From "Rules to Interpret" to "Rules to Follow": ePrescription in Greece

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Abstract: This paper aims to contribute to the on-going discourse on how to design and introduce governance technology for highly reliable professional work within healthcare. With this aim, we study the Greek ePrescription initiative. The empirical data used in this paper were collected over a nine month period from three different pharmacies implementing the new ePrescription platform. The analysis of data led to the identification of tensions between the established way of performing work (which was based on professionalism and discretion) and the new way imposed by ePrescribing (which is based on activity control and monitoring). Pharmacists traditionally interpreted rules in the light of knowledge, practice/habitude and contextual specificities but with ePrescribing the rules are solidified. From "rules to interpret" they turned to "rules to follow". The tensions are currently resolved by pharmacists with the employment of workarounds. We view workarounds as indications of incongruence between technology and task that can be productively used for design improvement. Furthermore, we attempt to generalise the case-specific insights by linking redesign recommendations to the concepts of usability, tailorability, and generativity of information systems.

Keywords: ePrescription, workaround, usability, tailorability, generativity, professionalism, governance

1. Introduction

Improving healthcare delivery (confronting quality-of-care problems and achieving cost containment) is one of the greatest challenges for the 21st century. Technology is instrumental for the aspired improvements but its design is far from straightforward. This paper aims to contribute design insights for effective technology-induced work organisation improvement initiatives. Specifically, it focuses on governance technology for highly reliable, professional work within healthcare. With this aim, we study the Greek ePrescription initiative which was recently launched. ePrescription was introduced in Greece as a solution for controlling the ever-increasing medication costs, improving patient safety and providing support for policy development (Law 3892/2010). It was launched on January 24th 2011, and although it is used on a pilot basis it has reached in less than a year almost 50% coverage (approximately 2,500,000 prescriptions processed by end November 2011) having more than 10,000 doctors and 8,000 pharmacists registered as users (Greek e-Government Centre for Social Security 2011). ePrescribing supports the circulation of prescription information between healthcare providers, pharmacies and reimbursing authorities. The introduction of this new eGovernment platform aims to improve healthcare delivery by reducing risks associated with traditional prescription-writing, improving coordination - eliminating time spent on disambiguation ("pharmacy call-backs") and capturing data required to support knowledgeable policy development. All these healthcare delivery related aspired benefits are clearly set-out in the law that provides the legal basis and the rationale for the adoption of ePrescription (Law 3892/2010). The law also mentions the economic benefits expected, and these expected benefits energised the swift and broad ePrescription implementation after years of postponement.

In our study we have focused on the modes of ePrescribing appropriation by a specific professional group: the pharmacists. To study how this group of professionals reacted to the introduction of the new tool which aimed both to facilitate and control their everyday work, we observed and analysed the workarounds employed by them and the situations that trigger them. We adopt the definition of workarounds from Ash et al (2004): ways to act that "allow users to live with the system while avoiding some of the demands that are deemed to be unrealistic or harmful". In a previous paper we have focused on the nature of the workarounds observed and pharmacists' motivations (Vassilakopoulou et al. 2012). In this paper we link remedies for workarounds to dynamic information system capabilities and generate recommendations for design improvement.

The remaining of the paper is structured as follows: first, we explain the purposes for ePrescribing decomposing them to specific objectives and we link them with key technological capabilities. We

then introduce the study of workarounds as a valuable source of information for the design of information systems. We continue with the case study (method and analysis) and we conclude by discussing insights, pointing to the limitations of our work and to its potential contribution.

2. ePrescription purposes and technological capabilities

ePrescribing has a dual objective: to control and to facilitate healthcare work. Thus, the technology deployed aims to steer behavior (ensuring conformance to rules) and also to support efficient task performance by knowledgeable professionals. Healthcare delivery has been traditionally linked with professional discretion as healthcare workers are expected to perform reliably addressing complex, singular problems related to patient conditions. Reliability in healthcare is not only the outcome of accumulated knowledge inscribed in formal routines but also, the outcome of an acquired capacity to perform even though working conditions fluctuate.

