

Peering below the Surface: Social Mechanisms for Analyzing Interorganizational Information Systems Integration

Full Paper

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Abstract

In an interorganizational relationships (IOR) context, interorganizational information systems (IOS) need to be integrated in order to support collaboration between partners and provide a fuller exploitation of the systems they share. Although research stresses the importance of the two phases of the IOS integration, that is the systems development and the systems diffusion, there is a paucity of studies on the mechanisms underlying the integration process and their recursive relationships. Adopting a processual approach and drawing on the concept of social mechanisms, we propose a multilevel conceptual framework that conjectures about the dimensions of the IOS integration process and the underlying social mechanisms that explain the *how* of the process and the relationships that dynamically link these dimensions.

Keywords

Interorganizational information systems, IOS integration process, social mechanisms, deep structures, surface structures.

Introduction

Critical to the success of interorganizational relationships (IOR) (Zhao and Xia 2014), the process of integrating the information systems (IS) of several organizations presents numerous challenges that are not only technical but most importantly social. The boundaries of these relationships have become increasingly permeable with the advent of open forms of collaboration (Davis and Marquis 2005; Gulati et al. 2012; Prasad et al. 2012) and dependent of the adoption, use and assimilation at all levels by organizations involved in the IOR (Barki and Pinsonneault 2005; Tanriverdi and Uysal 2011).

To better understand the integration process of interorganizational information systems (IOS) as well as their mechanisms, we first consulted the literature on IS integration in various contexts. We noted that IS integration has been defined and conceptualized in various ways and from diverse perspectives. For instance, in a technical perspective, IS integration is seen as the result of a process during which diverse applications are abandoned, modified or merged (Raymond et al. 2013). In a strategic and a structural perspectives, IS integration is defined as a set of changes to strategies, structures, and systems that support collaboration between partner businesses (Mehta and Hirschheim 2007). In a more relational

perspective, systems integration is also approached as a stable set of relationships and rules that are established concerning various ‘artefacts’, both human and technical (Prasad 2012). Finally, combining several perspectives, systems integration is studied through interoperability as a phenomenon requiring specific technical and managerial skills as well as socially complex abilities (Zhao et al. 2014). Overall, these approaches to study IS integration are based on the notion of a unified whole composed of different elements (Barki and Pinsonneault 2005; Tanriverdi and Uysal 2011) which are going to interact in a more or less deep way (Gulati et al. 2012; Jin and Robey 2008).

In a contemporary context of IOR, the IOS integration process may occur in an extended and open form where technological proximity does not simply refer to physical artefacts, but to the ability of the business partners to share knowledge and demonstrate some flexibility (Knoben and Oerlemans 2006; Robey et al. 2008; Zhao and Xia 2014). Therefore, IOS integration process calls upon the capacity of the concerned organizations to adjust and make the necessary changes.

In this regard, the IOS integration process can be divided into two interrelated phases, which are the development and the diffusion of IOS (Markus et al. 2006). The *development* of IOS puts the emphasis on *surface structures* that include transactions and technical interfaces shared by the partners (Jin and Robey 2008; Robey et al. 2008). The *diffusion* of IOS among business partners calls upon *deep structures* that corresponds to relations and social interfaces established between the partners (Markus et al. 2006; Venkatesh and Bala 2012).

However, extant literature reveals that the studies on IOS integration focus *either* on the development phase *or* on the diffusion of the integration process without a real concern about how surface (technical) and deep (relational) structures interact and influence each other as well as the mechanisms of change required to complete this process. Thus, in order to better understand how IOS integration occurs, there is a need for more research adopting social and behavioral perspectives about IOS and IOR (Bala and Venkatesh 2007; Markus et al. 2006).

We therefore suggest a more holistic view about the IOS integration process and its underpinning processes and structures (Avgerou 2013b; Pentland 1999). Our objective here is to propose a multilevel conceptual framework of the IOS integration process, which can be used to answer the following research question:

How does the interconnection between surface structures (technical interfaces) and deep structures (social interfaces) explain the process of IOS integration?

