Organizational value creation and information technologies in hospitals: the case of electronic patient records

Création de valeur organisationnelle et technologies de l'information à l'hôpital : le cas du dossier patient informatisé

Mathias BÉJEAN

Maître de conférences, Université Paris Est, IRG EA (2354) – mathias.bejean@u-pec.fr

Frédéric KLETZ

Enseignant-chercheur Mines ParisTech – frederic.kletz@mines-paristech.fr

Jean-Claude MOISDON

Professeur honoraire Mines ParisTech – jeanclaude.moisdon@free.fr

ABSTRACT

What types of organizational value do information technologies such as Electronic Health Records (EHRs) create in hospitals? Building on results from multi-site empirical research, this paper explores this issue in the case of the French EHR. Considering, on the basis of a theory of "management tools", the organizational changes induced by the implementation of EHR, it suggests that the organizational transformation expected by public decision makers is only starting. At the same time, it argues that an enriched conceptualization of the notion of "organizational value" could make it possible to identify and manage some weak signals differently, thus indicating that on-going collective learning is likely to reconfigure practices and work processes. Departing from a dominant view focused on the improvement of care quality, security and efficiency, this article thus contributes to enriching the notion of the "organizational value" of information technologies in hospitals.

Key-words

organizational value, learning, Information Technology, organizational transformation, hospitals

RÉSUMÉ

Qu'est-ce que la valeur organisationnelle des technologies de l'information telles que les Dossiers Patient Informatisés (DPI) au sein des hôpitaux ? À partir d'une recherche empirique multi-sites, l'article explore cette question dans le cas du DPI français. Considérant les évolutions organisationnelles consécutives à son déploiement à l'aune d'une théorie des outils de gestion, il suggère que la transformation organisationnelle attendue par les tutelles n'en est encore qu'à ses prémisses, mais qu'une conceptualisation élargie de la notion de « valeur organisationnelle » permettrait de mieux repérer certains signaux faibles émergents. Des apprentissages collectifs en cours sont, en effet, susceptibles de reconfigurer les pratiques et processus de travail. S'écartant d'une acception habituelle orientée sur l'amélioration de la qualité, de la sécurité des soins et de l'efficience, l'article contribue ainsi à enrichir la notion de

valeur organisationnelle des technologies de l'information à l'hôpital.

Mots-clés

Valeur organisationnelle, apprentissage, transformation organisationnelle, technologies de l'information, hôpital

INTRODUCTION

In hospitals and clinics, public authorities are the biggest promoters of information technologies. The USA, where the Office of the National Coordinator (ONC) for Health Information Technology was created in 2004 with a mission to coordinate federal efforts, and where President Barack Obama earmarked approximately 27 billion dollars in the 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act, is a prime example of a country where public spending for the implementation and use of health information technologies is considerable – not unlike France. Drawing on the US experience, the French Ministry of Health has been running a "Digital Hospital" programme since 2012, with considerable funds invested over the last five years.

With such high levels of public expenditure – and equally high stakes in raising the question – the subject of objectifying the value created by information technologies in hospitals has become tricky. For public decision-makers, it is a matter of evaluating and justifying their investments by demonstrating potential and measurable gains. For research, it is a contribution to a theory of information technology assessment. In the case of the hospital system, the dominant theory identifies quality, safety and efficiency as the main parameters to be measured. But this dominant approach to the value of information technology in hospitals tends to be increasingly criticized in practice as well as in theory.

In practice, while estimates of "potential gains" have sometimes met the expectations of public decision-makers (Hillestad *et al.* 2005), most studies found a significant gap between the expected value and the reality of the gains made (Black *et al.* 2011), due most notably to these technologies' low adoption rates on the field (Koppel 2012). With regard to this finding, researchers mention a set of "organizational factors" among the elements that could explain these repeated failures (Black *et al.* 2011). Other research efforts focus on the use of information technologies in working situations, thus opening up a variety of organizational analyses such as: the structuring of knowledge, the disappearance of oral knowledge, the rigidity of the information system as opposed to the cooperative nature of care work, or the difficulties encountered in coordinating actors (Fitzpatrick *et al.*, 2012).

The aim of this paper is to contribute to this organizational research on the value of information technology in hospitals, by analysing the French case of the Electronic Patient Record (EHR – referred to in French as *Dossier Patient Informatisé* - DPI). To this end, this article presents the results of a multi-site research on the EHR, which was ordered in 2012 by the Ministry of Health and the national agency for performance support ANAP (*Agence Nationale d'Appui à la Performance*). Based on a theory of management tools that takes the "tool-organization" twosome as the research subject (Hatchuel 1992, Moisdon 1997), it studies the interactions, rather than the "collisions", between the EHR and the existing hospital organization, especially within clinical units. Using the "conformation-exploration" categorization of the uses of management tools conceptualized by Moisdon (1997), the article contributes to the analysis of the organizational transformation induced by EHR in France by determining whether EHR uses are still limited to a conformation logic or whether they are open to new collective learning.

The article is organized as follows: after defining the conceptual basis of our approach, we present our research questions and the methodology used to explore them. We then draw out the main results of our research and conclude by critically examining the nature of the changes observed. This will allow us, based on the case of the EHR, to discuss the notion of "organizational value".