Healthcare delivery has to be governed in a way that preserves the requirement for high reliability and risk containment. Healthcare is high-risk and safety-critical but unlike aviation or nuclear power generation, the effort is not on anticipating high-impact rare events but on everyday coping with uncertainty. Every case is singular up to an extent and this explains the acknowledged need for discretion and professional accountability. Revisions of assessments, plans, and tactics are possible and reliable because processes of "understanding," "evidence collection," "detection," "evaluation," are well developed and stable (Weick et al. 1999). Professional healthcare work has limited potential for generalisation, adherence to global rules and standardisation. It is "work regarded as unusually complex, uncertain, and of great social importance. To insure the best possible outcomes under these difficult circumstances, the strategy pursued is to couple capability with discretion in one responsible actor and place him or her as close as possible to the problem situation … legitimate control over the nature and quality of professional practice is vested in the professional staff, not in the administration" (Scott 1982). For example, in hospitals, responsibility for the enforcement of standards for patient care lays with the medical staff irrespectively of hierarchical positioning. So, for ePrescribing, the key challenge is to impose constraints that regulate performance and at the same time provide affordances required for effective action-taking.

The constraints to be inscribed in ePrescribing technology are defined by the governance objectives and are related to: a) the authentication of persons that undertake prescribing and dispensing roles, b) the temporal and logical validity of actions (e.g. prescribed drugs cannot be dispensed after some elapsed time, quantities cannot exceed some upper limit), and c) the audit trail of prescribed and dispensed medication. These specific governance objectives are compatible with healthcare professionals' objectives: authentication is related to the elimination of forgery and relieves professionals from the need to verify the legitimacy of prescriptions, validity rules are related to the minimisation of health system abuse and to patient safety, dispensed drugs' tracking is related to the eradication of fraud and to the prevention of human error.

In order to succeed, ePrescribing has to complement constraints with proper affordances. It has to: allow quick and easy learning, support efficient task execution, prevent errors and support easy recovery from them and finally, it has to subjectively satisfy users (e.g. aesthetically). All these properties listed contribute to usability (Nielsen 1993). Usability relates to the capability of software to be easily appropriated when introduced under specified conditions (ISO/IEC 9126-1 2001) and is a prerequisite for ePrescribing success. But, usability does not suffice for the solution to be effective. Since there is a need to accommodate highly reliable action-taking under uncertain circumstances the solution has to be such that does not impose blocks when the conditions vary away from the specified ones (Koopman and Hoffman 2003). So, it has to be adaptable to the local circumstances by providing tailorability (Germonprez et al. 2007) through user-initiated processes. Finally, the solution has to build-in some generative capacity that will not only allow users to select one of a number of predefined possible alternative courses but also to evoke new thinking (Avital and Te'eni 2009). Generativity is the capacity of information technology to "enable the creation of contextually new possibilities and configurations for as-of-yet unknown problems" (Hovorka and Auerbach 2010). Generativity is a notion that transcends the tailorability of technology being associated with overall sociotechnical dynamics: "a system's generativity describes not only its objective characteristics, but also the ways the system relates to its users and the ways users relate to one another" (Zittrain 2008) and in that sense, it links to the on-going discourse on dynamic capabilities in the organizational theory literature (Hayes et al. 2011; Wang and Ahmed 2007).

The summary table that follows (Table 1) links the three key information technology capabilities described (usability, tailorability, generativity) with the governance objectives for ePrescription.

