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## An Organizational Culture-Based Theory of Clinical Information Systems Implementation in Hospitals\*

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### Abstract

*We propose an organizational culture-based explanation of the level of difficulty of clinical information system (CIS) implementation and of the practices that can contribute to reduce the level of difficulty of this process. Adopting an analytic induction approach, we developed initial theoretical propositions based on a three-perspective conceptualization of organizational culture: integration, differentiation, and fragmentation. Using data from three cases of CIS implementation, we first performed a deductive analysis to test our propositions on the relationships between culture, CIS characteristics, implementation practices, and the level of implementation difficulty. Then, applying an inductive analysis strategy, we re-analyzed the data and developed new propositions. Our analysis shows that four values play a central role in CIS implementation. Two values, quality of care and efficiency of clinical practices, are key from an integration perspective; two others, professional status/autonomy and medical dominance, are paramount from a differentiation perspective. A fragmentation perspective analysis reveals that hospital users sometimes have ambiguous interpretations of some CIS characteristics and/or implementation practices in terms of their consistency with these four values. Overall, the proposed theory provides a rich explanation of the relationships between CIS characteristics, implementation practices, user values, and the level of difficulty of the implementation process.*

**Keywords:** *Organizational culture; clinical information system implementation; implementation outcomes; theory development; implementation difficulty*

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## 1. Introduction

The potential benefits of clinical information systems (CIS), such as physician order entry systems and electronic health records, are widely recognized. Research has shown that CIS use can translate into positive outcomes, including fewer medication errors (Berger & Kichak, 2004), financial gains (Thouin et al., 2008), better quality of care (Øvretveit et al., 2007), improved performance (Kilbridge & Classen, 2008) and greater safety (Bates & Gawade, 2003).

Seeking benefits of this nature, OECD (Organisation for Economic Co-operation and Development) countries have been investing heavily in health information technology, including CISs (Anderson et al., 2006). It has been suggested, however, that most healthcare IS implementations have been failures (Avison & Young, 2007). A literature review reveals numerous studies that address this issue, focusing on factors deemed to be conducive to either the failure or success of CIS implementation. Some of the failure factors are technical – e.g., poor system quality (Poon et al., 2004) – while others are organizational – e.g., healthcare professionals' negative attitudes toward CISs (Callen et al., 2007). Success factors belong to the same two categories. Technical factors include: employing a system design that fits the nature of work (Ash et al., 2003) or augments physicians' judgment rather than replaces it (Garibaldi, 1998), feature functionality (Doolin, 2004), user friendliness (Ludwick & Doucette, 2009), and flexibility (Ash et al., 2004). Organizational factors include: leadership and champion identification (Garfield et al., 2004), clinician involvement (Doolan et al., 2003), physician empowerment (Ahmad et al., 2002), and ongoing user support (Ash et al., 2003).

Notwithstanding the importance of the above factors, some authors strongly emphasize that the role of organizational culture is paramount in explaining successes and failures in CIS implementation (Friedman, 1999; Kaplan, 2000). For instance, Friedman (1999, p.795) argues that, in the health care domain, "in order to be successful, [CIS implementers] must become part-time anthropologists, immersing themselves in the varied workplaces of their constituents to understand the work they do and the cultures that have grown up around this work." In addition, Chiasson and Davidson (2004, p.157) depict the healthcare milieu as "a markedly different social and technical context compared with many of the industries where IS research is conducted, and IS theory developed," and Reddy and Spence (2008) describe hospitals as richer in details than most settings.

Espousing these views, our study proposes a substantive theory – a theory developed for a particular area of inquiry (Gregor, 2006) – to provide an organizational culture-based explanation of the level of difficulty of a CIS implementation and of the implementation practices that can help reduce the level of difficulty of this process. Our theoretical explanation focuses on the CIS implementation process and its level of difficulty for two key reasons. First, literature reviews on the role of culture in IS endeavors strongly suggest that a cultural lens is most relevant for explaining events that occur during an IS implementation process, such as conflict among actors (Leidner & Kayworth, 2006) and user resistance (Kappos & Rivard, 2008). Second, research has shown that the difficulties encountered during an IS project have a direct impact on the project outcome, including user satisfaction with the process, system quality, and adherence to the budget, schedule and specifications (Barki & Hartwick, 2001; Wallace et al., 2004).

To build our theory, we adopted an analytic induction approach (Patton, 2002). Analytic induction begins deductively with the formulation of propositions and examines cases in depth to determine whether the case data support the propositions. This is followed by inductive analysis, during which the researcher remains "open to discovering concepts and hypotheses not accounted for in the original formulations" (Patton, 2002, p.494). In this study, the development of the initial propositions has a multidisciplinary grounding, as it draws from the IS implementation and the health informatics domains. These propositions are then framed within a multilevel conceptualization of organizational culture developed in the organizational behavior domain (Martin, 1992; 2002), yet widely recognized in the healthcare management literature (Braithwaite et al., 2005; Morgan & Ogbonna, 2008). After developing initial propositions, we analyzed the data from three cases of CIS implementation in hospitals to determine the extent of support for our initial propositions. Then, following an inductive

analysis strategy, we re-analyzed the case material to uncover additional theoretical insights, from which we developed new propositions.

## 2. Culture Defined

Culture refers to how members of a collective interpret, that is, make sense of, events and situations in their environment (Schein, 2004). Culture is reflected in manifestations, which are either material or ideational. Material manifestations are tangible; they include practices (Sackmann, 1992) (e.g., job descriptions, social norms of behaviors) and artifacts (Martin, 2002) (e.g., rituals, physical arrangements). Ideational manifestations are either cognitive (e.g., beliefs and tacit assumptions) or attitudinal (e.g., values) (Martin, 2002). Scholars have studied organizational culture from three main perspectives: integration (Sathe, 1985; Schein, 2004), differentiation (Smircich, 1983; Alveson, 2002), and fragmentation (Frost et al., 1991). These perspectives differ in terms of the degree of consensus assumed among the members of a collective in their interpretations of manifestations, the degree of consistency in the relationships among manifestations, and the clarity of the interpretations (Martin, 1992; 2002).

The integration perspective defines culture as the set of basic assumptions (Schein, 2004) or the system of value symbols and meanings – including their embodiment in objects and practices – that are shared by the members of a collective (Davies et al., 2000). In this perspective, patterns of meaning reflect clear interpretations of manifestations, consensus among the members of the collective in their interpretations, and consistency among the manifestations (Martin, 2002).

The differentiation perspective presupposes that within any collective there exist manifestations that are clearly interpreted only within subgroups of the collective and for which a consensus on the interpretations occurs only within the subgroups, which are organizational subcultures (Jermier et al., 1991). Although subcultures may interact in harmony, inconsistent interpretations across subgroups may lead to conflict. Indeed, rivalry and competition between subgroups may be the key feature of an organization's culture (Davies et al., 2000).

The fragmentation perspective posits that some manifestations are met with multiple interpretations, which do not depend on the subgroups to which the members of a collective belong and for which consensus – if it exists – is issue-based (Martin, 1992; 2002). From this perspective, members of a collective “do not agree on clear boundaries, cannot identify shared solutions, and do not reconcile contradictory beliefs and multiple identities” (Meyerson, 1991, p.131). Notwithstanding ambiguity in interpretations, the members of these collectives assert that they belong to the same culture (Meyerson, 1991).

Researchers have traditionally adopted a single perspective to study organizational culture (Kappos & Rivard, 2008; Morgan & Ogbonna, 2008). Commenting on the organizational behavior field, Morgan and Ogbonna (2008) observe that although all three perspectives have been used to study organizations, researchers generally adopt single perspectives in their conceptualizations of culture, with the integration perspective being most often used. A similar observation can be made on research pertaining to culture in an IS context. For instance, only eight of the 56 studies on culture and IS development and use reviewed by Kappos and Rivard (2008) had adopted two perspectives (integration and differentiation), and only one study (Dubé & Robey, 1999) had adopted all three perspectives. The integration perspective is the conceptualization of culture that is the most generally adopted by IS researchers, followed by the differentiation perspective. Indeed, only two of the 56 studies reviewed by Kappos and Rivard (2008) used a fragmentation perspective (Dubé & Robey, 1999; Nicholson & Sahay, 2001).

It has been suggested that using a single conceptualization illuminates one aspect of culture while obscuring others (Morgan & Ogbonna, 2008). In the present study, we adopt Martin's three-perspective theory of culture, which acknowledges that the culture of a collective “should be viewed from all three theoretical perspectives, not sequentially, but simultaneously” (Martin, 2002, p.120). The relevance of this conceptualization has been recognized in IS research (Dubé & Robey, 1999;

Kappos & Rivard, 2008). Similarly, scholars of the healthcare domain have acknowledged the value of Martin's three-perspective theory when studying hospital settings (Davies et al., 2000; Braithwaite et al., 2005; Morgan & Ogbonna, 2008). First, since most actors in a hospital (administrators, physicians, professionals, or nurses) reach a consensus on some values (such as quality of care), an integration perspective is appropriate for studying hospitals. Second, since hospitals are often depicted as "notoriously tribal" and are portrayed as settings where "rivalry and competition" are key features of the culture – with conflicts often seen as a clash of subcultures (Kaplan, 2000) – the differentiation perspective is also deemed a useful lens. Third, since the actors in a hospital often belong to more than one subgroup at any given point in time – a profession within a specialty, with or without managerial responsibilities – their interpretations of some events may at times be ambiguous. Indeed, in some circumstances consensus in interpretations will be reached on the basis of an issue, not on the basis of which hospital subgroup a person belongs to (Morgan & Ogbonna, 2008).

### 3. Theoretical Propositions on CIS Implementation and Organizational Culture

The development of a theoretical model begins with identifying critical concepts in the phenomenon of interest and drawing the model's boundary (Dubin, 1978). The focal concept of our model is the level of difficulty of a CIS implementation, meaning whether the CIS implementation is smooth or fraught with problems. Although an ex-post assessment of the overall level of difficulty of a CIS implementation is deemed feasible and at times useful in terms of the post-implementation evaluation, our conceptualization of the level of difficulty refers to how trying the implementation process is at any point in time over the course of the implementation. Because our theory aims to provide cultural explanations as antecedents of the level of difficulty of a CIS implementation process, we draw the model's boundary around this type of explanation. This means that although we acknowledge that a number of factors such as technological newness, project team expertise, and project size may also influence the level of difficulty of the CIS implementation process, these explanations are outside the boundary of our model.

Among all cultural manifestations, values are said to be "particularly useful in explaining certain behaviors with respect to how social groups interact with and apply IT in organizational contexts" (Leidner & Kayworth, 2006, p.359). Moreover, taking values into account has been found to be particularly useful for explaining user reactions to technological innovations in hospital settings. For instance, when studying technology adoption in hospitals in the early 20th century, Howell (1995) emphasizes the cultural nature of this type of choice, and posits that physicians' adoption of a technology depends on the degree to which the technology fits the set of values in medical practice. Similarly, Massaro (2005) suggests that a CIS that threatens the values of a medical center can be perceived as a "cultural assault." For this reason, our theoretical model focuses on values as the subset of cultural manifestations of interest to explain the level of difficulty of CIS implementation.

Two other key components are the CIS artifact, itself, and the implementation practices employed. As an artifact, a CIS is a system of computer hardware and software whose basic functions are to record and display medical information (Ward et al., 2004). More precisely, CISs are embodied in information technology to support the work of physicians and nurses in order to improve patient safety, quality of care, and organizational efficiency (Hübner et al., 2010). Fundamental functionalities of CISs are those of EMRs (Electronic Medical Records) and allow getting patient data (such as vital signs, laboratory data, radiology, patient care notes) from a variety of sources and incorporating these data into a format that is readily accessible and well organized (Bates et al., 2003; Miller & Sim, 2004). CISs usually incorporate additional functionalities like alarms, decision support, advanced graphic data presentation, and best practices guidelines that can further aid in patient care (Ward et al., 2004). Because CISs directly support the actual practices of clinicians within a hospital, they need to fit work processes (Littlejohns et al., 2003; Aarts et al., 2004; Ludwick & Doucette, 2009).

Implementation practices, defined as project management practices, include formal planning and control practices (e.g., module implementation scheduling and reliance on plans), project team management practices (e.g., team structure), and user participation (Barki et al., 2001).

Implementation practices can be enacted by actors who are from the same organization as the users or by actors from another collective – for instance, when the actors are hired consultants or are from another part of the organization.

In IS cultured-based research, some authors focus on the values embedded in the IS artifact, so they “refer to the values that are assumed in the work behaviors that the IT is designed to enable” (Leidner & Kayworth, 2006, p.374). Our theoretical model adopts a slightly different view, under which a given IT can carry different meanings in different cultural settings (Robey & Rodriguez-Diaz, 1989). In the context of technology adoption in a hospital setting, this means that “technology does not arrive at the bedside with its meaning already determined” (Howell, 1995, p.229), but that actors make choices “about what technology means, what it does, and how it should fit within [their] larger system of action and belief” (Howell, 1995, p.229). A similar reasoning applies to implementation practices, which are defined here as the subset of project management practices that enter the realm of users.