1. CONCEPTUAL BASIS FOR RESEARCH

1.1. Hospital Computer Systems and Patient Record

In France, the digitalization of hospital medical data is not new. The establishment of the information systems medicalization project, PMSI (*Projet de Médicalisation des Systèmes d'Information*), in 1982 is often cited as its official inception (Lenay and Moisdon 2003). Inspired by the American DRGs (Diagnosis Related Group), the PMSI aimed for a medicalized analysis of French hospital budgets. Designed as a medico-economic tool, it sought to establish a link between the medical characteristics of a "homogeneous patients group" (GHM – *Groupe Homogène de Malades*) and the costs entailed by treating that group. At the time, the authorities were already emphasizing the importance of collecting medicalized information on individual patients. The French Ministry of Health's 6 January 1989 decree n°275, providing an official definition of the information system of a health institution, stated the following: "*To manage medical information is […] to contribute to the overall coherence of the hospital information system's functions at all stages of patient management by care units and medical technical units. These functions are structured around three main priorities: the patient's file, care planning, and the institution's internal and external communication*"(p.6). This "patient-centred" orientation has been the backbone of all the measures concerning the computerization of hospital medical data ever since, although the process has moved along slower than expected.

It thus took the PMSI about twenty years to be deployed through successive experiments and to be used nationally, starting from 2004, within the framework of the implementation of the activity-based pricing system T2A (*Tarification à l'activité*). It was then another ten years before the EHR had a proper national deployment plan. Its scope extends far beyond the restricted list of codified information contained in the PMSI: the patient's clinical situation, examination results, prescriptions, summary of previous stays, chain of care processes, and so on. Note that the EHR is supposed to avoid the well-known drawbacks of a sometimes illegible handwritten patient file that one has to

search for across offices and corridors, instead making it possible to send or receive a patient's sometimes dated medical data in a single click. Moreover, with copying and pasting functionalities, it makes the task of writing a discharge report much easier. In short, it is a tool that is presented more as a practical aid than as a constraint added in the name of preoccupations that are far removed from professional values, such as financial limitations, under their various guises.

Considering the particularities of hospital care, it is obvious that there is nothing simple or self-evident about such a project, which is why the authorities decided to give it a central role in care processes again in 2012 only, with the "Digital Hospital" programme. The spirit of the 1989 circular was maintained in this programme: medical information must contribute to the improvement of the quality, safety and efficiency of care by focusing on patient data. By providing at any time and to any authorized hospital professional a rich and structured set of information on the patient, the EHR makes strong promises. As it can make information more traceable, readable and consistent, it is presented as a tool that serves to avoid redundant examinations, accelerate decisions and enhance coordination between professionals.

In short, if we were to consider the EHR's organizational value strictly from the angle of its ability to facilitate daily tasks or to enforce the work processes that it implements, which only reproduce official processes – such as drug prescription –, its organizational value would seem self-evident. But just as the PMSI and the T2A are now accused of many shortcomings (Moisdon 2017), the "young" EHR is already being scrutinized and criticized. The hypothesis of organizational value creation deserves to be discussed, especially since foreign experiences show many organizational difficulties in its deployment.

1.2. Organizational Factors and Challenges in Deploying EHRs

There is no shortage of foreign literature on the relationship between the computerization of patient data and hospital production. However, most contributions are quantitative studies aimed at assessing the triptych of quality, safety and efficiency, essentially through econometric techniques. There are far fewer

works in organization theory, using more qualitative approaches, focused specifically on the EHR. The aim here is not to draw up an exhaustive literature review, but rather to analyze their scope in order to understand the organizational transformations brought about by EHRs, particularly in terms of "creating organizational value".

The vast majority of these works is based on extensive empirical research, often through careful ethnographic analysis. Drawing on various theoretical approaches, such as the socio-technical approach, actor-network or structuration theory (Greenhalgh *et al.* 2009), these studies describe organizational problems encountered when implementing EHR, and suggest international comparisons. For instance, they show how the codification processes integrated in the tool differ significantly from physicians' thinking processes (Sicotte 1998, Creswell 2012) or from collective diagnosis construction practices (Reddy 2001, Hartswood 2003). In the latter cases, the implementation of EHR does not lead to learning, and some authors even point out phenomena of unlearning, with young doctors giving too much credit to prescription support software often present in tools such as the EHR (Campbell 2006). Some suggest that the informal and spontaneous modalities of coordination between actors involved in the care of a patient are undermined by the formal and linear logic contained in an EHR (Aarts 2007, Campbell 2006). Similarly, although the use of an EHR could save nurses' time, it could also waste physicians' time, particularly when requesting and monitoring exams (Poissant 2005). Symmetrically, several studies highlight a reduction in the time spent with patients and a deterioration in the quality of their relationship (Vikkelso 2005, Noteboom 2012). Finally, several authors challenge the "zero paper" policy promoted by EHRs, and show that it is unattainable and even harmful (Bruni 2005, Chen 2010, Saleem *et al.* 2009, Hardstone *et al.* 2004).

