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Taking IT Artifacts Seriously: Developing a Mixed Determinants Model of Assimilation of Telehealth Systems

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Abstract

A number of healthcare authorities are considering the adoption of telehealth into mainstream clinical care, bringing telehealth technology out of experimental settings into real life settings. To fully reap the benefits from a technological innovation, the innovation must be assimilated into the organization's work system. As most literature on telehealth adoption to date has focused on its evaluation (e.g., user acceptance), more work is warranted to understand how telehealth can be integrated into administrative and clinical practices and to identify factors that may impinge onto telehealth integration. Borrowing from institutional, structuration and organizational learning theories, we propose a research framework[*] to address limitations of past work and to guide research and managerial actions while integrating telehealth in the workplace.

Key words

Routinization, infusion, structures, institutions, and social cognition.

1. Introduction

Many western countries have undertaken telehealth projects for providing healthcare services to underserved populations living in remote regions and low-cost speciality services to areas where full-time staffing is uneconomical. The term telehealth is presently used to describe all possible variations of healthcare services using information and communications technology (ICT) such as tele-education, teleconsultation, and teletraining, among others.

Given the centrality of information technology in telehealth, many studies in information systems (IS) research have been devoted to telehealth systems. A close examination of these studies revealed three salient topics, namely 1) user acceptance/adoption of telehealth systems (Mitchell, Mitchell and Disney, 1996 ; Hu and Chau, 1999; Cohn et Goodenough, 2002), 2) the characteristics of these systems (McKee et al., 1996), and 3) the effectiveness of telehealth systems compared to conventional face-to-face delivery in different medical specialities (Picolo et al., 2000; Nordal et al., 2001; Bishop et al., 2002). Although our knowledge has been enriched by such diversity, we need to go a step forward in order to consider the organizational assimilation of telehealth systems. The following reasons justify such an endeavour.

First, since they have demonstrated clinical value and technical feasibility, telehealth programs must move from experimental settings to the real world calling for adjustments to healthcare organization's administrative and clinical routines (Saga and Zmud, 1994; Zucker, 1977) as well

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as into its work systems and technological configuration to account for its assimilation as a technological innovation (Kwon, 1987; Cooper et Zmud, 1990; Chatterjee and Segars, 2001; Keen and McDonald, 2000).

Second, innovation adoption is not always accompanied by widespread deployment (Fichman and Kemerer, 1999). For instance, Eveland and Tornatzky (1990) and Cooper and Zmud (1990) reported that new technology enjoying widespread adoption may fail to be widely deployed hence failing to be truly valuable to the adopting organization.

To be truly valuable, a technological innovation must be routinized and infused in the adopting organization's operational or managerial work systems (Zmud and Apple, 1992). Consequently, to materialize the benefits of telehealth systems, we need to better understand the mechanisms through which their assimilation into administrative and clinical practices occur. Little is known, however, about the process of telehealth systems assimilation and about assimilation enabling and impeding factors since most studies to date have focused on user acceptance and adoption little being said on what happens after the initial adoption decision has been taken.

This paper attempts to add to our knowledge of assimilation of large-scale IS by developing a mixed determinants model of telehealth systems and is structured as follows. First, we explain the nature of telehealth systems, the concerns raised by their deployment and elicit on this basis the underlying mechanisms of their assimilation. Next, we develop the conceptual model by integrating insights from three influential theories: the sociocognitive theory of organizational learning, the institutional theory and the structuration theory. Then, we proceed with our contributions to both theory and practice. Finally, we conclude by indicating the future steps of this research.

2. Theoretical background

We first propose a conceptualization of telehealth system to identify its characteristics. We then cover the role and nature of the technological artifact and their articulation with the social and institutional contexts in which the systems and the adopting organization are embedded (Orlikowski and Iacono, 2001). Such a theorizing strategy ensures that the technological artifact is at the core of the model.

