and why Ericsson started to develop these services
- what actors that have been involved
- how other actors have cooperated with Ericsson and end-users
- lessons learned from different sectors

Inputs from pre-study interviews have been used in the preparatory initial steps, planning for a number of case studies. We have selected the perspective of one specific technology supplier, i.e. Ericsson, following its attempts to develop new customer relationships of different types to new customers in different sectors in different countries.

During the spring 2014 a number of case studies have been performed; two for health care services (Armstrong, 2014), (Cedergren, 2014), one for the energy sector (Alvarez, 2014) and three for the transport sector (Deandres,2014), (Mesaikos, 2014) and (Micheli,2014). Currently the authors of this paper are analyzing these case studies in order to identify differences and similarities between different sectors and countries and to identify and analyse recurrent patterns.

4.2 Analytical Framework

We suggest that the following issues are among those interesting to pursue in business network studies on technology, service and business innovation. With a business network perspective, transactions are episodes in dynamic exchange relationships between counterparts. Relationships in networks have temporality and there are opportunities for mutual learning and adaptation to each other. And exchange relationships are directly and/or indirectly connected.

Thus, interdependence between interaction in relationships and the network context of such interaction is in focus. Interaction is affected by the network context and vice versa. Network resources are heterogeneous and complementary, explaining the need for cooperation between actors. Networks are characterized by variety and co-existence of different network processes. Change and stabilizing are two intertwined attributes of network processes. Innovation is thus a network process.

Our *research question 1* draws attention to the fact that in a business network all actors are *intermediaries* in the sense that they interlinked other actors. Also all activities and all resources are intermediaries in activity patterns and resource constellations. The role of intermediaries is to intermediate in network processes. Structural changes in activity patterns, resource constellations and web of actors signify changes in intermediation and which supplier has direct contact with the customer and/or user. One example is changes from buying individual services from different service providers to buying a bundle of services from a seller of services that then organizes service deliveries from specialist service providers.

Our *research question 2*, draws attention to the fact that the technical and industrial processes that are in focus of our empirical cases often are described as associated with on-going process of "technical and industrial convergence". They often imply a need for *overlapping* between established networks, to link activities, resources and actors in new ways (Mattsson 1998). Cross-bordering cooperation in networks and new competitive structures in business networks are parts of these processes (Andersson, Markendahl & Mattsson 2012). The service and business innovation processes that we are interested in here can be interpreted as *an overlapping process* involving many industries and integration between services from a user and/or supplier perspective. These service and business innovations, though we are mainly focusing on two in healthcare, have different degrees of connection/integration between other services. The transfer of the services can be provided by separate suppliers for each service, by cooperating suppliers or by a separate "aggregator" of several services, but can also, as in our case, be connected via one major supplier. Hence, networks overlap with business networks, which provides some issue for research. During that overlapping structural changes in the companies involved as well in relationships with other actors are needed. However, current solutions, and thinking about problems and solutions, are from the outset most often focused within traditional application boundaries ("stove pipes") thus separating for s focus on "vertical analysis", (e.g. as in our supplier case, energy, transport, healthcare and other services.) Aspects of overlapping to study are how actors may handle both cooperation and competition during the innovation process characterized by uncertainties and multiple dependencies.

5 Case descriptions

The first example draws attention to how the supplier, based on a stable relationship with a major customer, the telecom operator AT&T acting as “intermediary” implements a new remote patient monitoring system within the organization of a big hospital chain. The second example draws attention also to question 1 but describes the situation when the supplier has a *direct* relationship with the healthcare customer.

Customer example 1:

The implementation of remote patient monitoring services in hospital trials in Texas

In 2010, telecom operator AT&T announced the launch of a new cloud-based remote-monitoring service that incorporates video and helps doctors and patients manage chronic conditions. The service would help doctors manage patients' chronic diseases through live video chat. The remote-patient-monitoring (RPM) platform was built on an Ericsson cloud-based software as a service (SaaS) infrastructure. Ericsson's Remote Patient Monitoring System uses Bluetooth devices and medical sensors to transmit patients' vital signs remotely to doctors, who access the data from a secure device-agnostic cloud platform. Consumer mobile devices connect with the platform to enable patients to keep track of their health. Doctors can integrate data gained from RPM with their workflows. The new RPM platform was to be part of AT&T's so called ForHealth business, which the company created to accelerate wireless, cloud and networking services in health care. (AT&T launched ForHealth in 2010). Ericsson's SaaS platform would enable better management of chronic diseases, such as congestive heart failure and diabetes, as well as reduce hospital re-admissions, AT&T reported. In addition, the platform would provide reminders to patients about their medication routines and educate patients about their conditions. Nurses at a telemonitor center could use the service to monitor patients around the clock. Connecting with patients through a video session allowed doctors and nurses to see symptoms they may not pick up through just a voice conversation. During the implementation process, the Executive director for AT&T Mobile Healthcare reported: “-We heard feedback from the provider community that they wanted a video-coaching component, which we are now scaling and building through Ericsson”. Live, on-demand, two-way video enabled a personal connection for the patient and doctor, extending the relationship beyond the hospital walls. Video allowed doctors to detect clinical indicators such as skin color and mood to determine if a patient is using medical devices and taking medications as directed. At the outset, the RPM SaaS platform was evaluated in pilot deployments at large health systems, academic medical centers and home care providers. AT&T officially announced that the planned to make the product available in 2013. Healthcare institutions moving data into the cloud was one of several trends to watch for health IT in 2013, according to AT&T. Another trend was the remote patient monitoring moving from pilots to large-scale adoption as more hospitals began to adopt the accountable care organization model to reduce hospital readmission costs associated with chronic conditions. AT&T anticipated that the results of the pilot study using a cloud-based remote patient monitoring solution at Dallas-Fort Worth-based Texas Health Resources would indicate reduced congestive heart failure-related readmissions.