These analyses thus help us to better understand the changes in hospital organization brought about by EHRs and, in particular, the difficulties that they pose. However, as they often explore a single site or a single organizational issue (e.g., time spent with the patient), they do not provide enough grounds to analyze the intersections of various organizational dimensions, which is essential if we are to address

organizational transformation issues beyond "local micro-practice" analyzes (Besson and Rowe 2011, 2012; Habib *et al.* 2017). In reality, despite its contributions, the existing literature seems to uphold a vision in which tools and organizations run counter to one another. In doing so, it analyses the discrepancies between the representation of the organization which is written into (and prescribed by) the tool, and that of the "real" organization, i.e. as it can be described by an analysis of concrete practices, especially in terms of the division of labour, coordination, and results assessment. It is perhaps in this capacity that the vast majority of authors reason in terms of "impact", as if the tool behaved in a ballistic manner, disrupting a work community, its practices and habits. As a result, the relationship between tool and organization becomes a kind of hostile confrontation, with damage on both sides. There is therefore still a lack of research on situations where new organizational forms appear upon the introduction of a new management tool. These transformations do not immediately translate into value creation in the usual sense of *outcomes*, but represent an additional capacity for action, which is never spontaneously visible to the outside world and which must then be revealed through specific modes of investigation.

1.3. EHRs and organizational transformation: a management tools approach

As mentioned earlier, this research explores the notion of "organizational value" by developing a particular conceptualization of organizational transformation, through the analysis of the interaction between tools and organizations. The theoretical framework used refers to the "management tools" approach developed at Mines ParisTech's Centre de Gestion Scientifique (Moisdon 1997) and is part of a field of research that is currently very active in management and other disciplines (Aggeri and Labatut, 2010). In particular, the management tools approach is now widely used in the field of public institutions management, particularly to address issues of assessment, appropriation and transformation of public organizations (Gillet and Gillet, 2013; Mériade and Mainetti 2013; Martineau 2014; Pupion and Chappoz, 2015).

In the framework that we are using, an information system is defined as a "management technology" in Moisdon's (2005) sense: "a management technology is prescriptive. It makes a conduct visible and shapes it; it disciplines this conduct and even creates the actor themself, assigning them a place, defining a system of values for them through performance specification, telling them how they must coordinate with others" (Moisdon, 2005: 165).

Thus understood, the analysis in terms of management tools no longer focuses on the idea of a direct opposition between tools and organizations, but on the management technology's "individuation" process, coupled with the emergence of its "organizational site", which can be perceived as its "associated milieu" as Simondon (1964) defines it. According to this theory, this individuation process is fragile and its future is largely undetermined. The system of actors involved can produce many revisions over time, or even lead to its rejection. In the best of cases, these multiple objectification and revision processes – within which the researcher-contributor can have a central place (Moisdon 1984) through an "immersive practice" (Béjean and Moisdon 2017) – follow on from one another until the reformatted technology finds its organizational site. This ideal end is not given at the beginning of the process, but will eventually be co-produced during the process of individuation of the management technology in question.

1.4. Are EHR tools for conformation or for exploration?

In the theoretical context that we have defined, the "organizational value" of a management technology such as that of the EHR is therefore measured as a function of the increase in actors' ability to act, whether or not the individuation process allows it. Our research questions do therefore not concern the measurement of a variation, of the safety, quality, efficiency triptych in known work routines – even if this variation turned out to be positive. Rather, what is relevant here is a measure of the increase in this power to act, on the possible production of new and yet unknown habits. In this respect, Moisdon (1997) identifies two types of use for a management tool, with one only marginally affecting individual or collective actors' power to act,

and the other regenerating their capacities by drawing on an exploration dynamic.

The first use refers to that of a "conformation tool"; it does not substantially modify existing habits. In the case of the EHR, this would consist in noting the previous organizational system's resilience: imposed by supervisory authorities, the EHR would be used, it would facilitate and standardize work processes, but there would be no effort to transform hospitals' existing organization. The second use refers to that of an "exploration tool"; here, the tool generates collective learning by allowing for new possibilities to be explored. In the case of EHRs, this would mean that we could observe a fruitful appropriation of this tool by health professionals and their organizations, possibly going so far as to invent new possibilities, for example new training or research practices, new indicators for assessing or managing clinical activity, or new ways to communicate with patients. These are the types of observations that our research aimed to make, based on a field survey.

Were actors in hospitals able to benefit from the EHR to imagine and invent new organizational devices? Has it disrupted or reconfigured their established habits and practices by generating collective learning? Is it used for conformation or exploration in hospital organizations? The following section specifies the context and method for exploring these research questions.

2. BACKGROUND AND RESEARCH METHODOLOGY

This section provides elements of definition and context for our research. It also specifies the methodology used to conduct it by detailing the different phases and sites of data collection, as well as the method used to analyze them.