2.1 Understanding telehealth Systems

Information technology systems for telehealth projects are large-scale systems linking two or more organizations and many categories of actors. Considerations about social context are essential to insure the success of systems deployment. An understanding of social relations, work structures, cultural factors and the organization's experience with IT are additional imperatives. Given the scope of telehealth information systems, decisions are far too numerous and technology is too diffuse and complex to be grasped by a single person's cognitive ability. Moreover, acquisition and deployment decisions of such systems are not generally situated within the discretionary power of a single member of the organization (Eveland and Tornatzky, 1990 p. 124). When deployment of an information system requires complex organizational arrangements regarding the location of individual decisions, its adoption and application are the product of numerous decisions dictated by economic and social forces that go beyond managerial logic. The organizations' institutional properties, their work politics as well as certain environmental characteristics (Orlikowski, 1992) can be included into the conceptual model by means of the use

of relevant social theories to better understand participating organizations' IT assimilation. Most telehealth initiatives to date aimed at extending conventional health systems by overcoming their limitations such as the inability to provide proper and accessible care throughout large geographical areas. Telehealth projects, combining primary as well as specialized services, not only enable health care coverage beyond geographical boundaries, but also offer the organizational integration of entities with distinct vocations. The rationale for this type of integration goes beyond the logic specific to each organization. All these reasons suggest that assimilation of telehealth systems is influenced by institutional factors, if only to mobilize the necessary resources required to the system integration.

Further, since telehealth systems comprise a variety of technologies such as home healthcare monitoring, telemedecine and tele-education, the very nature of the technology must be accounted for in our conceptual model. Telehealth applications are diverse and are deployed based on numerous technologies such as teleconferencing, digital imaging, data storage and retrieval (sound, images, alphanumeric data), robotic, two-way interactive television, etc. An appropriate infrastructure enabling data transmission and data entry, the creation of multimedia databases as well as communication between different partner organizations must be in place. Accordingly, telehealth information systems comprise different classes of technology. These vary from technologies that do not interact with users to more advanced technologies that require high interaction with professionals as they intrude into health care practices. Some technologies not only support clinical activities, they also provide reasoning behind medical evaluation and training (Grémy and Bonnin, 1995). Finally, they include infrastructure-type technologies, the purpose of which consists of managing large flows of information coming from numerous sources and going to numerous places, services or persons within the organization. These technologies have no reason for existence in and of themselves, they are an integral part of the telehealth organization (Grémy and Bonnin, 1995). When faced to such a broad range of technologies, individuals can feel threatened about partly losing control over their work schedule and professional autonomy. Moreover, given that the systems impose their own representations of the world, individuals' choices become limited. Feelings can range from fascination for some users to frustration for others. .

Telehealth systems combine several heterogeneous parts made up of numerous intrinsically complex components (Paré and Sicotte, 2004). Therefore, it appears more appropriate to conceptualize them as focal technological systems linked by a web of connections to its social, political, and institutional contexts (Kling et Scacchi, 1982). As such, despite the reality that the technological artifact is central to telehealth systems, it remains that it is an element of an ensemble that also comprises the necessary components to apply the technical artifact to a given socio-economic activity (Kling and Dutton, 1982; Illich, 1973). Among these components, we find commitment, additional resources such as training, qualified personnel, organizational agreements, the political and reward systems. In short, we find all that is necessary to promote the effective management of systems (Kling and Scacchi, 1982). The ensemble view of telehealth systems entails at least three things. First, the necessity to consider these systems as embedded in a dynamic and complex social context and the examination of the manner in which different social influences contribute to model its deployment along with how different user groups integrate them (Orlikowski and Iacono, 2001). Second, the structural potential of IT on the rules and resources and the spirit of these systems (Giddens, 1984; DeScantis and Poole, 1994). Finally, it is necessary to consider uncertainties and consequently the interpretation problems due

to the diversity of the technologies involved, the organizational agreements they require and changes into organizational schemas and procedures for everyday action (Barley, 1986).

The previous developments lead us to understand that, not only does the assimilation of telehealth systems entail that we proceed with shared social representations of these systems but also that they are susceptible to become influenced by factors related to these systems' attributes, to characteristics of the institutional context, and to interactions between technological innovation and the organizational milieu.