Table 1: ePrescription purposes and technological capabilities

		Purpose (decomposition of ePrescribing objectives)		
		Control authentication	Regulate actions	Monitor the drug trail
Fit for purpose (capabilities required)	Usability "for effortless appropriation"	Need to make it simple and time-efficient to minimise the risk of rejection by time-deprived, professionals.	Need to support efficient task execution (sensitivity to operations) and convey dependability.	Need to prevent errors and support easy recovery from them.
	Tailorability "for local variability"	Need to make it globally applicable even though working conditions fluctuate.	Need to support best possible outcomes under uncertain circumstances by coupling technical effectiveness with adaptability.	Need to align action with goals, not to regulate minute details. Avoid blocks that keep users from reaching goals.
	Generativity "for professionalism and innovation"	Need to allow contextually new possibilities - involve diverse user groups and their respective activity spaces.	Need to foster the process of practice renewal and extension.	Need to shape conduct but also provide for exceptions handling endorsing professional discretion and expertise.

3. The study of workarounds

Workarounds have been extensively studied in the Information Systems literature for different purposes and through different lenses. For example, in his classic book on usability engineering, Nielsen proposes the measurement of "the number of times the user had to work around an unsolvable problem" for quantifying usability and system performance (Nielsen 1993). A second view on workarounds focuses on their positive effects that allow work systems to be resilient. Workarounds have been viewed as manifestations of a "secondary design process to tailor a system to fit the user's situated tasks, metaphors, and use patterns" (Hovorka and Germonprez 2011). This view advocates system tailorability by end-users that address dynamic environments, altered plans, and non-typical work situations (Henderson and Kyng 1991; Robinson and Bannon 1991). Workarounds have been also studied as "resultant activities" of resistance to new information systems (Ferneley and Sobreperez 2006; Lauer and Rajagopalan 2002). This third view goes beyond the indication of lack of usability or tailorability implying that workarounds are not only reactions to particular problems that surface "here and now" but demonstrate deeper reasons that make users resist system adoption. Such reasons can be linked with the fear that the system will deprive users from their capacity to evolve and self-configure their tools to match contextually new possibilities. This fear of imprisonment in courses of action defined and maintained by third parties can be addressed by generativity (Grisot and Vassilakopoulou 2012).

We view workarounds as indications of incongruence between technology and task that can be productively used for technology improvement. When workarounds are left to linger in everyday practices they weaken trust to technology, they can cause drift away from governance plans and intentions and undermine overall reliability (Ash et al. 2004). What we advocate here is that instead of sanctioning them through management procedures, or eliminating their possibility by imposing stricter technological controls or even simply tolerating their presence because "this is what users do anyway" it is essential to study them in order to inform and update the design of information systems.

There is extended literature on workarounds related to ICT use in medical practice (e.g. Azad and King, 2008; Halbesleben et al, 2008, 2010; Schoville, 2009; Safadi and Faraj, 2010); the research reported in this literature is mainly focused on the supportive role of technology for the execution of everyday tasks. Our analysis has a different aim: acknowledging the dual objective of the specific e-government initiative (both to control and support work execution) we track and evaluate workarounds to get insight on how the tension between regularisation (required for control) and flexibility (required for professional work support) is resolved at the field level. Juxtaposing the workarounds identified to the characteristics of the platform, we focus on its dynamic capabilities as means a) to anticipate and accommodate situated needs and interests without losing its coordinative and controlling capacity,

and, b) to foster advancement and change preparedness. With this paper we aim to bring into focus and articulate possible approaches for robust e-government platforms, i.e. platforms that will be able retain their core governing characteristics while being designed for contingency containment and forward-looking preparedness.

4. Method and case analysis

4.1 Method

Our research is designed as an interpretive case study (Eisenhardt 1989; Klein and Myers 1999). Data collection was carried out in two phases. At first, we reviewed relevant available documentation which included: the electronic prescription user manuals, the Greek pharmacy legislation and guidelines, the healthcare and welfare funds guidelines for medication disbursement, the Health Ministry position papers and the pharmacists' code of conduct. The second phase included fieldwork (field observations and semi-structured interviews with the pharmacists) in pharmacies that use the new ePrescription platform. Access to the pharmacies was granted by the Athens' Association of Pharmacists. The empirical data used in this paper were collected from three different pharmacies over a nine month period (January 2011 – September 2011). Observations of the pharmacy personnel were directed towards the identification of workarounds related to the usage of the ePrescription platform and their possible causes. Our interviews were directed towards understanding: the stances of pharmacists towards the ePrescription application, their needs and expectations, initial difficulties and the ways they overcame them. No access to personal health data was required and consequently no such data were obtained.