Our model focuses on the interpretations that users will make of the CIS characteristics and of the implementation practices within their value set. These user interpretations, which will be clear or ambiguous, consistent or inconsistent with the actors' values, and shared among all the actors of the collective or within subgroups only, will ultimately result in behaviors. In an IS implementation context, these behaviors may reflect acceptance or resistance (Kappos & Rivard, 2008) or conflict among actors (Leidner & Kayworth, 2006; Kappos & Rivard, 2008) and will hinder or facilitate the implementation process: that is, raise or lower its level of difficulty. This focus on user interpretations and behaviors implies that the implementers' interpretations are outside the boundary of the model.

We developed preliminary theoretical propositions on the basis of extant CIS and IS culture-based research and Martin's three-perspective conceptualization of culture. Adopting an integration perspective helps explain both increases and decreases in the level of difficulty of CIS implementation. Indeed, from a review of the literature on culture and IS development and use, Kappos and Rivard (2008) report that a consensus among users on the characteristics of an IS can at times lead users to accept it – which facilitates the implementation – while at other times it leads them to enact resistance behaviors – which hinders the implementation. Similarly, Leidner and Kayworth (2006) suggest that “when a specific system is seen to conflict with the values held by members of a group, the group will resist adopting the new system as long as possible” (Leidner & Kayworth, 2006, p.376) and that they will tend to accept it when the values of the system are aligned with their own values. This is supported by Romm et al., (1991), who found that similarities between the cultural assumptions embedded in an IS and those of the users facilitate acceptance. Conversely, they found that resistance often follows the implementation of an IS that embeds cultural assumptions that differ from those the users share.

A similar pattern can be expected in terms of implementation practices. For instance, Robey and Rodriguez-Dias (1989) studied a situation in which negative reactions of a user community where an IS was implemented were associated with implementation practices (e.g., users did not participate and system manuals were in a language that the users did not speak) that users interpreted as inconsistent with their values. Conversely, they observed another situation where implementation practices were consistent with user values, which facilitated the implementation. Hence, the following propositions:

- P1:** *When some characteristics of a CIS or some implementation practices are consistent with values upon which all users reach a consensus, the implementation process is facilitated.*
- P2:** *When some characteristics of a CIS or some implementation practices are inconsistent with values upon which all users reach a consensus, the implementation process is hindered.*

It has been suggested that when users interpret some of the system characteristics as inconsistent with their values, it is possible to alter the IS design to make its characteristics more consistent with



users' values (Romm et al., 1991). We contend that the same reasoning applies to implementation practices. Thus:

**P3:** *When the implementation process is hindered because some CIS characteristics or some implementation practices are inconsistent with values upon which all users reach a consensus, changes to CIS characteristics or implementation practices can render them consistent. This facilitates the implementation process.*

Adopting a differentiation perspective acknowledges that subcultures exist within a hospital. For instance, a study of the implementation of new clinical governance practices in a hospital revealed that physicians and nurses had different interpretations of the new practices and of how they were implemented (Morgan & Ogbonna, 2008). In this case, physicians "united in their dismay over the lack of consultation, as well as their concern regarding the direction of the new initiatives" (Morgan & Ogbonna, 2008, p.51). In contrast, the nurses interpreted the new practices positively in view of their own values, and "suggested that clinical governance [...] has heralded a new era of empowerment" (p.52). This suggests that different user groups in a hospital may have different interpretations of either the characteristics of a CIS or the implementation practices – or both. The IS literature provides some evidence of different interpretations of system characteristics across user groups. For instance, Von Meier (1999) found that actors from two occupational groups (engineers and operators) interpreted the same technological innovation differently, which sometimes resulted in conflict between the groups. We extend this observation to implementation practices and propose the following:

**P4:** *When some characteristics of a CIS or some implementation practices are consistent with some user groups' values and inconsistent with other user groups' values, the implementation process is hindered.*

In their review of the literature, Kappos and Rivard (2008) found that when some development practices were consistent with some groups of developers' values and inconsistent with other groups of developers' values, project management practices could be used to help avoid conflicts between the groups. They give the example of Tellioglu and Wagner (1999), who suggested that respecting boundaries across groups of developers (by organizing project activities that keep interactions among subgroups of developers to a minimum) can help alleviate conflicts. Although the literature does not provide evidence for situations involving user groups only, we propose that in such situations, modifying CIS characteristics or implementation practices can resolve conflicts and create harmony between subgroups. Thus:

**P5:** *When the implementation process is hindered because some CIS characteristics or some implementation practices are consistent with some user groups' values and inconsistent with other user groups' values, changes to the CIS characteristics or to the implementation practices can create harmony between the subgroups. This facilitates the implementation process.*

When they adopt a fragmentation perspective, researchers acknowledge the multiplicity of interpretations that the actors of a collective can make of an object or an event. It has been suggested that the closer researchers get to the collective under study, "the more socially complex and multi-variate ... the populations" appear (Braithwaite et al., 2005, p. 1160). For this reason and because the extant literature does not provide an appropriate basis for developing fragmentation-based propositions, we do not offer such propositions here. Rather, we will use the inductive phase of our study to analyze our cases from this perspective and, from this, develop propositions.

In addition to paying heed to all three perspectives, Martin calls for acknowledging perspective interplay, which posits that the perspectives should not be considered alternate views, but rather as complementary lenses. In their model of culture and IS implementation, which is based on Martin's conceptualization of culture, Kappos and Rivard (2008) suggest three areas of perspective interplay: level of analysis, time, and system characteristics. Two of these areas – time and system

characteristics – are particularly useful for studying CIS implementation (because our theoretical development focuses on the organizational level, we will not consider the level of analysis as an area of perspective interplay). Time plays a role in perspective interplay, inasmuch as a given perspective may be salient or latent at a particular time, depending on events. System characteristics also play a role in perspective interplay. Indeed, some characteristics may be consistent with a value on which consensus exists within a collective, while others may be consistent with one subgroup’s values and inconsistent with another subgroup’s values, or may even be ambiguously interpreted by the members of the collective. We will use the inductive portion of our study to explore perspective interplay during CIS implementation.

#### 4. Methodology

Our analytic induction approach was based on a multiple-case design. We selected the cases to ensure some level of control and replicability (Dubé & Paré, 2003). We used a literal and theoretical replication strategy to identify consistent patterns and to uncover new and/or divergent themes. The three sites were similar (three healthcare organizations, three CIS implementation projects involving the same types of actors) but varied in terms of hospital type (teaching or community), system (two different CISs), and outcomes (success vs. failure).

We conducted the interviews following a snowball sampling procedure (Patton, 2002). We interviewed 43 people – including physicians, nurses, and administrators (Table 1) – who were the major stakeholders in their respective projects. In each case, the first respondent was a person identified as a key actor in the project. Each interviewee was asked to suggest other respondents who could provide critical information about the implementation and/or were identified as favorable or antagonistic to the system. To ensure an unbiased account of events, we met with all the actors identified, sometimes after relentlessly contacting them to obtain an interview. When no new actor was identified and no new information was revealed during interviews (point of redundancy), we terminated data collection. Each interview lasted approximately one hour and elicited narratives from the respondents of the CIS implementation in their hospital, from software selection to project completion or abandonment. We used project documentation and observation notes as a means of triangulation.

Case	Physicians	Nurses	Administrators
Case 1	7	4	5
Case 2	4	4	5
Case 3	4	6	4

The unit of analysis was the project, with different phases of the implementation acting as sub-units of analysis. The phases correspond to key events – software selection, early implementation, and continued implementation – in each case. The CIS selected was the same in Case 1 and Case 2 but not in Case 3. Both CISs had been developed to support the care process and facilitate clinical work. Both systems were providing the information infrastructure needed to coordinate care and made available patient records from different locations. The modules available in both CISs were: EHRs (electronic health records), CPOEs (Computerized Physician Order Entry), ATD (admission, transfer, discharge), scheduling, test prescription (laboratory and radiology), care plans, clinical notes, pharmacy services, and decision support tools.

The data were collected as part of a larger research program on CIS implementation (Lapointe & Rivard, 2005, 2007). Data collection included semi-structured interviews that began with a generic question, inviting respondents to share their experience of the implementation, and continued with more specific questions that allowed comparisons between the cases. The several hundred pages of transcripts that resulted were rich and diverse and are deemed appropriate for studying the relationships between culture and CIS implementation. We used QSR NVivo to code the data. We

first created categories of user types, CIS characteristics, implementation practices, values, users' reactions and their effect on the level of difficulty of the implementation. Then, we coded each transcript. The resulting set of categories and codes is listed in Table 2.

<b>Table 2. Categories and Codes</b>	
<b>Category</b>	<b>Codes</b>
Actors	Nurses, physicians, pharmacists, administrators
CIS characteristics	Centralization of data, standardization of processes, accessibility, user roles and privileges, user interface, quality
Implementation practices	User participation, user training and support, communication, management of change requests, project control, planning, top management support, project structure
Values	Quality of care, efficiency of clinical practices, medical dominance, professional autonomy
Users' reactions	Acceptance, resistance, conflict
Effect on CIS implementation process	Facilitated, hindered

As per the analytic induction process, we analyzed data in several iterations, both within-case and across the cases. We conducted our within-case analyses in two stages. First, following a deductive approach, we analyzed the data to determine whether they supported our initial propositions. This included the assessment of the degree of consensus among actors in their interpretations and of the degree of consistency between the actors' interpretations of CIS characteristics and/or implementation practices with their values. Second, following an inductive analysis strategy, we revisited the case data to unearth additional theoretical insights: (a) by adopting a fragmentation perspective and (b) by focusing on the degree of saliency of each perspective and on perspective interplay. We then conducted a cross-case analysis, investigating similarities and differences between the cases: first, in terms of support for the propositions or the lack thereof and, second, in terms of the new insights gained during our inductive analysis. From this we derived new propositions that constitute the basis of our theory.

## 5. Results from the Within-Case Analysis

For each case, our within-case analysis describes the software selection, initial implementation and continued implementation, and presents our deductive and inductive analyses.

### 5.1. Case 1. Implementation of Alpha in a New Community Hospital

Located in the suburb of a large Canadian city, Case 1 was a new community hospital of some 250 beds. This hospital was primarily oriented toward short-term care and short-stay surgery. It offered general care and services from numerous specialties: medicine, surgery, psychiatry, pediatrics, geriatrics, intensive care, oncology, and mother-child care. Nurses were hospital employees who received a salary. Physicians were small for-profit independent businesses who were associated with the hospital. They billed the provincial insurance plan on a fee-for-service basis.

Early on, a CIS was deemed instrumental in realizing the vision of a paperless hospital. Even before they joined the hospital, the physicians, nurses, and other health professionals were informed of the CIS implementation. When the hospital opened, however, the system was not yet operational and a paper-based system was initially used. Motivation for using a CIS nevertheless remained high, and people contemplated the inefficiencies that would be overcome through its use.

#### **Phase 1. Software selection**

A search committee selected Alpha, a CIS developed and distributed by a large healthcare



information solutions provider. Though the platform was developed centrally, the database was to be tailored locally. Indeed, despite the turnkey nature of the system, it was to be adapted to the specific needs of Case 1. Alpha included both electronic healthcare record components and clinical aids features. A number of physicians and nurses visited a site in California where Alpha was in operation; all confirmed their approval of the system.

### **Phase 2. Initial implementation**

Functionalities related to patient admission, radiology, laboratory, and requests-and-results were implemented first. Nurses and physicians were trained, and support was made available to help solve problems and clarify issues involving system use. Several nurses saw the CIS as a means for eliminating paperwork. The physicians saw the patient information retrieval functions as a benefit, especially the ability to access the information at any time from remote locations. Some nurses and physicians – mainly people unfamiliar with IT – found the CIS difficult to learn and use.

### **Phase 3. Continued Implementation**

Phase 3 marked the full implementation of the nursing notes module, which included patient diets and vital signs as well as the documentation of all nursing care activities. A particular feature was not well received by physicians. This hospital had a long-established practice whereby physicians dictated test and treatment prescriptions to nurses, who actually wrote them down. The CIS was designed in such a manner that only the physicians could enter prescriptions. Numerous physicians refused to comply and wanted to continue dictating prescriptions to nurses. The nurses, however, appreciated this feature and did not want to return to the previous practices. Conflicts emerged between the two groups. The administrators took the side of the nurses and tried to impose use on the physicians. As a result, all the physicians (including those who were using the CIS) signed a petition to have it removed. Ultimately, the nursing notes module was removed; only functionalities related to patient admission, radiology, laboratory, and requests-and-results were kept.

#### **5.1.1. Deductive Analysis**

The data from Case 1 provide support for three propositions (P1, P2, and P4). As explained below, propositions P3 and P5 were not relevant in this case. Table 3 synthesizes the case analysis.

**P1:** When some characteristics of a CIS or some implementation practices are consistent with values upon which all users reach a consensus, the implementation process is facilitated.

The administrators formed an interdisciplinary committee, consisting of representatives of the physicians, the nurses, and other healthcare professionals, to evaluate the systems available on the market. This committee chose Alpha as the system best suited to the hospital's needs.

*Employees and physicians selected the system in a positive group process. People went to a center in California that already had the system, they saw it in operation, and they gave their approval (...) Everyone was in agreement... Administrator 7*

Initially, nurses and physicians interpreted Alpha's key characteristics (paperless CIS with online data entry and retrieval) as consistent with efficient clinical practices and quality care.

