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1.1 Background and Aim of the Book

Confronting quality-of-care problems and achieving cost containment in healthcare delivery is one of the greatest challenges for the twenty-first century. Realising the promise of eHealth for ensuring sustainability of Europe's healthcare systems is becoming urgent. When seen in a context of increasing needs for health personnel, growth in chronic disease, an ageing population and a consequential expected rise in public health expenditures, the successful utilisation of information and communication technologies becomes crucial. The eHealth Strategies Report prepared on behalf of the European Commission, Directorate General Information Society and Media, in 2011, points to implementation as a key challenge: "Reaching agreement about eHealth strategies and, even more so, implementing them has almost everywhere proven to be considerable more complex and time-consuming than initially anticipated. The complexity of eHealth as a management challenge was vastly underestimated." (Stroetmann et al. 2011). If we want substantial advancements in healthcare information infrastructures, we need knowledge on actual experiences, and the contributions in this book aim to give the readers a better grip on what facilitates and hinders successful implementation and utilization.

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Currently, European countries have reached a level of technological maturity where most healthcare organisations (both within hospitals and within primary care) have impressive systems to support their day to day operations (European Commission DG Communications Networks Content & Technology 2013; European Commission Joint Research Centre Institute for Prospective Technological Studies (JRC-IPTS) 2014). But, the systems tend not to talk to each other: if a patient has a blood test at a primary care outlet, then a treatment at a specialist hospital, and then an operation in a different hospital, it may take weeks for the electronic records to reflect comprehensively all encounters. Information flows that cross organisational boundaries are still a major issue for healthcare.

Within European healthcare, the problem that we now have to address is how to introduce new technological capabilities that link and leverage what is already in place, blending in the already densely populated health technology landscapes. In the extant literature on health informatics the relationship between novel systems and pre-existing infrastructural resources has been mostly addressed as an issue of connectivity or interoperability (from a technical point of view) or technology acceptance/appropriation (from an organizational point of view). Novelty is viewed as something distinct from what is already in place and the main concern is how the new and the old can be fitted together. In this book we propose an alternative way to understand and approach the challenges of implementation. The central theme here is how change initiatives encounter the pre-existing health technology landscape. The overall aim of the book is to provide insights on the role of existing elements as resources for new development, the conducts through which they contribute to the composition of novelty and the modes through which the pre-existing technological and institutional resources are mobilized, recombined, or obliterated. We explore this issue by analysing cases of inter-organizational information systems where a multitude of pre-existing infrastructural elements exist.

Specifically, the book includes a number of case studies on the design and implementation of systems that span organisational boundaries in different healthcare settings across Europe. The two types of systems covered are: e-prescription and governmental patient-oriented web platforms. The case descriptions go beyond the trajectories of design and development to include experiences of reworking and reconfiguration during and after deployment as this has proved to be pivotal for systems' evolution. We have selected the two specific types of systems not only because they are widespread around Europe and allow comparisons but also because they are exemplary of two different types of grand aims. E-prescription initiatives are usually seen as opportunities to improve health care delivery by systematic and not dramatic change (controlling the ever-increasing medication costs, improving patient safety and providing rich information for performance management). Governmental patient-oriented web platforms are seen as opportunities to pursue wider and more radical innovation, aiming to strengthen the patients' role and to facilitate a shift from provider-centred health care towards patient-centeredness.

The empirical material from the different cases is analysed through the information infrastructure perspective (Star and Ruhleder 1996; Hanseth and Lundberg 2001; Hanseth and Lyytinen 2010). Information Infrastructures go beyond self-contained IT applications as they span localities and temporal scales. Information

infrastructures are sociotechnical bases to build upon implying that they cannot be defined through a distinct set of functions, or strict boundaries. Infrastructures are never built “de novo”; they develop amidst a stream of technical antecedents, social conventions and professional rules and have to be adaptive to the developments of practice. At the same time, they have to be stable enough to reliably support activities that make use of them: “only a stable installed base allows new connections to be created” (Tilson et al. 2010). Working with infrastructures within healthcare is especially challenging because novelty has to link to complex conventions of practice and to technologically congested landscapes that have gradually matured during several decades. Taking an infrastructural perspective does not only orient attention to interconnections and relationships but also to issues of durability, permanence and strategies for effectively managing future evolution (Ribes and Finholt 2009; Karasti et al. 2010).

The chapters of the book present rich empirical cases analysed through a specific theoretical lens. Therefore, we offer a book where theoretical insights and practical experiences are tightly connected. The contributions to the book are sourced from a network of academics that have been working on the topic for years, have previously collaborated and share a common understanding of the challenges entailed in expanding information infrastructures within health care.