The pharmacists contacted were all experienced, with an average of 25 years in their profession. They were also familiar with computer applications. Two of the pharmacies were small-sized visited by an average of 50 patients per day. The third was a centrally located, mid-sized pharmacy visited by an average of 150 patients per day. Apart from the pharmacist, all three pharmacies were staffed with 1-2 pharmacy technicians. A pharmacy technician is responsible for retrieving from the pharmacy depot the medication needed for an order to be processed and for registering payments, always under the supervision of the pharmacist.

4.2 Case analysis

The technical solution implemented in Greece is web-based and supports both physicians (as prescribers) and pharmacists (who are responsible for processing the prescription orders). The solution is currently being "rolled-out" as a pilot while the functionality offered is being amended and improved. ePrescribing is accessed via simple internet connections. Access is controlled at the user level (registered users go through a username and password identification process) and a central repository of all prescriptions is maintained nationally. Our interviews and observations showed that the overall stances of pharmacists were positive to ePrescription as they benefited from improved legibility and completeness of medication orders and by system checks that prevent errors. Nevertheless, they did not always use the solution exactly as foreseen by its designers as they did resort to workarounds.

We organised the workarounds observed according to the three main practical governance objectives: authentication of persons that undertake prescribing and dispensing roles, delineation of the temporal and logical validity of actions, and, correspondence of prescribed medication to dispensed commercial drugs. Table 2 presents a specific example for each category, our proposal on how to transform the workaround to a re-design specification and the classification of the proposal as a usability/tailorability/generativity improvement. In the paragraphs that follow the three examples are described in detail.

4.2.1 A workaround related to authentication

According to the formal procedure the authorized user of the ePrescription platform at the pharmacy side is the pharmacist, consequently, only pharmacists have been granted with user names and passwords. Nevertheless, we observed that pharmacy technicians were also processing orders. When the pharmacy is crowded, pharmacists delegate to the pharmacy technician the electronic processing. This type of delegation is well-known in healthcare environments: for example, in hospitals frequently doctors prepare handwritten prescriptions which are then typed by assistants. The name and title of the doctor that ordered the prescription appears on the electronic record along

with the name of the assistant that entered the information. This way, both efficiency and accountability are preserved and the person in charge of entering the prescription details knows that his/her role and responsibility in the process is acknowledged. Such an approach could be adopted in this platform. By freely sharing their user names and passwords pharmacists not only undermine the accuracy of the data captured but they also undertake risks and potentially weaken the role and vigilance of their assistants. By not acknowledging the work reality within pharmacies, control can only be exercised partially. This is an example of a workaround that would be minimised by improving the fit of the software to the task (usability).

4.2.2 A workaround related to the regulation of possible actions

In cases where only some of the drugs from a prescription are delivered to the patient, the platform allows the registration of a "partial processing" status. Pharmacists can use this "partial processing" option, and justify it in three possible ways: (a) limited drug availability, (b) discrepancy among the recommended dosage and the prescribed quantity, (c) patient refusal to take certain drugs. Nevertheless, pharmacists resort to partial processing also after taking by themselves the decision not to deliver specific drugs (e.g. after identifying potential adverse drug interactions). Pharmacists feel they have a singular expertise on medicaments which entitles them to make professional judgements and obliges them to refuse supply of drugs that they don't think are appropriate. In such cases they register "limited drug availability". Pharmacists are reluctant to take the role of mere pharmaceutical dispensers and they defend their capacity to exercise judgment and assume a role of a "gatekeeper". The recent turn towards patient safety justifies such a pharmacist role (Weiss and Sutton 2009). At the same time, doctors say that pharmacists should not exclude drugs from prescriptions as it is sometimes unavoidable to prescribe drugs that have known interactions weighting this risk as lower than the risk of not giving patients the specific medicament. There is on-going discussion on how far the pharmacist role can go into the prescribing authority of doctors and in different countries and different healthcare systems the role of pharmacists vary (e.g. in 2003, legislative changes were introduced in the UK which permitted prescribing to pharmacists under specific arrangements). There is no practical way to prevent pharmacists from exercising judgement (shortage of drugs can always be used as an excuse if desired) and it is not advisable to disguise their motives. By allowing pharmacists to register in the ePrescription platform what happened really and to articulate their concerns a new feedback loop to doctors and policy makers can be activated. This could evoke new thinking and after collecting evidence from large numbers of real cases a sound policy could be generated.