2.2 Understanding the assimilation

Assimilation is often conceptualized as a learning process (Attewell, 1992; Fichman and Kemerer, 1997, 1999). Our conceptualization, though, differs slightly as we model assimilation as two processes: technological routinization and infusion. Routinization refers to the fact that as time goes by, the system ceases to be perceived as a novelty and becomes taken-for-granted (Saga and Zmud, 1994; Ritti and Silver, 1986; Zucker, 1977). Infusion refers to the system's embeddedness into organizational procedures and work architectures as it links different organizational elements such as roles, formal procedures, and emerging routines (Cooper and Zmud, 1990; Kwon, 1987). As telehealth systems combine diverse technologies their development and implementation, like that of complex systems, become a continual process (Weick, 1990).

2.3 Underlying Mechanisms of assimilation

Making sense of telehealth systems is needed due to the nature of the system and because telehealth constitutes a new form of health services delivery.

Telehealth systems are complex, a reality that is not only due to the institutional agreements that their deployment requires but also to their technological constituents. For example, the Sores Care Tele Assistance Project (SCTAP) implemented by the Sherbrooke Integrated Health University Network deploys seventy three (73) information technologies within sixty five (65) points of care. The deployment comprises eight phases each including the organization of new clinical services and the elaboration of a deployment strategy of new virtual clinics, etc. (RUIS de Sherbrooke, 2007).

Given their complexity, systems in healthcare can create problems never-before seen by managers or by health care professionals (Weick, 1990). As exogenous to the organization context, their introduction is likely to create a certain hiatus between existing meaning, legitimization and domination systems and the new exigencies related to the organization's daily actions (Barley, 1986). These new technologies affect organizational members' capacity to reason on telehealth systems structures because technologies in general, and new technologies in particular, are interpretively flexible (Weick, 1990), they allow for different possible and plausible interpretations by diverse social groups and can be misunderstood, uncertain, and complex (Pinch and Bijker, 1987; Weick, 1990; Orlikowski and Gash, 1994).

This interpretive flexibility results from the presence of information technology artifacts as well as from cognitive schemas (Orlikowski and Iacono, 2001; Chae, 2002). While artifacts are made up of material resources like equipment, applications (Kling, 1987), non-material resources, networking capacity, programming languages (Chae, 2002) as well as structural elements built-

into technology (DeSanctis and Poole, 1994), schemas point to generalizable procedures that take root in the context or pre-existing institutions (Chae, 2002). Within the context of implementation and utilization, procedures can be associated to the social organization of computerization (Kling and Iacono, 1989). Further, since telehealth systems often involve several organizations and individuals, this may even lead to equivocalities in meaning. For example, the SCTAP project regroups thirteen (13) Health and Social Services Centers (Centres de Santé et des Services Sociaux, CSSS), spreading through three of Quebec's geographical regions and calling up ninety nurses. Consequently, schemas can be considered complex, numerous and embedded into multiple structures.

Precedent arguments stress both the participants' perception of ambiguity regarding the nature of telehealth systems and users' need to make sense of these technologies for using and integrating them in their daily practice. Following Orlikowski and Gash (1994), participants develop hypotheses and expectations to build their comprehension about what the technology is and what it is good for and their interpretation of the technology often dictates how he/she will use it. Hence, sensemaking is essential for assimilating the technology into work practice. Further, sensemaking clarifies the system's rationale and the development of its underlying philosophy or, in other words, its spirit (De Sanctis and Poole, 1994). It helps understanding the nature of the technology and its consequences within a given context (Orlikowski and Gash, 1994).

In our view, sensemaking is also a process that modifies the user's cognitive structure (mental models) which could be described as: "a built-up repertoire of tacit knowledge that is used to impose structure upon, and impart meaning to otherwise ambiguous social and structural information to facilitate understanding" (Gioia, 1986, p.56).

2.4 Technology routinization and infusion

Our conceptualization of sensemaking also meets Hall and Loucks' (1977) theory of cognitive adaptations. Individuals go through several understandings (meanings) of the technology as they first make sense of it before using it. Through their use of the technology, their sharing of their experiences with others and their coordinating of their activities with those of others, they refine their understandings (meanings) of it. Users confront their meanings with those of others and refine their understanding of the nature of the technology and of what it is good for though at times conflicts could arise that would lead to a new system's social representation (Lauriol, 1998).

