

Uptake of inter-organizational IT systems in two Australian agricultural cooperatives: a match between business relationships and design features

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Abstract

In this paper we will advance a perspective that links business network analysis to interorganizational IT systems (IOS) uptake, starting with an analytic framework to characterize both different types of electronic business to business interactions (via the web) as well as the network of business relationships in which they are used. In order to see whether inter-organizational IT systems and business networks (mis)match they are compared on two dimensions: 'mode of interaction' (relational versus transactional) and 'nature of coordination' (emergent versus directive). The study analyses two Australian agricultural cooperatives 'Capgrains' and 'Bluegum'. The transactional focus and directive control of Capgrains' online ordering system did not match with the relational interaction and emergent coordination that was common in their network of business relationships, resulting in a mismatch and low level of use of the system. The Bluegum's group communication system much better matched with the business relationships in the cooperative and higher use of the IOS. Indicating a positive relation between match and uptake of the IOS.

Introduction

Following the argument of Steinfield (2002) that successful collaborative e-commerce should recognize and complement existing relationships and communication channels, this paper analyses the match between characteristics of business relationships and the IOS used in two Australian agricultural cooperatives.

Inter-organizational systems (IOS) can be defined as automated information systems connecting two or more parties, allowing them to share data and resources of a digital format (Morrell and Ezingard, 2002). An IOS is an IT system that transcends organizational boundaries. According to Kumar and Crook (1999), management of these systems could be significantly more complex than managing IT within individual organizations. An IOS involves collaborations among multiple organizations and usually takes the form of long-term information technology related business arrangements (Kumar and Crook, 1999). The boundary-spanning aspect implies a level of cooperation and co-ordination and often the system has to deal with power differences among users. A problem with organizational boundary crossing IT, such as IOSs, is that many implementations do not pay attention to the characteristics of the organizational environment in which the inter-organizational IT system is implemented, and which it is meant to support. Illustrative examples of this problem are given in a case study of the Prato textile industry (Kumar et al., 1998), where trust and personal relationships that had developed over centuries made an inter-organizational system redundant, and a study of the Australian beef industry (Driedonks et al., 2003), where loss of social capital and nature of communication channels were barriers to the uptake of an online auction system.

Up till now research on IT use in inter-organizational networks is limited and inconclusive, most research focuses on IT use within organizations. Though, in IT research there is a need to handle the implementation and use of IT and communication technologies between organizations with more caution as successful inter-organizational IT use should complement existing relationships (Steinfield 2002). We argue that a valuable contribution to our understanding of IOS development can come from studies of business networks.

We will advance a perspective that links business network analysis to IOS uptake, starting with an analytic framework developed from the industrial network approach (Hakansson & Snehota, 1995; Berthon et al. 2003) to characterize both different types of electronic business to business interactions (via the web) as well as the network of business relationships in which they are used. In order to see whether inter-organizational IT systems and business networks (mis)match they are compared on two dimensions: 'mode of interaction' (relational versus transactional) and 'nature of coordination' (emergent versus directive). In this way the two Australian agricultural cooperatives are investigated. The study was motivated by questions concerning the low rate of use of an online ordering system in one of the cooperative, and the relatively high level of use of another IOS in the almost similar other cooperative.

Match between Business relationships and B2B interactions on the web and uptake of IOS

Berthon et al. (2003) have developed a model to map the wide variety of IT based business-to-business interactions via the web, and the processes that underlie them. By distinguishing two dimensions they categorize four types of inter-organizational IT systems. The four different types of systems are related to two dimensions, the mode of interaction and nature of coordination. Coordination is viewed as ranging from directed to emergent. Directed coordination occurs when one party has control of the interaction. Emergent coordination is the

case if control is not pre-specified (as in markets) and emerges according to situational requirements or from ongoing interactions.

Mode interaction, the second dimension, is viewed as ranging from transactional to relational. Transactional relationships are discrete one –time interactions, while relational interactions are frequent or take a long time horizon in which mutual investments are made. The dimensions ‘nature of coordination’ and ‘mode of interaction’ indicate what type of electronic business-to-business interaction can be characterized in terms of exchange process (from transactional to relational transactions) and coordination (from emergent to directive). By using these two dimensions, business-to-business electronic interactions can be classified in four ideal types (e.g. emergent-transactional such as auction exchanges; directive transactional such as catalog and hub-and-spoke interactions; emergent-relational such as collaborative networks; and directive relational such as coupling organizations along the value chain).