*There was a system that was known as the best (...) Best in terms of its integrity and how easy it was to integrate all our data. Administrator 2*

The users' reactions reflected their acceptance, which facilitated the implementation process:

*Everyone was in full agreement that we should go ahead with an innovative system like that; everyone, including the physicians, nurses and administrators. Everyone was on the same wavelength. Administrator 8*

This supports P1, both in terms of CIS characteristics and implementation practices.

**P2:** When some characteristics of a CIS or some implementation practices are inconsistent with values upon which all users reach a consensus, the implementation process is hindered.

In Phase 2, when the system was introduced, a common complaint concerned the response time that was considered too long and even unacceptable, particularly at peak periods.

*In the beginning (...) the response time was very long. Before, when I wanted to prescribe a patient blood count, I'd write PBC and sign my name and that's that. Now, I asked for a blood count and the computer would freeze up for I don't know how many seconds.*  
Physician 14

*At the start there were complaints about the speed, because when everyone got on it at the same time, it was slow (...) so the system was slow, and it was more complicated.*  
Nurse 5

This provides support for P2, as it shows how all users considered a characteristic of the system inconsistent with efficient clinical practices. It generated dissatisfaction, even some resistance, with some users complaining and others threatening to stop using the system. This hindered the implementation process.

**P3:** When the implementation process is hindered because some CIS characteristics or some implementation practices are inconsistent with values upon which all users reach a consensus, changes to CIS characteristics or implementation practices can render them consistent. This facilitates the implementation process.

Case 1 provides no instance of changes made to some CIS characteristics or implementation practices employed by the implementers to render them consistent with users' values.

**P4:** When some characteristics of a CIS or some implementation practices are consistent with some user groups' values and inconsistent with other user groups' values, the implementation process is hindered.

In Phase 2, the nurses interpreted the early implementation of the nursing notes as consistent with their value of professional status and autonomy. However, the physicians interpreted this implementation practice as inconsistent with their value of medical dominance. They would have preferred a module that would be helpful to them, as opposed to the nursing notes, which they saw as beneficial only to the nurses.

*The nurses didn't see the problems at first, all the problems that the system could create for the doctors, and when the doctors asked that it be withdrawn, they didn't understand why, since the system was good for them. We understood why it was a good thing, why it wasn't all that bad. Their working hours hadn't changed; they still worked from 8 to 4, but that wasn't true for us. So they thought the system was good, and they weren't alone. But for us, this wasn't the case.* Physician 3

This translated into nurses' support and physicians' resistance.

*There was like a gulf between the two groups. The nurses wanted it, the doctors wanted it out. This created a power fight, that's how it played out. They were fighting with each other. "I want to keep it." "I want it out, and I'm the one who decides." "It's my profession, that's why I can do it." "It keeps me from doing my work." Administrator 8*

In Phase 3, the use of the nursing notes module was still the subject of poles-apart interpretations. One characteristic of the CIS, in terms of user roles and privileges, was that the physicians had to

enter test and treatment prescriptions themselves. Indeed, the hospital is located in a region where a government regulation states that only physicians have the authority to write test and treatment prescriptions. Yet just like in many other hospitals in the area, an informal practice had developed whereby physicians prescribed by giving verbal orders to nurses. Before system implementation, this practice was generally accepted by all, despite the inconsistency with government regulations. The physicians interpreted this system characteristic as inconsistent with the value of medical dominance. They resisted and insisted on continuing to give verbal orders to the nurses.

*When they introduced [nursing notes], when things really got out of hand, you couldn't tell a nurse, "Take off his band-aid" without her telling you to enter it in the system. Physician 4*

The nurses interpreted this feature as being consistent with their professional status and autonomy, allowing them to do their own professional work and not to act as clerks for the physicians.

*The important thing was that they wouldn't have to type. (...) For them, it was like playing secretary. (...) They said, 'We aren't secretaries. Get the nurses to do their work.' But nurses aren't secretaries, either. Nurse 11*

The differing interpretations resulted in acceptance from the nurses, resistance from the physicians and conflict between the two groups.

*It was getting to be a bit like the Hatfields and the McCoys. Nurse 5*

*There was a lot of tension created between the nurses and the doctors, and it took a long time before that settled down, because it was a war, a cold war. Physician 6*

Reacting to the physicians' resistance, the administrators took the side of the nurses. The interpretation that each group made of this implementation practice crystallized the nurses' acceptance and physicians' resistance to the CIS and resulted in a new level of conflict between the two groups, thus hindering the implementation process even further.

*It was, I would say, not unavoidable, because it was avoidable, but it became a major conflict between the nurses and the physicians, because management had become the element that sustained and even contributed to the confrontation between nurses and doctors. Administrator 8*

This provides support for P4, as it shows how different interpretations of some implementation practices and CIS characteristics hindered the implementation process.

**P5:** When the implementation process is hindered because some CIS characteristics or some implementation practices are consistent with some user groups' values and inconsistent with other user groups' values, changes to the CIS characteristics or to the implementation practices can create harmony between the subgroups. This facilitates the implementation process.

Case 1 does not provide evidence of attempts to change some CIS characteristics or of implementation practices employed to create harmony between groups.

**Table 3. Analysis Case 1**

	Phase 1 - Selection	Phase 2 - Initial Implementation	Phase 3 - Continued Implementation
CIS, practices and values	<p><b>P1 - Integration</b>  <b>CIS:</b> Integrated, paperless system and online data entry and retrieval  <b>Practice:</b> Form an interdisciplinary selection committee  <b>Values:</b> Efficiency of clinical practices and quality of care</p>	<p><b>P2 - Integration</b>  <b>CIS:</b> Slow response time  <b>Value:</b> Efficiency of clinical practices</p> <p><b>P4 - Differentiation</b>  <b>Practice:</b> Order of module implementation  <b>Values:</b> Medical dominance and nurses' professional status and autonomy</p> <p><b>Inductive analysis - Fragmentation</b>  <b>CIS:</b> Difficult to learn and use  <b>Value:</b> Efficiency of clinical practices</p>	<p><b>P4 - Differentiation</b>  <b>CIS:</b> Physicians obliged to enter prescriptions  <b>Value:</b> Medical dominance and nurses' professional status and autonomy</p> <p><b>P4 - Differentiation</b>  <b>Practices:</b> Administration takes the side of nurses in reaction to physicians' resistance  <b>Value:</b> Medical dominance and nurses' professional status and autonomy</p>
Interpretations	<p><b>P1 - Integration:</b>                      Some characteristics of the CIS and some implementation practices interpreted as consistent with values</p>	<p><b>P2 - Integration:</b> Some characteristics of the CIS interpreted as inconsistent with values</p> <p><b>P4 - Differentiation:</b> Order of module implementation interpreted as consistent with nurses' professional status and inconsistent with physicians' medical dominance</p> <p><b>Inductive analysis - Fragmentation</b>                      Some nurses and physicians were ambiguous when interpreting the costs/benefits of learning and using the CIS in terms of efficient clinical practices</p>	<p><b>P4 - Differentiation:</b> Some characteristics of the CIS interpreted as consistent with nurses' professional status and inconsistent with physicians' medical dominance</p> <p><b>P4 - Differentiation:</b> Some implementation practices interpreted as consistent with nurses' professional status and inconsistent with physicians' medical dominance</p>
Actions/ Reactions	<p><b>P1 - Integration:</b>                      Physicians and nurses support the selection of Alpha</p>	<p><b>P2 - Integration:</b> Widespread dissatisfaction that hindered the implementation process</p> <p><b>P4 - Differentiation:</b> Nurses supported the implementation and physicians resisted, which hindered the implementation process</p> <p><b>Inductive analysis - Fragmentation</b>                      Some complained about the system while others were more positive, which created additional challenges for implementers</p>	<p><b>P4 - Differentiation:</b> Nurses support the implementation and physicians resist; conflicts emerge; implementation process is hindered</p> <p><b>P4 - Differentiation:</b> Nurses support the implementation and physicians resist; implementation process is hindered further</p>
Salient	<p>INTEGRATION</p>		
Latent	<p>DIFFERENTIATION FRAGMENTATION</p>		

### 5.1.2. Inductive Analysis

The fragmentation perspective reveals that although all users shared the value of efficient clinical practices, some interpreted the difficulty to use the CIS as consistent with this value while others interpreted it as inconsistent. In terms of perspective interplay, the data illustrate that the saliency of a given perspective may vary during the implementation.

#### 5.1.2.1. Fragmentation perspective

Early in Phase 2, despite the fact that users interpreted some CIS characteristics clearly, they interpreted another characteristic – difficulty to learn and to use the system – in multiple ways, regardless of whether the users were nurses or physicians. Indeed, despite the promise of more efficient clinical practices, some users believed that the costs involved in becoming skilled at using the CIS or actually using it exceeded its benefits.

*It's because at the start – I'd say in the first month – it's clear, the thing is new, you'll start using anything; it's new. You don't like it because it gets a bit in the way of your usual way of doing things. Nurse 9*

*If you count the extra time for prescriptions and going to get the data, among other things, it added about two extra hours to each doctor's rounds. (...) from the time that it'll always be like that (...), well, it doesn't work. Physician 14*

Others were more positive toward the CIS and were willing to invest energy in learning and adapting to it.

*We tried to find ways to make it faster, so that we could save some time. That was the goal, to spend more time with patients. Nurse 5*

*Sitting down in front of a keyboard isn't something that disgusted me, I didn't hate it. I liked it. I saw it as something positive. Physician 6*

For the implementers, the users' mixed reactions created confusion, and it became more difficult to find the best means to resolve the situation.

#### 5.1.2.2. Perspective Interplay

Table 3 shows the results of our analysis by implementation phase. As illustrated at the bottom of Table 3, the integration perspective was salient in Phase 1, while the differentiation and fragmentation perspectives remained latent. Indeed, during this phase the characteristics of the CIS were consistent with quality health care and efficient clinical practices, and there was hospital-wide consensus on these goals. This does not mean that no-one in the hospital had qualms about the CIS, or that no-one felt that its implementation was incongruent with other values. However, there was a general consensus about the benefits associated with the CIS.

At the start of Phase 2, integration was still salient. However, with time, fragmentation and differentiation became salient, and integration became latent. Indeed, when the system was first implemented, the consensus about the value of a CIS was uncontested, even though users agreed that the response time was too slow. However, the time and effort required to learn and use the system (which people were beginning to experience) was interpreted ambiguously by some users in terms of the efficiency of clinical practices. Some reacted by shying away from using the CIS, while others were more positive about it. The nature of reactions did not depend on whether someone belonged to a given subgroup. This suggests that fragmentation had become a salient perspective. Later on, however, when the implementation practices were interpreted by the nurses as consistent with their values while the physicians interpreted them as inconsistent with their values, the reactions of each subgroup were clear: nurses supported the implementation and physicians resisted by complaining. Here, differentiation became salient and took precedence over fragmentation and over integration, which became latent.



Phase 3 was marked by the pre-eminence of differentiation, with a feature of the nursing notes – physicians being obliged to enter prescriptions – playing a critical role. This feature was inconsistent with medical dominance, while being consistent with the nurses' professional status and autonomy. The physicians resisted the CIS, and the nurses supported it. A conflict ensued. The administration took the side of the nurses, which was met with the same interpretations as those of the CIS features. The saliency of differentiation became such that it superseded fragmentation, which became latent. Indeed, whether or not they had been ambiguous in their earlier interpretations of the costs and benefits of the CIS, all the physicians now joined forces to resist it. The conflict became so intense that the nursing notes module had to be abandoned.

## 5.2 Case 2. Implementation of Alpha in a Teaching Hospital

Case 2 was a teaching hospital of approximately 300 beds, located in a Canadian university town. Its mission included care delivery, clinical training, research, and evaluation of technologies and modes of intervention in health. It offered specialized care, including a trauma unit as well as medical and surgical specialties: emergency, cardiology, neurology, internal medicine, blood-oncology, pneumology, nephrology, intensive care, neonatology, pediatric, geriatrics, obstetrics-gynecology, and psychiatry. Nurses were hospital employees. Physicians were small for-profit independent businesses who were associated with the hospital. They received a fee-for-service from the provincial government. They also got a salary from their affiliated university for their teaching and training activities.

A general belief held by most of the parties involved – administrators, nurses, and physicians – was that technological change is inevitable and, as a teaching hospital, they should try to innovate and implement an integrated CIS that would provide both greater efficiency and improved quality of care for patients, which led to the implementation of Alpha.

### **Phase 1. Selection of the system**

A multidisciplinary committee selected the system. The committee members made visits to a number of sites, after which they chose Alpha, the same software package that was bought and implemented in Case 1. The guiding principle was to obtain a system that would improve patient care while supporting research and teaching activities.

### **Phase 2. Initial implementation**

The admission module was implemented first, followed by requests for and results from radiology, pathology, and the laboratories. Most physicians and nurses appreciated Alpha's capacity to improve quality of care and support teaching and research, but some initially considered it complex and time consuming. The administrators ensured that support would be provided to all. While the implementation began with modules that first met the needs of the physicians, these modules were also useful to the nurses.

### **Phase 3. Continued implementation**

Although the implementation was proceeding relatively smoothly, physicians and nurses eventually started complaining about the response time. The administration worked on upgrading Alpha so that it would be acceptable to all. The hospital, however, hit a stumbling block in its implementation of the pharmacy module. Indeed, prescribing drugs with the CIS was considered cumbersome and potentially dangerous for patients. Given a general sentiment that the pharmacy module was unusable, the administrators removed it and stated that they would reintroduce the module only when it was fixed. All the actors were satisfied with this solution, and they continued to use the Alpha system.