Coordinating their activities with other users is an important means of assimilating the technology because it is the very nature of organizational learning, whose main outcomes are routinisation and infusion. Coordination helps users build up new cognitive coordinations, to memorize them, to repeat them and to transpose them to new situations. Coordination also implies norms and rules and can promote the incorporation of technology into organizational routines. As long as the organization evolves in its understanding of the system and its possibilities, it tends to modify its workplace architecture to increase the extent of systems' use, to integrate the systems' usage and to accomplish activities not previously considered feasible (Saga and Zmud, 1994).

In summary, assimilation starts as an individual learning process through which participants later develop new schemas and scripts to represent the system. Afterwards, though interaction and coordination, an organizational learning process occurs through which individuals' schemas and scripts evolve leading to a shared understanding which initially blends into their routines but ends

up being integrated into their daily practices and organizational beliefs, transcending the individuals who were at the beginning of the process.

3. Development of the conceptual model

3.1 The organizing vision

In the case of technological innovations like telehealth systems, institutional processes come into play from the beginning of the diffusion process. An heterogeneous network of parties creates and employs an organizing vision that contributes to reduce uncertainties surrounding the systems along with their applications (Swanson and Ramiller, 1997). This organizing vision allows members of this network to make sense of the innovation. An organizing vision aims at making the spirit of the technology explicit, namely the underlying philosophies of the IT artifacts as well the motives for its development (Chae, 2002)

Therefore, users do not rely exclusively on their own interpretations of the technology during the early phase of sensemaking as they can use the organizing vision as a starting point. From their original understanding, they will seek to search, probe and confirm meanings with others (Swanson and Ramiller, 1997). They will assess interpretations that exist within their own organisation, yet consistent with those of partner organisations due the presence of an organizing vision. There are, however, some pitfalls and limitations that may arise during the process of sensemaking.

Telehealth projects vary in nature and objectives. They may vary in configuration (same technologies but configured differently) or even use immature technologies or prototypes. System components are ill-defined and their applications are not well understood (Swanson and Ramiller, 1997). Meanings assigned to such technologies reflects incompleteness and instability (Rosemberg, 1994). An organizing vision is warranted to provide a structure that helps users understand the very nature of telehealth systems as well as their role given social, technical and economic contexts (Klecun-Dabrowska and Cornford, 2002). It also provides for reducing equivocalities and creating shared understandings of the system.

The sociocognitive theory of organizational learning, however, suggests that for a given technology, each group is likely to develop a specific set of shared understandings thus forming a technological frame. This frame emerges from interactions among group members through the coordination of their interdependent activities (Schein, 1985; Strauss, 1978) and also through the way the group’s specific norms influence its members (Porac et al., 1989; Grégory, 1983 ; Van Maanen et Schein, 1979).

By formulating expectancies, assumptions and knowledge about key aspects of telehealth systems, the organizing vision contributes to make congruent the groups' technological frames. Therefore, organizations are likely to experience fewer difficulties or conflicts linked to systems’ implementation and use (Orlikowski et Gash, 1994 p.180). Consequently, we make the following hypothesis:

> Conjecture 1- A compelling organizing vision is likely to positively influence the assimilation of telehealth systems.

The organizing vision also provides a structure of legitimization that complements and reinforces the structure of interpretation by including in its discourse aspects directed toward justifying the technological innovation. Discourse pointing to the systems' legitimacy deals with technical and functional arguments with political, organizational and business arguments. This discourse is not just formulated in terms of the low-cost associated with electronically delivered services, it also includes dominant social values and principles like improving the quality of citizens' life (Klecun-Dabrowska et Cornford, 2002). This dimension of the organizing vision is dedicated to communicating not only the expected benefits of the innovation but also its spirit. To illustrate, by promoting teleheath as a means to bring specialized care services to remote regions and to recruit and maintain physicians in those regions, the organizing vision capitalizes on current norms and social values of our society. In so doing, it legitimates telehealth and mobilizes resources needed for its successful deployment (Orlikowski and Gash, 1994, Swanson et Ramiller, 1997). The preceding development suggests the following conjectures:

> Conjecture 2- An organizing vision that promotes telehealth on the basis of the health system's current values and social norms is likely to positively influence the assimilation of telehealth systems.
>
> Conjecture 3- Perceived social benefits are likely to positively influence the assimilation of telehealth systems.

