Governance of Open Source Electronic Health Record Projects: A Successful Case of a Hybrid Model

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Abstract

Electronic Health Records (EHRs) are at the heart of most health system reforms. As an increasing number of hospitals are adopting open source *EHRs and as many questions are still unanswered for potential adopters of open source EHRs, analyzing the governance of such systems has become important. Due to the increased diversity of sponsors and stakeholders of open source software (OSS) over the past few years, numerous governance models of OSS projects have emerged. In contrast to earlier "community-managed" governance models, these emergent models are characterized by the sponsorship of a corporation or a not-for-profit entity or by other hybrid forms. This paper reports on the investigation of such a hybrid model of open source EHR project governance adopted with success by a large Canadian hospital. The case study provides rich insights for other hospitals wishing to adopt an EHR of the open source type.*

1. Introduction

Healthcare spending is growing faster than the economy in most countries of the OECD, maintaining a trend that began in the 1970s [1]. For instance, in the US, from 1960 to 2010, "national health expenditures have grown nearly five times as much as the economy as a whole, on a real, per capita basis" [2, p.6]. In 2010, total health expenditures reached 17.6% of GDP in the US and 11.4% in Canada [3]. Now a breakdown of health expenditures outlines hospitals as the most important category of public-sector healthcare spending, accounting for 33% and 37% in the US and Canada, respectively [4, 5]. At the same time, most OECD countries are facing increasing workforce shortage issues in the healthcare sector [6,7]. The conjugation of both situations is threatening citizens' care as well as the economic viability of the concerned countries.

In this context, a consensus has emerged in the scientific literature and within practitioner communities regarding the critical role that information technologies (IT) must play in healthcare in general and in hospital settings in particular. Prior research shows that IT is a key lever for containing costs as well as bringing improvements in patient safety and in the quality of care provided to citizens [8,9]. It is for this reason that governments are promoting the adoption of IT in hospital settings [10, 11]. While hospitals are known to be information-intensive organizations, they still lag behind other information-intensive industries such as insurance and banking with regard to computerization of their core business activities [12,13]. Consequently the adoption and use of clinical information systems such as EHR systems is at the heart of most health system reforms [14]. In this regard, one must note that there is no consensus on the definition of EHR systems [15]. In this study, we adopted the definition offered by the Office of the US National Coordinator for Health Information Technology: "electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be created, managed, and consulted by authorized clinicians and staff across more than one health care organization" [16].

With regard to EHRs, empirical evidence reveals that hospitals face a number of challenges when it comes to adopting, implementing and using these systems, and that their cost along with their interoperability represent the two most important barriers [17,18,19]. Indeed, acquiring and implementing an EHR system can be very expensive for a hospital, small or large. In addition, the low level of interoperability of most proprietary EHRs increases the cost of their implementation and use and hinders health information exchange, in turn minimizing the benefits of these systems [20]. For instance, Dartmouth-Hitchcock Medical Center, a 371-bed general medical and surgical hospital in

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Lebanon, New Hampshire, that has approximately 8,500 employees [21,22] and an annual budget of $1.3 billion showed a weak operating performance in 2012, partly because of expenses related to the implementation one year earlier of an EHR system at a cost of $80 million [23].

Given that lower acquisition and maintenance costs and the use of open standards are among the characteristics that distinguish OSS from proprietary software, and following Poba-Nzaou, Raymond and Fabi [24], we argue that the availability of open source mission-critical IT applications such as EHRs represent an opportunity that is worth exploring by hospitals. Examples of open source EHRs include VistA, Oscar, GNU Med, OpenEMR and OpenMRS, to name but a few. In fact, several hospitals have already opted for OSS EHR in a number of countries in Europe and North America [25,26]. For instance, Midland Memorial Hospital, a 320-licensed bed hospital in Texas, implemented VistA with a budget of $6.3 million (over 80% of which was for consulting fees), whereas the cost for a proprietary EHR was estimated to be approximately $19 million for a hospital of this size [27], representing approximately 9% of its annual budget [28]. In the same manner, Oroville hospital, a 153-bed semirural California hospital successfully implemented VistA with a budget of $10 million, including all costs [29].

