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STUDYING THE EVOLUTION OF THE INTER-ORGANIZATIONAL INFORMATION INFRASTRUCTURE (IOII) IN FINNISH HEALTH CARE FROM A PRACTICE THEORETICAL PERSPECTIVE

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Abstract

Finland has been chosen to study the evolution of the inter-organizational information infrastructure (IOII) in health care due to its advanced national and regional initiatives since the late 1960ies. Based on data collected in 2010 and 2012, we reconstruct the evolution of the IOII in respect to prescribing and dispensing medicines in Finland. Our aim is to understand how such a complex infrastructure is created and co-created by several interrelated stakeholders with different work practices and practical logics. By adopting a socio-technical and practice-based approach and on the basis of the concept of boundary objects, the spatio-temporal transmission of practical logics and the consequences for the respective local practices are studied. Preliminary results indicate that 1) local stakeholders co-design national programs through the support of inter-organizational actors resulting in the blurring of design boundaries, 2) some inter-organizational mediators tend to neglect the inter-professional perspective which, however, is necessary for successfully co-designing an IOII, 3) the actively designed IOII offers opportunities for undesigned, emerging uses in other areas , and 4) the social embedding influences the perception of opportunities and constraints considerably resulting in slightly changing local practices of the same professional purpose.

Keywords: inter-organizational information infrastructure, evolution, health care, practice theory, boundary objects, Finland.

1   Introduction

In health care, a large number of heterogeneous stakeholders communicate and collaborate daily across organizational and professional boundaries in order to provide health care services. In line with such a complex context, information and communication technology (ICT) is perceived as a helpful tool to support work practices. Many ICT-based initiatives have emerged worldwide striving to transfer patient data across organizations, however, with variable success. Work practices of involved stakeholders such as physicians, nurses, and pharmacists are often not considered sufficiently in the design of information infrastructures (Martikainen et al., 2012). By employing a socio-technical and practice-based perspective, we concentrate on the stakeholders of an inter-organizational information infrastructure (IOII) in the Finnish health care sector, and on their work practices. The theoretical concept of boundary objects, introduced by Star and Griesemer (1989), was chosen and elaborated to analyze how various interrelated stakeholders participate in the unfolding process of an evolving IOII by transmitting practical logics across space and time, and by discursively reifying aspects of them in technology which in turn can have consequences for the local practices of stakeholders.

Finland has been chosen for studying the evolution of an IOII due to its productive technical environment since the 1960ies. So far, electronic health care developments in Finland have been described particularly in relation to architectural or political aspects discussing the integration of patient information systems within regional pilot projects or with respect to the national IT development program (Suomi and Salmivalli, 2002; Hyppönen et al., 2005; Häyrinen and Saranto, 2005; Doupi et al., 2007; Ruotsalainen et al., 2007; Hämäläinen et al., 2009). The most studies concentrate either on technical coordination between physicians of primary and secondary health care, or between physicians and pharmacists. By doing so, the perspective is narrowed down to single aspects of the electronic health developments neglecting the interactions and interrelations between various stakeholders being crucial to understand how such complex processes as the evolution of an IOII unfold. Hence, the research question is: which practices and practical logics contributed in which way to the evolution of an IOII in the health care sector in Finland? And which consequences have these findings for the conceptualization of an IOII? For answering these questions, we concentrate on drug prescription and dispensing in Finland between 1990 and 2012.

The paper is organized as follows: In section 2, we explain our theoretical approach. The research design and method is presented in section 3. Section 4 describes the background of the case. Section 5 presents our findings and analysis, and in Section 6, we discuss the case and draw conclusions from it.

2   Theoretical Approach

The study is motivated by a socio-technical approach striving to understand of how various stakeholders contribute to the evolution of an IOII in the health care sector. In line with this perspective, people are considered as a part of infrastructure (Hanseth, 1996). Within the socio-technical framework, technology is characterized as creator of conditions for human encounters with technology which vice versa is configured by users applying the technology in a particular historical and social context (Greenhalgh and Stones, 2010; Monteiro et al., 2012). By including the 'users' as integral part into the study of IOIIs, work practices become central, calling for a practice-based approach. Practice theory concentrates on everyday practices of meaningfully acting human beings embedded in a social and historical context (Wenger, 1999). In this paper, practices are not studied in vivo, but from a retrospective, and reconstructive perspective for studying the evolution of an IOII. Consequently, practices are discussed rather from their past aspect, and with respect to their discursive and material instantiation reflecting temporary aspects of practical logics. We define a practical logic as the implicit cognitive pattern which organizes a particular work practice meaningfully. The concept of boundary objects, originally introduced by Star and Griesemer (1989), is chosen for conceptualizing