2.1. Definitions

When the EHR is mentioned, some people spontaneously think of the computer tool obtained by digitalizing medical files. This includes administrative data (age, sex, etc.) and medical data (diagnosis, history,

observations throughout the stay, prescriptions, examination results, etc.), possibly incorporating data relating to the patient's visits to other medical units (hospitalization reports, for example, which can be transmitted by computer if the units in question have the same software or compatible software). However, the use of the medical record in this restrictive sense cannot be independent from that of other systems of the same type pertaining to patient handling in clinical units: software for prescribing products and procedures, computerized return of examination results, care record (planning and recording of nursing procedures), possibly anaesthetist record, etc. The EHR must be seen as referring to all the interrelated computer tools that the staff of a clinical unit is required either to supply or to consult for a particular patient, and whose precepts it must follow in terms of work processes. Obviously for any given site, this system may not be complete, nor integrated into a single software. From an organizational point of view, what is relevant is the digitalized management of the various actions performed around a patient, and their interdependencies. This definition of the EHR is therefore broader than many others.

As for the organization, which is known to have multiple representations, here too we have deliberately chosen a broad meaning, based on a definition by extension: all the ingredients of the activity that can have an influence on the multidimensional performance of a clinical unit (quality of care, patient safety, costs and productivity, working conditions, etc.). As no *a priori* list can be considered exhaustive, this position leads to an examination of elements as diverse as individual and collective competences, the division of labour, formal or informal coordination mechanisms, the performance assessment system, or working relations – here, the bibliographical analysis and the first interviews are designed precisely to identify, within the literature focused specifically on this theme, the main defining parameters in the interaction studied between the EHR and the organization.

Our research thus aimed to analyze the organizational changes that take place during the implementation of EHR-type tools. As summarized and illustrated in Table 1, these changes could be of different natures, depending on whether or not they occur in instrument-based modes of coordination (schedule

or habit) and depending on actors' practices and cognitive capacities (the profession), modulations in the delegation of tasks, working conditions, relations between actors, including hierarchical relations, the greater or lesser adoption of external norms, modes of performance assessment, relationships with patients, etc.

2.2. Background

Our research was essentially based on a qualitative approach, through observations in various hospitals, a series of interviews, and a questionnaire handed out to hospital staff (doctors, care givers, executives, medical secretaries). The organizations in the sample were selected on the basis of several criteria: the existence of a mature information system in place and in daily operation; recommendations from previously visited organizations; guidance from a federation of organizations; etc. In total, 23 organizations were involved in the research (15 public institutions, 3 non-governmental not-for-profit clinics, 1 regional cancer treatment centre, 4 private clinics); 140 people have been interviewed to date, including 60 doctors, and 55 questionnaires were filled out, of which 25 were by doctors. The institutions and clinical units studied vary widely in nature (size and status for institutions, specialties for clinical units) as well as in their digitalization processes: they use different software and have not digitalized exactly the same tasks (the "extensive" EHR system defined above is seldom complete), and they have not opted for the same deployment strategies (some have gone for a big bang, others for slow and cautious increments). Far from being an obstacle to research, this variety has been a resource for our work, because of the questions we were asking. It should be remembered that the idea was essentially to have a qualitative view of a maximum of organizational changes related to EHRs, rather than to document a single one of these aspects in detail.

2.3. Data Collection

In terms of data collection, a first exploratory phase took place in 2014. It consisted in conducting unstructured interviews in four hospitals in Paris that had recently been equipped with an EHR. In parallel, an analysis of the international literature allowed us to define categories of sought-after effects

OBSERVATION DIMENSIONS (examples of potential induced effects)	MANAGEMENT TOOL USE TYPE	
	CONFORMATION	EXPLORATION
Professional knowledge	Integration of provided EHR information into existing work habits, structuring of existing patient information	Creation, deletion, evolution of professional tasks, new protocols, new relationships with patients, new type of formalized information
Work division and coordination modes	Clarification of existing roles, strengthening of the existing (prescribed) role structure, formalization and improvement of informal rules for information transmission and sharing according to existing modalities (transmission, staff meetings, etc.)	Modification of the structure of roles in the organization, for the diagnosis and treatment plan implementation; transfer of tasks, new work organization in clinical units, reduced use of existing supports (oral communication, paper, telephone, fax, etc.)
Performance assessment modes	Enhanced control of clinical units according to existing criteria	Better control of clinical units according to new management indicators
Learning modes	Improvement of existing practices, supported by the EHR	EHR becomes a new way of learning and teaching (clinical research, data structuring, etc.)

Table 1 – Analysis framework for data collection (from Moisdon 1997)

and types of "interactions" between the EHR and the organization (see previous section). We thus retained 5 types of change, depending on whether it occurred: in professional knowledge and learning, in performing individual activities, in the division of work and professional valorization/devaluation, in forms of coordination, or in the work process (in which is inserted the issue of "paper resilience" raised in the literature we reviewed). Based on this initial exploration and coding of the interviews, we extended the observations to seven other institutions, gradually finalizing the questionnaire.