The book aims to respond to the needs of different audiences:

- Academic researchers from different disciplines including: information systems research, health care management, innovation studies
- Practitioners involved in the design and development of information systems within health care, policy makers and ordering organizations
- Students in information systems, technology management and health care management programs.

1.2 Outline of the Book

The book is organized in three sections. In section A we present the empirical domain of the book, the context of eHealth infrastructures, the core theoretical concepts, and the cross-case analysis of the cases. This is followed by eleven chapters analysing various European experiences with putting in place eHealth infrastructures. Section B includes empirical chapters on e-prescription from Spain, Norway, Greece, the UK and Germany. Section C includes empirical chapters on governmental platforms for patient-oriented eHealth services from Spain, Norway, Denmark, Sweden and Italy.

1.2.1 Section A: Information Infrastructures in Healthcare

The first chapter in this section provides an introductory overview of the eHealth landscape, and then a more detailed discussion of e-prescription solutions and governmental patient-oriented web platforms and their drivers. E-prescription

initiatives are driven by concerns to monitor and control prescriptions not only for ensuring healthcare quality but also for reasons of cost control. Patient platforms seek to realize visions of patient-centered care, but are also driven by needs to improve the efficiency of healthcare provision, such as overcoming existing communication barriers and mobilizing citizens towards self-care and proactive disease prevention. We argue that eHealth infrastructures have a dual character. They have a transformative orientation and are expected to instigate the reshaping of core roles and relationships within the healthcare systems. However, they also leverage and need to fit to, existing services, capabilities, institutions, data sources, systems, and communication channels.

Then, in the second chapter of the section, we give an account of the theoretical lens used in this book, the information infrastructure perspective, with a special emphasis on the notion of “installed base”, which is central to the empirical chapters’ analyses. The installed base, we argue, serves as the foundation for any change and development, and can be both enabling and constraining. New developments need to fit and make use of existing arrangements and at the same time transform them. This paradoxical relationship is illuminated through the book’s empirical investigations of how new eHealth initiatives make use of existing arrangements and at the same time transform them.

The last chapter in this section presents a cross-case analysis of the eleven empirical chapters of the book. We discuss the six e-prescription cases and the five patient-oriented eHealth cases in terms of the initiatives’ scope, starting point, motivation, and then, we turn to observed strategies towards the installed base for the two types of infrastructures. The e-prescription cases illustrate a variety of approaches towards the installed base, and we identify what we call installed base-friendly, installed base-hostile and installed base-ignorant approaches. The cases of patient-oriented eHealth initiatives illustrate a variety of approaches for the coordination of multiple involved actors, for handling technical heterogeneity, for addressing uncertainty and for supporting transformations. We conclude by pointing to the importance of taking an installed base perspective.

1.2.2 Section B: E-Prescription Infrastructures

In this section, the first chapter is written by Joan Rodon Modol and presents the genesis and evolution of the public ePrescription information infrastructure of Catalonia, Spain from 2000 to 2013. The implementation of this solution required a transition from a mainly paper-based and asynchronous prescription model to a digital and synchronous one, and required changes in the practices, systems and roles of the Catalan Health Service, doctors and health providers, pharmacists and Colleges of Pharmacists, and ultimately patients. The chapter shows how the pre-existing technological and institutional resources of professionals shaped the design, and evolution of the infrastructure. The narrative traces events from the perspective of pharmacists, and shows how the exploitation and expansion of the installed base of pharmacists helped maintain the existing pharmacy model.

The second chapter, written by Ole Hanseth and Bendik Bygstad presents the Norwegian experience. While early attempts to put in place an e-prescription solution in Norway failed, the current solution is widely adopted and considered a great success. The chapter analyses the approaches for coping with the existing installed base and how they played a major role in the initiative. A combination of changes in the strategy towards the installed base (i.e. loose coupling and flexibility in integration between EPR systems and the prescribing module); in the development approach (from specification driven to a prototyping/evolutionary approach); and in the organizing and governance structures is seen as key to the (final) success of the Norwegian ePrescription initiative.

In the third chapter, Polyxeni Vassilakopoulou and Nicolas Marmaras examine the surprisingly swift deployment of a national e-prescription service in Greece. The analysis identifies how a series of pragmatic decisions allowed building upon a “good-enough” installed base by exploiting its latent potential without perpetuating all of its weaknesses, and by being responsive to exogenous shifts. These tactical decisions, were supported by an enabling combination of novel technological capabilities, standards and architectural arrangements that allowed connections, extensions and continuous adaptations to exogenous shifts in the installed base.

