

Identifying Where the Values Come from IT-Innovations in Health and Social Care

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ABSTRACT

Studies aimed to capture the effects of IT-innovations in health and social care have shown that there is a gap between expected and factual outcomes. Many decision makers feel the need to articulate an ideal end-state for their organizations. Striking the balance between novelty and believability of such an ideal end-state is often tricky and they become neither satisfied with the ideal nor the visioning. In this study, we explore the contribution of IT-innovations to health and social care. The results showed that coherence between context and IT-innovation is important to capture effects and outcomes. Being coherent rather than visionary contributes to identify where you are, as an organization, and to capture effects and outcomes that “make sense” in the context in question. The paper makes an exposition from the model building, algorithm design to performance analysis and contributes to the academic prosperity in Intelligent Information Management. The knowledge generated is expected to provide input when identifying goals that IT-investments are supposed to achieve.

Keywords: IT-Innovation; Intelligent Information Management; Health and Social Care; Coherence

1. Introduction

Innovation is a fundamental dynamic capability allowing organizations to renew their products and services offerings in order to match or create market changes. Since Schumpeter wrote his book the theory of economic development [1] scholars have emphasized the importance of innovation as driver of structural changes and economic growth.

Investments in IT-innovations in health and social care are usually done to improve productivity and performance in the delivery of services, to enable new ways of interaction within individuals, to achieve organizational flexibility, increasing vertical and horizontal integration, and/or to develop new business models [2].

Leaders and stakeholders at all levels are interested in knowing where the contributions of IT-innovations to health and social care migrate from. Previous research in the area of health informatics, has, however, shown that the introduction of IT-innovations has profound consequences for complex organizations, such as health and social care, and usually brings, *i.e.* changes in the organizations' structure, changes in work processes, as well as changes in interaction with and within practitioners

and patients [2-5]. The results have also shown that there is a need to adapt IT-based innovations (products or services) to organizational context; otherwise large unexpected adverse effects have deep and long-term impact that affects the delivery of care services [6-8] as well as the productivity, effectiveness and efficacy.

While there are many emerging initiatives, that attempt to capture benefits or value of the implementation and use of IT-innovations in health and social care, it is our contention that it will require more studies about which kind of impacts are coherent to expect depending of the organizational context in which the innovation is applied and the type of innovation implemented. Most of the available studies have been limited to the investigation of specific issues, e.g. how IT can support managers to distribute the information throughout the organization [8]; how technological developments have made high quality services more cost-effective; or how technology can be introduced to meet competition [9-11].

The aim of this study is to make an exposition from a model building to performance analysis and explore the contribution of IT-innovations to health and social care organizational contexts. The knowledge generated is expected to provide input when identifying goals that

IT-investments are supposed to achieve and contribute to the academic prosperity in Intelligent Information Management.

2. Method

A review of the literature on health IT evaluation for the years 2000-2011 was performed at the first step of the study in order to identify previous studies related to the effects of IT-innovations in health and social care. The review was performed in an iterative form in collaboration with researchers from the Swedish national e-health network (a network that groups senior researchers in the area of Health Informatics at a national level). In contrast to systematic review, the interactive process allowed us to summarize the findings of the literature and extend the number of reviewed papers and achieve a broad coverage of the field rapidly.

We limited the search to studies related to impacts of IT-innovations in the area of health informatics and published during 2003 and 2010. We searched therefore articles using terms and combination of terms such as: evaluation of IT-innovations, economic evaluations of IT for health and social care, economic investment in IT-based innovations. The searches were conducted using the PubMed, MEDLINE, NLM, and OT seeker.

The bibliographic findings were read in its totality to decide if they belong to the scope of this study or not. Studies considered interesting, ($n = 145$) were those with an explicit focus on how to evaluate and capture benefits of IT-based innovations in health and social care. Studies aimed to evaluate technical issues, pure usability effects or evaluation of e-health services from a socio-technical perspective was not considered.

From the literature, we concluded that mainly three methods are used to perform the studies. They are: surveys, case studies, and test (including clinical testing). Many of the IT-innovations mentioned in the studies we have examined are relatively common, and usually are electronic health record (EHR, EHR and/or CPR), decision support and telemedicine services. EHR constitute 44% of the number of studies. Decision support systems constitute 34% of the number of studies. Telemedicine represents 12% of the studies. Patient portals represent only 10% of the studies.

Evaluations of IT-based innovations tend in general to be concerned with usefulness and user-related issues such as user acceptance and satisfaction and attitudes towards new systems. We found even some studies that aimed to evaluate the effects of IT-innovations on the quality of work performance. Studies that focus on how to manage information systems report the positive effects of the technology in use and its effects for the quality of care, or improvements in management and work process.