A second phase of our research took place between 2015 and early 2016, and we integrated another 11 organizations. Based on the first research phase's theme-structuring work, we handed out three types of questionnaire to healthcare professionals, one for each category studied (doctors, managers and nurses, secretaries). These questionnaires each comprised about 40 questions. The first questions

related to the context, for instance: "Is your department hosting a scheduled, unscheduled, mixed activity?" or "For how long (in number of months) has the EHR been installed?" or more precise questions on the EHR's structure (imaging, biology, prescriptions, decision support, etc.). As Table 2 illustrates, the other questions related to respondents' feelings – for example: "Do you think that oral exchanges between team professionals decreased after the EHR's introduction?" – and practical organizational developments, for example: "Have there been any changes in work processes?" In order to keep interviews from being too lengthy, the responses were generally of the "yes/no" type, often with pre-filled lists, except for a few questions that required positioning on a Likert scale, for example on the theme of time saved or lost in using the EHR. Other questions were semi-open. Filled-out questionnaires were almost always matched with short observation periods in the clinical units and offices in question.

OBSERVATION DIMENSION (examples of questions)	TYPE OF MANAGEMENT TOOL USE	
	CONFORMATION	EXPLORATION
Professional knowledge	Does the EHR allow you to better follow care protocols?	Has the EHR led you to develop new care protocols?
Work division and coordination modes	Does the EHR improve coordination between trades within the ward? Does the EHR improve coordination between medical specialties within the institution? Has the EHR led to a formalization of work processes?	Does the EHR lead to new division of tasks? between senior and junior doctors? between doctors and nursers? between doctors and secretaries? Has the EHR led to a redefinition of the role of the pharmacy? Does this "pharmaceutical aid" lead to improved prescribing? Has the EHR led to an evolution of work processes?
Performance assessment modes	Does the EHR allow you to better monitor the ward's activity?	Does the EHR contribute to the emergence of new assessment and management indicators?
Learning modes	Does the EHR improve traceability? Or junior doctors' training?	Does the EHR allow you to better capitalize on new knowledge in your field? Is the EHR a new tool for epidemiological research? Clinical research? Feedback?

Table 2 – Structure of interviews and questionnaires

The national healthcare oversight agency DGOS (*Direction Générale de l'Offre de Soins*) had initially planned on the questionnaires being sent in, which proved difficult for practical reasons; hence the need to meet professionals in person and administer the questionnaires directly. Field studies lasted between 0.5 and 2.5 days per site. The general outline began with an initial meeting with executives and those members of the management team who were directly involved (information systems director, nursing manager, finance and management oversight director, etc.), then by meeting two or three clinical units to talk with care professionals, observe the system at work on screen and, if necessary, submit the questionnaire. All in all, this general pattern was followed on twelve sites. On the others, our ability to work on-sight was sometimes limited, due to problematic local situations.

2.4. Data Analysis

In terms of data analysis, following the first thematic coding of the exploratory interviews in 2014, the questionnaires were analysed and interpreted, starting in late 2015. Although they were read collectively, each researcher then offered their own interpretation of the data before comparing it with their colleagues',

thus enriching the analysis and making it more robust. On the other hand, the small sample size of the questionnaires did not warrant the use of in-depth statistical processes and, for many questions, a simple count of responses would often suffice to reveal a saturation effect. For instance, to the question "Did the EHR allow you to spend more time with the patient", the answer was "no" for all 55 respondents, with the comment "somewhat less". The more qualitative interviews, as well as the numerous remarks made by respondents while answering the questions, also reinforced the general conclusions that researchers could draw from the questionnaire, which are listed below. Finally, regular meetings were organized within a consortium with other research teams studying other aspects of EHRs. These meetings made it possible to compare interpretations, to refine them and even to clarify them.

3. RESULTS

One of the main findings of our research is that the EHR's introduction in French hospitals has brought about very little change, despite its massive implementation and the many "virtuous" properties that it is supposed to have as a tool. On the other hand, we were able to identify a certain number of weak signals that suggest that the EHR is potentially the bearer of more significant organizational changes, which we interpreted as creators of "organizational value", but which would need to be better identified and supported in the long run, as these transformations take place gradually.

3.1. System resilience:
a dynamic driven mostly
by conformation

The starting point of our research was to document the variety of organizational changes related to the recent digitalization of patient records in France. At this level, the results show that the use of the tool is generally accepted by stakeholders. Of course, we have observed resistance effects in line with those noted in the international literature (from certain doctors in particular), but to a much lesser degree. The opinions are thus sometimes critical or nuanced, but a conformation to its use in practice

is evident. For example, on the perception of time savings, although physicians do not perceive any gain related to the use of the EHR (which is why some circumvent it and continue to use paper files), the vast majority of them appreciate the enhanced traceability and accessibility of data. And, although they experienced difficulties during the system's implementation, nurses could no longer do without it; their overall opinion is that it allows them to save time (in frequently consulting files and feeding the EHR with individual care information). Secretaries believe that it saves them even more time (with doctors pre-writing discharge reports, enhanced information search tools, etc.). Finally, none of the respondents want to go back to the previous tools, and some even deemed that the authorities had done well to impose it upon them.

On the other hand, our research has not revealed any profound change in the way hospital clinical units are organized: even though it is sometimes facilitated and accelerated, coordination between actors has not changed and the cooperative aspect of healthcare work has been preserved in most of the organizations. For example, there has been little change in oral exchanges, be it within the ward or between wards. More surprisingly, it seems that the use of paper has not decreased in the expected proportions, and even remains significant in some places. Moreover, apart from a marginal transfer of tasks generated by the EHR (e.g. doctors can no longer pass prescriptions to nurses orally but must enter them by authenticating themselves in the EHR), but which in reality amounted to correcting practices that had moved away from the prescribed job descriptions, the overall division of tasks and roles has remained unchanged.

