The management of misalignments in implementations of technological innovations in networks of organizations

José Coelho Rodrigues (corresponding author)
jose.c.rodrigues@inescporto.pt
INESC TEC (formerly INESC Porto)
Faculdade de Engenharia, Universidade do Porto
Rua Dr. Roberto Frias, 378, 4200-465 Porto, Portugal
Tel. +351 222 094 000
Fax +351 222 094 050

Ana Cristina Barros
acbarros@inescporto.pt
INESC TEC (formerly INESC Porto)
Rua Dr. Roberto Frias, 378, 4200-465 Porto, Portugal

João Claro
jclaro@fe.up.pt
INESC TEC (formerly INESC Porto)
Faculdade de Engenharia, Universidade do Porto
Rua Dr. Roberto Frias, 378, 4200-465 Porto, Portugal

The management of misalignments in implementations of technological innovations in networks of organizations

Abstract

This paper presents a conceptual framework for the management of misalignments between technological innovations and networks of organizations in implementation projects. The framework is based on a comprehensive review of innovation implementation studies, with particular attention to studies about misalignments and implementations in networks of organizations, although these were found to be scarce. The paper offers a set of influencing relations between technical and structural misalignments and the implementation management, process and outcome. This study moves the focus of research on misalignments in implementations of innovations beyond an organizational locus of adoption, to an interorganizational network locus of adoption. Managerial implications from the improved understanding of the management of misalignments in implementation projects are provided.

Sumário

Este artigo apresenta uma ferramenta conceptual para a gestão de desalinhamentos entre inovações tecnológicas e redes de organizações em projetos de implementação. A ferramenta de gestão proposta é construída a partir de uma revisão da literatura sobre implementação de inovações, com particular atenção aos estudos sobre desalinhamentos entre utilizador e inovação, e sobre implementações em redes de organizações, ainda que estes últimos sejam escassos. O artigo introduz um conjunto de relações de influência entre os desalinhamentos técnicos ou estruturais e a gestão, o processo e o resultado das implementações. Este estudo avança o foco da investigação em desalinhamentos em implementações para lá das organizações como locais de adoção, para as redes de organizações como locais de adoção. São também apresentadas algumas recomendações de gestão resultantes de um melhor entendimento dos desalinhamentos em projetos de implementação.

Keywords: Innovation implementation, implementation management, misalignment, network change, learning process, technological innovation

1. Introduction

Today's economy is dominated by networks of organizations – systems of complementary products or services provided by different organizations (Hayes, 2005). Networks of organizations are usually complex scenarios, as they feature a semi-dependence structure, i.e., organizations with independent power structures but mutual dependence as they jointly seek to provide a competitive product or service.

The operations of these networked structures, especially the interactions between organizations, often use technological solutions. Electronic data interchange (EDI) systems, radio frequency identification (RFID) systems, and other software tools have been adopted by networks of industrial organizations, supply chains in particular, to support collaborative business operations (Chwelos, Benbasat *et al.*, 2001; Croteau e Bergeron, 2009; Cegielski, Jones-Farmer *et al.*, 2012). Specific software platforms have been created to support collaborative R&D work between different universities and R&D organizations (Grethe, Baru *et al.*, 2005; Cunha, Oliveira *et al.*, 2007). Health information systems, such as electronic health records, and evidence-based practices have been adopted by networks of health care providers to provide better and more integrated care (Barlow, Bayer *et al.*, 2006; Sicotte, Paré *et al.*, 2006; Aarons, Hurlburt *et al.*, 2011; Palinkas, Fuentes *et al.*, 2012).

A full realization of the potential of technological innovations requires a good understanding of the adoption process. Adoptions of technological innovations by individuals are simpler than adoptions by organizations, or by networks of organizations. In the latter two, the process of *implementation* becomes critically important for the assimilation of the technology in the routine operations of the organization, or the network (Leonard-Barton, 1988; Rogers, 2003; Greenhalgh, Robert *et al.*, 2004). The implementation process includes activities from the adoption decision to the incorporation of the innovation in the routines of the adopter, or its abandonment, and can be divided into three main stages: adoption decision, implementation, and assimilation (Rogers, 2003; Greenhalgh, Robert *et al.*, 2004). This paper focuses on the study of the implementation and assimilation stages.

Implementations of technological innovations in networks of organizations inevitably cause initial losses of productivity, mainly due to misalignments between the technological innovation and the network (Leonard-Barton, 1988; Wei, Wang *et al.*, 2005; Basoglu, Daim *et al.*, 2007; Wu, Shin *et al.*, 2007). Misalignments lead to a dynamic sequence of mutual adaptations throughout the implementation process, with adjustments to both the structure and the capacities of the network, and the technology (Leonard-Barton, 1988; Wei, Wang *et al.*, 2005). These mutual adaptations will most likely have a significant impact in the outcome of the implementation process and are thus an important concern for its management. This means that implementation management practices (decisions and actions) will influence and be influenced by the sequence of mutual adaptations.

