Inter-organizational information systems in cooperative inter-organizational relationships: Study of the factors influencing to success

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Abstract. Significance of inter-organizational information systems (IOSs) in inter-organizational relationship (IOR) has been highlighted recently. IOSs are not only technical solutions to enhance communication across organizations, but they are also supporters and enablers of cooperation as well as symbols of formal IORs. The success or failure of these systems can have severe effects on cooperative relationships. In this conceptual-analytical research based on existing literature the role of different factors influencing to success of IOSs are considered. When considering implementing an IOS the role of these factors should be asserted to be able to enhance cooperation in IORs on one hand and successfully implement IOSs on the other hand.

1 Introduction

Increased competition in world markets has led companies to concentrate on to few core processes and development of their own core competencies [32] while outsourcing other processes where reasonable [12, 33]. Specialization increases productivity [9], but outsourced parts of processes create dependencies between companies and those relationships have to be managed. Engagement in Inter-Organizational Relationships (IOR) means that also design of work processes has to cross the organizational boundaries [40]. This development has raised the issue of cooperative inter-organizational arrangements [34, 40].

Engagement in IOR has a deep effect to many aspects of organizational life. One of the most important subjects for development of cooperation is to ensure fluent information flows between cooperating partners. Modern information and

communication technologies (ICT) have a great influence how these information flows are shaped and handled today. Hong [20] even argues, that 'there is a shift in the role of IT - from a competition weapon to a cooperation enabler among businesses'.

Nevertheless of its importance, companies are facing all kind of difficulties when implementing different kinds of Inter-Organization Information Systems (IOSs) to support cooperative IORs. Even very simple information sharing projects can fail for numerous of reasons, which include at least technological, economical and socio-political factors [7, 25]. The IOS projects greatly differ from conventional Information Systems (IS) projects focused on single company, as in those cases legal boundaries of a company is not penetrated. In contrast to inter-organizational systems, traditional intra-organizational systems have two characteristics that facilitate their management [41]:

1. One organization can always fully control the information system
2. The cost caused by the information system can always be addressed to one single organization, so can the benefits they create

As Suomi [44] noted: 'In one word, the world of IOSs will be that of cooperation'. IOSs are needed to enhance ever growing needs of inter-organizational cooperation. On the other hand, IOSs are also accelerating this development by offering opportunities for redesigning cooperative networks and to outperform. Cooperative environment, dyadic relationships and multi-partner exchanges increase the complicated and political nature [6] of these systems and thus the result of IOSs are often a result of negotiation process in which interests and power play significant role [7]. Consequently, understanding these and other factors influencing the success of IOSs is important as failure in IOS can have severe effect on cooperative relationship in addition to loss of invested time and money. Despite the evident importance of IOSs in today's networked competitive environment not too many articles have been published about the influencing factors. This study tackles this issue and seeks to increase knowledge on factors influencing success and failure of IOSs used in cooperative IORs.

Applying a conceptual-analytical research approach based on existing literature the role of different success factors of IOSs is discussed. Research question can be formulated as "what factors influence the adoption decision, success and failure of IOSs". Considering the nature of cooperative IORs in Section 2 starts the examination. In this study the cooperative IORs constitute the context in which IOSs are implemented. The role and effect of IOSs in cooperative IORs is discussed in Section 3. In Section 4 different influencing factors found from extant literature are reviewed. In Section 5 we supplement and compile these existing lists, classifications and models of factors influencing the adoption of IOSs in cooperative IORs. The conclusions are drawn and further subjects of research are suggested in Section 6.

2 Cooperative Inter-Organizational Relationships

According to [11] an economy based on knowledge favor alliances and any kind of inter-firm cooperation. However, cooperation within networks, or in other words

inter-firm or inter-organizational cooperation, is not a new phenomenon. Research concerning factors of successful innovations as far back as in the 1970's illustrated the significance of external resources and knowledge to innovations [16]. The global distribution of work and changes in competitive environment put the pressure for companies to develop cooperation in their business networks.

Inter-firm cooperation is important as it also influences on the way companies' competitiveness is formulated. Conventional strategic thinking has focused on individual firms as the competitive unit in any industry [24]. However, in today's networked business environment competition is moving from individual companies to networks of businesses [15, 37, 40]. As a result, efficiency seeking has exceeded the company limits to consider the efficiency of the whole business network. Creating close collaboration and integrating whole value chain in a way, that brings unique value for customers, can be source for sustainable competitive advantage [31]. Thus, collaboration can be seen as the key to value creation [37].