[Figure 1 about here]

In order to have a tool to investigate the content of (mis)match between business relationships and IOS in the two cooperatives studied and because the two dimensions can be used to map B2B interactions in general, we applied them for analysing both IOS and business relationships. In fact for the business relationships we will describe the dominant mode of interaction and nature of coordination and for the IOS we will indicate the mode of interaction and the nature of coordination that the design features of the system allow. The two dimensions are further operationalized based on the model of business networks (Hakansson and Snehota, 1995) in three groups of variables related to actor bonds, activity links and resource ties. The actual variables are derived from the industrial network approach as well as from transaction-cost analysis and organisation sociology (see appendix 1 for this operationalization). Finally, based on the work of Taylor (2002) we decided to determine and compare the level of uptake in the two cooperatives by the ‘number of users’; the ‘frequency of use’ and the ‘features of the system that are used’. To conclude, an overview of the various aspects of our approach is provided in Figure 1.

Capgrains Cooperative and Bluegum Cooperative

The Capgrains Cooperative started in 1984, and at present it has about 70 members. The head office is located in Rockhampton, Queensland, and most of its members are located in the wide area around there. The cooperative was formed by a group of farmers who believed that their future depends on the power they can have throughout their supply chain. By grouping together and building up purchasing and selling power, they could get lower prices for their supplies and better prices for their sales by accumulating all their products. To date, Capgrains comprises a grain trading and a purchasing department. The Capgrains Purchasing Department manages sourcing the merchandise for the members of Capgrains. Capgrains tries to get the best possible price for its members, through their extensive network of suppliers located throughout Australia, which contains over 500 suppliers. It is not compulsory for members to do all their purchasing through the Capgrains office. Most members also do their purchasing at local suppliers as members often live close together in communities and have strong and long lasting ties with their suppliers.

For reasons of efficient purchasing and administration, Capgrains recently introduced an online order system for its members, which contains over 25.000 products. The system is also

open for non-members. This online order project started in 2001 and the first edition of the system was launched in 2002. This online one-stop shop can be reached by visiting the Capgrains website and by logging-on with username and password. The system also comprises access to their account in the Capgrains administration. The system is developed by Capgrains management and some former board members have provided feedback on the system. In this case, the problem is that the online ordering system seems to be poorly used by members, despite the promised efficiencies for both members and the purchasing department.

The Bluegum Cooperative started in 1995 with approximately 15 members. After the split up of Capgrains and Capbeef in 1997, it merged with the Capbeef Cooperative in 2000. Bluegum Cooperative members are beef producers and the 45 members are also located throughout Queensland, though compared to the Capgrains members less concentrated in communities. The Bluegum Cooperative is closely related to Bluegum Beef, which is the Bluegum marketing organization through which members of the Bluegum Cooperative can sell their beef under the Bluegum brand name. Bluegum Cooperative members are not obliged to sell their beef through Bluegum Beef, but only members can sell their beef through Bluegum. Approximately half of them choose to use other marketing channels and have their own customers. In order to guarantee a high quality level of their beef, the Bluegum Cooperative decided to start the implementation of a quality assurance system, as one of the first in their industry. Although use of the system was not made compulsory for every member, almost all of the members agreed with this idea and implemented the quality assurance procedures. This development has resulted in a sharing of knowledge and experience with regard to business matters.

Because of the initiated quality assurance, there was a need for more efficient ways of interaction, as due to geographical spread of members interaction by phone was very expensive. The adoption of the Internet and email for group communication was initiated by the group coordinator at that time. After a demonstration session the group decided to get the whole cooperative online. Bluegum intended to use electronic communication for different purposes: as a tool for group coordination; as a benchmarking system for quality differences among members; as a means to provide electronic feedback through the supply chain (mainly from customers); as a facilitator of their quality assurance system; and for the marketing of their beef via the Internet. By supporting these interactions between members, management and customers, the project became the uptake of an inter-organizational system, existing of Internet and email facilities for group communication. The Bluegum group communication now seems to be successfully used in most of the members' business interactions.

Collecting & analysing the data

Data gathering occurred in two stages. First, a series of data collections was conducted to gain more industry insight and to get to know the two cooperatives better. A multiple data collection method was preferred to obtain relevant systematic as well as anecdotal data. This data collection method concerned a mix of face-to-face interviews and research in archival sources like project reports. Here, 14 interviews were held with industry experts, cooperative members, management of the cooperatives and suppliers of the cooperatives. Also, an agricultural field event was visited to meet members and suppliers of the Capgrains cooperative.

The second stage explicitly focussed on the members of the Capgrains and Bluegum cooperatives. From members' databases of each cooperative, 15 interviewees were randomly

selected. Facts and feelings concerning the interactions in their business networks were gathered by open structured interview questions. Due to the large geographical spread of the interviewees, all 30 interviews were held by phone.

Following a grounded theory approach the analysis started by taking the raw data (interviews, fieldnotes and documents) and look for themes in the data that appear crucial for understanding the uptake of IOS. The first stage of analysis involved the coding and categorizing of the data (Corbin & Straus 1990), which means that we assigned bits of the raw data to particular categories. As discussed before categories were derived from literature on business networks, B2B interactions on the web and adoption of internet technologies.