4.2.3 A workaround related to monitoring the drug trail

According to the formal work procedure, pharmacists must electronically process prescriptions before delivering medication. For doing so, they scan the medication packages' barcodes which are then matched automatically with prescription details. In cases of mismatch an error message appears on the screen and processing cannot be concluded. Nevertheless, pharmacists were frequently observed to deliver the prescribed medication to the patients and electronically process the order at a later time by keeping pieces of the packaging for scanning. In some cases pharmacists processed all orders after closing the pharmacy, while in other cases they processed orders in batches, whenever they had free time during the day. System response delays and losses of internet access were mentioned by pharmacists as reasons for this workaround. But this workaround undermines the effort to control the correspondence of drugs delivered to drugs prescribed. Not only there is a risk of messing with detached labels but there is also limited traceability of what actually happened at the moment of delivery. Since the important thing is to record what gets delivered to patients at the actual moment of exchange, it would have been more prudent to allow also as an alternative the off-line scanning and registering of delivery. Matching delivery to order would then be performed on-line whenever this becomes possible. This way, all activity would be registered and monitored and pharmacists could adapt system usage to their local needs without resorting to workarounds. This alternative is obviously more risky than performing the whole task on-line but certainly less risky than omitting synchronous delivery registration altogether.

Table 2: Examples of workarounds identified

ePrescription objective	Workaround description	Re-design proposal	Re-design classification
Control authentication	Password sharing with pharmacy technicians	Amend current functionality to include support roles that participate in the process	Usability improvement (enhance efficiency in task execution)
Regulate actions	Usage of the "partial processing" option in in ways not anticipated by ePrescription designers (selected by pharmacists when they skip drugs due to safety concerns)	Build in the platform a registry for the cases when pharmacists opt for not delivering drugs due to safety concerns	Generativity improvement to evoke new thinking and support the development of new rules and policies
Monitor the drug trail	Post-processing of prescriptions	Allow tailoring of the task timing as long as delivery is synchronously registered (e.g. allowing off-line drug scanning)	Tailorability improvement to allow users modify their course of action according to local circumstances

5. Discussion

In this paper, we aim to contribute to the on-going discourse on how to design appropriate governance technology for highly reliable professional work within healthcare (Bekkers and Homburg 2007; Currie and Guah 2007; Greenhalgh et al. 2010; Westbrook and Braithwaite 2010). Studying a specific case of ePrescription we identified tensions between the established way of performing work (which was based on professionalism and discretion) and the new way imposed by ePrescribing (which is based on activity control and monitoring). Although the rules that are guiding the pharmacists' conduct were not significantly changed by the ePrescription initiative, their nature has changed. Pharmacists traditionally interpreted the rules in the light of knowledge, practice/habitude and contextual specificities but with ePrescribing the rules are solidified. With the introduction of ePrescription, the collaboration between physicians and pharmacists started being mediated by a new tool where the rules have been inscribed. From "rules to interpret" they turned to "rules to follow" (Reynaud 1996). The tensions are currently resolved by pharmacists with the employment of workarounds.