#### **5.2.1. Deductive Analysis**

The data from Case 2 provide support for all our propositions. Table 4 synthesizes the analysis.

**P1:** When some characteristics of a CIS or some implementation practices are consistent with values upon which all users reach a consensus, the implementation process is facilitated.

The hospital administrators formed, and participated in, a multidisciplinary selection committee that

included physicians, nurses, and other health professionals. The committee reviewed existing systems to learn what was available on the market. Committee members first considered three different CISs; after further analysis, they chose Alpha.

*It was a multidisciplinary group that chose the system (...) one that included the general manager, researchers, doctors, nurses, and other professionals. Administrator 10*

During Phase 1, some of Alpha's characteristics, such as data integration, easy storage/retrieval features, and embedded best practices, were perceived as consistent with the values of efficient clinical practices and quality care. Both the physicians and the nurses interpreted the CIS as providing an opportunity to revise and modernize their clinical practices and, ultimately, to improve the quality of the health care they provided.

*We chose the system accordingly. We didn't want to reproduce existing problems or computerize poor methods. We also wanted to take advantage of the implementation to improve our professional and medical operating procedures, to review all our patterns of practice. Administrator 12*

*On the other hand, in terms of computers, you can't be against it when it helps you do better. You know it's coming, and, for the Centre, it's always been important to innovate in many different ways. Nurse 5*

Given that the system was interpreted as consistent with their values, the users readily accepted it, which facilitated the implementation process.

*My colleagues (...), they bought it, seeing the advantages in terms of improving the quality of care, teaching, and research. They bought it enthusiastically. Physician 11*

*The doctors, the nurses, everyone agreed. Everyone liked the system. Administrator 13*

In Phase 2, when the system was introduced, a team responsible for training and troubleshooting was available day and night to support users and ensure that clinical work could be performed efficiently. Physicians and nurses could contact the support team on beepers or cell phones.

*In other words, support was organized in a way that I thought was very sensitive to user needs. So there was what I considered an authentic client-centered approach. It wasn't just for show. This takes an enormous amount of energy. I don't know if you've noticed, but it's a very dedicated team. Nurse 2*

*That's what we tried to do because, since there are different types of users among the staff all over the place, what we tried to do was do it in such a manner that even the biggest moron would be comfortable and not slow down someone who has been doing the same thing for five years. Administrator 10*

Doctors and nurses were diligently using the CIS and believed that it was beneficial to their clinical work. For example, they felt that there were improvements in terms of confidentiality and efficiency.

*No-one refused to use the system. Nurse 4*

*In terms of avoiding unauthorized changes in patient records. Making a change in a patient's records requires a key and a password, and it's recorded. We discovered that people were sometimes making changes in patient records that were none of their business. We let them know that we knew it was happening. That was enough, as far as we know it disappeared. Administrator 12*

These data provide support for P1.

**P2:** When some characteristics of a CIS or some implementation practices are inconsistent with values upon which all users reach a consensus, the implementation process is hindered.

Two events provide evidence for P2. First, during Phase 2, both physicians and nurses complained about the response time, and claimed that the system was inconsistent with swift clinical practices.

*One day we had incredible problems with response time. You know, when at one point you need to download a list and it takes 5 or 10 minutes, well that just doesn't happen. I can wait like that at home while I'm making myself some coffee, but not while I'm taking care of a patient. Physician 9*

*The biggest problem we had, I think it was the slow system seeps we had at one point. (...) It was long. My colleagues said that it didn't make any sense; we were losing so much time. Nurse 2*

Second, when it was implemented in Phase 3, the pharmacy module was met by a consensus among physicians and nurses that it was cumbersome and even dangerous for patients. They saw its characteristics as inconsistent with the values of efficient clinical practices and quality care. The CIS required that physicians navigate through the system to prescribe each individual medication, which was deemed inefficient. Furthermore, the complexity of the drug prescription features increased the risks to patients, such as dangerous drug interactions; this was interpreted as inconsistent with the value of quality care.

*When you're in the system [pharmacy module]... it complicates the options (...) It becomes very difficult to make prescriptions. When I prescribe some tests, I can do them in one batch. I can say that I want such-and-such a test at such-and-such a time. I can't do that with the drugs. Physician 9*

*I used the pharmacy module to try to see what was usable. The module wasn't usable. We tried it in two units, and it didn't work. Nurse 6*

*The doctors consulted agreed that the system could even put patients' health or lives at risk. Administrator 10*

Not only did the pharmacy module not meet the operating standards, but it also exacerbated the response time problem. Nurses and physicians expressed their frustration; the residents even sent a letter to the administration, summoning the hospital to improve response time.

*Because the resistance went all the way to a petition sent to the Board of Directors. It took the position that if the problem wasn't resolved by such-and-such a date, the residents would refuse to use it. Administrator 12*

This provides support for P2.

**P3:** When the implementation process is hindered because some CIS characteristics or some implementation practices are inconsistent with values upon which all users reach a consensus, changes to CIS characteristics or implementation practices can render them consistent. This facilitates the implementation process.

When users complained about the CIS's poor response time, the administrators took action to upgrade the system.

*When we realized how high the level of frustration and dissatisfaction had become (...) we stepped in with timely improvements, even technical improvements for the response time. Administrator 10*

As a result, the performance of the CIS improved and users stopped complaining about it.

*That's where we took a position, and you have to admit that they had a point. We improved the system, and it turned out well. Administrator 12*

Moreover, given the general user consensus about the potential dangers inherent in the pharmacy module, the administration decided to remove it and to reintroduce it only when the problems had been fixed. This reduced user resistance.

*I must tell you that at one point even I thought of packing up the entire system and putting it in the basement. (...) Many of the doctors and nurses said, "No, don't do that. Find some solutions." Administrator 12*

This provides support for P3.

**P4:** When some characteristics of a CIS or some implementation practices are consistent with some user groups' values and inconsistent with other user groups' values, the implementation process is hindered.

During Phase 2, some of the implementers' practices (e.g., acknowledgement of medical power, asking the nurses to support the physicians, late introduction of the nursing notes) were interpreted as consistent with the physicians' value of medical dominance and inconsistent with the nurses' value of professional status and autonomy. This led to dissatisfaction and disagreements.

*Take the example of patient discharges. At the beginning, the doctors rarely entered discharges into the system; they continued to write them out on paper... So we ... refused to enter them. We called the doctor and said: prescribe the discharge in the system. Nurse 6*

*The nurses were no longer accepting verbal orders because they said, "Enter it into [Alpha]." We had to say: "Listen, I'm not near a terminal, I'm busy taking care of someone else: just take the verbal order." Physician 9*

These disagreements raised the level of difficulty of the implementation. These data support P4.

**P5:** When the implementation process is hindered because some CIS characteristics or some implementation practices are consistent with some user groups' values and inconsistent with other user groups' values, changes to the CIS characteristics or to the implementation practices can create harmony between the subgroups. This facilitates the implementation process.

In view of these disagreements, and in order to avoid further hindrance of the implementation process, the hospital administration used new practices (e.g., discussions among directors, weekly meetings with nurses to allow them to vent frustration).

*So we discussed it a lot and arrived at the conclusion that a group couldn't just act on their own, and if others remained behind, it was their fault. In other words, we didn't blame each other, it was clear that we needed to act together. Administrator 1*

*We have a CEO who is very sensitive to medical issues, without necessarily always taking their side. But he recognizes that, in a hospital, physicians represent the group of people that you have to deal with, the people who can play a decisive role in a project's success. We also have a DNS [director of nursing services] who is very comfortable working with medical colleagues. Administrator 10*

*I remember, I attended two-hour meetings every Thursday where nurses let off steam. The head nurses arrived and it was: Sheer nonsense, etc. We had 9 months of that, every Thursday at 11:00 – I'll never forget it. (...) Taking it all apart and talking openly with everyone. Taking their frustrations, letting it out, and living with it. It took 9 months. It was a lot of work, but we got through it. Administrator 13*

The changes created harmony between physicians and nurses; they all decided to focus on the primacy of quality care and efficient clinical practices, which facilitated the implementation.

*We don't do it for the doctors... But if we think that it's important for the patient, we'll do it. Nurse 6*

These data provide support for P5.

### **5.2.2. Inductive Analysis**

The fragmentation perspective reveals that when hospital users ambiguously interpret a system characteristic vis-à-vis efficient clinical practices, the implementation process is hindered. In terms of perspective interplay, the data suggest that a given perspective, in this case integration, may remain salient during the entire implementation process.

#### **5.2.2.1. Fragmentation perspective**

During early implementation – Phase 2 – ambiguous interpretations of the difficulty to learn and use the CIS were observed among both the physicians and nurses. Indeed, many saw the lack of user friendliness of the system as hindering the delivery of health care. Some nurses and some physicians questioned whether the system was consistent with the efficiency of their clinical practices, while others were more positive.

*There were people who found that it took a lot of time. Entering vital signs in a patient record doesn't take much time. Now we had to go into the computer, select the beneficiary, find the right menu. So it ended up taking a lot more time. (...) Nurse 2*

*I know shortcuts, but I know doctors who didn't know them, and they found that it really slowed them down in their work. Physician 9*

For the implementers, these mixed reactions can simultaneously facilitate and hinder the implementation process, as they create confusion around the actual interpretations of some characteristics of the system.

*The ones who didn't like it, they spoke out, in the sense of saying, of complaining. They didn't like it. Nurse 5*

*While most of us were using it, but there were some people who were systematically obstructive. They entered all kinds of things in [the CIS]. There's one doctor who, each time he asked for a test from Radiology, marked 'bullet wound' as the reason. Just to show that he was fed up, that he found it ridiculous to always be entering it like that. That's a bit how it was expressed. Physician 9*

#### **5.2.2.2. Perspective interplay**

Table 4 shows that the integration perspective was salient throughout the project, while the differentiation and fragmentation perspectives remained latent most of the time.



**Table 4. Analysis Case 2**

	Phase 1- Selection	Phase 2 - Initial Implementation	Phase 3 - Continued Implementation
<b>CIS, practices and values</b>	<p><b>P1 - Integration</b>  <b>CIS:</b> Integrated, embedded best practices, easy storage and retrieval of data  <b>Practice:</b> Create a multidisciplinary selection committee  <b>Value:</b> Efficiency of clinical practices and quality of care</p>	<p><b>P1 - Integration</b>  <b>CIS:</b> Confidentiality; integrated, easy data storage and retrieval  <b>Practice:</b> Make a support team available 24/7  <b>Value:</b> Efficient clinical practices and quality care  <b>P2 - Integration</b>  <b>CIS:</b> Slow response time  <b>Value:</b> Efficient clinical practices and quality care  <b>P4 - Differentiation</b>  <b>Practices:</b> Acknowledgement of medical power; late introduction of nursing notes  <b>Values:</b> Medical dominance and nurses' professional status and autonomy  <b>P5- Differentiation</b>  <b>Practices:</b> Acknowledgement of medical power; late introduction of nursing notes  <b>Change:</b> Favor consensus among directors, weekly meetings with nurses  <b>Fragmentation - Inductive analysis</b>  <b>CIS:</b> Difficult to learn and use  <b>Value:</b> Efficiency of clinical practices</p>	<p><b>P2 - Integration</b>  <b>CIS:</b> Pharmacy module complex, dangerous process for drug prescription  <b>Values:</b> Efficient clinical practices and quality care    <b>P3 - Integration</b>  <b>CIS:</b> Slow response time; pharmacy module is complex, dangerous process for drug prescription  <b>Change:</b> Upgrade to the system; pharmacy module temporarily withdrawn and modified</p>
<b>Interpretations</b>	<p><b>P1 - Integration:</b>  Some characteristics of the CIS and some implementation practices interpreted as consistent with values</p>	<p><b>P1 - Integration:</b> Some characteristics of the CIS interpreted as consistent with values  <b>P2 - Integration:</b> Some characteristics of the CIS interpreted as inconsistent with values  <b>P4 - Differentiation:</b> Implementation practices interpreted as inconsistent with nurses' professional status and consistent with physicians' medical dominance  <b>P5 - Differentiation:</b> Changes interpreted as consistent with the primacy of quality care and efficient clinical practices  <b>Fragmentation - Inductive analysis</b>  Some nurses and physicians were ambiguous in interpreting the costs/benefits of learning and using the CIS in terms of efficient clinical practices</p>	<p><b>P2 - Integration:</b> Some characteristics of the CIS interpreted as inconsistent with values    <b>P3 - Integration:</b> Changes in CIS interpreted as consistent with values</p>

<b>Actions/ Reactions</b>	<p><b>P1 - Integration:</b> Physicians and nurses support the selection of Alpha</p>	<p><b>P1 – Integration:</b> Physicians and nurses use Alpha  <b>P2 – Integration:</b> Physicians and nurses complain about the slow response time  <b>P4 – Differentiation:</b> Implementation practices lead to dissatisfaction and resistance  <b>P5 – Differentiation:</b> Changes re-create consensus about the primacy of quality care and efficient clinical practices and facilitate the implementation process  <b>Fragmentation - Inductive analysis</b>                  Some complain about having difficulties learning the CIS while others are more positive; this creates confusion around the actual interpretations of the system</p>	<p><b>P2 - Integration:</b> Resistance toward the pharmacy module</p> <p><b>P3 - Integration:</b> Changes defuse resistance and facilitate the implementation process</p>
<b>Salient</b>			
<b>Latent</b>	<p><b>DIFFERENTIATION</b></p> <p><b>FRAGMENTATION</b></p>		

During Phase 1, the actors interpreted the CIS features as being consistent with quality care and efficient clinical practices, and they supported the selection of Alpha. Although it is possible that some people interpreted the CIS features as being inconsistent with other values, our data suggest a hospital-wide consensus on the beneficial nature of the system.