In other words, we aim at providing a methodological tool to better explain “how, why, and when things happened, relying on varying views of causality and methods for argumentation” (Gregor, 2006, p.619). Engaged in a theory-building effort, we put “less emphasis on the synthesis of prior literature and more emphasis on theoretical development” (Rivard 2014, p.iv). To this end, we introduce the social mechanisms lens as an approach to better understand the sequence of events as well as the specific mechanisms of change related to the IOS integration process.

The structure of the article is as follows. The first section presents the conceptual background related to IOS, IOR and social mechanisms, including more complete definitions of our concepts. We then describe the conceptual framework and discuss the related methodological aspects. Finally, expected contributions and avenues for future research are identified.

Conceptual Background

Interorganizational systems and relationships (IOS/IOR)

Research in the areas of IOS and IOR respectively took an important turn over the last 15 years. The IS literature we consulted highlights the fact that knowledge generated in the context of traditional interorganizational relationships, such as electronic data interchange (EDI) or supply chain management, is generally insufficient for the study of IOS in the 21st century that are based on open IT standards and universal applications, whether or not Internet-based (Markus et al. 2006; Robey et al. 2008).

In the contemporary IOR context, the IOS process is complex. IOS integration process can now be considered from various points of view: technical (Raymond et al. 2013; Tanriverdi and Uysal 2011),

strategic (Mehta and Hirschheim 2007), relational (Prasad et al. 2012), or a combination of all of these (Rai et al. 2012; Zhao and Xia 2014). Not only it compromises about the balance between legacy systems and emerging applications that must be made (Raymond et al. 2013) because of the presence of a network of partners (Trang et al. 2013), but it is also necessary to orchestrate the collaboration between partners (Bala and Venkatesh 2007; Markus et al. 2006).

Therefore, the first phase of the IOS integration process - the development of systems (surface structures) – should no longer be dissociated from the second phase – systems diffusion (deep structures) – through social mechanisms and interfaces that are established (Jin and Robey 2008; Markus et al. 2006). The IOS integration should be undertaken in a manner that allows not only the adoption and use of ISs, but also their assimilation and coordination at every level of the partners' network (Venkatesh and Bala 2012; Williams and Karahanna 2013).

Instead of concentrating on specific technologies, this new paradigm focuses on collaboration and the knowledge about technologies that users possess and share (Knoben and Oerlemans 2006). This line of thought underscores the importance of identifying the mechanisms that allow partners both to cooperate effectively and to take full advantage of the technological tools that they share. Studies adopting this perspective illustrate the evolution of IOR from a dyadic mode to a network mode where knowledge sharing and collaboration replaces the hierarchical context (Gulati et al. 2012; Hagedoorn 2006; Howard et al. 2003).

Interorganizational information systems integration process – a complex multilevel mode of change

We consider organizations as being multilevel phenomena (Robey et al. 2008) and, therefore, IS-driven organizational changes, such as the integration of IOS, is best outlined as a process theory that takes into consideration how processes at different levels of analysis shape each other (Van de Ven and Poole 1995; Van de Ven and Sun 2011). These changes can be illustrated over time by four different theories of change: life-cycle, teleology, dialectic, and evolutionary (Van de Ven and Poole 1995). Life-cycle and evolutionary are prescribed modes of organizational development and change because the process unfolds in a pre-established order; teleology and dialectic are constructive modes of change as the development is discontinuous and unpredictable. Furthermore, life-cycle and teleology depict development and change of a single organizational entity, while evolutionary and dialectic depict multiple organizational entities such as an IOR arrangement among business partners. We suggest that IOS integration be examined using evolutionary and dialectic modes where multiple entities are facing both competitive and conflicting changes (Van de Ven and Sun 2011). This approach will provide a better understanding of the sequence of events as well as the specific mechanisms of change related to the IOS integration process.