Studies performed with the aim to evaluate the finan-

cial impacts of introducing IT-innovations seldom use a systematic identification of all costs. Usually the studies that aim to capture the contribution of IT-innovations to health and/or social care concern user attitudes and perspectives, user satisfaction, and the usefulness of the systems implemented. They normally missed the relationship between usability and economic or usefulness and cost-effectiveness

The most common techniques that the studies have used to capture the economic effects of IT-innovations are current market prices or loss of income. The articles give, however, no clear picture of how the effects have been measured and many times only the direct effects were included in the calculations. The studies are mostly descriptive and indicate the difficulty in measuring qualitative effects of changes. They are usually carried out a priori, *i.e.* before an IT-innovation has been introduced and used in practice and thus cannot confirm that any anticipated effects have been realized. In some cases, studies have been conducted a-posteriori, noting that the promise of economic gain has not been realized. Empirical attempts to demonstrate or measure the Return on Investment (ROI), has often failed due to the complexity of health and social care organizations, or are of limited use when evaluation is only conducted on prototypes with a limited number of users.

The most common indicators used to express impacts of IT-innovations in the reviewed articles are:

- Increased incomes related to a general use of electronic journals;
- Cost reductions as a consequence of reduced time for paper-based work or for reduction of printing documentation;
- Reduction of costs for medicine due a more effective prescription process;
- Costs reductions due to effectiveness of work-routines;
- Cost reductions for less administrative support;
- Productivity improvements both at the individual and organizational level;
- Quality improvement of care processes and its subsequent reduction of costs due to less;
- Reduction of costs due to errors both in processes, prescriptions and treatment.

A general reflection that we find in the studies reviewed is that concrete evidence of the benefits of IT-based innovations are still few and of varying quality. The articles give no clear picture of how the effects have been measured and normally only the direct effects were included in the calculations. The benefits of IT innovations depend heavily on factors that may take considerable time to reach full power. It often means that the total benefits are rarely identified in the short term. Although much research has been done in this area it is still the case that IT-innovations lead to un-expected costs and

organizational changes.

Most of the literature indicates, however, the limitations of a strictly quantified economic framework to measure the benefits in relation to investments in IT-innovations in health and social care [7-143]. Most of the studies are descriptive and indicate the difficulty in measuring qualitative effects of changes. A significant trend can be seen in an increased focus on systemic perspective that takes into account several areas such as organization, patient perspective and social consequences. It is interesting to note that most of the studies included in this review, did not discuss a specific theory, approach or model to be applied when evaluating IT-innovations and its contribution to health and social care organizational contexts, and none study generated new theories or extended old ones. Furthermore, many studies perform formative evaluations, and a high proportion of studies perform summative evaluations.

Previous research shown, however, that IT is used for different aims in different organizations, [2,5,10,11,20,25,34,38,48,49,51,65,95,117,118,121,123,131,144,145] consequently, it is rational to expect that in order to capture where the values of IT-innovations come from it is necessary to first identify the context in which IT is implemented. For this reason, when building the contexts' landscape in this study, we used the principle of coherence [11] and tried to reflect these organizational contextual differences by theoretically classifying the contexts in which an IT-innovation is applied into three types:

The Micro context: Characterized by IT investments in systems that supports exchange of information and communication between one patient and its current healthcare provider as well as the production of basic services at the local organization.

The Intra- and inter-organizational context: Characterized by a multiple organizational perspective and includes investments in IT-innovations that support cooperation, communication and work flows as well as the production of services between several different health and social care organizations.

Virtual networks context: Characterized by a patient focused perspective and includes investments in IT-innovations where the healthcare receiver is an active actor and influences the demand and supply of services at both the micro and the inter- and intra-organizational level.

All propositions related to the contexts' landscape were discussed with senior researchers belonging to the Swedish national e-Health research network and representatives from The Swedish Association of Local Authorities and Regions, Center for eHealth (CeHis). In a series of iterative drafts, the effects reflected what was considered of key importance and coherent between a vision and what can be expected from specific IT-inno-

vations in each specific context were discussed and analyzed. Researchers and practitioners were asked to use their experience to decide if the effects and outcomes proposed at each specific context were coherent with the expectations stakeholders believe IT-innovations should bring to complex organizations such health and social care organizations. They were also asked to deal with each context separately, in order to be able to set boundaries and see adjacent possibilities in each environment or context.