Integration remained salient during Phase 2. On the one hand, most CIS characteristics were interpreted as consistent with quality care and efficient clinical practices. On the other hand, there was a consensus that the system’s slow response time was not consistent with the swiftness and quality of clinical practices in this hospital. Meanwhile, both differentiation and fragmentation also became salient. Differentiation emerged when some implementation practices – acknowledging medical power, asking nurses to support physicians, and the late introduction of nursing notes – were interpreted as inconsistent with the nurses’ professional status and autonomy and consistent with the physicians’ medical dominance. As a result of the administration’s response – e.g., weekly meetings that allowed the nurses to express their discontent – differentiation eventually became latent. Fragmentation became salient when some users wondered whether the gains in efficiency of clinical practices were worth the cost of becoming familiar with the CIS and using it. Among these users, some complained, while others were more positive. Later, when users gained experience with the CIS, these ambiguous interpretations went away, and fragmentation became latent.

During Phase 3 only integration was salient. The administration upgraded the CIS in response to the generalized user complaints about response time; this facilitated acceptance. Also, there was a consensus that some characteristics of the pharmacy module – related to the drug prescription process – were not consistent with the values of efficient clinical practices and quality care. When users expressed their discontent, the administration withdrew the module until the appropriate modifications could be made.

### 5.3 Case 3. Implementation of Delta in a Teaching Hospital

Affiliated with the medical school of a nearby university, Case 3 was a teaching hospital of 231 beds located in a Canadian capital city. It provided general care to the community as well as specialized (most particularly, obstetrics and mother-child care, vascular surgery and medicine, palliative care,

and drug addiction treatment programs) and emergency care services. It was also involved in university teaching and training and in research. While nurses were paid employees of the hospital, physicians were small for-profit independent businesses who were associated with the hospital. They were compensated by the provincial government on a fee-for-service basis, except for their teaching and training activities, for which they received a salary from the university.

The hospital considered itself *avant-garde* and believed that it was important to keep up with technology. It had four autonomous systems – Admissions, Radiology, Laboratory, and Pharmacy – that were deemed inefficient and had to be replaced, ideally by an integrated CIS.

### **Phase 1. System Selection**

The hospital mandated head nurses and physicians to visit sites across North America and recommend a CIS. They settled on Delta, which had been implemented at numerous North American sites. In addition to its computerized patient file, Delta provided integrated support for clinical practices. In this hospital, many departments – including pediatrics, geriatrics, and surgery – volunteered to be a pilot site. Given the pre-eminence of the surgeons in this hospital, the project began in surgery, followed by pediatrics and geriatrics.

### **Phase 2. Initial Implementation**

The project ran into difficulties almost immediately when the admissions, test requests, and nursing notes modules were implemented in the surgery ward. Although the nurses were generally positive toward the CIS, the physicians found it time consuming to use, given that they had to enter test and treatment prescriptions and nursing care plan information. They complained and even threatened to stop using the CIS, which led to conflicts between physicians and nurses. The administration attempted to rectify these problems by creating a data entry position. While this briefly upset the nurses, it led to temporary system acceptance by the physicians.

### **Phase 3. Continued Implementation**

After the pharmacy module implementation, a conflict arose between the pharmacists and the surgeons, since system use revealed practices that did not conform to drug prescription norms and regulations. In this healthcare system, pharmacists are responsible for approving a prescription before the medication can be given to the patient. In this hospital, the practice was that once a surgeon had written a prescription and sent it to the pharmacy, nurses took the medication from the stock available in the care unit and gave it to the patient. The medication sent from the pharmacy was then used to replenish their stock. CIS use revealed this practice to the pharmacists, who insisted that the surgeons strictly follow the rule. The physicians were displeased and demanded the removal of the system from the surgery ward. The nurses reacted strongly and expressed their desire to keep the system. When the administration refused to comply with the surgeons' demand, their resistance escalated, and they began lobbying for hospital-wide system removal.

In contrast, Delta was generally well received in pediatrics and geriatrics. In reaction to the surgeons' lobbying against the CIS – and even though they did not have specific problems with Delta – most geriatricians decided, out of solidarity with the surgeons, to support them. The pediatricians, however, did not join the movement and continued to use Delta. In the end, the CIS implementation was abandoned in surgery, but remained available in the other wards.

#### **5.3.1. Deductive Analysis**

The data from Case 3 provide support for three propositions (P1, P4, and P5). Two other propositions (P2 and P3) were not relevant to the case. Table 5 synthesizes the results.

**P1:** When some characteristics of a CIS or some implementation practices are consistent with values upon which all users reach a consensus, the implementation process is facilitated.

The administrators had formed a selection committee that involved physicians and nurses in the selection of the CIS, a practice that facilitated the initial acceptance of the system. Thus, early on,

administrators, physicians, and nurses had an opportunity to evaluate several CISs. The process led the hospital to choose Delta. Indeed, the selection committee decided that the critical features of Delta (e.g., data integration and remote access) were consistent with the values of efficient clinical practices and quality care.

*I saw it in action [at the site we visited]. I saw residents entering prescriptions and receiving information from the system. I was totally captivated. I saw the interface between the laboratory, radiology, and the pharmacy, giving physicians access to results anywhere in the hospital. You could even use it from your office and monitor important metabolic data. The nursing plan was computerized, with data on vital signs and certain information that allowed optimal service delivery. And of course we saw computerized medical records. Administrator 3*

Evidence for consensus in favor of the system is provided by the fact that several departments were lobbying to be the pilot site for the implementation.

*I got personally involved with the implementation team to ensure that everything worked. (...) The administration gave everyone a chance to participate in the pilot project. All the departments wanted it, and I gave my name for a pilot department, but our department was not chosen to be one of the first. Nurse 10*

*They showed us things that were quite interesting. (...) Everyone was impressed. We all came out of it saying that it would be fantastic, and we surgeons agreed to get on board. Physician 8*

This provides support for P1, both in terms of implementation practices and CIS characteristics.

**P2:** When some characteristics of a CIS or some implementation practices are inconsistent with values upon which all users reach a consensus, the implementation process is hindered.

There was no instance of CIS characteristics or implementation practices that were inconsistent with the values of all users. Indeed, our analysis of the data reveals that Delta characteristics and implementation practices were either interpreted as consistent with the values of all users (as per P1) or inconsistent with those of one group but consistent with those of another group (as per P4).

**P3:** When the implementation process is hindered because some CIS characteristics or some implementation practices are inconsistent with values upon which all users reach a consensus, changes to CIS characteristics or implementation practices can render them consistent. This facilitates the implementation process.

There was no instance of changes being made to some CIS characteristics or implementation practices employed by the implementers to render them consistent with users' values.

**P4:** When some characteristics of a CIS or some implementation practices are consistent with some user groups' values and inconsistent with other user groups' values, the implementation process is hindered.

There were multiple instances of support for P4 in Case 3. First, early in Phase 2, one particular implementation practice – the early implementation of nursing notes – was consistent with the nurses' value of professional status and autonomy but inconsistent with the physicians' value of medical dominance. This resulted in the nurses supporting the CIS and the physicians resisting it.

*That's where we made a mistake. We decided, because of the internal dynamic, to favor the nursing plan. Administrator 3*

*From the outset, the physicians rejected the system because they didn't see benefits. For them, it was the nurses who reaped benefits; they found that the nurses got more out of it. Administrator 2*

Second, one feature of the CIS as implemented in Phase 2 was that physicians had to enter all orders related to the nursing care plan themselves. In the surgery ward, this feature was interpreted by physicians as inconsistent with medical dominance, but the nurses interpreted it as consistent with their professional status and autonomy.

*Of course it changed the distribution of tasks. Given the way we entered prescriptions, we ended up creating their [the nurses'] care plans. They no longer had to prepare any care plans. It just came out of the machine. By working this way, we were doing it for them. Physician 8*

*At one point the nurses said, "It isn't my job to enter your orders, it's your job. I'm doing my job, you do yours." Nurse 4*

As a result, the physicians on this ward demanded that the CIS be removed. Because the nurses appreciated it and wanted to continue using it, conflicts emerged between the two groups.

*When it comes to those nurses who called us imbeciles, they're just lucky they're still alive. With comments in the cafeteria like "Everybody knows you just aren't bright enough to learn how to use it," the working climate was deteriorating. Physician 7*

Third, another characteristic of the CIS (i.e., the drug prescription features of the pharmacy module) was consistent with the pharmacists' professional status and autonomy and inconsistent with the surgeons' medical dominance because the CIS formalized the requirement for pharmacist approvals of drug prescriptions.

*The pharmacists took advantage of it to change how we operate. Physician 7*

*The pharmacy was particularly rigid. (...) Before, there were things that the care units would let go by, in the sense that they knew that they shouldn't have a lot of medication on the floors, but they kept it in case they'd need it, that kind of thing. Sometimes the pharmacy isn't aware that they're keeping medication on the floor. These are the kinds of things that go on; there can be a bit of this everywhere. But the system made things a bit more difficult. Nurse 10*

The pharmacists insisted that the surgeons follow the rule to the letter, which upset the physicians from the surgery ward, who disagreed with this feature. Conflicts surfaced between surgeons and pharmacists, and the surgeons resisted the CIS, which hindered the implementation.

*The computer system was such that, for example, the physician entered a prescription in the system, it went to the pharmacy, and the medication was prepared in the pharmacy, which then sent it... So there was reason to ask whether the prescription is only valid when it is authorized by a pharmacist, or as soon as it is written by a physician. The nurse can give the patient someone else's pill and then do what she does now and give it. That made for terrible arguments; the pharmacists said, 'Hey, we're responsible for the prescription. It has to be validated.' Administrator 3*

Fourth, later on in Phase 3, when the hospital administrators were faced with the surgeons' demand to remove the CIS from their ward, they chose to refuse. Their decision to keep Delta in the surgery ward was consistent with the nurses' professional status and autonomy but inconsistent with the surgeons' medical dominance, because it supported the nurses' desire to keep using the CIS in the surgery ward.



*Management decided to stand up to us. They said, "If we do that, if we drop the system, the nurses are going to walk." Physician 7*

*The nurses said: "It's too bad, we're keeping the system, we don't want to lose it. We've invested a lot of time in it; for us, it's very useful, for many reasons." Administrator 5*

In reaction to the administration's decision to keep the CIS on the unit, the surgeons decided to refuse to hospitalize patients and lobbied for Delta's removal from the hospital. Several beds remained unoccupied. This created much tension and even conflicts between surgeons and unit nurses.

*We had given our colleagues a very clear message: You guys better not take those beds, or there's gonna be one helluva fight. Because there's always one idiot who wants more beds and is willing to crucify himself. Physician 8*

*It lasted 3 months. Interminable meetings, letters, residents resigning. Of course the nurses were furious because they found it extraordinary to have their nursing plans with everything that came with it (...) Administrator 3*

This provides evidence for P4, both in terms of CIS characteristics and implementation practices.

**P5:** When the implementation process is hindered because some CIS characteristics or some implementation practices are consistent with some user groups' values and inconsistent with other user groups, values, changes to the CIS characteristics or to the implementation practices can create harmony between the subgroups. This facilitates the implementation process.

There was only one instance of change to the implementation practices that created, albeit temporarily, harmony across the groups. As described above, the CIS feature that required physicians to enter the prescriptions themselves was seen as inconsistent with medical dominance but consistent with nurses' professional status and autonomy. In response, the administration created a data-entry position. The physicians' immediate reaction was rather positive.

*So at one point we said, "We're fed up. We aren't entering any more data." The administration told us they were going to give us what they called agents. (...) So there were nurses set up upstairs to enter prescriptions. That lasted for a while. Physician 9*

At first, several nurses opposed this idea; after numerous negotiations between the hospital administration and the unions, the nurses complied, mainly because they felt that the benefits outweighed the concessions they had to make. For a while – that is, until conflicts emerged between physicians and pharmacists – there was harmony on the surgery ward.

*Luckily, the nurses were able to compromise with many doctors and enter prescriptions in their place, even though they had really objected, saying, "We don't make the doctors' prescriptions in the system." There could have been big problems, but it didn't happen. Physician 14*

This provides support for P5.

### **5.3.2. Inductive analysis**

The inductive analysis of Case 3 reveals the saliency of fragmentation in all three phases. In this case, ambiguous interpretations were associated with an implementation practice (the choice of the surgical ward as pilot site) and with two CIS characteristics (difficulty to learn and use the CIS, and system performance). In terms of perspective interplay, the data illustrate that the saliency of a given perspective may vary during the implementation process.

### 5.3.2.1. Fragmentation perspective

In Phase 1, when the time came to select a pilot site, the choice of the surgical unit was met with a lack of consensus among the hospital's physicians. Indeed, in addition to the surgeons, the pediatricians and the geriatricians wanted to host the pilot site. The surgeons interpreted the decision to select the surgical unit for the pilot as consistent with the dominance of their professional group within the medical profession; the physicians from the other specialties interpreted this implementation practice as inconsistent with their own position.