We have observed little to no discontinuity in the professional knowledge in use. Respondents believe that the EHR has had only a minor impact on professional knowledge, be it in training or in research, and none of the actors (doctors, managers, nurses, secretaries) believe that the status of their profession or their professional identity has been modified by the arrival of the EHR. Similarly, the adaptation of software to work processes has not had any impact on management, since the EHR has not yet generated new management indicators or methods for wards or units. Finally, all of the hospital staff that

we met think that the changes in the relationship with patients are invisible, or even negative: less time is spent on the patient's clinical examination, professionals are more focused on their screen and so on, which seems to converge with the analyses drawn from the aforementioned foreign literature.

For now, the "organizational value" of EHRs, that is, the new possibilities that they may offer, rather than what they allow users to keep doing – with or without improvements – seems limited. Only a few small developments, pertaining to professional knowledge and research or to the development by clinical units of new monitoring tools tailored to their own needs, have been found to exist. Examples encountered during our investigations include: local protocols written to save time, the insertion of the EHR into the bed management system, small personal tools made from EHR to improve a local organization (one manager had made a list of patients for the week to come, some had drawn up to-do lists, or sheets for pain assessments monitoring, etc.). This is why we speak of an overall "resilience" of the previous organizational system. With that said, we encountered some situations in which we observed trends which, although they were in their early stages, belied the assertion that the existing organizational system remained wholly unchanged. We will see this in the following section. The most noteworthy, in our opinion, concerns the role and status of the hospital pharmacy.

3.2. Clinical pharmacy: weak signals of an exploratory logic

Despite the findings we have mentioned, some weak signals seem to indicate that some are making an exploratory use of the EHR, thus making a stronger "creation of value" possible, in the sense of an increase in the power to act of stakeholders and their organizations. The clearest case is that of hospital pharmacies, which, with knowledge of the patient's file, seem likely to acquire competences ranging beyond the current roles of internal suppliers, and start helping and advising doctors in the task of writing prescriptions. Our research shows that access to the EHR allows pharmacists to analyze drug prescriptions in relation to the patient's clinical data. As a

result, in many of the organizations that we visited, the pharmacist's role is changing from simply providing drugs to participating in diagnosis and care. However, this transformation is occurring to various extents, depending on the cases studied.

In some cases the pharmacist just gives a little help by sending a notice or alert to the prescriber or their ward. This is already a considerable step forward, as the organizations in our sample are experimenting with this way of doing things and generally appreciate this help in avoiding a certain number of incidents, particularly related to drug interactions. In other cases, this assistance can apply to the patient's entire stay, from their admission – with the information support constituted by their usual physician's prescriptions – up until their discharge, with analysis work of the discharge prescription. This is also part of the process known as "medication reconciliation", which ensures consistency in prescriptions throughout the patient's stay.

But the "medication reconciliation" process involves a complex organization that we have not observed in our sample: on the one hand, it is a question of ensuring that pharmacists can actually intervene at each stage of the process, thus organizing the communication device between them and the prescribers (this organization leads towards a physical insertion of pharmacists in clinical services, a movement that can be observed in some countries); on the other hand, the additional workload that it generates generally means that this reconciliation work cannot be applied to all patients. This entails that the choice in targets must be considered collectively: they may be defined according to wards, or pathologies, or by filtering them based on biological analysis results. Few organizations have yet arrived at this stage of maturity, but, as the experiments launched by France's highest healthcare authority, the HAS (Haute Autorité de Santé), show, there can be no doubt that this overall transformation is in motion. Based on these results, we can hypothesize that this dynamic will gradually pick up speed. This is therefore a significant potential change.

Table 3 below summarizes all of these findings.

DIMENSIONS OF OBSERVATION (examples of questions)	TYPES OF MANAGEMENT TOOL USE	
	CONFORMATION	**EXPLORATION**
Professional knowledge	The EHR is used by professionals. Its use has made it possible to preserve and sometimes improve patient information, without greatly modifying its structure. On the other hand, it is technically difficult to adapt to a professional-specific logic as, for instance, to produce a polymorphic "summary section", that all specialists could interpret and use.	The EHR has led to the development of care protocols, but these seldom contribute anything fundamentally new. While medical staff are not yet using the EHR to change their professional practices, administrative staff and healthcare managers seem to be transforming theirs, albeit marginally.
Work division and coordination modes	Inter-departmental (but not intra-departmental) oral exchanges, as well as use of paper, have decreased, but EHR uses tend to preserve existing coordination modes, particularly within clinical units.	Hospital pharmacy is changing in some institutions, especially for prescription assistance, bringing pharmacists closer to hospitalization services and seeking integration into medication reconciliation.
Performance assessment modes	The EHR is used to track existing indicators, such as the care schedule.	Some professionals use the EHR to develop new indicators, for example on pain monitoring.
Learning modes	In some organizations, the EHR is used during staff coordination meetings as a support for discussion, or for certain work meetings, for example with junior doctors.	Uses of the EHR as a new learning or research tool are still few, mainly for technical reasons pertaining to the user-unfriendliness of information query processes.