OSS EHRs raise a number of issues and questions for hospitals however [30]. Some of these issues are related to the complexity of open source ecosystems which increases with the heterogeneity and the number of OSS projects. There are now more than 200 medical OSS applications available at sourceforge.net and it appears that "grassroots communities in public forums" are no longer the only entities that initiate or manage OSS projects [31, p.139]. Consequently, organizational arrangements related to the governance of these projects show a great diversity of structures and mechanisms that are still poorly understood [31]. As an increasing number of hospitals are adopting open source EHRs, analyzing the governance of such projects has become important for at least two reasons.

First, prior studies reported that governance affects not only the attractiveness of an OSS project [32] but also its performance and sustainability [33]. Second, because of the growth in diversity of sponsors and stakeholders of OSS projects over the past few years, a number of governance models have emerged [31,34,35]. Although these models may adopt elements of the original "community-managed" model, hybridization is most likely to arise. In contrast to the original model, hybrid OSS governance models are characterized by the sponsorship of a corporation or a not-for-profit entity, or by other hybrid forms [31]. Stakeholders engaged in these hybrid forms "are likely to face different challenges than grassroots founders" [31, p.142].

This study reports on a case investigation of such a hybrid model of OSS governance, that is, the governance model adopted by a large Canadian hospital that has successfully implemented and uses an open source EHR system. Our study addresses the following research questions: *How is the governance of the open source EHR project orchestrated at Capital Hospital*[1]*? Has the governance model adopted at Capital Hospital evolved over time and if so, how?* This case study may be considered "unique" [36] in that its approach takes advantage of an opportunity to access a rich, yet extremely rare occurrence of a situation that has not received significant attention in the fields of information systems and medical informatics.

From a theoretical perspective, the present study contributes to a deeper understanding of a hybrid open source EHR governance model and of the reasons for its success. From a practical perspective, our study reveals the uniqueness, challenges, and advantages of Capital Hospital's open source EHR governance model, which may be very useful to the hospital's decision makers. In addition, the case provides rich insights to other hospitals wishing to adopt an EHR system of the open source type.

2. Conceptual background

We introduce in this section important concepts from the OSS governance literature that are relevant to our study. We selected various concepts that we found more "insightful" to our empirical materials from an interpretive point of view [37]. These concepts include OSS governance definitions along with "stages" [38] and "dimensions" [39] of open source governance models.

The extant literature reveals that OSS governance can be defined in a variety of ways [38-42]. For the purposes of this study we adopted the definition proposed by Markus [34] since it is one of the most used and cited. Hence, OSS governance is defined as "the means of achieving the direction, control, and coordination of wholly or partially autonomous individuals and organizations on behalf of an OSS development project to which they jointly contribute" [34, p.152].

As for the stages of open source governance, de Laat's [38] three-phase process model was selected

[1] We used a fictitious name to preserve the anonymity of the organization and its members.

among others [42,43] because of its good "fit" with our data. As presented in Figure 1, OSS governance is deemed to evolve as follows:

- Phase 1 (*spontaneous governance*) is characterized by informal and emergent coordination and control.
- Phase 2 (*internal governance*) is characterized by an array of explicit and formal tools for coordination and control to achieve optimal project outcomes.
- Phase 3 (*external governance*) is characterized by the management of relations with external parties, typically by the creation of a not-for-profit foundation that handles donations and upholds copyright licenses, brand names, and trademarks.