Managing implementations in networks of organizations is far more challenging than for other loci of adoption because many implementation decisions will have to be orchestrated between organizations (Goes e Park, 1997; Dhanarag e Parkhe, 2006), and the dynamics of network evolution will depend not only on each organization, but also on their mutual alignment.

Research on misalignments between technology and adopter in the context of implementations in networks of organizations is scarce. In this paper we contribute to address this gap by suggesting a conceptual framework for their study, characterizing the effects of misalignments on the implementation process and outcome, the effects of misalignments on decisions about implementation management practices, and the effects of management practices on the evolution of misalignments throughout the implementation process. The conceptual framework presented in this paper will allow future empirical research, namely addressing the research questions such as: “How do misalignments influence implementation management, process and outcome?”, and “How do implementation management practices moderate the impacts of misalignments in the implementation process and outcome?”

In order to build the conceptual framework we conducted a comprehensive review of the innovation diffusion, adoption and implementation literatures, with particular attention to studies about misalignments and to studies with networks of organizations as the locus of adoption, although these were found to be scarce.

The variety of foci observed in implementation studies, both in terms of industries and innovations, suggests the interest of an interdisciplinary perspective on innovation implementation, and consequently the relevance of theories other than diffusion of innovations theory. Additionally, the occurrence of dynamic adaptations suggests the use of a learning theory lens to address the evolution of the implementation process. Therefore, our framework is supported mainly by diffusion of innovations theory, but also considers important contributions from network theory, institutional theory, interorganizational learning theory, and other research streams such as product architecture, and dynamic capabilities.

The remainder of the paper is organized in four sections. Section 2 presents the misalignments that may be found in implementation projects. Section 3 presents the conceptual framework. Section 4 discusses the conceptual framework, with a specific emphasis on managerial implications. Finally, section 5 presents future research and concludes the paper.

2. Misalignments

Misalignments between the technological innovation and the network of organizations result from a lack of compatibility between them and emerge dynamically and unpredictably during the implementation process, especially in its beginning (Leonard-Barton, 1988; Wei, Wang *et al.*, 2005). They influence performance at different levels – network, organizations, units, and personnel – which have different evaluation criteria and perspectives on the implementation process (Leonard-Barton, 1988). The mutual adaptation process that takes place during the implementation is thus very difficult to plan and has an unpredictable outcome (Wei, Wang *et al.*, 2005).

In this section we present these misalignments, following their broad categorization as technical or structural (Leonard-Barton, 1988; Wei, Wang *et al.*, 2005; Basoglu, Daim *et al.*, 2007). We describe each type of misalignment and identify the key elements of the network and the technology that can lead to it. We then suggest a simple system to assess the impact of misalignments. As we are focused on the network as a level of analysis, this system focuses on measuring the impact in the network and in its organizations.

2.1. Technical misalignments

One of the sources of the lack of compatibility between the technology and the network is the learning complexity of the technology. **Learning complexity** is the degree to which a technology is perceived as difficult to understand and use (Rogers, 2003), in terms of the capabilities it requires (Linton, 2002; Berta, Teare *et al.*, 2005). In general, higher degrees of diversity and newness of the capabilities required correspond to higher complexities (Edmondson, Bohmer *et al.*, 2001; Linton, 2002), and the technology is perceived as difficult to use or complex to learn if the capacities available in the network are not aligned with the capacities required. As a perception, learning complexity is a subjective characteristic, and different networks may have different perceptions for the same technology.

Network capacity is the degree of maturity and technical capacity of the organizations in the network. Maturity is the prior experience that the organizations have with similar innovations and implementations (Berta, Teare *et al.*, 2005; Hausman, Johnston *et al.*, 2005), and it provides the organizations, and consequently the network, with higher technical capacity (Hausman, Johnston *et al.*, 2005). Technical capacity comprises the existing technical capabilities in the organizations of the network (Hausman, Johnston *et al.*, 2005). More mature organizations also tend to be older, which, as believed by network theorists, may be a disadvantage for implementation projects, since they feature more deeply established routines that increase their resistance to change. However, from an organizational ecology theory perspective, mature organizations bring prestige to the network, especially to the part of the network directly connected to them, which might be an advantage for implementation management. These conflicting views indicate that maturity is a characteristic that should be managed with caution, as in some cases it might be advantageous, but in others it might be disadvantageous (Linton, 2002).

The different capabilities required may be mapped to specific functional modules of the technology (desirably a functional module is used by only one organization in the network) to facilitate the comparison with the capacities available in the network organizations, and the identification of the misalignments. A map of the capabilities of each organization (allowing possible duplication between organizations) can be recorded in a simple matrix, including an indicator of how long they have existed. As the capabilities of an organization might change over time, this might be a better maturity indicator than the age of the organization.