Using empirical evidence from our field study in three pharmacies, we propose the analysis of workarounds as a way to develop recommendations for design improvements. Furthermore, we attempt to generalise the insight from our case by linking design recommendations to the concepts of usability, tailorability and generativity of information systems. Our overall aim is to bring into focus and articulate possible approaches for robust e-government platforms, i.e. platforms that will be able retain their core governing characteristics while being designed for contingency containment and forward-looking preparedness. While usability is a well-established notion and considered a prerequisite for any serious design, the other two technological capabilities are acknowledged less. They are both related to preparedness for change and uncertainty anticipation, but, they embrace different change patterns. Tailorability enables an application to continue functioning in the face of perturbations by offering users the option to adopt alternative predefined courses of action. Generativity is the property that makes information systems to be evocative fostering the evolution of practices. Tailorability can be a beneficial characteristic of information systems in many contexts, but, is indispensable for high reliability under uncertainty. Similarly, generativity can be proven useful in different settings, but, is particularly important for professionalism to thrive.

We suggest that technology can resolve the tensions that it creates by further developing advanced capabilities. With the proper design, eGovernment platforms can not only ensure that actions performed with their mediation will be regularised and transparent to governing authorities, but, can also cater for personalised responsibility. Discussing the potential of technology as a regulative regime, Kallinikos observes: "technology can be conceived as a generic form of regulation that cuts across contexts … a key question thus pivots around the degree to which core properties of a technological system may condition its very negotiability and local appropriation" (Kallinikos 2009).

The ePrescribing solution implemented currently in Greece has as a key strength the establishment of visibility for the actions it mediates and the enhancement of personalised responsibility. The psychological effects of this new visibility alone are such that warrant appropriate conduct or what is termed as "anticipatory conformity" (Zuboff 1988). Enhancing dynamic capabilities that are related to preparedness for change and uncertainty anticipation can be instrumental for further enhancing prescribing governance. Unlike traditional governing which has been associated with formal structures and procedures ruling over people and commanding action, the contemporary notion of governance is understood as a less invasive mode of social coordination. Governance "is not concerned with running the business per se but with giving overall direction, overseeing and controlling actions and satisfying legitimate expectations for accountability" (Tricker 1984). For contemporary governance, all actors hold power through knowledge, resources, and rights granted to them, and governaning is achieved through mechanisms for organising negotiations, determining objectives, influencing motivations, setting standards and monitoring compliance (Kemp et al. 2005). In that sense, dynamic capabilities are indispensable: governance, is not about the minute details of everyday work, but, about continuous alignment with overall goals. Furthermore, ensuring that workarounds are not left to linger in everyday practices is a necessity: repetitive detours, bypasses and tinkering, undermine the new platform's fidelity and causes a drift away from governance objectives.

This research is not without limitations. First of all, although we place our study in the context of on-going transformations within healthcare, our case is specific to the Greek context. In Greece, the limited availability of institutional mechanisms for feedback collection and adaptation of regulatory mechanisms makes more probable to find users that opt to work around technological constraints rather than lobbying to change them. Nevertheless, workarounds and tinkering with technology are to be found in all healthcare settings as the rich literature on the issue proclaims (Azad and King 2008; Debono et al. 2010; Halbesleben et al. 2008; Halbesleben et al. 2010; Safadi and Faraj 2010; Schoville 2009; Yang et al. 2012). Second, we have confined our analysis to a single ePrescription platform which also happens to be rather simple. In our specific case, the strongest feature of the ePrescription platform is the enhancement of key actions' visibility and the establishment of control for professional conduct, the platform does not support anything apart from prescription information exchange (e.g. it does not support data exchange with inventory management and payment registration applications). For a more comprehensive analysis, the trajectories of more platforms within different institutional environments would have to be studied.

Despite these limitations, we believe that our research makes a contribution to both theory and practice. At the theoretical level, by using a synthesis of concepts from information systems' literature (usability, tailorability, generativity) we propose a lens to study workarounds in order to inform design decisions. Additionally, by describing this specific initiative we hope to add to the collective repository of case studies of interest to policy makers and ICT practitioners, and bring into the forefront possible approaches for robust eGovernment platforms.

Acknowledgements

This work was partially supported by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: Heracleitus II, investing in knowledge society through the European Social Fund.

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