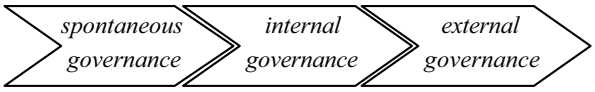

Figure 1. Evolution of OSS governance

We found that there is as of yet no consensus as to the main dimensions of OSS governance and thus decided to adopt the six dimensions of OSS governance proposed by Markus [34]. These dimensions are:

- *ownership of assets* (related to the intellectual property licenses and formal legal organizational structures);
- *chartering of the project* (includes the project's vision and goals);
- *community management* (refers to rules on membership and roles, as well as changes in roles);
- *software development processes* (concerns important structures and rules at the operational development level such as requirements specification, allocation of manpower, management of software changes and release);
- *conflict resolution and rule changing*;
- *use of information and tools* (related to information flows and the use of software development tools and repositories).

3. Research method

We conducted a field study in the interpretive tradition of information systems [44,45]. Our main intent was to conduct an in-depth investigation of a single OSS project, focusing on the adopted governance model, the internal as well as external "factors" that influenced the evolution of the governance model over time, and the key actors' views of the project's successful outcome. In accordance with interpretive research assumptions, we attempted to understand the phenomenon of open source EHR governance through the meanings that people assigned to it [44]. Consistent with these assumptions, we adopted an inductive approach and consequently did not select an initial theory to guide our data collection and analysis. Instead, following Barret and Walsham [47] and Walsham and Sahay [48], the usefulness of the theoretical concepts described in the previous section developed as part of an emergent process at different stages of the research.

Capital Hospital was formed in the mid-1990s as a result of the merger of three distinct hospitals. It is a university hospital with more than a thousand beds and employs approximately 9,000 staff employees, 1,000 physicians and 3,000 nurses. It serves a population of more than 1.5 million inhabitants in Canada. The current technical IT infrastructure is composed of 600 servers running on five different operating systems and 9,810 desktop computers. The human IT infrastructure is composed of 16 individuals, including 10 external IT staffers dedicated to the development of the open source EHR system.

We relied on three data sources. First, we conducted semi-structured interviews with 11 key informants. All interviews were audio taped and transcribed verbatim. Each interview lasted approximately 90 minutes, a total of 18 hours of conversation thus being recorded. Second, project and organizational documents were consulted, as well as publicly available press releases related to the project. In sum, project and organizational documents and interview transcriptions included 66 documents for a total of 1,405 pages. Third, we participated as observers in three project team meetings.

We initiated the analysis during data collection as part of an iterative process. In accordance with the primary principle of interpretive research [44], data collection and analysis processes relied on the "hermeneutical cycle". We thus went back and forth between the whole and the parts [49], to expand our understanding of the project's governance. More specifically, data were read and re-read to familiarize ourselves with the collected materials. At all times, actual interpretations were challenged [44,50]. After several iterations, we were able to develop a deep understanding of the social and historical background of the governance of the EHR project

We then used a narrative strategy that allowed us to reconstruct the "story" by summarizing the data collected to describe the evolution of governance along with internal and external influencing factors in the form of a 'narrative report' [51]. As a result, we wrote a 40-page case study report which was formally presented to Capital Hospital's IT department head for review and eventual validation.

Such validation allowed us to depart from our own understanding and reach the "whole" within the hermeneutic circle, as the shared meanings emerged from the interactions between the researchers' interpretations and the informants' accounts [44]. Following Pentland [52], we identified sequences in time, focal actors' frame of reference (desirable project outcomes), and other contextual indicators.

A temporal bracketing strategy was used to include the time dimension and structure our analysis [51]. The chronological decomposition of data helped us make sense of informants' accounts and explicitly identify periods of continuity and points of discontinuity in the project's governance activities and arrangements over a 14-year period.

Lastly, the application of the interpretive principles of abstraction and generalization allowed us to generalize our findings to theoretical concepts [51]. More specifically, we drew on OSS governance dimensions [34] and evolution stages [38] as vehicles to derive abstraction and generalization from our findings. Again this was done in the process of moving back and forth between the data and the selected concepts in the hermeneutic circle [44].