There are two types of **technical misalignments**: between the technological innovation and the specifications defined in the initial adoption decision stage, and between the technological innovation and the capabilities that exist in the network (Leonard-Barton, 1988). We will not address the former, given our focus on the implementation and assimilation stages. The latter can be identified by comparing the maps of learning complexity and network capacity described above, to assess: whether the technological innovation will shift the role boundaries between the organizations in the network (Leonard-Barton, 1988; Edmondson, Bohmer *et al.*, 2001) – a capability previously in one organization is shared with other organizations; whether new tasks and capabilities are introduced in some organizations in the network; and whether existing tasks and capabilities are changed.

It is important to notice that these misalignments may be beneficial for the network, since they may introduce more systematic order into the operations of the network (Leonard-Barton, 1988). It is also important to take into consideration the fact that the technological innovation may initially be outperformed by current technologies, as misalignments inevitably lead to temporary losses of productivity, often more than anticipated (Leonard-Barton, 1988).

2.2. Structural Misalignments

The systemic complexity of technology and the network structure are the two elements leading to structural misalignments (Barlow, Bayer *et al.*, 2006). **Systemic complexity** concerns the structure of the users that are integrated in a same system that uses the technology (Fichman, 1992; Barlow, Bayer *et al.*, 2006). It defines the different organizations whose operations will have to be coordinated in the implementation, and whether or not a new network structure is required (Leonard-Barton, 1988; Fichman, 1992; Barlow, Bayer *et al.*, 2006). Measuring systemic complexity thus requires knowing how many different units of adopters (organizations) will use the technology, and how they will be connected (Barlow, Bayer *et al.*, 2006).

The use of a design structure matrix (DSM) (Steward, 1981) may be beneficial to characterize systemic complexity. It allows the representation of the interactions that exist between the functional modules of the technology. This will facilitate a comparison with the structure of the network, in order to identify structural misalignments. The DSM may also record information about the degree of dependency between modules, to enable the identification of misalignments in degrees of dependency.

Network structure can be described by a set of factors derived from network theory, such as size, centralization, homogeneity, connection density, connection strength, blindness, and stability (Tichy, Tushman *et al.*, 1979; Linton, 2002; Borgatti, Mehra *et al.*, 2009). Similar to systemic complexity, the structure of the network may be represented in a DSM, mapping the relations between the organizations and characterizing the strength of each connection (from weak to strong).

Structural misalignments, as the name suggests, are incompatibilities between the structure of the technological innovation (i.e., its systemic complexity) and the structure of the network. Similar to technical misalignments, structural misalignments can be assessed through the comparison of the matrixes of systemic complexity and network structure. This comparison will highlight the need for new organizations in the network, the need for new connections between organizations (Barlow, Bayer *et al.*, 2006), and impacts on the strength of interdependencies (Edmondson, Bohmer *et al.*, 2001). This analysis assesses the adequacy of the network structure to the use of the technological innovation (Leonard-Barton, 1988).

Given our focus on structural misalignments, the network structure will be characterized by the number of organizations (size), the structure of the connections between organizations, and the strength of each connection – the degree of dependency or social ties between organizations (Hausman, Johnston *et al.*, 2005; Taylor, 2005; Palinkas, Fuentes *et al.*, 2012).

2.3. Assessing the impact of misalignments

Misalignments have an impact on the performance evaluation criteria of the network and its organizations. Each misalignment will have specific impacts on the implementation process, its management practices, and possibly its outcome, so it is important to consider them individually when assessing their impact on implementation projects.

Impacts can be evaluated in two dimensions (Leonard-Barton, 1988):

- the significance of the impact of the misalignment on performance (from low to high), depending on how core or peripheral are the activities and capabilities affected, according to the objectives of the network;
- the nature of that impact – negative (as in the case of delays, decreased status, or routine unpleasantness) or positive (as in the case of the improvement of skills or of the quality of an output).

Similar to Leonard-Barton (1988), we propose the characterization of each misalignment in an evaluation matrix that considers the significance and impact dimensions, as shown in Figure 1.

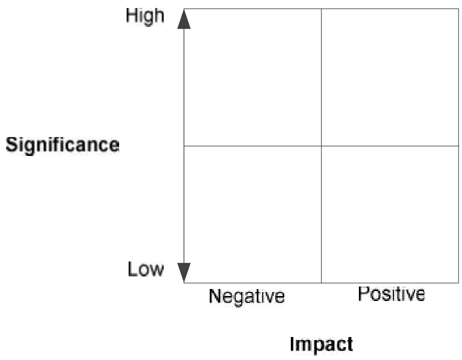

Figure 1 – Misalignment impact matrix (adapted from Leonard-Barton (1988)).