Over time, the interorganizational IS integration process has been studied from two main perspectives: 1) *complementarity* and 2) *recursivity*. The complementarity perspective adopts a linear study of the IOS integration process (Markus et al. 2006) and researchers in this line of thought focus on the description of resources, functionalities and structures (Robey et al. 2008; Trang et al. 2013). A number of studies focus on coordination mechanisms and capabilities (Rai et al. 2012; Tanriverdi and Uysal 2011; Williams and Karahanna 2013), others on collaborative structures (Aggarwal et al. 2011; Prasad et al. 2012) and IT governance (Croteau and Bergeron 2009; De Haes and Van Grembergen 2005). All these studies have two aspects in common. They do not identify the mechanisms that underlie the IOS integration process and they underscore a dominant evolution mode of organizational change that can be illustrated through linear mechanisms such as variation, selection and retention (Van de Ven and Poole 1995). Thus, this line of research is preoccupied with what is called *surface structures* (Avgerou 2013b; Pentland 1999).

The recursivity perspective focuses on in-depth analyses of the structures at all levels of the integration process with a particular attention to recursive diffusion mechanisms (Markus et al. 2006) and to the challenges related to collaboration between partners (Barnett 2004; von Hippel and von Krogh 2003). The authors of these studies are interested in unearthing the mechanisms that trigger and affect contextualized collaborative efforts during the IOS integration process (e.g., Jin and Robey 2008; Rodon 2008). For instance, Jin and Robey (2008) use the concepts of internal and external interfaces, which they divide into two categories corresponding respectively to the technical systems and the social systems to analyze an IOS integration process. Using structuration perspective, Rodon et al. (2008) proposes a

process-based model to analyze the mechanisms that influence user appropriation of interorganizational information systems.

To summarize, on one hand the recursivity perspective illustrates how, in a single study, it is possible to combine the two phases of the IOS integration process. This is accomplished by highlighting the recursive nature that characterizes interaction between the tangible structures (transactions and technical interfaces) and the relational mechanisms and structures (relations and social interfaces). However, these studies do not specifically analyze the latter. On the other hand, studies adopting the complementarity perspective do not take into consideration the deeper processes, mechanisms and structures, in order to explain how they interrelate with surface mechanisms in a causal explanation manner (Avgerou 2013b; Gregor 2006; Pentland 1999).

Following this line of thought, we consider that IOS integration process does not only imply that IOS work well across organizational boundaries between business partners from a technical perspective, but it also infers that the mechanisms that emerge between decision makers, IT professionals, and users are set in such a way that the IOS benefit everyone.

We therefore propose to assess how the technical and social dimensions of the process affect each other. Social interactions or mechanisms can be illustrated as *deep structures*, recurring social mechanisms that lie under the surface structures (Avgerou 2013a; Heracleous and Barrett 2001). The concept of deep structures is essential to a better understanding of the different levels of social systems (Gersick 1991). In the context of IOS integration, we understand deep structures to represent “continually recurring processes and patterns that underlie and guide surface, observable events and actions” (Heracleous and Barrett 2001, p.758). Any organizational change, such as IOS integration, will affect these patterns and principles of interaction by imposing new and different set of rules and practices (Gersick 1991). In terms of modes of change (Van de Ven and Poole 1995), the deep structures level of the IOS integration process can be addressed as a dialectic organizational change where the specific mechanisms are: thesis/antithesis, conflict, synthesis.

Social Mechanisms Lens

Rooted in the dynamics of relationships and the recursivity of action and its context (Gross 2009), the concept of ‘social mechanisms’ seems to be appropriate to be used to research in the field of IOS both conceptually and as the basis for a methodological strategy (Avgerou 2013b). We consider social mechanisms as being processes composed of actions, events (Avgerou 2013a; Goh et al. 2011), and “chains or aggregations of actors confronting problem situations and mobilizing more or less habitual responses” (Gross 2009, p.368). We believe that focusing on social mechanisms, including relational processes as well as structural elements (Robey et al. 2008) can lead to a more complete and dynamic explanation of the IOS integration process (Avgerou 2013b). Social mechanisms can provide a two-folded causal explanation of a phenomenon by: 1) identifying the processes underlying the outcomes of a phenomenon (Avgerou 2013b). For example, Avgerou (2013a) identifies social mechanisms that explain the process of emerging trust in e-voting in Brazil. In her study she distinguishes between initial formation of trust (*surface structure*)_based on institutional and governmental structures and recurrent manifestations of trust (*deep structure*) illustrated by social mechanisms; and 2) by bridging different levels of analysis (Hedström and Swedberg 1998). Social mechanisms can provide explanations on how one micro-level event leads to and affects the ensuing one. It can also shed light on how a macro-level or surface structure pattern (i.e., organizational level decisions) may trigger the succession of micro-level or deep surface events.