*We should have been the first, with the geriatricians. I believe that they should have started with us because it wouldn't have turned out this way. But the surgeons have always had an extremely powerful lobby, so they ended up being first, and as it turns out, it went against them, and then against the administration. Physician 14*

In Phase 2 – early implementation – several users, both physicians and nurses, were ambiguous in their interpretations of the new CIS. Although they saw benefits to its use, some were ambivalent with respect to the scale of the effort required to use it, and voiced concerns regarding how it contributed to efficient clinical practices.

*When we implemented it, things were a bit difficult. The nurses had to adapt. Technological change had arrived, it had advantages, the nurses had to make changes to the way they were working. (...) For a while there, we heard a lot of moaning and groaning. Administrator 2*

*Prescribing a blood count took six clicks on the panorama, whereas you can take a piece of paper and write "complete blood count" and everyone understands what you mean. The system was slow, it was extremely slow, and we quickly understood that it had serious limitations. Physician 8*

Other physicians and nurses had more positive reactions; this ambiguity could be difficult for the implementers to interpret, which increased the level of difficulty of the implementation process.

*People wanted to invest the time too, even if they knew that when the computers arrived, we wouldn't be leaving at 4:00. (...) We knew that we'd have to stay longer, but there was goodwill nonetheless. Nurse 4*

*I don't know if it's because we were naive or if it's because we showed that we were willing, but I think we adapted to the system quite quickly. Physician 14*

In addition, further insight is revealed by ambiguous interpretations of the performance of the CIS – in terms of efficiency of clinical practices and quality of care – within the physician subgroup. Indeed, when the system was finally implemented in the geriatrics and pediatrics wards, most physicians in these wards were routinely using the CIS, while other physicians, particularly in the surgery ward, were complaining. Some were even refusing to use it.

*The physicians were saying, "For us, it's gotten completely out of hand. Mistakes are being made, there've been others in the past, we've had it with this thing." Administrator 3*

*We [the physicians in the pediatric ward] saw it as a challenge. We saw it as progress, a challenge. We knew that the system had been implemented in American and Canadian hospitals, and we thought, why not here? So we started using it. Physician 14*

*I would say that we [physicians in the geriatric ward] were saving time, particularly when prescribing medication. I found it easier. Physician 13*

When the surgeons lobbied for a hospital-wide removal of the CIS, most geriatricians decided to support the surgeons, pediatricians chose to continue to support the system.

*They [the physicians in the geriatric ward] weren't using it. They didn't want to go get their codes. (...) As I said once, as a joke, they're like a bunch of sheep. They said, "We're part of a group." (...) There was one doctor who continued to use it, but he stopped for quite a while when the others asked him to. But he kept his code, and after that he continued to use it, except we weren't going out of our way to tell anyone." Nurse 9*

*We [in the pediatric ward] use it, and we think that it'll continue to be used in the hospital. It'll undoubtedly change their strategy, but it'll continue. (...) The new General Manager wants to place more emphasis on meeting this objective. Physician 14*

As a result, Delta was removed from the surgical ward but kept in pediatrics and geriatrics; most geriatricians had stopped using the CIS, while pediatricians continued to use it. Because of the ambiguities, the overall level of difficulty of the implementation was high.

#### *5.3.2.2. Perspective interplay*

Table 5 suggests that the integration perspective was salient in Phase 1, when there was consensus among the hospital actors that the CIS was consistent with efficient clinical practices and quality care. This is demonstrated by the enthusiasm on the different wards that volunteered for the pilot project. Some comments regarding the interpretation of an implementation practice – the selection of the surgical ward over the other wards as a pilot site – suggest, however, that the interpretation of this implementation practice was not met with consensus among the physicians. This is an indication that the fragmentation perspective was not entirely removed from the actors' minds.

The integration perspective was still salient at the beginning of Phase 2. This can be explained by the continuing consensus on the value of the CIS. It can also be due to the ability of the implementers to restore consensus by creating a data entry position in response to complaints – from the surgical wards' physicians – about a CIS feature that obliged them to enter test and treatment prescriptions themselves. However, differentiation quickly became salient, and integration became latent. The emergence of differentiation coincided with the interpretations that users made of a CIS characteristic (requiring physicians to enter care plan information) and an implementation practice (early implementation of the nursing notes module) that were consistent with the nurses' professional status and autonomy but inconsistent with medical dominance. Fragmentation's saliency increased – although to a lesser extent than differentiation – due to the ambiguous interpretations that some of the users (nurses or physicians) had about the difficulty of learning the CIS vis-à-vis efficient clinical practices.

During Phase 3, the differentiation and fragmentation perspectives were salient, with differentiation being preeminent. The integration perspective remained latent. The increased saliency of the differentiation perspective concurred with an implementation practice (the hospital administration taking the side of the nurses against the physicians, who were resisting the module implemented during Phase 2) and with the implementation of a new module of the CIS that had a feature (requiring approvals of drug prescriptions from the pharmacists). Both were interpreted as consistent with the nurses' and/or pharmacists' professional status and autonomy but inconsistent with the physicians' medical dominance. Fragmentation was also salient, with a lack of consensus within the physicians' group regarding the consistency of the CIS performance with the value of efficient clinical practices: The physicians from the surgical ward deemed the CIS inconsistent, while the physicians from the other wards where the CIS was implemented (geriatrics and pediatrics) interpreted it as consistent. The ensuing reaction from geriatrics was to support the surgical ward physicians, while the pediatricians withheld their support.

**Table 5. Analysis Case 3**

	<b>Phase 1 - Selection</b>	<b>Phase 2 - Initial Implementation</b>	<b>Phase 3 - Continued Implementation</b>
<b>CIS, practices and values</b>	<p><b>P1 - Integration</b>  <b>CIS:</b> Integrated, paperless system, remote access, online data entry  <b>Practice:</b> Form an interdisciplinary selection committee  <b>Values:</b> Efficient clinical practices and quality care</p> <p><b>Fragmentation – Inductive analysis</b>  <b>Practice:</b> Surgical unit as pilot site  <b>Value:</b> Medical dominance</p>	<p><b>P4 - Differentiation</b>  <b>Practice:</b> Early implementation of the nursing note module  <b>Values:</b> Medical dominance and nurses' professional status and autonomy</p> <p><b>P4 - Differentiation</b>  <b>CIS:</b> Physicians enter care plan information  <b>Values:</b> Medical dominance and nurses' professional status and autonomy</p> <p><b>P5 - Differentiation</b>  <b>CIS:</b> Physicians enter care plan information  <b>Change:</b> Creation of a data-entry position</p> <p><b>Fragmentation - Inductive analysis</b>  <b>CIS:</b> Difficult to learn and use  <b>Value:</b> Efficiency of clinical practices</p>	<p><b>P4 - Differentiation</b>  <b>CIS:</b> Requires approval from pharmacists for drug prescriptions  <b>Values:</b> Medical dominance and pharmacists' professional status and autonomy</p> <p><b>P4 - Differentiation</b>  <b>Practice:</b> Administration takes the side of nurses in reaction to surgery ward physicians' resistance  <b>Values:</b> Medical dominance and nurses' professional status and autonomy</p> <p><b>Fragmentation - Inductive analysis</b>  <b>CIS:</b> System performance  <b>Values:</b> Efficiency of clinical practices and quality of care</p>
<b>Interpretations</b>	<p><b>P1 - Integration:</b>                      Some characteristics of the CIS and some implementation practices interpreted as consistent with values</p> <p><b>Fragmentation – Inductive analysis</b>                      Surgeons interpret the choice as congruent with their dominance, other physicians see it as incongruent</p>	<p><b>P4 – Differentiation:</b> Early implementation of the nursing notes module interpreted as consistent with nurses' professional status and inconsistent with physicians' medical dominance</p> <p><b>P4 – Differentiation:</b> CIS characteristics interpreted as consistent with nurses' professional status and inconsistent with physicians' medical dominance</p> <p><b>P5 – Differentiation:</b> Change interpreted as consistent with nurses' professional status and physicians' medical dominance</p> <p><b>Fragmentation - Inductive analysis</b>                      Some nurses' and physicians' positions were ambiguous with respect to interpreting the costs/benefits of learning to use the CIS in terms of the efficiency of clinical practices</p>	<p><b>P4 - Differentiation:</b> Characteristics of the CIS interpreted as consistent with pharmacists' professional status and inconsistent with physicians' medical dominance</p> <p><b>P4 – Differentiation:</b> Implementation practices interpreted as consistent with nurses' professional status and inconsistent with physicians' medical dominance</p> <p><b>Fragmentation - Inductive analysis</b>                      Some pediatricians, geriatricians, and surgeons were ambiguous in their interpretations of the value of the CIS in terms of quality care and efficiency of clinical practices</p>

<b>Actions/ Reactions</b>	<p><b>P1 - Integration:</b> Physicians and nurses support the selection of Delta, lobby for hosting the pilot project</p> <p><b>Fragmentation – Inductive analysis</b> Surgeons are positive toward the pilot, other physicians are not</p>	<p><b>P4 – Differentiation:</b> Nurses support the implementation and physicians resist; conflicts emerge</p> <p><b>P4 – Differentiation:</b> Nurses support the implementation and physicians resist; conflicts emerge</p> <p><b>P5 – Differentiation:</b> Change re-creates consensus across groups</p> <p><b>Fragmentation - Inductive analysis</b> Some complain about having difficulty learning the CIS while others are more positive; this creates confusion around actual interpretations of the system</p>	<p><b>P4 – Differentiation:</b> Conflicts emerged between pharmacists and physicians</p> <p><b>P4 – Differentiation:</b> Nurses supported the implementation and physicians resisted; conflicts emerged and physicians from the surgery ward lobbied for removal of Delta from the hospital</p> <p><b>Fragmentation - Inductive analysis</b> Some physicians are using the CIS, others are not. This leads to different levels of implementation difficulty in different wards</p>
<b>Salient</b>			
<b>Latent</b>			

## 6. Results from the Cross-Case Analysis

### 6.1 Extent of support for the propositions

The purpose of our within-case analysis was to determine whether empirical evidence existed for each of the propositions in each case (Eisenhardt 1989). In terms of replication logic, this process enhances confidence in the validity of the relationships observed. Overall, there was strong support for all the propositions. Although some propositions did not apply in some cases, there was no instance of empirical evidence that disconfirmed a proposition. When a given proposition was deemed not relevant in a case, it was because there was no corresponding evidence in that specific context, not because it was disconfirmed or because there were not sufficient data to test the proposition. Table 6 summarizes the results.

<i>Proposition</i>	<i>Case 1</i>	<i>Case 2</i>	<i>Case 3</i>
P1 Integration	Supported	Supported	Supported
P2 Integration	Supported	Supported	-
P3 Integration	-	Supported	-
P4 Differentiation	Supported	Supported	Supported
P5 Differentiation	-	Supported	Supported

As Tables 7 and 8 show, there was strong support for P1 and P2, two integration propositions. In all three cases, the same two prominent values were associated with integration: quality of care and efficiency of clinical practices. When consensus existed that the CIS characteristics and/or implementation practices were consistent with these values, the implementation process was facilitated (Table 7). When consensus existed on inconsistency, the implementation process was hindered (Table 8).

**Table 7. Cross-Case Analysis – P1 Integration**

<i>P1: When some characteristics of a CIS or some implementation practices are consistent with values upon which all users reach a consensus, the implementation process is facilitated.</i>					
	<b>CIS Characteristics</b>	<b>Implementation Practices</b>	<b>Values</b>	<b>Interpretations</b>	<b>Implementation Process</b>
<b>Case 1</b>	Integrated; paperless; online data entry and retrieval	Formation of an interdisciplinary selection committee	Quality of care; efficiency of clinical practices	Hospital-wide consensus: consistent with values	Facilitated
<b>Case 2</b>	Integrated; embedded best practices; easy storage and retrieval of data	Formation of an interdisciplinary selection committee	Quality of care; efficiency of clinical practices	Hospital-wide consensus: consistent with values	Facilitated
<b>Case 3</b>	Integrated; paperless; remote access; online data entry	Formation of an interdisciplinary selection committee	Quality of care; efficiency of clinical practices	Hospital-wide consensus: consistent with values	Facilitated

**Table 8. Cross-Case Analysis – P2 Integration**

<i>P2: When some characteristics of a CIS or some implementation practices are inconsistent with values upon which all users reach a consensus, the implementation process is hindered.</i>					
	<b>CIS Characteristics</b>	<b>Implementation Practices</b>	<b>Values</b>	<b>Interpretations</b>	<b>Implementation Process</b>
<b>Case 1</b>	Slow response time	N/R	Quality of care; efficiency of clinical practices	Hospital-wide consensus: inconsistent with values	Hindered
<b>Case 2</b>	Slow response time; features of pharmacy module	N/R	Quality of care; efficiency of clinical practices	Hospital-wide consensus: inconsistent with values	Hindered
<b>Case 3</b>	In this case, there was no instance of CIS characteristics or implementation practices that were inconsistent with the values of all users. Indeed, our data analysis reveals that Delta characteristics and implementation practices were either interpreted as consistent with the values of all users (as per P1) or inconsistent with those of one group but consistent with those of another group (as per P4).				