3. Framework to manage misalignments

The lack of compatibility between the technology and the network described in section 2, may be reduced by changes in the technology – reinvention possibility – or by changes in the network, following the principle of mutual adaptation cycles (Leonard-Barton, 1988). Both types of change may be initiated by the managers of the implementation process (Wei, Wang *et al.*, 2005; Basoglu, Daim *et al.*, 2007), aiming at influencing positively the implementation process and outcome, motivating the users, and increasing the positive impacts and reducing the negative impacts of the misalignments (Leonard-Barton, 1988; Wei, Wang *et al.*, 2005; Basoglu, Daim *et al.*, 2007).

In this section we propose a conceptual framework to analyze and manage misalignments in implementation processes, illustrated in Figure 2. We first present our conceptualization of the implementation process and its outcome, and how their evolution may be influenced by misalignments. Then, we introduce implementation management practices in our framework, and explain how they may be influenced by the misalignments, and on how they may influence misalignments and implementation evolution.

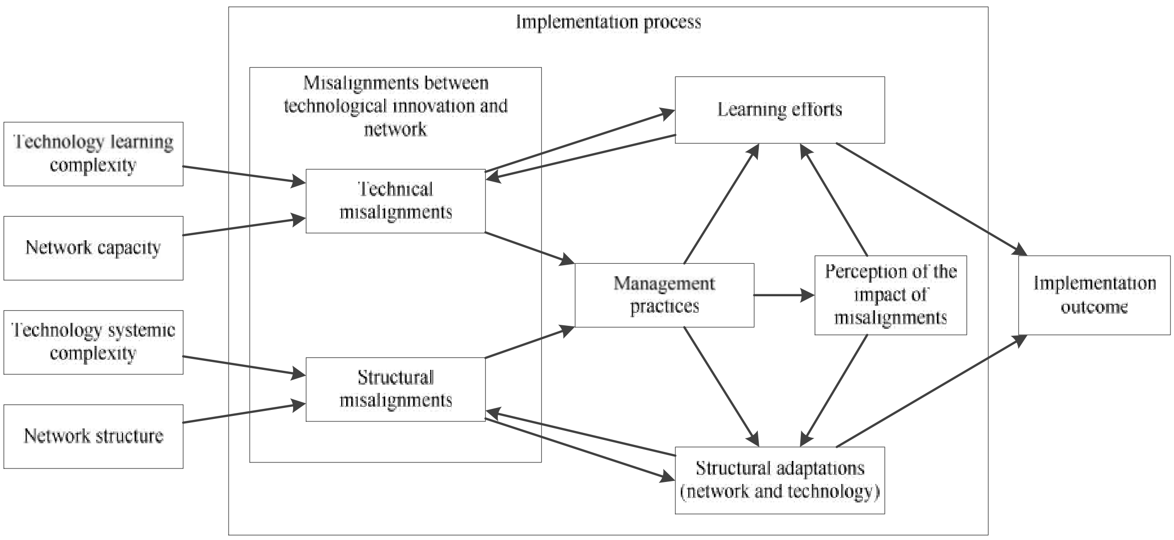

Figure 2 – Conceptual framework.

3.1. Implementation process and implementation outcome

This conceptual framework is focused on the stages of implementation and assimilation in the implementation process. It is at these stages that management practices play a role, influencing the assimilation of the technology into the daily operations of the network. In the adoption decision stage, the typical problem is to select the technology that best fits the organization, i.e., the technology with fewer misalignments (Hausman, Johnston *et al.*, 2005; Wei, Wang *et al.*, 2005; Wu, Shin *et al.*, 2007), whereas in later stages, the technology has been chosen and the misalignments have to be managed, which is the problem that motivates our framework.

We consider implementation as a **learning process**, similar to the process proposed by Baum e Ingram (2002). From an implementation management perspective, the challenge for the network is the creation of new interdependencies and capabilities, or the modification of the current ones, that will allow it to use the innovation efficiently. Implementation managers will use the performance criteria of the network throughout the whole process to assess the impacts of misalignments, and change dynamics will modify or create a network structure and capacity closer to the required structure and capacity, but they may also modify the learning and systemic complexities of the technology to better suit the network.

The success of an implementation can be evaluated by an outcome, whose evolution can be monitored for purposes of adjustment. An **implementation outcome** has two important general dimensions: the efficiency of the implementation process (the level of routinization and incorporation in the network) and the impact of the innovation in the performance of the network (the level of enhancement of its performance) (Klein e Sorra, 1996). Misalignments may have impacts on both (Wei, Wang *et al.*, 2005; Wu, Shin *et al.*, 2007).