the logic of a practice, rather than the practice itself: "Boundary objects are objects which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star and Griesemer, 1989: 393). Wenger (1999) adopted the concept of boundary objects in order to explain how people who belong to different communities of practice can coordinate interrelated work practices. Bowker and Star (1994) highlighted the discursive, material aspect of boundary objects. According to them, software can be regarded as temporarily frozen organizational discourse between different stakeholders which stay in a temporarily negotiated relationship to each other. In this paper, software is not considered as the complete representation of a discourse or a practice, but as a discursively evolving incomplete construct created by various, socially embedded stakeholders who each have its own practical logic and attempt to find an appropriate material reification of certain aspects of a practice. The boundary object, e.g. the understanding of how to electronically sign a prescription, unfolds in the respective local context to richer and even fluctuating practical logic. Depending on the perception of the consequences of exclusion or inclusion, the reaction to such discursively evolving materialized understanding of a practice can entail creative co-design (Pipek and Wulf, 2009), ignorance, or parallel use of different systems due to a dispersed material reification of a practice.

3   Research Design and Method

The study took place in the region of Helsinki and Turku, Finland. In both cities, many important institutions and companies are located, such as two university hospitals, two pharmaceutical wholesalers, several software vendors, two service providers of automated dose dispensing (ADD), the Social Insurance Institution of Finland (KELA), and the Ministry of Health. A case study design was chosen in order to reconstruct the evolution of an IOII within its social and historical context (Yin, 2003). Data collection took place during two one-week visits in Finland, in 2010 and 2012, by a group of 10 people. Semi-structured interviews with key stakeholders from different professions and in different positions along the health care sector (managers, administrators, politicians, physicians, pharmacists, traders, service providers) were conducted in tandem-teams of 2 persons following a common conceptual framework which was prepared in advance within a methodical seminar. Emphasis was placed on material, normative, and ideational dimensions (Reimers et al., 2012) in respect to eHealth projects such as the electronic patient records (EPR), ePrescription, and automated dose dispensing (ADD). By concentrating on different kinds of projects, national programs, regional projects, and local initiatives of eHealth endeavors were considered. On average, an interview took 50 minutes. Altogether 56 interviews were conducted. At the end of each day, all tandem-teams got together to discuss emerging issues and evolving questions. In addition to the interviews, archived and current artefacts, such as documents, software templates or packagings were collected, and work processes observed. Last but not least, a broad literature review on eHealth projects in Finland was conducted.

For the analysis, process data was structured by using table grids, temporal bracketing, and visual mapping (Langley, 1999). In addition, qualitative coding was employed for understanding the complexity of the evolution of an IOII. Qualitative codes unfolded in an abductive way (Van Maanen et al., 2007) including the following dimensions: material (technology), normative (laws, sanctions), and ideational (logics) structures, actors (functions, roles, professions), social constellations (relations, inclusion, exclusion, communication, coordination), and practices (handling, use of artifacts). Actors and practices were characterized according to organizational goals and professional purposes, respectively, departmental politicians and administrators of national institutions on the national organizational level, professional associations and inter-professional consortia of organizations or companies on the inter-organizational level, and single physicians and pharmacists or a single regional organization on the local organizational level.

4   Drug Prescription and Dispensing in Finland

The work practice of pharmacies is dispensing pharmaceutical drugs and ensuring its safe and effective use. In addition to compounding medicines, ready-made products delivered by the pharmaceutical industry are sold at the drugstore. In Finland, pharmacies have an exclusive right to sell medicines. Since 2000, a new form of drug dispensing for patients with multiple chronic illnesses entered the Finnish health care market: automated dose dispensing (ADD). Here, several different pills and capsules are automatically repacked in small plastic bags according to the patient's medication profile and delivered in strips every two weeks. Interaction checks are included in the service which is only offered for prescription medicine. To date, a pharmacy license is needed in order to establish an ADD service. Initiators have to invest a good deal into manufacturing machinery and equipment, and into a coordination and communication facility for transmitting data effeciently. In line with the eHealth developments, electronic prescription (ePrescription) software was developed enhancing the inter-organizational data transfer from 2007 on. The improved data transfer between physicians and pharmacists also facilitated drug ordering processes between pharmacies and ADD service providers influencing the practices and social relations of the involved parties.