Table 9 suggests strong support for P4 and reveals that in all three cases, the same two values – physicians’ medical dominance and nurses’ (and/or pharmacists’) professional status and autonomy – were associated with differentiation. Indeed, in some circumstances, some CIS characteristics and implementation practices were deemed consistent with physicians’ values, while they were considered inconsistent with other professionals’ (nurses and pharmacists) values – or vice-versa. In all three cases, the lack of consensus across groups hindered the implementation process.



**Table 9. Cross-case Analysis – P4 Differentiation**

<b>Table 9. Cross-case Analysis – P4 Differentiation</b>					
	<i>P4: When some characteristics of a CIS or some implementation practices are consistent with some user groups' values and inconsistent with other user groups' values, the implementation process is hindered.</i>				
	<b>CIS Characteristics</b>	<b>Implementation Practices</b>	<b>Values</b>	<b>Interpretations</b>	<b>Implementation Process</b>
<b>Case 1</b>	Physicians enter prescriptions themselves	Early implementation of nursing notes; administration takes side of nurses	Physicians' medical dominance; nurses' professional status and autonomy	Consistent with nurses' values; inconsistent with physicians'	Hindered
<b>Case 2</b>	N/R	Acknowledgement of medical power; late introduction of nursing notes	Physicians' medical dominance; nurses' professional status and autonomy	Consistent with physicians' values; inconsistent with nurses'	Hindered
<b>Case 3</b>	Physicians enter prescriptions themselves; requires pharmacists' approval for drug prescriptions	Early implementation of nursing notes; administration takes side of nurses	Physicians' medical dominance; nurses' and pharmacists' professional status and autonomy	Consistent with nurses' and pharmacists' values; inconsistent with physicians'	Hindered

The content of Tables 10 and 11 supports the propositions that changes to either the CIS characteristics or the implementation practices can have remedial effects. As Table 10 shows, when the implementation process is hindered (by conflicts or resistance) because there is consensus that CIS characteristics or implementation practices are inconsistent with the values of efficiency of clinical practices and quality care, implementers can bring about changes that will make them consistent. Subsequently, the implementation process will be facilitated (as per P3 – integration). Table 11 (P5 – differentiation) shows that when the implementation process is rendered more difficult because of a lack of consensus in users' interpretations of some CIS characteristics or some implementation practices, implementers can bring about changes that create harmony across groups and facilitate the implementation process.

**Table 10. Cross-case Analysis – P3 Integration**

<b>Table 10. Cross-case Analysis – P3 Integration</b>				
	<i>P3: When the implementation process is hindered because some CIS characteristics or some implementation practices are inconsistent with values upon which all users reach a consensus, changes to CIS characteristics or implementation practices can render them consistent. This facilitates the implementation process.</i>			
	<b>Changes</b>	<b>Values</b>	<b>Interpretations</b>	<b>Implementation Process</b>
<b>Case 1</b>	In this case, there was no instance of changes to some CIS characteristics or implementation practices that were employed by the implementers to bring about consistency.			
<b>Case 2</b>	Administrators upgraded the system and temporarily withdrew the pharmacy module and modified it	Quality of care; efficiency of clinical practices	Create consistency around values	Facilitated
<b>Case 3</b>	In this case, there was no instance of changes to some CIS characteristics or implementation practices that were employed by the implementers to bring about consistency.			

**Table 11. Cross-case Analysis – P5 Differentiation**

<i>P5 When the implementation process is hindered because some CIS characteristics or some implementation practices are consistent with some user groups' values and inconsistent with other user groups' values, changes to the CIS characteristics or to the implementation practices can create harmony between the subgroups. This facilitates the implementation process.</i>				
	<b>Changes</b>	<b>Values</b>	<b>Interpretations</b>	<b>Implementation Process</b>
<b>Case 1</b>	Case 1 does not provide evidence of attempts to change some CIS characteristics or of implementation practices employed to create harmony across groups.			
<b>Case 2</b>	Favor consensus among directors; weekly meetings with nurses	Primacy of quality care and efficiency of clinical practices	Create harmony	Facilitated
<b>Case 3</b>	Creation of a data entry position and negotiations with unions	Physicians' medical dominance; nurses' professional status and autonomy	Create harmony	Facilitated

### 6.2. Fragmentation

In all three cases, there were at times multiple interpretations of the CIS. For instance, when users began to assess the difficulty of learning and/or adapting to the CIS, some users resisted while others tried to do their best in view of the increased efficiency of clinical practices that the CIS was deemed to bring. Reactions were not typically associated with a particular subgroup of users. Indeed, in all three cases, some nurses and physicians were positive toward the CIS while others voiced complaints and concerns, hence, hindering the implementation. Moreover, in Case 3, the data reveal that within a given group of actors, multiple interpretations/reactions can also be observed. First, the pediatricians and the geriatricians interpreted the choice of the surgery ward as the pilot site to be inconsistent with their status, and the surgeons interpreted it as consistent. Second, while most geriatricians and pediatricians were initially positive toward the system, the majority of the surgeons complained and even refused to use it. As the physicians in the surgical ward grew resistant to the point that they demanded the CIS withdrawal, most geriatricians supported them and stopped using the system, while the pediatricians continued to use it. These multiple reactions hindered the implementation.

### 6.3. Perspective interplay

Our cross-case analysis led to four key observations in terms of perspective interplay. First, we observed the predominance of the integration perspective during the selection phase. Indeed, in all three cases, the key characteristics of the CIS – integrated system and online data entry and retrieval – were interpreted by all actors as consistent with the values of efficiency of clinical practices and quality of care.

Second, the early user interactions with the CISs were first met by ambiguous interpretations, which did not depend on the hospital sub-groups to which a user belonged. Indeed, while some interpreted the difficulty to learn and use the system as inconsistent with the efficiency of clinical practices, others were believed that the benefits of the system were worth the effort of learning it and using it. Then, the fragmentation perspective became salient.

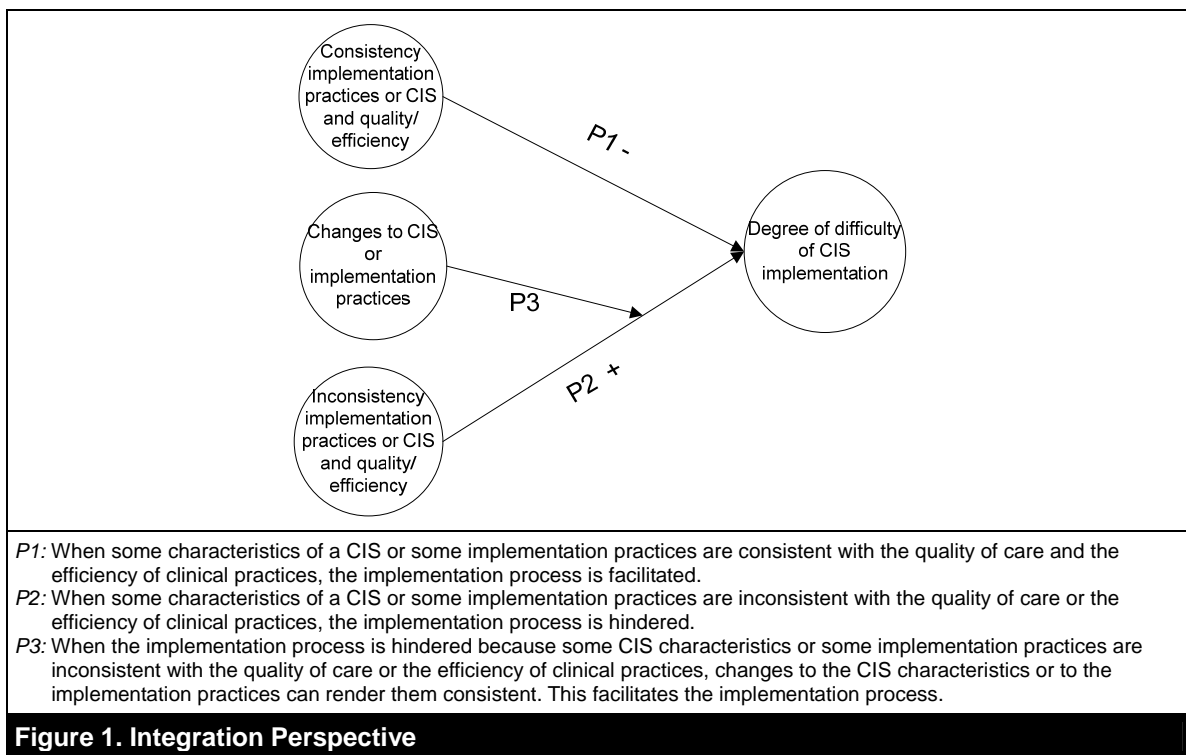
Third, as users became more experienced with the CIS, they realized that some of its characteristics were inconsistent with some values. This occurred in three types of situations. First, when a consensus was reached among all members of the hospital that some characteristics were not consistent with quality of care and/or efficiency of clinical practices. In that situation – Phase 3 of Case 2 – the integration perspective remained salient. Second, when the characteristics of the CIS

were interpreted as inconsistent with physicians' medical dominance but consistent with nurses' (or other professionals') professional status and autonomy. In these situations – Phases 2 and 3 of Cases 1 and 3 – the differentiation perspective became salient, gaining pre-eminence over integration. This resulted in conflict between the parties and hindered the implementation process. The third situation was when, in Phase 3 of Case 3, there was ambiguity within the physician subgroup in the interpretation of the CIS performance with regards to efficiency of clinical practices and quality of care. Here, although the differentiation perspective remained pre-eminent, the fragmentation perspective's saliency increased.

Fourth, we observed that the implementers' practices can influence the saliency of a perspective. In some situations, they may contribute to increase the saliency of the differentiation perspective when they are interpreted as consistent with the nurses' professional autonomy and inconsistent with physician's medical dominance – or vice versa. This situation was observed in all three cases. The implementers' practices can also contribute to maintaining the saliency of the integration perspective. This happened in Case 2 when the administration used implementation practices that contributed to restore hospital-wide consensus and keep integration salient.

## 7. An Organizational Culture-based Theory of CIS Implementation in Hospitals

We propose a substantive theory that furthers our understanding of the process of CIS implementation in hospitals. Figures 1 to 3 and Table 12 present the propositions that synthesize the theory. In addition to providing support for our five initial propositions, our analysis led us to specify the values that play a prominent role, refine our propositions, and develop new ones.



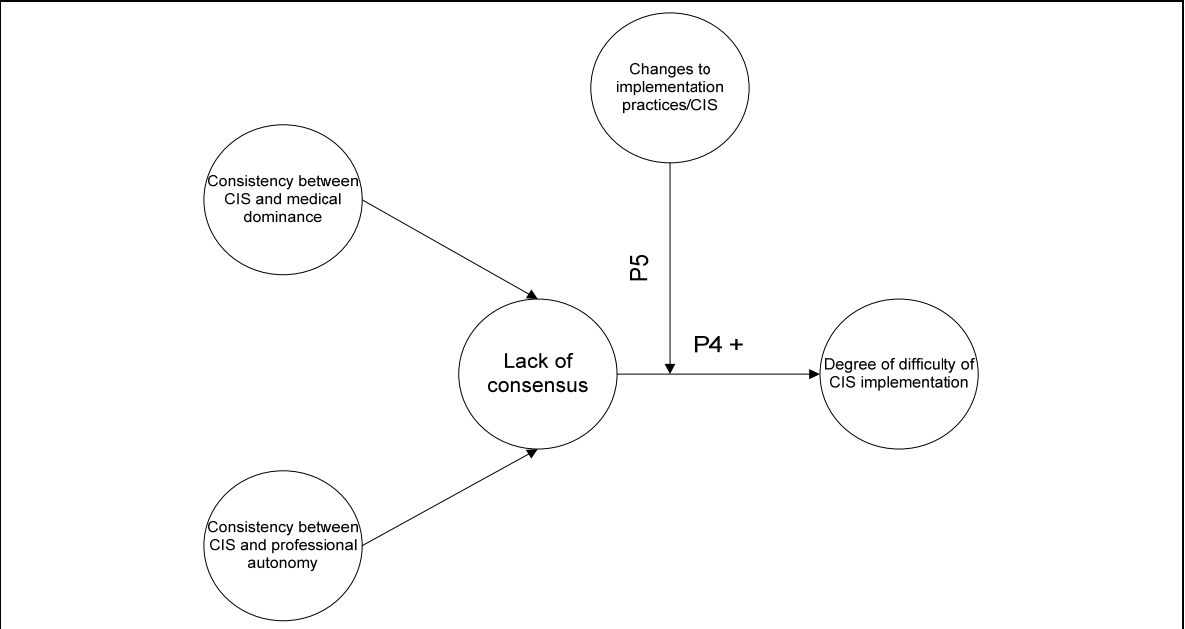
**Figure 1. Integration Perspective**

Four values – quality of care, efficiency of clinical practices, physicians' medical dominance, and other health professionals' professional status and autonomy – are critical to explain the level of difficulty of a CIS implementation. All four values have the characteristics of what Schein (2004) refers to as basic assumptions or non-negotiable values: They are taken for granted and they have become part of the identity of a given group. Quality of care and efficiency of clinical practices are basic

assumptions shared by all healthcare providers in a hospital. As such, they are paramount under an integration perspective. Physicians' medical dominance and health professionals' professional status and autonomy are also non-negotiable values. They are not, however, subject to consensus on a hospital-wide basis; rather, they are revealed by the differentiation perspective.