In this viewpoint, IOS integration can be described as a process encompassing a sequence of individual and collective practices and events unfolding over time in a specific organizational context. By using social mechanisms, the resulting view of the process will tell a rich and detailed story of the events taking place within a target situation by explaining how influential factors interact, how they collectively lead to future action, and what constrains them.

People from different organizations engaged in a shared practice, such as the process of IOS integration, draw on separate experiences from other situations, bring different interests and do not form an entirely homogeneous group given their idiosyncratic backgrounds and experiences (Brown and Duguid 2001; Knoben and Oerlemans 2006). The goal of change, then, centers around the expansion of the distributed

knowledge base, the production of novel activities, and the continuous shaping of a shared viewpoint, which would reflect the local idiosyncrasies of their shared practices (Gulati et. 2012). To better understand the intricacies of the IOS integration process, our study aims at proposing a theoretical framework that would provide a methodological tool (social mechanisms) to analyze deep structures and a causal explanation of the interaction between deep and surface structures.

Conceptual Framework

Despite the interest of prior researches, there is still a lack of understanding of how the transactions and the technical interfaces (*surface structures*) are related to the relations and the social interfaces (*deep structures*) during the IOS integration. We argue that there is a need for underpinning the causal processes that occur in a collaborative IOR context by using the social mechanisms lens. Such approach will not only allow the analysis of the combination of the two phases of the IOS integration process (development and diffusion), but it will also bring together the two perspectives (complementarity and recursivity) through which the processes can be better explained.

Our conceptual framework (see Figure 1) suggests that IOS integration process includes two phases that illustrate the relationship between the surface structures (related to transactions and technical interfaces) and the deep structures (that include the relations and social interfaces).

To better understand the IOS integration process, the framework proposes two interlinked analyses: 1) a macro analysis of the surface structures by looking at the transactions and the technical interfaces of the IOS connected to 2) a micro analysis of the deep structures that focuses on relations and social interfaces of the challenges related to the IOS integration.