5   The Evolution of an ICT-Based Drug Prescription and Dispensing Infrastructure in Finland

From the mid-90ies on, the promotion of ICT in health care gained more and more importance in political programs in Finland. After becoming an EU member in 1995, the Ministry of Social Affairs and Health framed for the first time a national strategy for the implementation of information technology in social and health care in 1996. The strategy aimed at seamless service structures horizontally integrating primary and secondary care services. By updating the ICT-strategy in 1998, specific emphasis was placed 1) on the adoption of electronic patient records (EPR) on all levels of care, 2) on the establishment of nationwide interoperability between legacy systems, and 3) on a high level of security and privacy protection (Ruotsalainen et al., 2007; Vuorenkoski, 2008; Hämäläinen et al., 2009). In line with this national strategy, inter-professional connectivity such as electronic prescription (ePrescription) between physicians and pharmacies was to be tested in several pilot projects between 1996 and 1998 (Hyppönen et al., 2005). These projects were headed by various software companies and encompassed various technical solutions such as card-based data transfer, centralized data storage or web-portals to retrieve patient data (Suomi and Salmivalli, 2002).

Due to the diverse regional legacy systems, the Finnish Government made in 2002 the decision to implement by the end of 2007 a nation-wide standardized solution. Initially, the aim was to use stand-alone systems for ePrescription. This idea, however, was soon abandoned as first test results showed that data insertion took too much time and errors occurred. Subsequently, the Ministry recommended a centralized ePrescription solution. The idea behind this initiative was that ePrescriptions were produced in electronic patient record (EPR) systems, provided with an electronic signature (eSignature), and transmitted to the centralized prescription database from where pharmacies could retrieve them (Hyypönen et al., 2005). A series of different acts provided the legal basis for this centralization endeavor. In 2003, the eSignature was introduced as prescribed by the Act on Electronic Signature (14/2003), and integrated into the regional systems of four nationally coordinated pilot projects (Häyrinen and Saranto, 2005). Due to reasons of data protection, the national committee designed the eSignature feature in such a way that the physicians had to sign each prescribed drug separately (interview, physician, May 2010). This legally oriented practice logic of the eSignature caused an unsatisfactory situation for the physicians. Therefore, they mobilized forces to change this situation, and, thus, actively redesigned the boundary object of how to sign ePrescriptions. Hereupon, the law was adjusted allowing serial signatures for drugs prescribed within a single visit since 2004.

After national elections in 2007, the new cabinet initiated a further attempt to establish a national eHealth infrastructure. Under this program, the Finnish government reinforced the previous endeavors, and, in addition, included an online-platform for patients (Ruotsalainen et al., 2008). By doing so, a democratic understanding of citizens as participants was highlighted. With respect to ePrescription, the earlier national initiative, launched in 2002/03, to integrate information systems inter-professionally, was only partly successful as pharmacies continued to use stand-alone systems (Doupi et al., 2007). With an enforcing Act in 2007, the new cabinet changed the situation from experimental to permanent ePrescription (61/2007). This new law was the starting point for another series of ePrescription pilot projects. However, these projects scheduled for 2009 only started in 2010 due to the disagreement on financial and technical issues between the involved parties (interview, KELA, Jan. 2012). After having solved these problems on the project management level, technical integration between physicians and pharmacies was accelerated. Both the Association of Finnish Pharmacies (AFP) as well as the Social Insurance Institution of Finalnd (KELA) supported the idea of a national ePrescription infrastructure. The AFP advocated the interests of pharmacies, 1) to substitute hand-written prescriptions, which were often hardly legible, by electronic ones, and 2) to resolve the authenticity problem caused by the use of varying ePrescriptions software (interview, AFP, Jan. 2012). Similarly, as a mediator, the AFP absorbed the local demands and negotiated them on the national level. KELA, for her part, was strongly interested in better traceability of the reimbursement of ePrescriptions by standardizing patient data transfer and chronological organization of centralized data (interview, KELA, Jan. 2012). The national program logic, aiming at centralization and standardized data transfer, was, thus, very much in favor of KELA's work practice, namely centralized administration of prescription data. However, the needs of pharmacies were only incorporated in regard to standardized data transfer; other crucial aspects of their work practices such as interaction checking or the compilation of patient medication data were largely neglected, or attached to the development of the electronic patient record (EPR) which experienced even more severe implementation problems. This ambivalent situation forced pharmacies to use various software products in parallel.