3.2 Policy making

Many barriers have been identified with respect to the diffusion of innovations, two of which are particularly relevant here: lack of reimbursement and legal liability. In the domain of reimbursement for instance, few public or private payers reimbursed healthcare services provided through advanced ICT in the USA during the early years of ICT. Some improvements have been made but are still deemed too restrictive. The Balance Budget Act expanded the coverage to telemedicine services but at the same time introduced new requirements that keep people from using telemedicine under current Medicare conditions (DHSS, 2001). Likewise, Gagnon et al. (2001) reported that the reimbursement system made some services less available and less accessible in the telehealth project implemented in Iles-de-la Madeleine.

Legal liability is an important issue in the diffusion of telehealth. Medical errors account for some 44000 to 98000 deaths every year in the US and errors are attributable in great part to the decentralized, fragmented, complex nature of the US healthcare delivery system (IOM, 1999). According to IOM, the relationship between the complexity of the healthcare system and medical errors can have serious adverse effects on the diffusion of telehealth. For instance, who is accountable for a medical error, the referent of the referring physician? There is no clear answer. Yet, specialists may be reluctant to give medical advice throught ICT. We hence propose:

> Conjecture 4- Policy making directed toward facilitating the reimbursement of telehealth services is likely to positively influence the assimilation of telehealth systems.
>
> Conjecture 5- Policy making directed toward establishing the liabilities of telehealth professionals when an error is reported is likely to positively influence the assimilation of teleheath systems.

3.3 Mediating institutions

Telehealth shares the properties of both technological and administrative innovations (Robinson et al., 2003). As such, deployment issues stem from their incorporation in the organizational and clinical routines (Paré et Sicotte, 2004). Partnerships with mediating institutions like knowledge generating organisations (consulting, universities) specialized in advanced technologies know-how could help lower knowledge barriers associated with technology integration (Attewell, 1992).

> Conjecture 6- Collaboration with some intermediating institutions is likely to positively influence the assimilation of telehealth systems.

3.4 Institutional alignment

Telehealth systems are deployed in healthcare organizations with well-defined values, norms and institutional practices. These institutional elements are instantiated in rules, work procedures, protocols and even current technologies which can influence their assimilation. It has been reported that social structures could serve either as constraints or as enablers to the implementation of systems (Kling and Iacono, 1989). Systems in turn have the capability to introduce a new organizational dynamic that modifies social and hierarchical relationships as well as the balance between institutional arrangements and the organization's daily life (Gosain, 2004). Then, telehealth systems not only triggers a structuration process, but also creates the potential for misalignment between the incumbent institutional regime (installed social base) and the institutional logics embedded in telehealth systems. Indeed, telehealth systems are best conceptualized as complex social objects (Kling and Scacchi, 1982) embodying traces of human intentions that resurface as they are put in use (Chae and Poole, 2005).

> Conjecture 7- Alignment between the incumbent institutional regime and the human agency embedded in telehealth systems is likely to positively influence their assimilation.

3.5 Compatibility

Information systems present a unique combination of human, material and disciplinary agency (Chae and Poole, 2005, Pickering, 1995). Agency refers to the capacity of a thing or person to act purposefully. While human agency involves self-reflexive monitoring and adjustment of action in order to achieve desired ends, material agency refers to the things the physical and biological world does (Chae and Poole, 2005 p.22). Disciplinary agency is the shaping and channelling of human action by conceptual and cultural systems. These differing agencies emerge when IS are put in use or when said differently through interactions with the adopting organizations. This raises a question of compatibility between telehealth systems and the adopting healthcare organization's work systems and technological infrastructure. Compatibility shares some similarity with the concept of institutional alignment described before.

> Conjecture 8- compatibility between telehealth systems and the adopting healthcare organization's work systems and technological infrastructure is likely to positively influence their assimilation.