Customer example 2:

The implementation of a health care information system in Croatia

Beginning in 2004, The Ministry of Health and Social Welfare of the Republic of Croatia entrusted Ericsson with introducing ICT in the National Healthcare System. The project was to be executed on a turn-key basis. Medical services are now provided to Croatian citizens within a new Healthcare Networking Information System. The new system is patient-centered and financially and medically transparent. The introduction of the new system was important for further uniform medical services provision across Croatia. The old paper-based system was unfit to handle the waste quantity of patient data because of its inherent slowness in medical records handling and the inefficient communication between different stakeholders. The Croatian government wanted to offer to its citizens a more sophisticated healthcare service delivery system. Ericsson was to coordinate the efforts from all involved, among them the Croatian Institute for Health Insurance and the Croatian National Institute of Public Health. With no existing system to replace or upgrade, Ericsson was able to base the design on the latest technologies, equipment and methodologies. To start from almost nothing also implied a high degree of coordination between the two stakeholders and Ericsson and a considerable amount of effort required to formally describe and optimize working practices and processes in healthcare. Ericsson was chosen to supply and implement the Primary Healthcare Information System amid the strong competition of companies such as IBM and Microsoft. Ericsson provided the infrastructure and the platform for eHealth services. The system implemented in Croatia paved the way for a healthcare reform which made it clear that doctors are paid for treatments supplied to patients as opposed to fixed monthly fees based on the number of patients. The Health Networking Information System in Croatia was deployed quickly regardless its complexity. Ericsson Nikola Tesla started work in 2004 and completed it in all 20 counties during 2005. Solution deployment was somewhat delayed by legal and regulatory issues and obstacles to electronic communication, commerce and invoicing. By spring 2008, a full-scale rollout in all 20 counties in Croatia was completed. All primary healthcare physicians (2300 in number) were connected to the system, together with both major stakeholders, the Croatian Institute for Health Insurance and the Croatian National Institute of Public Health.

6 Analysis and Discussion

How does a supplier manage the “way to market” challenges against the background of the fact that new types of end customers should be reached, the fact that other actors also need to be involved (here: telecom operators), and the fact that the internal organization is not adapted to this new types of customers and network situations? The cases that will be developed will approach the questions with a particular interest in the way in which the actors’ network positions change and develop, altering their positions as intermediaries, to each other and to other actors in their networks.

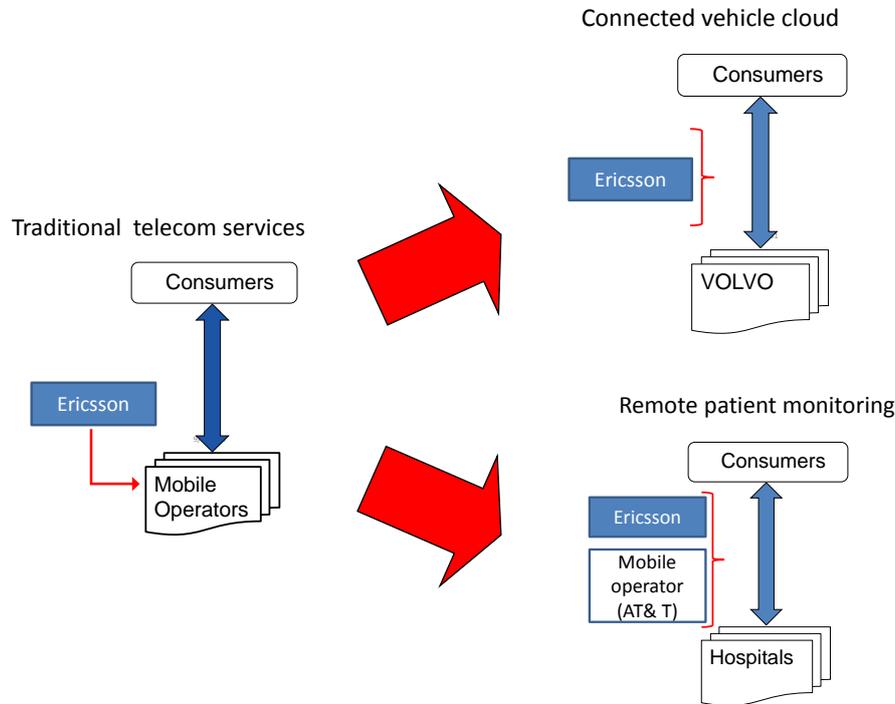


Figure 1. Change of market position of Ericsson when entering the service business

Traditionally the main customers of Ericsson have been mobile network operators. The offer of Ericsson is either “products” (complete networks, base stations, network equipment) or “managed services” (to operate and maintain operator networks. This situation is illustrated to the left in Figure 1. The last years Ericsson has also entered the service business in sectors like transport, energy and health care. The main role is linked to the resource called “service platform” and the activities related to managing the service platform. In our first health care example (lower right part in Figure 1) Ericsson together with the operator AT&T provides the service. As comparison we show an example from the transport sector. The connected vehicle cloud is used by the car manufacturer Volvo to offer remote diagnostics and maintenance (upper right part in Figure 1). Hence, Volvo establish direct contact with the car owners and the car dealers are by-passed.

The way to market issue also encompass many aspects of the internal marketing organization, how to break internal “vertical silo” thinking and behaviour. How does a supplier manage “the scalability challenges” against the background of the fact that standardization and learning needs to take place between relationships both within the same and between different “industries” and application areas? The second analytical perspective will focus on the broader and more long-term structural development issues. This also entails aspects of long-term organizational learning within and between different customer markets/application areas and relations.

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