A first report was distributed [145] for comments to all the individuals that participated in the workshops or seminars. The report was further discussed with national authorities, CeHis, county councils representatives and IT-managers. A final report was produced at the end of 2010 [144] and distributed through the Santa Anna IT-Research Institute at a national level. During 2011 a series of case studies were performed in order to validate the contexts and their respective effects and outcomes. A final report in which both the contexts and the case studies' results are presented was produced and distributed to all participants in the study, at the end of 2011.

Definition: An IT-innovation can be defined as "a mayor technological change resulting in the creation of a substitute technology for a particular organization" products and services or processes. The emergence of digital imaging as opposed to analog ones in healthcare can serve as an illustrative example of an innovation.

3. Identifying the Contributions of IT-Innovations: From Micro-Level to Virtual Networks

3.1. The Micro-Level Context

Investments in IT-innovations at the micro level are mainly made to reduce costly time-consuming errors from manual data entry, and to increase system usability. Health and social care organizations focus on facilitating internal communication and stimulating a good information management for the local work team. IT-innovations are mainly used to improve administrative issues *i.e.*, to keep records, order supplies, to support the provision of basic services (*i.e.* prescription renewal or cancellation of appointments) facilitating one way communication between stakeholders (*i.e.* patients and practitioners) with simple interfaces.

IT-innovations at this level, normally, do not allow possibilities to interact or to exchange information with the patients in real-time. There have neither any automation nor verification mechanisms to confirm the receipt of a request. In some cases e-mail is sent to confirm requests, but they are usually not sent in real-time or automatically.

Main outcomes at this level are related to the possibil-

ity to share information between different actors at the micro-level, reduce unnecessary consumption of resources, reduce the work-overload of frontline personnel and improve decision making process. Economic benefits that are generated at this level are not directly related with net economic savings for the single organization or for the investor. They are usually short-term returns as a result of reductions in transaction costs when administrative services can be rationalized (Table 1).

3.2. The Intra- and Inter-Organizational Context

Health and social care organizations at this level are often developing less hierarchical alternatives for organizing work and changing the way individuals (care professionals and patients) interact with and within organizations.

IT-innovations contribute at this level to create a modern and flexible information exchange along the entire chain of care empowering end-users to actively use IT for communication and interaction patterns. New structures created by the use of an IT-innovation improve internal and external integration of actors, supporting and enabling the creation of integrated services (*i.e.* the possibility to collaborate with pharmacies or social care actors). An important challenge at this level is the fact that the benefits of the implementation and use of technological innovations do not always go to the same stakeholder who funded the IT-initiative.

The relationship between cost and effectiveness is not necessarily directly or linear. Main challenges are, paradoxically, not related to the technology and its functional capacities, but to the willingness and frequency of the use of IT, and to governance. Of crucial importance is to

keep decisions about investment in IT-innovations separated from decisions concerning the financing of the innovation, and being coherent to identify the possibilities that the IT-innovation offers to the context to reduce the time and space of the communication and collaboration simultaneously to, to not be vulnerable to changes (Table 2).

3.3. Virtual Networks' Context

Health and social care organizations at this level are working actively with the total integration of organizational structures. The paradox of this step is that the benefits derived from IT-innovations become easier to appreciate, although the technology is interwoven in all activities. The values cannot any longer be analyzed at a single level. This is because IT-innovations has become powerful, complex and embedded in the organizations and accompanied by considerable changes in structures, work procedures and sometimes in division of labor.

The patient, at this step, is assumed to be the actor who is best updated on his own needs and preferences and knows best which services he/she wants to demand and adopt an active role becoming an important factor in the production and delivery of services. The ambition is to enable the patient to take an active part in his/her own care and to stimulate him/her to actively participate in the demand of services. Examples of IT applications at this level are: Portals, blogs, networks, social media, and business intelligence solutions support and encourage interaction with external private service providers/suppliers.

Effects emerge, at this level, from an increased patient involvement (awareness and empowerment). This presupposes, however, that patients are well informed about

Table 1. IT-innovations, effects and outcomes at the micro-level context.