Table 4 – Summary of findings from fieldwork and questionnaires

4. DISCUSSION

What does the EHR case teach us about the organizational value of information technology in hospitals? Could conclusions of a more general nature be drawn to allow, among other things, organizational heads and public decision-makers to move away from a vision focused on "impact assessment"?

4.1. Organizational Value and "Constructive Use" of Information Technology in Hospitalsl

While we noted organizational difficulties associated with the implementation of an EHR-type system, as described in the literature, they seemed to be mitigated for the most part, as teams of professionals have now succeeded in utilising the system. This has sometimes been at the cost of a waste of time and some circumvention, which allowed them to hold on to previous cooperation and coordination practices, but the system's implementation has been achieved. On the other hand,

we have seen that EHR-driven reconfigurations of the organization are limited and often superficial. Rather than a process of profound change, we found an accommodation of the structure to the tool, once it had finally been accepted and was looked upon positively by most professionals. This observation is reminiscent of Berbain's 2001 analysis of the digitalization of care processes in a large hospital in Paris. In those days already, the study showed that professionals know how to overcome the obstacles of technical learning (knowing how to handle the tool) and managerial learning (knowing how to adapt operating routines to the tool's prescriptions), but that they find learning more difficult when it comes to organization (knowing how to use the tool to invent new ways of doing and progressing). These observations are consistent with the literature on the appropriation of management tools (Grimand 2006).

While our investigations therefore confirm that the EHR has truly been implemented, as intended by the supervisory authority and in particular the «Digital Hospital» programme, they nevertheless show that the way these major public investment programmes are designed and deployed tends to leave open the question of organizational value creation. In practice, this trend actually seems to reduce the potential for transformation, for if this process is driven by a spirit of conformation, is it not an obvious example of incomplete appropriation of a management technology? In the case of the EHR, are the system's latent potentialities – i.e. potentialities that the clinical units could explore in working situations (and not such as defined beforehand by institutional prerequisites in some distant centre where the main concern is to respect standardized work processes in implementing new technologies) – not limited by this fact? In offering a glimpse of the benefits of an exploratory logic, the case of pharmaceutical aid, while still limited in practice, does seem to support this hypothesis. Rather than being based on the observance of processes in a perspective similar to that of ERP (Enterprise Resource Planning), the rationale in question is based on a very different development: the emergence, allowed for by the EHR, of actors able to contribute knowledge that is their own and that is complementary to that of the prescribers.

This discussion also draws on research in the field of activity theory. Rabardel (2005) contrasts «productive activity, oriented towards the achievement of situated goals « with «constructive activity, oriented towards increasing, maintaining, reconfiguring the subject's resources for future productive activity». If we take up the distinction proposed by Rabardel, we can categorize «productive uses» and «constructive uses» of information technologies in hospitals. Productive use would refer to the conformation logic, which is the dominant framework with regard to EHRs, and constructive use to the logic of exploration and creation of organizational value, which in this case is emerging. The latter seems to be poorly understood and weakly supported by public decision-makers, at least for now.

4.2. Coordination Information vs Content Information

Before we move on to the managerial implications of our work, it is worth mentioning one last element of discussion drawn from our field survey. Given the diversity of situations we encountered, it seemed necessary to distinguish between two types of information that EHRs seem to seek to integrate: "content information", linked to the cognitive content of the clinical activity itself, and "coordination information", which feeds coordination mechanisms between various professionals. This distinction gradually became a means to account for the differences observed between the wards we studied, as a function of whether the ward's activity involved a greater or lesser degree of dependence of coordination information on content information. Dependency seems strong, for example, in intensive care, emergency services and a few other specialties; in other words, in these situations, the coordination of actors cannot be established without reference to the content of the clinical work itself. Conversely, this dependence can seem weaker in an orthopaedic surgery unit, for instance, where coordination seems to be largely possible without involving strongly collective and/or discussed clinical interpretation work.

The value of this distinction is that, in our survey at least, it accurately reflects situations where the implementation of an EHR seemed almost self-evident

(low dependence), while it was "a real pain" in other cases (strong dependence). Some findings in the literature point towards this. For example, based on the observation of the functioning of an EHR in 8 intensive care units of a hospital, Reddy *et al.* (2001) emphasized the fact that, although different professions involved in patient care had to carry out interpretation work within the framework of their own knowledge and practices, the system only offered them a single and hardly polymorphic type of information. Here, of course, the EHR has its role in the collective work and can be an asset, according to the authors, but it is far from sufficient: it replaces neither discussion nor an understanding of the various dimensions of the case and of steps to take for treatment, based on the process of pooling individual contributions. This problem is accentuated when the EHR is common to several units with different specialities. The authors criticized the concept of CIS (Common Information Space) which, they argued, refers to shared information rather than to the construction of a representation of information. Even for a single team, the concept works poorly, given the strong differences between trades. For instance, physicians have a retrospective view of information, whereas caregivers have a prospective view, as they have to plan their care sequences. Overall, what mainly show are strong tensions between clinical work and coordination tasks. Similarly, Ellingsen (2006) shows how the structuring effort resulting from the implementation of an EHR can lead to efficiency losses and frustrations when it concerns the coordination of professionals with different cognitive structures (content information). Finally, Oborn *et al.* (2011) also observed the tensions that emerge from the variety of types of clinical practice (content information) in an oncology department where a single EHR had been implemented.