4. Results

Our main findings are presented using the three phases of de Laat's [38] process model as foreground theory and the components of Markus' [34] OSS governance model as background theory in order to describe and explain the observed open source EHR governance phenomenon.

4.1. Phase 1: Spontaneous governance

Capital Hospital had been facing huge budget shortfalls for many years. In 1999, the hospital was planning to acquire an EHR system in order to ease the transition to the year 2000. The IT department directly contacted potential suppliers but was dissuaded by the initial acquisition cost of 1 million dollars and the recurring costs of around $350,000 per year. Capital Hospital was therefore at an impasse until its head of IT development went overseas on a mission of cooperation on e-health with a European hospital. During his stay in Europe, he was impressed by the potential of a "homegrown" EHR system in use at Oversea Hospital[2] and thus asked the IT team from this hospital to come to Canada and present their system to Capital Hospital. The same year, both hospitals engaged in discussions on a possible collaboration that led to an offer from Oversea Hospital based on two main elements: 1) Capital Hospital's IT team would become a partner for the development of the EHR source code while Oversea Hospital would retain the *ownership of assets*; 2) the EHR system would be used for free by Capital Hospital to carry out its mission.

In the early 2000, an agreement based on these elements was signed between the two hospitals. This was the birth of a lasting collaboration that started with more than four years of formal mentoring and tutoring by Oversea in order for Capital to gain maturity with the EHR system. By signing the agreement, Capital Hospital's open source EHR project was being acquainted with a recently established oversea EHR user community composed of a number of health care organizations (HCOs) belonging to a public healthcare network (see Figure 2). Capital Hospital was a privileged community member because it did not belong to this network and was the only member that could participate in a joint *software development process* by forwarding source code to Oversea Hospital twice a year for integration into the EHR's main source code. Other community members could only express their needs with regard to the evolution of the EHR system and use the product for free. The EHR source code was distributed twice a year by Oversea Hospital to community members for local implementations and uses.

Sharing of new requirements and adjustments to the EHR *project's vision and goals* (chartering of the project) was done twice a year during a face-to-face meeting held at either Capital Hospital or Oversea Hospital, involving the IT teams from both institutions. Oversea Hospital was responsible for gathering the joint needs of oversea HCOs and Capital Hospital was responsible for bringing the needs of its own medical staff to the table. Thus, Capital Hospital's own EHR project vision and goals were identical to - or at least part of - Oversea Hospital's EHR project vision and goals.

The *community management* rules were under the control of Oversea Hospital that decided what HCO could become a member and what roles each could play in the community. These rules had no real impact on Capital Hospital's EHR project since Capital was a privileged member that only dealt with Oversea Hospital. At that time, if a HCO located in Capital Hospital's province wished to use the EHR system, it would have had to sign an agreement with both Oversea and Capital and express its needs to Capital Hospital.

[2] A fictitious name was used to preserve the anonymity of the organization and its members.