IT-innovation	The micro level context	
	Effects	Outcomes
Electronic decision support systems (EHR, EPR)	Electronic scheduling of appointments and registration of tasks	<ul style="list-style-type: none"> • Reduced number of missed contacts • Reallocation of time and resources • Reduce numbers of double referrals and/or errors due to manual registration
	Organizational learning	<ul style="list-style-type: none"> • Increase and stimulate information and knowledge exchange between different care givers at the same unit. • Support awareness of patient safety
Virtual logistic systems	Effective and fast access to information for joint planning and distribution of resources	<ul style="list-style-type: none"> • Shorter lead time for communication • Integration of the activities along the logistics value chain. • Proactive planning of resources • Shorter time for delivery of results, analysis etc • Reduce costs transaction costs due to effective and fast access to information for joint planning
E-basic services <i>i.e.</i> booking systems, birthregistration, renewal of prescriptions	Customization of services	<ul style="list-style-type: none"> • Flexibility and new options for booking/outbooking of appointments • Reduction of waiting time for accessibility of services (<i>i.e.</i> renewal of prescriptions, electronic birth registration)

Table 2. IT-innovations, effects and outcomes at the intra and interorganizational context.

IT-innovation	The intra and inter-organizational context	
	Effects	Outcomes
Organizational intelligent systems	Integration of electronic healthcare records and lab report systems	<ul style="list-style-type: none"> • Tests can be taken within all healthcare organizations (HC, hospital) and results are accessible in the system • Reduced waiting time for registration and follow-up of information on results from different tests • Particular prescription of drugs and its motivations are accessible for all actors in EHR • Strategies for prevention and control with the possibility to simulate for prognosis and redistribution of resources in real time • Pictures and opinions from different experts are presented and visualized in the system
	Integration and coordination of vertical and horizontal administrative and clinical information	<ul style="list-style-type: none"> • Reduced transaction costs for making information accessible for all healthcare providers • Embedded solutions for control and reduction of incorrect prescription of drugs, lab results and diagnoses • Electronic support for documentation of deviation handling systems improves service quality and patient safety • Prioritization and reduction of time for the selection of treatment efforts and routines • Information about private actors for follow-up on controls of costs and quality of efforts in real time • IT-based collaboration and development of e-based warning systems
	Best practices at inter- and intra organizational level	<ul style="list-style-type: none"> • Diminish of information asymmetry leads to fewer mistakes and more secure routines • Fast and effective access to key information in acute situations (<i>i.e.</i> epidemic, pandemic) • Better routines for follow-up acute situations
E-business models	Outsourcing of specialized services <i>i.e.</i> X-ray, tomography, screenings, etc.	<ul style="list-style-type: none"> • Rationalization and specialization of services • Alternative forms of resource use
	IT based economical information systems	<ul style="list-style-type: none"> • Individual health budget with possibility for follow-up

the challengers and requisites that of the use of an available IT-innovation demand, and how or if it should affect them at the individual level. Patients taking the initiative to active use technological innovations are those who trust in IT and those who are willing to test alternative communication tools but even those that are willing to in parallel to take the initiative and invest time and efforts.

Investments in IT-innovations are seldom financially sustainable at the short run in this context. They are a combination of investments in a specific IT-innovation, and investments in changing the relationship between practitioners and patients as well as the manner to produce and up-date health and social care information. Additional costs, not having been present at the previous two levels of the model appear at this level. Namely costs for producing trustfully and state-of-the art information, costs for financing the accessibility to services to the patient, costs for organizing the supply of information in real-time and in a new context and costs for supporting the new and the old system in parallel, at least for a while. There exists at this level, consequently, a clear need for to develop innovative and sustainable business models

that meet the economic and administrative requirements as well as the demand for stimulating patient to being active demanders of services (**Table 3**).

4. Discussion

There is today a good deal of wisdom and experience in how to identify the values and contributions of IT-innovations outside of the health informatics area (*i.e.* ERP-systems). There is no shortage of writers in the IT field who have tackled the problematic task of IT-innovation investment appraisal. When discussing where the values of IT-innovations migrate from in health and social care, issues concerning process reengineering, resource allocation, organizational issues and individual behavior and its consequences are usually discussed often as exogenous factors related to the use of a new IT system. Evaluation reports have, usually, shown that the introduction of IT in health and social care leads to failures, resistance to use ICT or to a non-optimal use of the scarce resources [2,6,7,16,47,53,100,107,144].

Investments in IT-innovations are usually made based

Table 3. IT-innovations, effects and outcomes at the virtual networks context.