3.1.1. Influences of misalignments on implementation process and outcome

Technical misalignments require a learning effort during the implementation process. The larger the misalignment, the larger the amount of learning effort needed (Hausman, Johnston *et al.*, 2005). This learning effort may require capabilities and tasks to be created, transferred or start being shared between organizations in the network. As a result, there will be a different distribution of knowledge and capabilities in the network, and the boundaries of the roles of organizations may be blurred (Leonard-Barton, 1988; Edmondson, Bohmer *et al.*, 2001; Wei, Wang *et al.*, 2005).

Towards an efficient incorporation and routinization of the technology, **structural misalignments** will require the creation of connections between the organizations in the network (Barlow, Bayer *et al.*, 2006), or their modification to increase or diminish interdependencies (Edmondson, Bohmer *et al.*, 2001). These misalignments may also require changes in the structure of the technology, most likely in coordination with the innovator.

This suggests that the learning effort required to overcome technical misalignments and the structural adaptation required to overcome structural misalignments are considerable barriers for the assimilation of the technology (Rogers, 2003; Greenhalgh, Robert *et al.*, 2004), with an impact in its routinization and incorporation, hopefully leading to implementation success. Misalignments of technical competencies and structural misalignments thus have a direct impact in the implementation process and outcome.

3.2. Implementation management practices

All through implementation, management practices are of extreme importance to lower resistance to change, increase motivation, keep the network stable, and deal with the misalignments (Leonard-Barton, 1988; Edmondson, Bohmer *et al.*, 2001; Greenhalgh, Robert *et al.*, 2004; Wu, Shin *et al.*, 2007). They may influence and modify characteristics of the network, of the organizations, and of the implementation process. In the scope of our framework, implementation management practices are actions and strategies chosen by the managers, to mediate, reduce, or enhance the effects of the misalignments in the implementation process and outcome.

Management practices differ among projects, as they depend greatly on the experiences and beliefs of managers. Table 1 lists some management practices that have been used to address technical or structural misalignments, together with the references that provide support to their direct or indirect influences. These influences were identified in the literature on implementations in organizations, and therefore all of them require empirical support for the case of implementations in networks of organizations.

Management practices	Technical misalignments	Structural misalignments
Clear communication and problem discussion	Edmondson, Bohmer *et al.* (2001)*	Edmondson, Bohmer *et al.* (2001)*
Promote participation in decisions	Barlow, Bayer *et al.* (2006)*, Leonard-Barton (1988), Wei, Wang *et al.* (2005)	Leonard-Barton (1988)
Associate qualities of technology with performance criteria	Leonard-Barton (1988)	Leonard-Barton (1988)
Promote knowledge creation	Edmondson, Bohmer *et al.* (2001)*, Barlow, Bayer *et al.* (2006)*, Wei, Wang *et al.* (2005)	Edmondson, Bohmer *et al.* (2001)*, Barlow, Bayer *et al.* (2006)*, Wei, Wang *et al.* (2005)
Break existing routines	Edmondson, Bohmer *et al.* (2001)*, Leonard-Barton (1988)	Leonard-Barton (1988)
Manage cascading effect of actions on misalignments	Wei, Wang *et al.* (2005)	Wei, Wang *et al.* (2005)
Change roles	Wei, Wang *et al.* (2005)	Wei, Wang *et al.* (2005)
Select and assure stability of project team	Edmondson, Bohmer *et al.* (2001)*	
Integrate with legacy systems	Leonard-Barton (1988), Wei, Wang *et al.* (2005)	Leonard-Barton (1988), Wei, Wang *et al.* (2005)
Adopt complementary technologies	Leonard-Barton (1988), Wei, Wang *et al.* (2005)	
Change technology	Leonard-Barton (1988), Wei, Wang *et al.* (2005)	
Integrate processes / organizations' activities		Leonard-Barton (1988), Wei, Wang *et al.* (2005)
Champion the technology	Edmondson, Bohmer *et al.* (2001)*, Barlow, Bayer *et al.* (2006)*	Edmondson, Bohmer *et al.* (2001)*, Barlow, Bayer *et al.* (2006)*
Have and adjust project management plan	Edmondson, Bohmer *et al.* (2001)*, Wei, Wang *et al.* (2005)*	
Plan training	Wu, Shin *et al.* (2007)	
Rethink goals / redefine success	Leonard-Barton (1988)	
Use modular implementation	Linton (2002)*, Leonard-Barton (1988), Greenhalgh, Robert *et al.* (2004)	

Table 1 – Implementaiton management practices to address technical and structural misalignments (* - indirect support that shall be verified with empirical research).

3.2.1. Influences of misalignments on implementation management practices

The impacts of misalignments may be mediated by management practices, but the choice of practices may itself result from the misalignments identified by the managers, as particular misalignments may inspire or require one or more management practices aiming at reducing or enhancing their impacts. Some of the examples listed in Table 1 are management practices that result from the identification of misalignments.