From an integration perspective – Figure 1 – our theory posits that when users interpret the characteristics of a CIS or implementation practices as consistent with quality care or efficient clinical practices, the implementation process is facilitated (P1); it is hindered when some CIS characteristics or implementation practices are interpreted as inconsistent with these values (P2). In the latter case, the theory proposes that modifying the CIS or the implementation practices can make the system or the practices consistent with these two fundamental values (P3).

From a differentiation perspective – Figure 2 – we theorize that when some characteristics of a CIS or some implementation practices are consistent with a professional group's professional status and autonomy and inconsistent with physicians' medical dominance, or vice versa, resistance from the given subgroup and conflicts among groups may occur, thereby hindering the implementation process (P4). The theory also posits that, by modifying CIS characteristics or implementation practices, implementers can create harmony between the subgroups (P5).



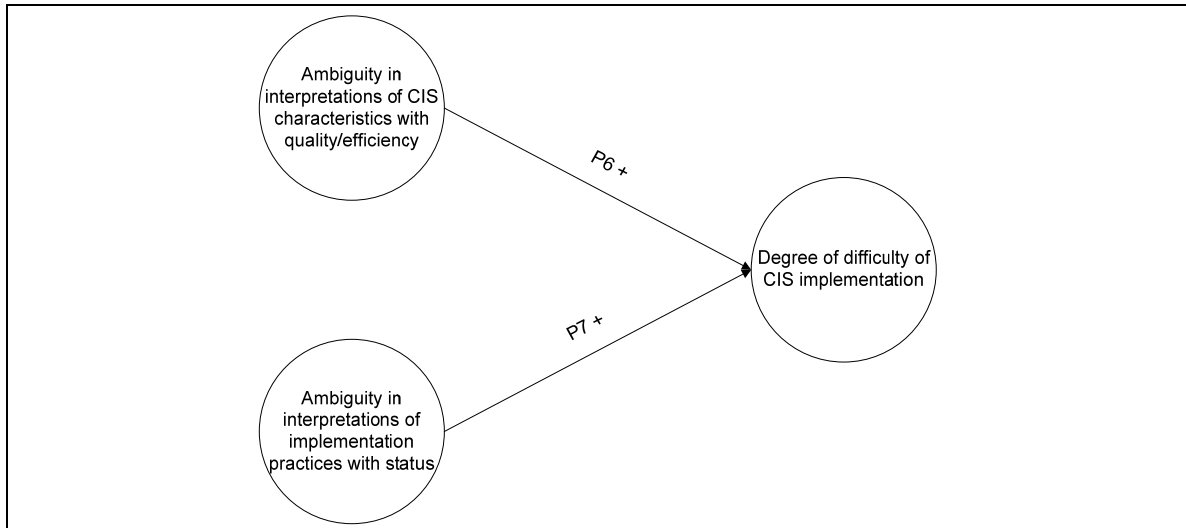
**P4:** When some characteristics of a CIS or some implementation practices are consistent with a professional group's professional status and autonomy and inconsistent with physicians' medical dominance – or vice versa – resistance and conflicts may result. This hinders the implementation process.

**P5:** When the implementation process is hindered because some CIS characteristics or some implementation practices are consistent with a professional group's professional status and autonomy and inconsistent with physicians' medical dominance – or vice versa – changes to the CIS characteristics or to the implementation practices can create harmony between the subgroups. This facilitates the implementation process.

**Figure 2. Differentiation Perspective**

From a fragmentation perspective – Figure 3 – we theorize that some of the non-negotiable values play a key role when ambiguous interpretations are made about their consistency, or lack thereof, with CIS characteristics or with implementation practices. When ambiguous interpretations exist about the consistency between the difficulty to learn and use the CIS and the efficiency of clinical practices and/or quality of care, the implementation process is hindered (P6). Similarly, when ambiguous interpretations exist, within a subgroup, about some implementation practices and the subgroup actors' status, the implementation process is hindered (P7).

Perspective interplay is a key feature of the theory, which posits that implementers' actions can be instrumental in making a perspective salient or latent. Indeed, as stated in Table 12, we propose that the implementers can deliberately use implementation practices to create, maintain, or repair consensus within the hospital or, notwithstanding a lack of consensus, create, maintain, or restore harmony between user groups. Implementers may also employ, perhaps inadvertently, practices that exacerbate the lack of consensus or ambiguity in interpretations (P8).



*P6:* When some hospital actors in any given subgroup interpret the characteristics of a CIS – in terms of difficulty to learn and use – as consistent with efficient clinical practices and or quality care while other actors in the same subgroup interpret the same characteristics as inconsistent with these values, the implementation process is hindered.

*P7:* When some actors in any given subgroup interpret the implementation practices as consistent with their status in the hospital while other actors in the same subgroup interpret these implementation practices as inconsistent with their own status, the implementation process is hindered.

**Figure 3. Fragmentation Perspective**

Although the dynamics of perspective interplay do not readily lend themselves to the development of formal propositions, we would like to offer the following conjecture in the context of CIS implementation. First, we suggest that the degree of saliency of a given perspective is affected by the degree of awareness and understanding that individuals have of the characteristics of a CIS. When the CIS is at the stage of an organizational vision, and users are only aware of its key functionalities, they are more likely to reach a consensus in their interpretation that those functionalities are consistent with quality care and efficient medical practices. In this case, the integration perspective will be salient and hospital members' reactions will reflect acceptance. As they start interacting with the CIS, however, we suggest that the individuals' interpretations of the system features will not be in terms of their belonging to the hospital or to one of its subcultures, but rather in terms of the multiplicity of values that surround them, including the values associated with their specialty, gender, age group, education, and so on. In this case, the fragmentation perspective will become salient, and users' actions and reactions will reflect both acceptance and resistance. Later, when users have been more exposed to the CIS and better understand its features, they may continue to interpret them as consistent with quality care and efficient clinical practices, which will lead to reactions that reflect hospital-wide acceptance. If, however, the features are interpreted as inconsistent with these values, actions and reactions will reflect hospital-wide resistance; in both cases, the integration perspective will be salient. But the actors will also interpret these features in terms of their subculture's values: either medical dominance or professional status and autonomy. Again, consistency between CIS characteristics and the subculture's values will result in actions that reflect acceptance; lack of consistency will result in actions that reflect resistance and/or conflicts, and the salient perspective will be differentiation.

**Table 12. Perspective Interplay Conjecture**

*P8:* Implementation practices can affect the degree of saliency of the perspectives; they can help maintain the primacy of a hospital-wide consensus, create harmony between the hospital subgroups, but they can also exacerbate the lack of consensus between subgroups or exacerbate ambiguous interpretations.

## 8. Discussion and Conclusion

The literature in healthcare management research, medical informatics, and IS provides further support for our substantive theory. Indeed, we have identified two non-negotiable values that are common to all users and, therefore, associated with integration. In medicine, there is evidence of a broad consensus about the importance of high-quality and efficient health care (Grol, 2001; Teasdale, 2008). In health informatics, a systematic review of 257 studies on the impact of health IT on the quality, efficiency, and cost of medical care found quality of care and efficiency to be the most important variables used to assess the value of health IT (Chaudhry et al., 2006). Similarly, a study of 13 sites in the UK identified efficiency and quality of care as the most important values in the healthcare domain (Schade et al., 2006).

We found two other non-negotiable values – physicians' medical dominance and the status and autonomy of other professionals – to be associated with the differentiation perspective. The extant literature in healthcare research supports the notion that medical dominance is seen by health professionals other than physicians as negatively impacting their own status and autonomy (Adamson et al., 1995; Gair & Hartery, 2001). In addition, medical dominance, which encompasses physicians' traditional autonomy, legitimacy, and status, has often been identified in the literature as critical to understanding why physicians adopt – or do not adopt – an IS. Some researchers explain that medical dominance renders physicians' mandatory IS use more difficult (Kohli & Kettinger, 2004), that physicians resist such systems because they believe that these technologies undermine their professional status (Kaplan, 2000), or that the control features of some systems interfere with their traditional independence (Jensen & Aanestad, 2007). The literature also refers to the role played by nurses' professional status and autonomy – recognition of their expertise and clinical knowledge, their ability to fulfill their responsibilities without medical authority (Ulrich et al., 2003) – in a CIS implementation. It has been suggested that nurses believe it is important to become familiar with a CIS in order to “carry out their profession as a nurse” (Jensen & Aanestad, 2007, p.39) and that they appreciate CISs that reduce interruptions and the need to clarify orders with physicians (Ketchum, 2008). In our study, when the actors interpreted the implementation context – the CIS characteristics or the implementation practices – in terms of its consistency with either value, consensus was reached within sub-groups only; conflicts between groups often followed.

Our theory also posits that implementers can play a significant role in making a perspective salient or latent. This is also consistent with extant IS literature. For example, Kohli and Kettinger (2004) highlight the importance of aligning the implementation process with physicians' values for ensuring a successful implementation of clinical DSSs. Similarly, in medical informatics, Paré et al., (2009) state that using strategic actions to counter the inherent risks of CIS implementation is especially important when conflicts can polarize users into opposing factions.

Though we acknowledge that our study builds upon only three cases, we argue that the replication logic we used in the selection of our cases allows for some generalization. Indeed, whether the hospital type, the nature of the CIS, and/or the final outcome of the implementation were similar or not, the emerging patterns were the same. Notwithstanding this limitation, our study makes a number of contributions. First, by taking into account the organizational culture, the system characteristics, and the implementation practices in our analysis, we provide a rich explanation for the intermediate and final level of difficulty of an implementation. Second, by building upon Martin's three-perspective theory of culture, we adopt a conceptualization of culture that is particularly well suited to the study of hospital settings, which enhances the substantive nature of the theory we developed. Third, by developing theoretical propositions on the basis of extant research from multiple disciplines and empirical data, we anchor our theory in solid ground. Fourth, we identify four fundamental values (quality care, efficient clinical practices, physician medical dominance, and status and autonomy of



other health professionals) that play significant roles in explaining the level of difficulty of a given CIS implementation. Fifth, our study also contributes to IS implementation research by suggesting that identifying the core, non-negotiable integration and differentiation values of an organization can help implementers develop a better understanding of what happens in a given system implementation.

Our analysis leads us to propose avenues that researchers might want to explore. One promising avenue would be to test the model. Although we do not claim to offer a thorough research design, we make some suggestions as to how to conduct such a test. First, because the constructs are at the unit level – that is, they refer to entities that are composed of two or more individuals – the model ought to be tested with a multilevel approach (Klein & Kozlowski, 2000). Indeed, the degree of consistency of a CIS with physicians' medical dominance represents the aggregate influence of all the physician population of a hospital. Similarly, the degree of consistency – or lack thereof – of a CIS with the quality of care represents the “aggregate influence of individuals” (Klein & Kozlowski, 2000, p.15), in this case, of the healthcare professionals population within a hospital. This means that for assessing the degree of consistency of a CIS with the quality of care within a given hospital, it would be necessary to aggregate consistency perceived at the individual level. In such circumstances, it becomes essential to define the process of emergence of the unit-level construct from the individual level. This process of emergence can either be compilation or composition. Compilation refers to situations where the unit-level phenomenon emerges from different, independent individual contributions that do not converge. In contrast, a composition process refers to situations where the unit-level phenomenon “emerges from individual members' shared perceptions, affect, and responses” (Klein & Kozlowski, 2000, p.33). In terms of measurement, the within-unit variance of a unit-level construct conceptualized as having a composition emergence process should be smaller than the variance that would be observed if the responses from the group members formed a uniform distribution (Bliese, 2000). Second, testing the model would call for going from the abstract level of constructs and propositions to the concrete level of variables and hypotheses. The reformulation of the propositions into hypotheses would have to take into account the multilevel nature of the constructs. Testing the hypotheses would require an examination of whether the data agree with the assumptions about the emergence process of the unit-level constructs entailed by each perspective and a rephrasing of the propositions in a way that corresponds to the nature of the emergence process. Finally, in testing the model, researchers should pay attention to the issue of method bias. Ideally, the model should be tested in a longitudinal study, with several data collection points and several methods for collecting data. If the data are collected through a cross-sectional survey, researchers will have to take measures to address the issue of self-report and common method bias (Burton-Jones, 2009).

Another potential avenue for research would be to examine whether the final outcome of a CIS implementation is related to the saliency of a given perspective. Although our analysis focused on the implementation process rather than its outcome, our data suggest that when the final, most salient perspective is integration, success seems more likely; when the final most salient perspective is differentiation, failure appears more likely; and a pre-eminent final fragmentation perspective will be associated with mixed results. Future research, better geared to measure such relationships, may advance our understanding of CIS implementation in hospital settings.

Finally, our theory also offers practical contributions, in that it may help hospital managers better understand the actions and reactions associated with a CIS implementation. Hospitals may see the inherent characteristics of a CIS as consistent with quality care and efficient clinical practices when they are selecting a system. Yet, as we have shown in this study, the integration perspective may not remain salient throughout the entire project. Members of the hospital community may very well interpret some of the features of the CIS or some of the implementation practices as inconsistent with the values of their subculture – professional status and autonomy or medical dominance – or interpret them ambiguously, and this may render the implementation difficult, despite its potential. Our study does not only provide managers with explanations for the level of difficulty of a CIS implementation, it also suggests that implementation practices can be used to maintain hospital-wide consensus and create harmony between the hospital subgroups.

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