From 2010 on, the ePrescription pilot projects proved successful; pharmacy software was technologically ready for the data transfer between physicians and pharmacists (interview, KELA, Jan. 2012). Before this technical development, pharmacies were seamlessly connected only to KELA for reimbursement issues, and to the first ADD service provider founded in 2000. In order to improve communication originally done by fax, the AFP designed an information network to which all pharmacies, KELA, and the first ADD service provider had access (interview, AFP, Jan. 2012). Pharmacies were, thus, enabled to order ADD strips electronically. Since the information system based on real-time data transfer, drug availability and ordering status could be checked immediately and questions or demands communicated directly. For reimbursement issues, each purchased drug within the ADD service was listed in a patient medication database. These data additionally provided the basis for interaction checking which is a crucial practice of pharmacies. Besides prescribed drugs, over-the-counter (OTC) drugs were included to complete a patient's medication history. As the pharmaceutical database and the patient medication history were integrated in the same system, drug interaction checking could easily be done.

As mentioned above, software solutions for inter-professional collaboration with respect to ePrescription were steadily improved since 2002. The improved prescription software allowed any kind of medication data transfers. By this enhanced technical option, unintended opportunities for new stakeholders emerged. In 2007, a second provider established an ADD service. The company was founded by a consortium of two pharmacists and a pharmaceutical wholesaler (interview, ADD service provider, Jan. 2012). As this consortium was excluded as a service provider from the pharmacies' information network hosted by the AFP, it had to develop its own network for informing customers about drug availability and order status. Beyond these services, a web-portal for direct communication to nursing homes and a database of drug illustrations for nurses was provided. The database supported the work practices of nurses by enabling them to identify and remove single drugs packed in the ADD strips if a patient's medication scheme had to be adjusted immediately. These additional services made the new ADD service provider very attractive for nursing homes. While the

number of customers from the new service provider increased from 400 in 2008 to 5'000 in 2010, the increase in customers of the long-established service provider was only from 9'500 in 2008 to 11'000 in 2010 (interview, AFP, Jan. 2012).

6   Discussion and Conclusions

The findings suggest that the practical logic on the national level is oriented towards and constrained by strict regulations and consequent administration. This leads to a reductive material reification of other work practices in national programs. By designing the eSignature feature according to a legal logic, the practice of physicians became overwhelming because they had to sign each drug separately. This resulted in the intervention of physicians to change the nationally defined understanding of the eSignature. Consequently, the boundary object of how to sign a prescription was fine-tuned by bringing the local practical logic of physicians into perspective. Hence, the national design was not any longer purely oriented towards a legal logic, and the national design boundaries became blurred within the negotiation process of stakeholders with different practical logics.

The example of the AFP supporting the practical logic of pharmacies in the national eHealth developments, highlights the importance of mediators on the inter-organizational level in supporting stakeholders' needs. However, mediators representing a single professional background also can overlook crucial instants of coordination and communication in designing a technical solution. This happened for the information network of the AFP which only concentrated on fulfilling the pharmacists' purposes in respect to ADD ordering, but did not sufficiently take the practices of nursing homes into account, and, thus, oversaw an opportunity which was discovered by the second service provider adopting an inter-professional perspective. Following, mediators on the inter-organizational level are supportive for transmitting practical logics to the national design, however, such mediators benefit from employing an inter-professional perspective developed in networks beyond professional associations.

The technical developments implemented in line with the national ePrescription project improved not only the data transfer between physicians and pharmacists, but also created an unintended opportunity for a new stakeholder to enter the ADD market. However, as he was excluded from the pharmacies' communication network, he had to appropriate the opportunity into a useful arrangement by designing its own comunication network. These findings illustrate how technical developments influence the social context and the local practices undesignedly, and on the other side, how the social embedding can set opportunities and constraints for local practices and the creation of technical solutions. Hence, practices, technical developments, and social relations are to be studied as interrelated constellations.

By introducing ADD services in 2000, the work practices of pharmacies changed slightly. The production of ADD strips increased the demand for compiling patient medication data and conducting regular interaction checks of the patients' medication scheme. While the national goal to centralized patient data took decades to be implemented, the first ADD service provider and the pharmacies already used patient medication histories - including OTC drugs in addition to prescription medicines - for years. This shows that a boundary object, here the understanding of an electronic patient history, can assume different discursive and material reifications depending on the professional, social and historical context. In addition, a particular boundary object can be instantiated simultaneously in different areas resulting in parallel technical developments which can become intertwined, or not, in space and time. In conclusion, IOIIs can be regarded as an unfolding and discursive process by which stakeholders strive for creation of explicit understanding of a practical logic and its material reification in relation to their perception of contextual and temporary conditions, as well as the reaction to such materially reified understanding by other stakeholders who adjust, refine or ignore it, depending on their perception of the consequences of inclusion or exclusion and their co-designing possibilities.

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