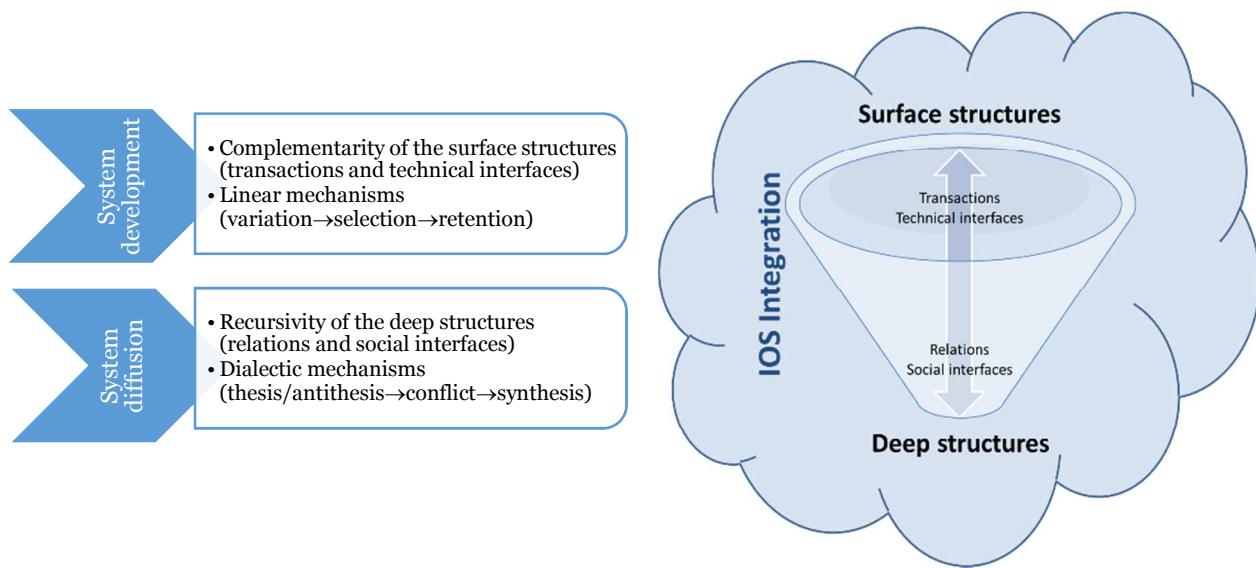


Figure 1. A Multilevel Conceptual Framework of the IOS Integration Process

The use of these two levels of analysis conjectures that we should also take into account the different types of events and interactions that occur. Specifically, it means identifying the modes of change, as well as the mechanisms that are the most appropriate (Van de Ven and Poole 1995; Van de Ven and Sun 2011), depending on the complementarity of the surface structures and the recursivity of deeper structures.

Our interpretation of the IOS integration in a contemporary and collaborative IOR context suggests that during the first phase of this process – the systems development which addresses the transactions and the technical interfaces –, we see an evolutionary mode of change wherein the variation, selection and retention processes are completed through linear mechanisms (Van de Ven and Poole 1995). During the second phase, which relates to the systems diffusion, we posit that the relations and the social interfaces

evolve via dialectic mechanisms wherein the thesis/antithesis, conflict and synthesis processes are realized (Martin 2009; Van de Ven and Poole 1995). In other words, the IOS integration between business partners is realized when different technical interfaces are merged or modified to thereafter end up in a combination of distinct and complementary technological resources that form a unified well integrated IOS (Raymond et al. 2013; Barki and Pinsonneault 2005).

Furthermore, with the notion of complementarity associated to the evolutionary mode of change at the surface level, and the recursive perspective which is related to the dialectic mode of change at the deeper level, our framework suggests that both linear and recursive interactions occur at different levels of the IOS integration process.

Based on the above arguments, we advance the following research propositions:

P1: The development phase of IOS (technical interfaces) will affect and be affected by the diffusion phase (social interfaces) in a way that encompasses both linear and dialectic mechanisms.

P2: Understanding the mechanisms that occur in both phases of the IOS integration process will enable a better collaboration between the partners and a fuller exploitation of the technological tools they possess and share.

P3: The successful completion of the IOS integration in a contemporary and collaborative IOR context will be obtained from the continual adjustment between the surface and the deeper structures.

A phenomenon such as the IOS integration process, is enriched when studied through social and behavior lenses (Jin and Robey 2008; Markus et al. 2006). This is what our conceptual framework offers by adding the social mechanism lens as a methodological strategy to the more common linear approach (Avgerou 2013b). Based on the process theories of change (Van de Ven and Poole 1995; Van de Ven and Sun 2011), our proposed approach allows the observation of the causal intermediates events as well as the specific mechanisms that link the surface structures with the deep structures of the IOS integration process.

Methodological Considerations

According to Avgerou (2013b), explanatory theorization of IS phenomena should comprise three methodological components.

Choice of the research design: It needs to foster the identification of the process of interest and provide solid methodological foundation for the explanation required by the research goal. Explanatory theory-building-from-cases approach (Eisenhardt 1989) represents the appropriate research design to empirically test a process theory such as the practice perspective (Orlikowski 2002). More specifically, the practice perspective focuses on daily practices that are centrally organized around shared practical understandings (Schatzki 2001) and are defined as being the “recurrent, materially bounded and situated action engaged in by members of the community” (Orlikowski 2000, p.256). It provides a process-based view to ‘how’ practices are generated within a specific context, reinforced, reproduced, and altered, and with what intended and/or unintended outcomes. Phenomena such as social order, knowledge, meaning, power, language, and social institutions are intimately linked to practices (Schatzki 2001). Thus, a case study approach represents “a research strategy which focuses on understanding the dynamics present within single settings” (Eisenhardt 1989, p.534). In this way, the researcher will be able to identify emerging dimensions of the IOS integration process (surface and deep structures) and the underlying social mechanisms that causally explain the relationship that dynamically link these structures (Avgerou 2013b; Gregor 2006; Pentland 1999). Explanatory theorization will provide the *how* IOS integration initiatives fail or succeed even if the explanation differs from that developed for other IS integration efforts or collective actions in different contexts (Markus et al. 2006).