However, it is not purposeful to deeply collaborate with all companies in business network. Rather that trying to intensify cooperation with all companies in business network, companies should identify the key partners with whom to boost the cooperation. In fact, key network management has been recognized to be efficient way to cooperate in business networks [29]. The importance of different companies should be asserted to be able group companies to different groups. With each group company can then aim to have different kind of cooperation.

Kumar and van Dissel [25] divide business relationships according to level and nature on *interdependency* to pooled dependency, sequential dependency and reciprocal dependency. However, their classification seems to be concentrating more on nature of dependency, not so much on level. For example, they consider pooled dependency to be of least contingency and requiring only the simplest coordination mechanisms. Here, they ignore the level of importance of dependency. Shortage of some pooled resource immediately increases its importance, like occasions of shortage in oil or microchips show. More commonly, the importance of any pooled resource for company depend on its importance for company's own production: oil refinery can not supply its customers with gasoline if it can not acquire oil from its own suppliers; mobile phone manufacturer can not produce any more phones than what it can acquire chips to its phones. Thus, it seems to be more appropriate to divide relationships according to level of interdependency instead of nature. This division can be done, for example, according to classical division to operational, tactical or strategic issues [2]. Note, that in this study we are concentrating on cooperative IORs and excluding the market transactions on one hand and vertical integration on the other hand as well as IOSs built for those purposes from our examination.

In the first group (operational) are companies, with whom the company is doing business with on a little bit more sustainable basis than mere market transactions, e.g. buying some MRO (maintenance, repair and overhaul) materials or other goods or services needed in daily business operations. With these companies, cooperation is mainly targeted to increase efficiency e.g. by implementing some automated ordering systems or sharing information on stock levels or increasing other kind of communication between organizations.

In the second group (tactical) are companies, with a significant importance for company. The reason for importance can be, for example, nature of the object of trade, which might be a non-commodity with increased complexity and novelty. It can also be rare with imperfect markets or a critical component of firm's own production that requires accuracy from deliveries. Also, the dependencies between consecutive tasks spanned across organizations can increase and especially if production is time-sensitive where time span of separate tasks overlap, the coordination of tasks between different performers is needed. In these cases, the dependencies between companies are usually at least somewhat mutual. For example, a trade-relationship might require relationship-specific investments and thus continuity is highly appreciated.

In the third group (strategic) are companies that's importance can be evaluated to be strategic from nature. Collaboration with these companies can be seen necessary in areas where uncertainty prohibits company to achieve its goals or to operate properly. The distribution of work might have developed so far and complexity and novelty of objects of cooperation can be so high that only way to be able to achieve consistent products is to combine the knowledge and expertise of different parts and of different partners. Collaboration might also be required because of a radical shift in markets or technologies or to develop new boundaries crossing products and service to better serve the customers. Companies can seek new ways to capitalize on new technological or customer originated innovations in collaboration. Core competencies can be developed in collaboration to create efficient and effective ensemble of complementary competencies. With these companies there exists a long-term mutual dependence.

The above classification was presented to show the importance of level of dependency in addition to nature. These classifications were also introduced to highlight the fact that it's not worthwhile to try to cooperate with all companies in business network in similar levels and ways, but to use different approaches for different groups of companies. Accordingly, it's not worth trying to introduce same kinds of IOSs to every IOR but to only implement appropriate systems supporting/enabling the cooperation with each firm.

3 The role of Inter-Organizational Information Systems in IORs

Inter-organizational information sharing is conducted through both formal and informal channels. Beside the more informal personal relationships companies might decide to build inter-organizational systems [43] to support information sharing across company boundaries [23]. IOSs may promote major interests of organization, e.g. by enhancing cost efficiency, speed and flexibility or to create new distribution channels for new products and services [7]. On the other hand, IOSs can also be a threat for organization if it unbalances the current competition or power equilibrium unfavorable or even leads to disintermediation of a company. These factors give IOSs' a political nature.

According to Senn [39] 'all types of inter-organizational systems are increasing in number as business processes are modified so that organizations can respond to new opportunities as well as to the constant pressures for greater responsiveness to the needs of customers and trading partners'. The Internet and related Information and Communication Technologies (ICT) have enabled the cost-effective dissemination of information [14]. IOS can help to improve performance e.g. by lowering transaction costs [42]. Also, the strategic value of Inter-Organizational Systems (IOS) has been well recognized [28]. However, it is important to view IOSs in a broader context that encompasses not only the traditional value chain but also partnerships and strategic alliances among firms [20]. The context in which IOS is implemented is especially important as it has been argued that 'real benefits reside not within the IT domain but instead in the changes in the organizational activities that the IT system has enabled' [13]. This lesson need to be understood: 'if we have learned one thing…it is that IT is at best a catalyst and an enabler. It is never an answer in itself' [19].