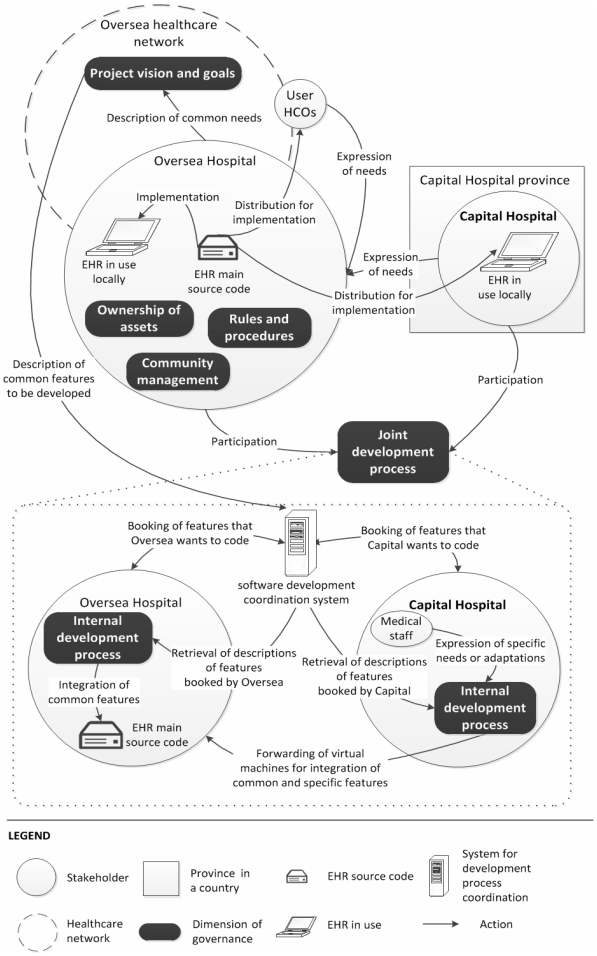

Figure 2. Spontaneous governance (1999-2007)

All other governance *rules and procedures* were also under the control of Oversea Hospital and mainly served to manage the joint software development process. In this regard, most important was the use of a computerized system to describe the functionalities to be added in the EHR system. This approach was subsequently used by system developers at Capital Hospital to "book" the functionalities they had chosen to develop within Capital's internal development process. Oversea Hospital's developers would do the same with functionalities that they had themselves chosen to prioritize. This approach also allowed the coordination of development efforts between the two organizations. The source code developed by Capital Hospital was forwarded to Oversea Hospital by virtual machines and systematically incorporated to the EHR source code. This included source code developed or adapted for the specific needs of Capital Hospital's medical staff, i.e. needs not shared with oversea HCOs. All source code was developed using the ASP software that Oversea Hospital had already chosen as the main software development tool. Capital Hospital had no choice but to use ASP in order to participate in the project.

4.2. Transition period to phase 2

The passage to the second phase did not happen overnight. Two years of transition (from 2007 to 2009) were marked by key events that allowed Capital Hospital to pave the way for the improved internal governance of its own EHR project.

During this transition period, an increasing number of provincial HCOs were interested in using Capital's EHR system, thus leading its IT Director to ask Oversea Hospital for the right to distribute the system and manage the community in Capital Hospital's province. Oversea Hospital readily accepted and an official agreement was signed between both hospitals. Oversea Hospital's CIO went to a provincial healthcare IT colloquium to jointly present with his Canadian counterpart the open source EHR and invite all HCOs to join the open source community.

Many changes were taking place in the oversea healthcare network at the time, requiring extensive adaptations of the EHR source code during the transition period. At that point, Capital Hospital and Oversea Hospital began to diverge and became less concerned with each other's needs. By mutual agreement, the joint software development process was terminated and both hospitals continued their separate development of the source code. This was the opportunity for Capital Hospital's IT team to make the decision to migrate Capital Hospital's EHR source code from ASP to .NET in order to stay current with the evolution of software development technologies .

In 2007, a first hospital joined the provincial community and implemented the EHR system with the help of Capital Hospital. This hospital has been using the system with great success since then. Having invested a lot of time and effort in this first implementation, Capital Hospital began to realize that market development and system implementation would be better left to private partners.

4.3. Phase 2: Internal governance

By 2009, Capital Hospital had gained enough maturity with its development and use of the EHR system to become independent (see Figure 3). With the blessing of Oversea Hospital, Capital thus created its own open source EHR project based on Oversea Hospital's source code. Since then, Capital Hospital

has been the leader of the EHR project in its province and has the *ownership of assets* for the whole of Canada in its entirety while Oversea Hospital owns the EHR assets in its own European country.

The joint development process had thus given way to a *software development process* that was fully controlled by - and took place at - Capital Hospital. However, Capital and Oversea pursued their collaboration by exchanging virtual machines containing locally developed source code. Furthermore, depending upon the needs of its community, each hospital can decide to incorporate in its own EHR system the functionalities developed by the other. The system that served to book functionalities was no longer in use since the *project's vision and goals* were not determined by common needs anymore. Capital Hospital's EHR project vision and goals are rather influenced by the needs of provincial community members.