The identification of technical misalignments may lead to: training plans to support the creation of new knowledge; careful breaking with existing routines, change of the roles of the organizations, or integration of previously unlinked activities; adoption of complementary technologies to complement the use of the innovation, or to facilitate its introduction in daily operations through integration with existing technologies; management of the cascading effect of management actions, as acting on one misalignment may lead to other misalignments.

Similar to technical misalignments, the identification of structural misalignments may also lead to management practices such as: careful breaking with existing routines, changes in the roles of organizations, integration of new needed organizations to the network, and management of cascading effects.

3.2.2. Influences of implementation management practices on misalignments

Other implementation management practices, not resulting from the identification of misalignments, may also influence the implementation process and outcome: clear communication and problem discussion, encouraging a shared climate of trust and safety (Edmondson, Bohmer *et al.*, 2001); involvement of targeted users in some management decisions (Leonard-Barton, 1988; Wei, Wang *et al.*, 2005; Barlow, Bayer *et al.*, 2006); selecting an appropriate team, with members from the different organizations, and ensuring its stability (Edmondson, Bohmer *et al.*, 2001); associating the qualities of the technology with performance criteria (in particular, criteria prior to implementation) to help turn perceptions of negative impact into perceptions of positive impact (Leonard-Barton, 1988); championing the technology (Edmondson, Bohmer *et al.*, 2001; Basoglu, Daim *et al.*, 2007); developing and iteratively adjusting a project management plan (Edmondson, Bohmer *et al.*, 2001; Wei, Wang *et al.*, 2005); and using modular implementation strategies (Leonard-Barton, 1988; Linton, 2002; Greenhalgh, Robert *et al.*, 2004). Implementation management practices, tailored for each specific scenario, can increase the likelihood of implementation success, improve the performance of the organizations in the network during the implementation project (Wei, Wang *et al.*, 2005), increase the credibility of the project (Edmondson, Bohmer *et al.*, 2001), promote the internalization of norms associated to the use of the technology (Leonard-Barton, 1988; Rogers, 2003), overcome indifference and resistance to change (Rogers, 2003), and promote the motivation of users, perceived usefulness, and perceived ease of use (Basoglu, Daim *et al.*, 2007).

Through these practices, managers are also indirectly working on overcoming the negative impacts and enhancing the positive impacts of the misalignments, in particular by changing the perceptions of users. Perceptions of positive impacts are enhanced, and perceptions of negative impacts are moderated as they are addressed or as they fade with the use of the technology (especially when a certain time is required to develop new capabilities needed to use the technology), increasing users acceptance and motivation to perform the necessary efforts (learning efforts and/or structural adaptations) to overcome the misalignments.

4. Discussion and managerial implications

Implementation is a multidisciplinary topic that combines perspectives from different theories to better understand the complex scenarios where it takes place. Implementation studies have been focused mainly on individual adoption and on organizational implementations. In spite of being scarce, studies of implementations in networks are a very relevant topic of research (Fichman, 1992; Goes e Park, 1997; Linton, 2002; Rogers, 2003; Hausman, Johnston *et al.*, 2005; Barlow, Bayer *et al.*, 2006; Palinkas, Fuentes *et al.*, 2012). Only a very small number of studies investigate implementations with a network perspective (Linton, 2002). From these, many actually address implementations in one organization and not implementations in networks of organizations, where decisions have to be orchestrated among the multiple different organizations.

With the conceptual framework that we propose, we extend the studies of misalignments in implementations of technological innovations from an organizational locus of adoption to a focus on networks of organizations. We do not consider the adoption decision stage of the implementation process, because in this stage the problem is the selection of the technology, whereas in the later implementation and assimilation stages that decision is already made, and the misalignments of the chosen technology have to be managed, this being the problem that motivates our work.

We classify misalignments as technical or structural, following the literature (Leonard-Barton, 1988). Technical misalignments are a consequence of the learning complexity of the technology, whereas structural misalignments are a consequence of the systemic or structural complexity of the technology. These misalignments require an adaptation of the competencies of the organizations in the network, and of the structure of the network itself, during the implementation process, with inevitable impacts on the implementation outcomes. The influences of the misalignments in the implementation process and outcome, and in the organizations, are decreased or enhanced by the use of adequate management practices. Some of these practices result from the identification of misalignments, and aim at overcoming them.

The adaptation processes are dynamic processes that take place during implementation, consistent with the learning perspective view that we propose to use. They are required by the misalignments and lead to changes that are very difficult to plan, with unpredictable outcomes. Each misalignment may require different types of management practices that may affect the network, the organizations in the network, or even the technology itself. These practices must be planned and deployed with caution, since management actions to address one misalignment might result in a later appearance of other misalignments in the implementation process.