IOSs have a central role in formation of formal IORs. IOSs are central for the development of business networks by reducing costs and extending the possibilities for communication and coordination and linking technologies and sources of knowledge to support innovations [45]. Johnston and Vitale [22] studied how inter-organizational systems could also help in creating competitive advantage and created a set of categories to guide exploration. They concluded that inter-organizational systems were an avenue to cooperation on a widening range of initiatives that improved the economic performance of each partner. Thus, inter-organizational systems are not only a mean to achieve objectives of cooperation but also a facilitator of cooperation as they 'necessitate some kind of cooperation because they are technologically and financially demanding projects' [42]. IOSs have a dual role in cooperation; they have both enabling and supporting role in cooperative IORs [25].

Contribution to partner development is partly due to the fact that building IOSs require ex ante investments which reduces the possibility of partners to behave opportunistically (firms being concerned for their investments) and thus, IOSs as a "mutual hostage" increase trust [17]. In other words, the process of implementing and using IOS seems to imply a process of partners deliberately entering into situation where they become dependent on each other [7]. It should also be noted that use of IOS may alter the balance of power in inter-organizational relationships [7], highlighting the evolving nature of business relationships.

The importance of IOSs in IORs is evident just as is the challenges IOSs entail. Understanding the factors influencing the IOS adoption process is important as the success or failure of adoption can have severe effects on cooperation and competitiveness of different partners.

4 Factors influencing to the success of IOSs

Clearly, one of the complicating issues of IOSs compared to traditional information systems is the number of stakeholders involved [7, 27]. Traditional information systems have remained inside the legal boundaries of single organization where at

least some level of internal harmony and common goals can be expected. In context of IOSs these issues needs to be extended to next level, that of network.

IOR context introduce new issues to consider when planning adopting an information systems. According to Kumar and van Dissel [25] IOS literature has traditionally relied on economic arguments but actually three kinds of arguments are needed to explain the formation and risks of alliances: rational/economic, technical, and socio-political. Boonstra and de Vries [7] conducted a literature review on selected articles and they found four groups of IOS inhibitors and barriers:

1. technology related;
2. ability-, awareness- or knowledge-related;
3. interest-related;
4. power-related.

Technology related barriers refer to a lack of standards, incompatibility of software and hardware and security problems like encryption of information transfer that rises from heterogeneity of technological platforms and system portfolio of cooperating partners. For example, if one participating company is struggling with its internal information flows between different systems, it's not realistic to expect inter-organizational information exchange to be fluent. Ability-, awareness- or knowledge-related barriers refer to legal barriers when moving information across organizational boundaries or to barriers related to the awareness of the opportunities of IOS or lack of knowledge on how to apply available technologies [7].

Interest-related barriers refer to notion of potential parties for whom the IOS does not bring enough economic and/or strategic advantages [7]. Or at least this is the perception of participating company. Power-related barriers refer to situation in which potential participating companies doesn't have enough power to establish and to make others use an IOS [7].

Boonstra and de Vries [7] consider overcoming technology related barriers (group 1) and ability-/awareness-/knowledge-related barriers (group 2) as pre-conditions for IOS success and only when these pre-conditions are fulfilled, conditions 3 (interest) and 4 (power) become relevant. I disagree with their view and see situation as a quit contradictory. I see that presence of sufficient interest and power are pre-conditions, because without them there is no reason at all to build an IOS. If built, it would be a failure and waste of money and effort as no party commit themselves to it. Instead, only when preconditions of barriers 3 and 4 have been met the question of barriers 1 and 2 become relevant.

Boonstra and de Vries [7] emphasize 'that only if the appropriate technology is available and if the ability, awareness and knowledge are there, it makes sense to diagnose interest and power positions'. Their perspective seems imply that it is not worth to learn or develop anything new, only use what already exists. I agree that awareness has to be there, at least in an extent that the question of IOS arises. However, for my view awareness of opportunities and knowledge how to apply IOS can be developed gradually through learning [3] or bought from outside, e.g. by hiring some outside consultants. Also, technological issues are rarely too complex to overcome. As Boonstra and de Vries [7] themselves state, 'there are hardly any technical barriers left which are keeping organizations from shifting from mainly internal information systems to systems which transcend organizational borders and

connect companies electronically with external parties'. Because of these views, I see that barriers of interest and power are pre-conditions and ones which have to be met before making the decision to design and implement an IOS, and thus to tie required resources to the process.