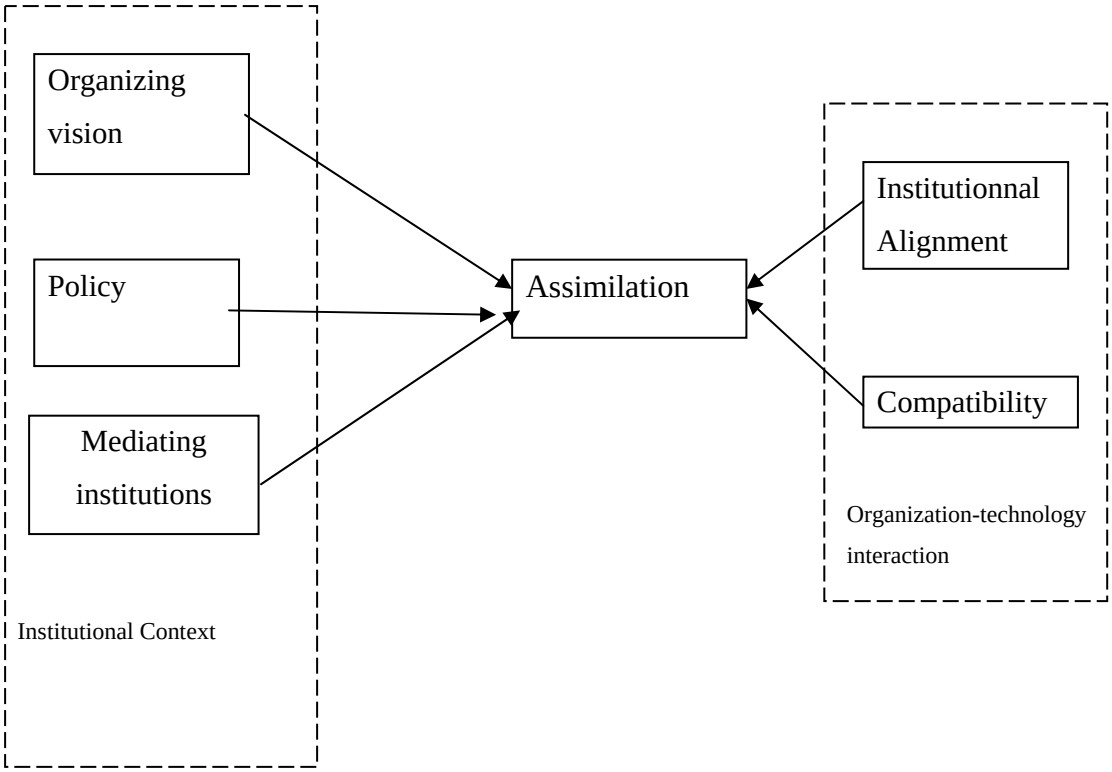

Figure 1: Factors of organizational assimilation of telehealth systems

4. Discussion and conclusion

This paper developed a theoretical perspective for understanding the assimilation of telehealth systems on the grounds of their very nature and the issues raised by their deployment. We propose that systems innovation attributes, institutional environment properties, and interaction between technology and organizations are important determinants of telehealth systems assimilation.

Our paper contributes to research in pointing to the value of grounding the theorizing of assimilation of telehealth systems in the fundamental characteristics of the technological artifact like its interpretive flexibility as well as the complex organizational arrangements necessary to its deployment. Further, unlike in prior studies of assimilation of IS innovations (Chatterjee et al., 2002; Purvis et al., 2001; Gallivan, 2001; Meyer and Goes, 1988), assimilation is conceptualized as an organizational phenomenon that has its theoretical origins in individual interpretation but emerges through social cognition processes to manifest itself as a higher-level phenomenon. It also explains how this compositional process occurs thereby making explicit the sociocognitive mechanisms that underly the assimilation of IS innovations (Kozlowski and Klein, 2000). Second, the model uncovers the interplay between the institutional context and cognitive regulations. In so doing, it makes more salient the fact that assimilation of telehealth systems is essentially a multilevel phenomenon.

Our study also carries implications for practice. Particularly, it points to the importance of examining the assimilation process within the continuum of IS phenomena surrounding the deployment of telehealth systems. As such, it helps understand why managerial actions directed toward facilitating the assimilation process should be employed as early as the adoption phase.

For instance, issues related to compatibility between the systems and the organization's work infrastructure should be managed during the development phase. Briefly, even though routinization and infusion are post-implementation behaviours, factors that are likely to influence them should be taken under consideration before systems acquisition.

Given that the goal of this paper is theory development, additional work is needed to fully operationalize the constructs and empirically test the model. Nevertheless, it builds a sound foundation for better understand assimilation of telehealth systems.

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