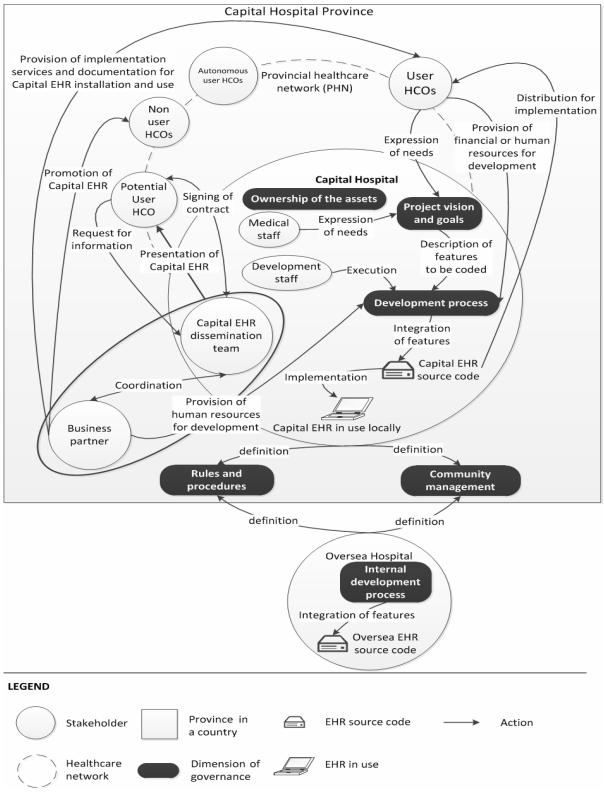

Figure 3. Internal governance (2009-2012)

Community management rules are under the control of Capital Hospital but are inspired by those in application in the Oversea Hospital EHR project. Moreover, Oversea Hospital often counsels Capital Hospital when changes or new rules are needed. For example, Capital Hospital recently wanted to include a new type of community member, namely, nursing schools that could train their students with Capital's EHR system, and asked Oversea Hospital for their opinion on the matter.

Capital Hospital's EHR community members are typically HCOs belonging to the provincial healthcare network. In order to have the right to express its own needs for the evolution of the system and use the current version for free, a HCO has to provide financial or human resources to Capital Hospital to assist in the development of the source code. HCOs' needs are expressed every two weeks in face-to-face meetings involving Capital Hospital's IT staff and user HCOs' IT project managers. The needs thus determined are prioritized by Capital Hospital by giving more weight to those shared by the greatest number of community members. Capital Hospital then uses its own programmers, programmers supplied by other HCOs and, if necessary, those provided by its business partner to develop new functionalities based on the expressed needs. The source code is distributed twice a year by Capital Hospital to community members.

Any hospital belonging to the provincial healthcare network could decide not to become a community member but still use Capital Hospital's EHR system. In this case, Capital Hospital donates the two-year old - rather than the current version of the - source code and allows the autonomous hospital to pursue further developments internally for its own needs. However, ownership of the EHR assets is retained by Capital Hospital and the autonomous hospital has the obligation to transfer internally developed source code to Capital Hospital for potential implementation in Capital's own EHR system.

All other project governance *rules and procedures* are under the control of Capital Hospital but many of these are inspired by the rules and procedures applied by Oversea Hospital in its own EHR project. Oversea Hospital again has a role to play when existing rules must be modified or new rules created. Most notably, when Capital Hospital's EHR community started to grow, Oversea Hospital suggested that Capital find a business partner to take care of the marketing and implementation of the system in provincial HCOs, allowing it to remain focused on its caregiving mission. Oversea assisted Capital in the tender process for the selection of the partner, a private company with an expertise in EHR solutions. At the beginning of Phase 2, Capital Hospital signed a 3-year contract with this company to: 1) disseminate Capital's EHR in the provincial healthcare network, 2) initiate a dialogue with HCOs interested in the project, 3) implement the EHR in other HCOs, 4) create documentation for the

implementation and use of the EHR system, and 5) provide programmers to Capital Hospital for the development of the system when needed.