Theoretical lens adoption: Usually a social theory, such as the practice perspective (Orlikowski 2002), will comprise fundamental assumptions on how processes of socio-technical change happen (Avgerou 2013a; Avgerou 2013b). Practice-based explanatory theorization will identify the social mechanisms that explain the intermediate events that partially influence the collaborative practices during an IOS integration process in an IOR context. The empirical focus will be on the daily practices in which individuals engage by having a common goal, that is, the IOS integration.

Social mechanisms identification: Social mechanisms unfold in time (Gross 2009) and emerge from the narratives of events (Avgerou 2013b), practices, and interactions that cause the outcomes of the IOS integration process. While it would be preferable to focus on identifying only events that can be observed (Avgerou 2013b), it has been suggested to also take into consideration social mechanisms that are created by organizational members as an intellectual construct based on their perceptions of imaginary situations. These frames of mind mimic real life with abstract actors casted in a specific context (Gross 2009).

Adoption of a process-based approach instead of a variance-based approach and using social mechanisms to understand the complex nature of the relationship between deep and surface structures, has a two-fold methodological advantage: 1) variance approach advances linear cause-and-effect types of relationships under contingent conditions between antecedents and outcomes. Processual approach posits that the outcome may or may not happen considering the same contingent conditions. However, each causal path will be explained by several social mechanisms “interwoven in broader processes that bring about the phenomenon under study and its outcomes” (Avgerou 2013b, p.411); and 2) process-based theorization defines outcomes as being discrete phenomena, whereas variance-based theorization hypothesizes them as variables that reflect a range of values. Thus, only a processual approach will provide explanation of how processes of IOS integration will unfold over time (Van de Ven and Poole 2005).

Conclusion

Our work makes two main contributions. First, it contributes to the IS literature on IOS by proposing a multilevel framework based on two modes of change, evolutionary and dialectic, that explains how dialectic mechanisms emerging at the deep surfaces level recursively interact with the linear mechanisms at the surface structures level during the IOS integration process. Second, our study answers Robey et al.’s (2008) call for new research approaches that would address the lack of clear explanatory status of the characteristics of IOS in the extant IS literature (p.512). Our framework suggests that the concept of social mechanisms, as a methodological tool, can identify more complete and unique causal explanations of the IOS integration process dynamics.

Despite their explanatory power to provide better understanding of the *how* (deep and surface structures recursive relationships) of the IOS integration process, researchers should take into consideration two major challenges when using social mechanisms. First, is related to the difficulty of making sense of rich, unstructured process data (Langley 1999; Pentland 1999). Researchers need to develop reliable methods for identifying and tracing social mechanisms that will provide a balance between rigor on one side and imagination and novelty on the other side. Second, researchers should take into consideration that in the end social mechanisms-based process theorization needs to be considered as an incomplete form of causal explanation. These may appear as an important limitation, but empirical causal explanation by social mechanisms is probably the only type of explanation appropriate for socio-technical phenomena (Avgerou 2013b). Explanatory theorization can be used by IS researchers as complementary to deterministic-type models in terms of otherwise unobservable elements that might increase the validity of the variance models.

Our study opens up avenues for more in-depth explorations of the IOS integration process. Practice theory-related perspectives, such as sociomateriality (Leonardi 2013), could be used to shed further light on, for example, how practices are negotiated during the integration process rather than being systematically selected by the upper management of the IOR partners at a particular moment in time. The central tenet of the sociomaterial perspective is that neither technology nor social agency can be represented independently. Therefore, we suggest that a sociomaterial analysis can be performed to study how technologies, people, and organizations continuously interact during the IOS integration process.

In conclusion, the IOS integration in an IOR context is a journey, not a discreet one-time event. Thus, we suggest that a social mechanisms-based processual approach can help IS researchers understand the complex process of IOS. However, in adopting this approach, they should take into account methodological issues, such as the identification and analysis of social mechanisms, implied by an explanatory theorization approach.

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