IT-innovation	The virtual networks context	
	Effects	Outcomes
Patient portals	Digitally integrated information tools for follow-up and interaction with health-and social care	<ul style="list-style-type: none"> • Electronic follow-up or control of the state of services • Information on actual current questions for different target groups • Possibility for follow-up and support healthcare receivers in different clusters • Services adapted to the individual preferences • Reduced number of steps for access to information • Rationalization of information supply for healthcare units • Visualization of treatment strategies, efforts, interventions, e.g. individual care plan
	Innovative work-routines	<ul style="list-style-type: none"> • Re-design of work routines and processes and electronic access to individual information • Possibilities to control number of visits and reallocate resources • Reduced the number of steps for distribution of information • Control of consumption of services • Automatic reminders or follow-up on care plans or healthcare efforts and their effects • Post information or questions before an appointment or follow-up of information during a care-process
On-line communities	“Health-facebook” or such including tools for simulation and visualization for preventive efforts	<ul style="list-style-type: none"> • eHealthcare teams for virtual care and to particularly support for chronically ill individuals • The healthcare receiver is offered possibilities to participate in specialized “communities” with chat rooms and interaction opportunities • Faster and more effective decision making that favors the healthcare receiver and makes administration for certain matters more cost-effectives • Telemedicine and distance healthcare within all areas: elderly, children, chronically ill, palliative healthcare, cardio vascular etc • Follow-up in areas and of healthcare receivers with special healthcare needs, with the possibility for cooperation between external actors
Virtual systems for control and accounting	Automatic decisions for third party (i.e. health insurance office or insurance company)	<ul style="list-style-type: none"> • Faster and more effective decision making that favors the healthcare receiver and makes administration for certain matters more cost-effective • Information/answers for costs/ support of different efforts between and within different healthcare providers, including both private and public healthcare providers • Real-time interaction with external organization such as social security offices • Cost-control and effective management of demand of services both at the individuals and group level
	Standardization with the healthcare receiver in focus	<ul style="list-style-type: none"> • Standardization of health and social care information about treatments and interventions, it consequences and costs at a national level • Standardization of answers related to private life issues offers possibility to keep anonymity if it is desirable and reduce personal visits to primary healthcare • Facilitate search services and comparison of providers for the health care receiver

on a vision designed beforehand and in which a series of expectations of improving organizational operations, reducing costs, controlling resource allocation and achieving of a higher standard of quality are described. The generation of evidence on the success of these initiatives cannot be possible without a coherent relationship between the context and the specific the type of innovation analyzed.

Many decision makers feel the need to articulate an ideal end-state for their organizations. Striking the bal-

ance between novelty and believability of such an ideal end-state is often tricky and they become neither satisfied with the ideal not the visioning. Being coherent rather than visionary contributes to identify where you are, as an organization, and to capture effects and outcomes that “make sense” for health and social care organizational contexts. Health and social care organizations must find ways to interpret effects of IT-innovations so as to make their environments more predictable in order to understand the co-evolution needs that IT-innovations demand.

Coherence between a specific context, IT-innovation, effects and outcomes serves as the glue, which allows both managers and the organization to reassert identity in the face of continues change demanded by technology. Roles, processes and interactions evolve continually with each new occasion of use of IT-innovation, because new situations, negotiations, and activities, inevitably recast it in a new form. Change in complex organizations as health and social care cannot longer be undertaken as though *ceteris paribus* was true. It is necessary to find the coherence between linkages from an IT-innovation at each specific organizational context. While the importance of coherence has not yet become a common issue to analyze where the values migrates from IT-innovations in health and social care, its critical role is well recognized in managerial contexts, and in other fields like psychology.

Coherent organizations thrive in attainment of their purposes. As coherence between IT-innovation and context increase, a much higher level of organizational coherence and alignment is possible. The adjacent possibilities that IT-innovations allow in the current environment become clearer and new organizational and business opportunities evolves, but at the same time demand investments that normally are not considered when developing a general vision to achieve.

Decision makers can benefit from using the contexts and effects suggested in this article as a practical instrument at the moment to plan investments or identify the outcomes that IT-innovations can bring to the organizations to avoid frustration or mismatch between vision and outcomes. The rapid pace of change in health and social care as a consequence of the increasing use of IT-innovations as substitute of manual routines, poses serious starting problems for any large investment. If IT is to emerge as a beneficial corporate tool, the decision to invest needs to be examined as rigorously as with any other large investment. To do this, it is necessary to use tools, as the contexts suggested in this study that visualize if the investment decisions will come true not just to make food forecasts.

The economic motivation of investments in IT-innovations in health and social-care cannot only be justified by its economic benefits to the investors. The economic risks are thus higher than the ones done at the private sector and sometimes have to sacrifice financial return in favor of social return. However, to motivate stakeholders to invest in social ventures, it is necessary to identify where the contributions of IT-innovations to specific organizational contexts migrates from and have a clear picture about the progression of the outcomes at different levels. Identifying the environmental, organizational and its correspondent outcomes can facilitate to attribute a financial value to them and made an evaluation of the

balance between economic efficiency, organizational context and potential contributions of the chosen IT-innovation.

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