This element seems particularly important here. It reminds us that there is not "one" medicine but "several medicines", each of which bases itself on its own history and its most recent operating methods to explore the wealth of potential offered by an EHR. It also suggests that the risks of tensions related to the reliance of coordination information on content information are increased when the EHR is seen as a tool to integrate all information into a single framework. This therefore reinforces the idea that it is preferable to consider EHRs in a broad sense,

which may include different tools, even though this constellation could cause technical problems in terms of interoperability. Insofar as these findings suggest that organizational value closely depends on taking into account differences in clinical and care practices, they have managerial implications that we will now consider.

4.3. Managerial Implications

Two factors were common to all of our findings. Firstly, all of the systems studied in this research had been implemented over long periods of time. In all cases, implementation times were spread over more than 10 years and the most extensive and sophisticated system we have observed, that of a private clinic, took more than fifteen years to materialize despite a proactive and enthusiastic management team, in whose eyes it is still not completely accomplished, especially with regard to the structuring of medical information. The management of such transformations must therefore not be seen as a change in the short term, but rather considered and described as a profound change in the long run. As such, it requires continuous efforts and must necessarily be associated with opportunities for collective learning.

Secondly, the invention of constructive uses of technology and, in turn, the creation of organizational value associated with these uses, both assume that the latent potential of the tools, which cannot be decided in advance but must be explored in situ by the actors, are taken into account. However, as we have seen, these potentialities depend on the knowledge and representations of the actors themselves; they are the main resources with which the actors engage with tools' constructive logic. The case of clinical pharmacy is instructive in this respect because it shows how a strong and meaningful appropriation can take place on the basis of an exploratory professional logic. The case of the EHR is thus an instance of a typical situation in which the organizational value of an information technology is currently limited in practice, whereas it could be developed if the invention of constructive uses for a management technology by the actors in their work situations was recognized and supported by public decision-makers.

In conjunction with other work in the literature on organizational aspects, our results also seem to suggest that limitations to the organizational value creation process can be associated with ways of assessing and supporting the transformations brought about by information technologies in hospitals. In fact it seems that the steering of such long-term transformations cannot be done solely on the basis of impact measurements to justify the scale of the – often public – investments made, or by monitoring the adoption of work processes included in new management devices. Such measures and reporting are not useless per se, and they definitely do contribute to the assessment of a given implementation at a given moment in its development, but they do not seem to be operational in the strategic management of organizational value creation. This would require a better understanding of the activities involved and of the meaning that actors are able to give to these technologies, based on a constructive use that is developed step by step.

From a managerial point of view, what our research on EHRs suggests is that the "meaningful use" (Blumenthal 2009) that public authorities seek so much does not happen naturally , nor can it be decreed, even with the greatest of convictions; it is built along the way, starting from the situated regeneration of the actors' capacities for action. However, these transformations require support that is specific in two ways: first, it is a question not of helping to conform, but of helping to invent; and second, given the plurality of medical professions, it calls for a differentiation of efforts. It is a question of being interested in and providing assistance to those who need it, i.e. the activities for which it is hardest to reconcile content information and coordination information (see 4.2).

5. CONCLUSION

Based on the case of the Electronic Patient Record, our research on organizational transformations induced by information technology aimed to analyze what the use of information technology can bring to professionals, and whether it makes an effective reconfiguration of action processes, relationships and knowledge possible in order to improve performance. The aim of our work was therefore to discuss the notion of organizational value based on the development, or lack thereof, of actors' power to act, or, in other words, of a regeneration of "capacities to do", in the sense of performance improvement, whether in terms of costs, deadlines, or quality.

The fact that these latent potentialities have been realized to a very limited extent only is undoubtedly due to efforts being focused primarily on the integration and implementation processes. There is no doubt that these processes are long and difficult, but such a focus only postpones reflection on the higher-level appropriation of the tool. The fact that pharmaceutical aid is far from being systematically installed wherever the maturity of the system would allow it, goes to show that the idea that organizations are automatically renewed when instruments are introduced is debatable at best. Only actors in the flesh, acting within the framework of their constraints and their professional logic, may or may not produce this type of transformation – and here too, as with the implementation of tools, support is most often essential (de Vaujany, 2005, Ologeanu-Taddei, 2015).

As far as the EHR is concerned, now that institutional implementation is well under way, it is certainly time to look at the changes taking place during the life cycle of associated technologies, and in particular to record "constructive" initiatives and capitalize on them, such as those emerging around medication reconciliation. This is certainly an example of a substantial reconfiguration of organizations and mechanisms of action, involving the emergence of new actors in the processes and a redefinition of their role: the very types of transformation that we are proposing to identify, monitor, assess and possibly stimulate.

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