In the fourth chapter, written by Ralph Hibberd, Tony Cornford, Valentina Lichtner, Will Venters and Nick Barber, the development of the Electronic Prescription Service (EPS), adopted by the English NHS for primary care is presented. The analysis illustrates how EPS has been assembled within a rich institutional and organizational context including causal pasts, contemporary practices and policy visions. This process of assembly is traced using three perspectives: as the realization and negotiation of constraints found in the wider NHS context, as a response to inertia arising from limited resources and weak incentive structures, and as a purposive fidelity to the existing institutional cultures of the NHS.

The fifth chapter, by Hajar Mozaffar, Robin Williams, Kathrin M. Cresswell, Neil Pollock, Zoe Morrison and Aziz Sheikh, describes a second case from the UK about the Hospital Electronic Prescribing and Medicine Administration (HEPMA) systems and their difficult implementation processes. The chapter analyses how the implementation of Commercial-Off-The-Shelf (COTS) solutions resulted in systems with limited configurability, poorly matched to the needs and practices of English hospitals. The analysis reflects on the case by recollecting a similar experience with Enterprise Resource Planning systems in the 1980s/1990s when immature, often unfinished, products went into the market. An analysis of the installed base influence on information infrastructures illuminates how the evolution of COTS solutions is conditioned by the structure of adopter and vendor ‘communities’.

Finally, the sixth chapter by Stefan Klein and Stefan Schellhammer presents the experience with ePrescription in Germany. The narrative focuses on a specific initiative on medication management for polypharmacy patients, and traces the associated discourse over the last 10 years. The difficulties faced, which ultimately led to the termination of the initiative are analysed with the notion of “installed base of opposition”.

1.2.3 Section C: Governmental Patient-Oriented eHealth Infrastructures

In the first chapter of this section, Joan Rodon Modol describes the genesis and evolution of the public patient portal called *Carpeta Personal de Salut (CPS)* of Catalonia, Spain from 2008 to 2015. The CPS started as a web-browser viewer of a subset of citizens' health data stored in the systems of the public health system, and has gradually turned into an information infrastructure as new relations with other systems, services, actors, regulations, practices have been established. This chapter suggests how in order to cope with the conditions of indeterminacy and uncertainty characterizing the building of patient-oriented information infrastructures, designs must always be open and connectable so as to be able to respond to new possibilities.

The second chapter by Miria Grisot, Polyxeni Vassilakopoulou and Margunn Aanestad, describes the conceptualization process, early stage development, and incremental changes in the creation of the Norwegian eHealth platform for patient-oriented services. The platform was launched in 2011 and was gradually developed into a complex platform enabling several eHealth services. The narrative focuses on how some of these services required the linking and reuse of existing components and resources, while other required the creation of novel parts. Three strategies of dealing with the installed base are identified as complementing, creating substitutions, and expanding the installed base.

In the third chapter, Tina Blegind Jensen and Anne Asmyr Thorseng present the experience of another Scandinavian country, Denmark. The chapter describes the evolution of the Danish national e-health portal, *sundhed.dk*, which has been a frontrunner and reference case for other countries. The initiation phase was characterized by broad engagement and mobilization of core stakeholder in the Danish healthcare sector. Due to the broad buy-in and consensus, *sundhed.dk* was able to establish itself as an early and comprehensive portal, through assembling existing information resources directly, as well as repurposing and enhancing available information resources. However, the story of *sundhed.dk* also shows that this mode of working comes with challenges for the further pursuit of innovation.

The fourth chapter by Nina Sellberg and Johan Eltes, describes the evolution of the Swedish patient portal together with the definition of the eHealth architecture and the overall national eHealth infrastructure. The case narrative illustrates the central role played by the national reference architecture. The analysis illustrates how infrastructure evolution results from the complex interplay between many different actors intertwined in a step-by-step cultivation process.

Finally, in the fifth chapter by Andrea Resca and Mauro Moruzzi a case from Italy is examined. This case is probably the first example of an e-booking system in Europe. The chapter traces the genesis of a booking services put in place in the Municipality of Bologna for accessing specialized care. The narrative focuses on the role played by institutional components as obstacle to the innovation process, and on the mobilization of political, organizational, and technological resources.

The main message coming out of the empirical cases presented in the book, is that the successful development and implementation of initiatives for eHealth infrastructures require much more than creating a clear description of the goal and having in place the necessary technological capabilities and human skills. It also requires a discerning and knowledgeable engagement with the particularities of the situation and an informed and conscious approach for working with the installed base.

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