In order to coordinate its efforts with the new private partner, Capital Hospital has created a dissemination team composed of systems analysts and clinical "super-users". The role of this team is to receive requests for information from potential adopters, to meet with them and the business partner for a presentation of the EHR system, and finally to approve the inclusion of new members in Capital's EHR community by signing contractual agreements. From there, the business partner assists each new member in implementing the EHR system, including training and change management activities. However, the partner acts under an outsourcing mode, as Capital Hospital remains responsible for the new member's compliance with the agreement. Meetings are regularly held in order for the dissemination team and the business partner to stay informed of each other's activities. At the end of our data collection, it was evident that Capital Hospital's EHR project governance was well established in the "internal governance" phase, with many explicit and formal tools in use for coordination and control to achieve optimal project outcomes. The community was strongly led by the same individual who had initiated the collaboration with Oversea Hospital in 1999, as Capital Hospital's head of IT development, and who was now its CIO since 2010.

4.4. Towards Phase 3

In early 2013, members of the research team made a formal presentation of the study report to Capital Hospital's IT executive team, Oversea Hospital's IT management team and Capital's business partner. The presentation was followed by a discussion about the future of Capital's EHR governance model. Interestingly, we found that Capital Hospital was paving the way for "external governance". In line with Phase 3 in de Laat's [38] model of OSS governance, Capital Hospital's IT management team has included several nursing schools in the EHR community and hoped to eventually include schools of medicine as well. Moreover, there is awareness to the fact that computer science faculty members as well as research laboratories are showing interest in contributing source code to the EHR system and in studying the many facets of the open source project.

As the provincial Minister of Health publicly endorsed Capital Hospital's EHR project, the interest of outside parties and membership in the community may grow substantially in the years to come. Capital Hospital is therefore considering the creation of a not-for-profit foundation for the EHR project. The mission of this foundation would primarily be to lead the evolution of the *project's vision and goals* by becoming a place for sharing among community members, and in particular for helping to discover and prioritize the common needs that will dictate the functionalities to be developed and incorporated to the source code. For the time being, however, Capital Hospital wishes to maintain its leadership in relation to the other dimensions of the EHR project's governance.

5. Discussion

A significant body of research on OSS projects now exists, but much more is needed to build a contextualized understanding of the evolution of OSS projects governance [42,53,54]. Our work contributes to a deeper understanding of open source project governance and its evolution, especially in the context of non-community managed OSS projects and mission-critical systems. De Laat's [38] three-phase process model was useful to explain the evolution of OSS project governance in the context of EHR at Capital Hospital. We thus were able to identify two points in time that made the governance evolve. First, we observed a transition from spontaneous to internal governance that lasted two years and was marked by the growth in the size of Capital's EHR community. The growth of an OSS community requires the use of many explicit and formal tools for coordination and control in order to achieve optimal project outcomes [38]. Second, we observed the early transition from internal governance to external governance. In line with de Laat's model, this phase was triggered by the growth of the number of external parties participating in Capital Hospital's EHR community (e.g. nursing schools) or keenly interested by this community (e.g. research laboratories). Capital Hospital is therefore considering the creation of a legal structure for the open source project that would be distinct from its own legal entity. A not-for-profit foundation would provide institutional stability independent of any one individual, as well as legal status to negotiate with external entities, concerning in particular the provision of resources including financial ones. This tendency towards increasing institutionalization is typical of OSS projects that grow larger and achieve greater success with outsiders [38].