Throughout the paper we have gone through important notes for managers who are confronted with implementation projects. Managers should bear in mind that the technological innovation, in a first stage of use, might be outperformed by existing technologies, since the processes to use the new technology are not yet completely incorporated in the operational routines of the network. When analyzing and evaluating the impact of misalignments, be aware of the fact that some of them might be beneficial to the network, because, for instance, they bring more systematic order into the processes. It is important that managers have a sense of what network structure and technical capacities are needed to use the technology, and what structure and technical capacities are in place at the beginning of the implementation. Managers should look at the maturity of the organizations carefully, as it may be advantageous to allow a faster assimilation of technology modules that require the same competencies, but it may also lead to resistance to the introduction of the new technology. After understanding the technical and structural characteristics of the technology and the network, use that information to analyze whether the technological innovation will blur role boundaries of the organizations in the network, whether new organizations will have to be included in the network, whether connections between organizations of the network will have to change or be created, and whether competencies will have to be reinforced or acquired. This analysis will enable managers to better plan their management efforts during the implementation process.

During the implementation process, it is important that managers are open to change the performance criteria of the network and of the implementation process itself, and change the specifications and goals of the project, which may have to happen in order to address some misalignments. Managerial actions generally seek a beneficial effect over the network and the implementation process: clear communication and regular discussions of the project with the users increase the safety feeling among them; implementing the technology modularly makes the implementation more manageable, especially when the implementation takes place in a network of organizations; actions towards knowledge creation and “sense-making” about the technology and the implementation increase the motivation of users and their perceptions about the usefulness and ease of use of the technology; highlighting the positive impacts of the technological innovation decreases resistance to change; and, a good project plan makes the project more credible. Managerial practices such as these help to enhance the perceptions of the positive impacts of the misalignments, and collectively work to reduce the negative impacts of the misalignments during implementation.

5. Conclusions

We propose a conceptual framework to analyze misalignments in implementations of technological innovations in networks of organizations. The framework integrates network learning, to describe the dynamics of evolution of the network organization during the implementation process, with the concepts from network theory and from diffusion of innovations, namely with the stream regarding research on misalignments. The conceptual framework is built, establishing relations of influence between technical and structural misalignments with the implementation management, process and outcome. Throughout the paper we go through important notes for managers who are confronted with such implementation projects, which are summarized in the discussion section.

Future research is extremely important to validate the conceptual framework suggested. Empirical support for this framework can test its generality and enable the creation of useful and verified management implications. It might be interesting to consider other queries such as whether or not it is important to categorize the changes that happen during the project in more detail than only distinguishing whether it is a network, an organizational or a technology change, and whether it is a technical or structural change.

Acknowledgements

This work is financed by the ERDF – European Regional Development Fund through the COMPETE Programme (operational programme for competitiveness) and by National Funds through the FCT – Fundação para a Ciência e a Tecnologia (Portuguese Foundation for Science and Technology) within project «FCOMP - 01-0124-FEDER-022701».

Bibliographical references

AARONS, G. A.; HURLBURT, M.; HORWITZ, S. M. Advancing a conceptual model of evidence-based practice implementation in public service sectors. **Administration and Policy in Mental Health and Mental Health Services Research,** v. 38, n. 1, p. 4-23, 2011. ISSN 0894-587X.

BARLOW, J.; BAYER, S.; CURRY, R. Implementing complex innovations in fluid multi-stakeholder environments: Experiences of 'telecare'. **Technovation,** v. 26, n. 3, p. 396-406, 2006. ISSN 0166-4972. Disponível em: < http://www.sciencedirect.com/science/article/pii/S0166497205000970 >.

BASOGLU, N.; DAIM, T.; KERIMOGLU, O. Organizational adoption of enterprise resource planning systems: A conceptual framework. **The Journal of High Technology Management Research,** v. 18, n. 1, p. 73-97, 2007. ISSN 1047-8310.

BAUM, J. A. C.; INGRAM, P. Interorganizational learning and network organization: Toward a behavioral theory of the interfirm. In: MARCH, M. A. J. G. (Ed.). **The economics of choice, change, and organization: Essays in memory of Richard M. Cyert**. Cheltenham: Edward Elgar, 2002. p.191-218.

BERTA, W. et al. The contingencies of organizational learning in long-term care: factors that affect innovation adoption. **Health Care Management Review,** v. 30, n. 4, p. 282-292, 2005. ISSN 0361-6274.

BORGATTI, S. P. et al. Network analysis in the social sciences. **Science,** v. 323, n. 5916, p. 892-895, 2009. ISSN 0036-8075.

CEGIELSKI, C. G. et al. Adoption of cloud computing technologies in supply chains: An organizational information processing theory approach. **International Journal of Logistics Management, The,** v. 23, n. 2, p. 184-211, 2012. ISSN 0957-4093.

CHWELOS, P.; BENBASAT, I.; DEXTER, A. S. Research report: empirical test of an EDI adoption model. **Information Systems Research,** v. 12, n. 3, p. 304-321, 2001. ISSN 1047-7047.