Comparing to the three arguments of Kumar and van Dissel [25], Boonstra and de Vries [7] add fourth group of arguments, that of knowledge. Rational/economic group of Kumar and van Dissel (1996) is similar to interest related group by Boonstra and de Vries [7] and both have a group for technological issues. However, power-related topics of Boonstra and de Vries [7] are only one issue of socio-political group that of Kumar and van Dissel [25]. Socio-political factors include, in addition to power relations, at least inter-organizational trust [45] and social networks [5, 18] that have an important role in the decision-making process. Also, cultural differences (that of corporate, regional, profession, etc.), conflicting interests between IOS parties, unequal expectations and a heterogeneous organizational environment have to be asserted and managed [21]. Even though Boonstra and de Vries [7] don't explicitly cover these kinds of issues in their list of inhibitors and barriers, their flower auction case example shows the importance of such issues: 'Many retailers also appreciated their relations with wholesalers, which were highly based on trust and personal and informal contacts'. In order for IOSs to succeed and provide sustainable benefits the socio-political risks require also people–based strategies to manage and contain these risk factors [25].

Ruohonen et al. [36] suggest that at least four issues should be considered when studying e-Business innovations in organizations: 1) Business environment evolution, 2) Technological environment evolution, 3) Maturity of adopting organization and 4) Potential to apply new e-Business solutions. In this study, environmental forces are recognized as one group as they lay down the context in which cooperation and implementation of IOSs takes place. These issues might have significant role in decision making, as it is a very common that companies implement same services and systems as their leading competitors are implementing. Public forces, laws and regulations can also influence the decision making. Noteworthy is also public R&D funding that might change the economics of IOS development projects favorable.

Technical issues are recognized as its own group of influencing factors, one group that has earlier been perhaps the biggest obstacle in IOSs projects. Nowadays all kind of common interfaces, standards and mediating technologies exists in addition to building direct customized links between different systems and thus, technological barriers are not as significant as before. However, there still lie many open questions for how to efficiently build an IOS, considering the heterogeneity of organizational IT-infrastructures, different standards used in industry and available solutions for IOSs. If planned incautiously, life time costs can be quite a surprise, e.g. if update of one organizations internal IT-systems require adjustment or rebuilding of all links to other organizations' systems. You can imagine what kind of hassle it could be If these issues are neglected, considering that organizations update their systems once or twice a year, and potentially different cooperating organizations at different time.

Maturity refers to current use of ICT in organizations as well as ability, awareness and knowledge issues. For example, paper based documentation is not a very good starting point for building an IOS. Building an IOS does require some preconditions from implementing partners or else the journey will be long and muddy. Also, previous use of different kinds of ICT-based solutions is usually also indicator of ICT-based capabilities that organizations have, making transition to an IOS easier. Thus, maturity of different companies, in terms of technical as well as knowledge-related, largely defines the potential that these companies have when planning to implement an IOS. Another factor influencing to potential is available resources. This issue belongs to rational-economical group as amount of needed and granted resources are often compared to perceived benefits accrued from an IOS.

Rational-economic issues, like perceived economical gains or strategically improved position, are perhaps most deeply covered influencing factors to success of IOSs [4, 7, 22, 25]. If benefits are unclear and costs can't be justified, companies are more unlike to participate and commit to use of the system. On the other hand, in addition to rational issues many not-so-rational issues can have significant effect on success of these systems. Personal relationships and social networks influence behavior of human beings that also the decision makers are. Compatibility of partners' organizational culture might also affect how closely, despite the contracts, they truly want to cooperate with certain partner. Mutual respect of other partners' professionalism, use of power, direct personal relationships and inter-organizational trust are some issues belonging to socio-political group of influencing factors.

5 A new model of influencing factors

Understanding the most important critical factors influencing the success of IOS is important to be able manage and overcome obstacles and drawbacks and to unleash the full potential of these systems. Figure 1 summarizes the factors discussed above and below that have an influence to success or failure of IOSs. It is argued that these five groups of influencing factors (technological, rational-economic, socio-political, knowledge and environmental issues) influence on decision made and more importantly to the actions taken.

However, we have to acknowledge other factors as well, factors that influence to the final result, relative success or failure. Even the network of businesses would have achieved a harmony and found common goals, even if all companies would have best intentions to take needed actions, some influential factor can ruin the effort. These factors can be, for example, some uncontrollable event like natural disaster, war, criminal action, market discontinuity or some other factor such as bankrupt, change of supplier, fusion, or as simple as change in key personnel. This group of influencing factors is almost totally neglected in earlier studies.