Our case study also contributes to the stream of research on hybrid organizations that combine different institutional logics in unprecedented ways [55]. Examples of such an organizational form are the

alliance of *not-for-profit* and *for-profit* logics [56]. In the context of its open source EHR project, Capital Hospital represents a good illustration of a hybrid organization that has developed a governance model characterized by three distinct logics, namely, *care providing*, *software publishing* and *software integration*. First, care providing at Capital Hospital consists of provision of general, specialized and highly specialized care in many areas, including infectious diseases and pathology, as well as a set of high-quality care, including anesthesiology and medical imaging. Second, software publishing consists of "operations necessary for producing and distributing computer software, such as designing, providing documentation, assisting in installation, and providing support services" to Capital's EHR users [57]. Finally, software integration consists in the incorporation of Capital's EHR in the business processes of HCOs by connecting the EHR system with these organizations' legacy applications and existing data [58,59]. By combining these three logics, Capital Hospital created an uncommon combination for which a supportive ecosystem does not exist. To our knowledge, this study is the first to put light on such a combination in a governance model. An in-depth analysis of the case data indicates that Capital Hospital could "rely neither on an existing model for handling the tension between the logics they combine nor on a pool of job candidates with experience in doing so" [60, p.1420]. Consequently, sustaining Capital Hospital's hybrid organization is highly challenging and we show that most actions deliberately orchestrated to adjust the governance of the open source EHR project were aimed at enhancing the sustainability of the hybridization or strived to attain the "hybrid ideal" [61]. With the help of a private business partner and the counseling of its former collaborator in the project, Capital Hospital created the ecosystem needed to support and sustain its hybrid form.

From a practical standpoint, our investigation shows that open source EHRs represent a viable solution for HCOs with limited financial resources and strong collaboration and learning capacities. Indeed, Capital Hospital was able to seize the opportunity to collaborate with Oversea in the co-creation of an open source EHR that was used for free to support the hospital's mission. This participation in a project initially led by a more experienced hospital in terms of open source EHR development allowed Capital Hospital to learn from its collaborator. When the opportunity came, Capital Hospital was able to use that knowledge to push the governance of the project towards a strong internal form. At this point, an increasing number of HCOs are joining the community and more and more outsiders are interested in Capital's EHR. This puts more pressure on Capital Hospital to lead this growing community and meet its demand, therefore forcing a shift towards an even stronger form of governance.

We also show that hospitals engaged in software publishing and/or software integration logics should consider forming alliances with other organizations such as private business partners in order to enhance the sustainability of their hybrid nature. This relates to Karopka et al.'s [62] suggestion that sustainable OSS projects in healthcare should consist of an ecosystem of actors such as developers, users, support companies, OSS experts and advocates, and OSS supporters among health IT decision- and policy-makers. Our analysis of the case of the EHR project at Capital Hospital has revealed that some of these ingredients are already present and that some are intended to be put in place in the next governance phase of the project.

6. Conclusion

The theoretical and methodological postures taken in this study obviously cannot fully-encompass the complex organizational phenomenon that is the governance of OSS projects. When attempting to interpret such a project, "it is always wise to maintain a sense that things could have been otherwise" [62, p. 124]. A single case study of "successful" OSS project governance should be counterbalanced by future cases rather considered as "unsuccessful", using a wider multiple case study approach for comparative purposes. And this should include alternative theoretical interpretations on the extent to which the distinctive features of OSS (as opposed to proprietary software) require distinct IT governance policies and practices [24].

This study has demonstrated that OSS principles effectively "hold a great potential for addressing several of the most critical problems in health care IT [...], to create health IT systems that are able to evolve over time as medical knowledge, technologies, insights, workflows etc. continuously change [..., and] to provide up-to-date systems for an acceptable cost/value ratio" [63, p.1]. We hope that the details provided in this case study will allow hospital managers to compare their own experiences and gain practical knowledge. Moreover, the "thick description" [64] of our case has enabled us to not only explain what we have observed at Capital Hospital, but may also encourage other researchers to further scrutinize this important yet relatively new phenomenon.

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