CROTEAU, A.-M.; BERGERON, F. Interorganizational governance of information technology. System Sciences, 2009. HICSS'09. 42nd Hawaii International Conference on, 2009, IEEE. p.1-8.

CUNHA, J. P. S. et al. **BING: The Portuguese Brain Imaging Network GRID**. IberGRID. Santiago de Compostela**:** 268-276 p. 2007.

DHANARAG, C.; PARKHE, A. ORCHESTRATING INNOVATION NETWORKS. **Academy of Management Review,** v. 31, n. 3, p. 659-669, 2006. ISSN 0363-7425.

EDMONDSON, A. C.; BOHMER, R. M.; PISANO, G. P. Disrupted Routines: Team Learning and New Technology Implementation in Hospitals. **Administrative Science Quarterly,** v. 46, n. 4, p. 685-716, 2001. ISSN 0001-8392.

FICHMAN, R. G. **Information Technology Diffusion: A Review of Empirical Research**. Proceedings of the 13th International on Information Systems. DEGROSS, J. I.;BECKER, J. D., *et al*. Dallas, Texas**:** 195-206 p. 1992.

GOES, J. B.; PARK, S. H. Interorganizational links and innovation: The case of hospital services. **Academy of Management Journal,** v. 40, n. 3, p. 673-696, 1997. ISSN 0001-4273.

GREENHALGH, T. et al. Diffusion of innovations in service organizations: Systematic review and recommendations. **Milbank Quarterly,** v. 82, n. 4, p. 581 - 629, 2004.

GRETHE, J. S. et al. Biomedical informatics research network: building a national collaboratory to hasten the derivation of new understanding and treatment of disease. **Studies in health technology and informatics,** v. 112, p. 100-110, 2005. ISSN 0926-9630.

HAUSMAN, A.; JOHNSTON, W. J.; OYEDELE, A. Cooperative adoption of complex systems: a comprehensive model within and across networks. **Journal of Business & Industrial Marketing,** v. 20, n. 4/5, p. 200-210, 2005. ISSN 0885-8624.

HAYES, R. H. **Operations, strategy, and technology: pursuing the competitive edge**. Wiley, 2005. ISBN 9780471655794. Disponível em: < http://books.google.pt/books?id=UF61AAAAIAAJ >.

KLEIN, K. J.; SORRA, J. S. The challenge of innovation implementation. **Academy of Management Review,** v. 21, n. 4, p. 1055-1080, 1996. ISSN 0363-7425.

LEONARD-BARTON, D. Implementation as mutual adaptation of technology and organization. **Research Policy,** v. 17, n. 5, p. 251-267, 1988. ISSN 0048-7333. Disponível em: < http://www.sciencedirect.com/science/article/pii/0048733388900066 >.

LINTON, J. D. Implementation research: state of the art and future directions. **Technovation,** v. 22, n. 2, p. 65-79, 2002. ISSN 0166-4972.

PALINKAS, L. A. et al. **Inter-Organizational Collaboration in the Implementation of Evidence-based Practices Among Public Agencies Serving Abused and Neglected Youth**. Administration and Policy in Mental Health and Mental Health Services Research. http://dx.doi.org/10.1007/s10488-012-0437-5: Springer Netherlands**:** 1-12 p. 2012.

ROGERS, E. M. **Diffusion of Innovations, 5th Edition**. Free Press, 2003. ISBN 9780743258234. Disponível em: < http://books.google.com.ag/books?id=9U1K5LjUOwEC >.

SICOTTE, C. et al. A risk assessment of two interorganizational clinical information systems. **Journal of the American Medical Informatics Association,** v. 13, n. 5, p. 557-566, 2006. ISSN 1067-5027.

STEWARD, D. The design structure matrix: A method for managing the design of complex systems. **IEEE Transactions on Engineering Management,** v. 28, n. 3, p. 71-74, 1981.

TAYLOR, J. E. **Three perspectives on innovation in interorganizational networks: Systemic innovation, boundary object change, and the alignment of innovations and networks**. 2005. PhD Thesis (PhD). Stanford University

TICHY, N. M.; TUSHMAN, M. L.; FOMBRUN, C. Social network analysis for organizations. **Academy of Management Review,** v. 4, n. 4, p. 507-519, 1979. ISSN 0363-7425.

WEI, H. L.; WANG, E. T. G.; JU, P. H. Understanding misalignment and cascading change of ERP implementation: a stage view of process analysis. **European Journal of Information Systems,** v. 14, n. 4, p. 324-334, 2005. ISSN 0960-085X.

WU, J. H.; SHIN, S. S.; HENG, M. S. H. A methodology for ERP misfit analysis. **Information & Management,** v. 44, n. 8, p. 666-680, 2007. ISSN 0378-7206.