Furthermore, many of the earlier studies has treated different factors as given and ignored the interplay between them. This kind of view promotes static examination of networks that fails to reveal the underlying dynamics. As companies engage to interactions with each other, their knowledge and perception of IOSs will change

[26]. To promote more dynamic and rich picture of IOS adoption the interplay between different factors and actors should be considered.

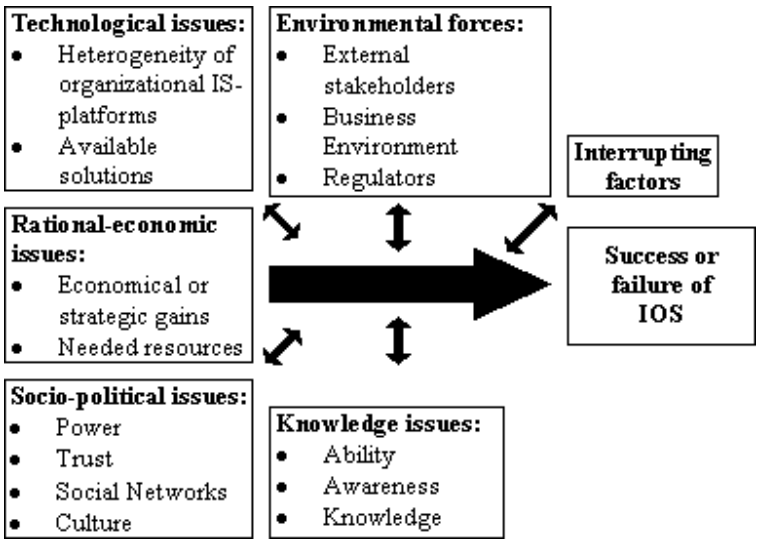

Fig. 1. Factors influencing the success and failure of IOSs

6 Conclusions

The IOS literature considers inter-organizational systems to be strategic instruments of great promise [25]. IOSs have role of enabler and supporter of cooperation. The IOSs are also important because they usually formalize the cooperative relationship. Building IOSs requires ex ante investments and thus bind the partners to the relationship.

Contribution of this study is seen from three perspectives. First, this paper aims to increase the understanding of the important role of IOSs in IORs as a formalizing element of cooperation. According to Kurnia and Johnston [26] earlier studies have tended to give insufficient attention to the inter-organizational context of these systems. Managers need to understand that implementing IOS is not only a technical issue, but requires complex negotiations between different parties with different interests. IOS negotiations can even be seen as an extension to cooperation negotiations or as in some cases, an initiator to them. Second, describing some of the most important influencing factors to success of IOSs may help managers to address these issues before IOS implementation and thus before actualization of possible conflicts. Recognizing the influencing factors may also help managers to make more informed decision to implement or not to implement an IOS. As earlier studies have

identified three to four influencing groups of factors, this study seeks to offer broader selection of influencing factors. Third, this study tries to highlight the evolving nature of influencing factors. When each company enters into a complex series of interactions with other parties company's knowledge and perception of IOSs will change [26].

One clear limitation of this study is its focus on organizational and above levels of factors influencing to success and failure of IOSs. This focus can be justified within the IOS implementation context, which is inter-organizational environment. This environment introduces new and somewhat different constrains than traditional organizational environment and studying them is important. Also, the factors considered concentrate on planning and negotiating phase where as factors influencing building, implementing and using phases could be somewhat different [8]. These phases introduce new challenges and lower level factors influencing success that are closer to traditional IS success factors. These factors have been extensively studied in literature [1, 30, 35, 38] but they shouldn't be neglected either in IOS context. For example, failure in organizational change management and change resistance can severely affect the success of an IOS that had been well accepted and agreed in a network level. Thus, it's important to acknowledge organizational influencing factors in addition to inter-organizational factors recognized in this study.

Further studies are recommended to analyze the role of different factors in IOSs. Especially empirical studies are needed to verify and challenge theoretical studies. The interplay between different factors and actors might be difficult to analyze using statistical methods, which suggest the use of in-depth interpretive research methods, such as case studies or action research [26]. Qualitative methods can give greater insights to dynamic and complex interactions between different companies. In addition to empirically test the role of different factors in success and failure of IOSs, one potential perspective for further study could be the stakeholder theory applied to network context. It is seen in organizational context that a strategy and planning is best understood by identifying stakeholders and how goals influence and are influenced by stakeholder perspectives [10]. Another interesting future research direction could be examining the social context in which IOSs are used and how this social context evolves over time. This point of view would especially contribute to dynamic examination of relationships, instead of more static examination of discrete transactions. Also, in this global economy, research on effect of nationality, culture and languages on cooperative IOSs could provide new insights on multinational context.

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