In order to analyse the degree of match between business relationships and IOS used, interview data were reduced by assigning a value to each variable of 'mode of interaction' and 'nature of coordination' (as represented in Appendix 1) both for the IOS and the business relationships in the two cooperatives on a 5-point scale.

For mode of interaction the scale was:

- I 1 *Fully transactional interaction*
- I 2 *Mainly transaction interaction, but with a single aspect of relational interaction*
- I 3 *Both transactional and relational interaction*
- I 4 *Mainly relational interaction, but with a single aspect of transactional interaction*
- I 5 *Fully relational interaction*

And for nature of coordination the scale was:

- C 1 *Fully directive coordination*
- C 2 *Mainly directive coordination, but with a single aspect of emergent coordination*
- C 3 *Both directive and emergent coordination*
- C 4 *Mainly emergent coordination, but with a single aspect of directive coordination*
- C 5 *Fully emergent coordination*

Average scores were calculated to characterize the investigated business relationships and the IOS on each dimension. The average scores were represented in a two dimensional graph, resulting in a map indicating the degree of match between business relationships and IOS in the two cases (see Figure 2). In order to tell something about use of IOS in the two cooperatives the level of uptake was compared with the degree of match.

Case study findings

From the findings can be concluded that Capgrains' online ordering system hardly supports personal relationships and cooperation in the business network (see Table 1 and Figure 2), where the Bluegum group communication system is built around the idea of cooperation and integration through personal contacts (see Table 2 and Figure 2). Also with regard to the type of economic coordination, the Capgrains IT system is much more developed and controlled by a central actor, where the Bluegum system has a more decentralized control structure in which coordination is based on individual initiatives. The business relationships in the part of the Capgrains cooperative for which the IOS is meant, can be characterized by a high level of relational interaction, combined with a strong emergent type of control. The Capgrains online ordering system can be characterized as almost the opposite: it focuses on transactional interaction with directive coordination. As a result of these differences in the investigated systems, the degree of match between Capgrains as a network of business relationships and its online ordering system is

much lower than the match between the business relationships in the Bluegum cooperative and their group communication system. In the latter case, the scores on the two dimensions match for the cooperative and its IOS. With regard to the case characteristics and the match and mismatch found, the case study findings will now be presented in more detail. A discussion of problems that the Capgrains members have with the online ordering system may show the differences in fit compared to the Bluegum system. This analysis mainly focuses on how the mode of interaction and type of coordination has been in the days before the introduction of the IOSs, and in the way the inter-organizational systems were intended to change these.

[Table 1 and Table 2 about here]

From the social point of view dominant in the Capgrains cooperative, the management is not regarded as the coordinating institution, at least not in the members' perception. With the online ordering system the function of the management remains the same as before, namely organizing beneficial purchasing possibilities for members. However, before the online ordering system, these buying-selling interactions were based on personal communication, mainly by phone. During the interviews, members indicated that interaction by phone was a convenient way of doing business, as it gives you direct feedback and enables you to discuss details of the product or the transaction straightaway. The possibility to negotiate implies a consensus approach to the business transaction and often the interaction resulted in some social talk as well. Members indicated that most interaction with the Capgrains office did not feel as a business interaction at all, but more like a social interaction. With the online ordering system, the management would get a stronger coordinating position, as they were the initiators and controllers of the system and its content. The members would become the anonymous users of the IT system, without any interaction with their management. Members also indicated that the system did not have clear incentives for them, as there were hardly any price advantages. Discrete transactions and a controlling position of Capgrains' purchasing department creates a very different type of interaction and coordination than was common before in their business relationships. Also with regard to the level of formality, the members perceive the system as negative, as the possibility of personal interaction disappeared in the online ordering system. The new IOS includes electronic formalities, which are required to go through before placing an order, such as password authorization to see indicative prices. In conclusion, the online ordering system would replace the existing communication channels and coordination mechanisms that characterize the network of business relationships, and thus creates a gap between existing processes of communication and coordination in the business relationships and the type of interaction and coordination allowed by the online ordering system.

[Figure 2 about here]

Bluegum's group communication system creates its value by supporting the many interactions in the network of business relation in the Bluegum cooperative that create and support knowledge exchange. This is exactly where the members of the cooperative were looking for, in order to support their quality assurance, customer feedback and internal benchmarking, and to remain an industry leading cooperative. As stated before, interaction via telephone was very expensive because of the geographical spread of actors, so the cooperative was looking for a more efficient way of interaction in their business relationships. A culture of frequent and high quality

interactions already existed to develop exchange of business information, and the group communication system facilitates the interaction and information exchange among members and between members and customers in a cheaper and faster way than before. It supports the activity links, resource ties and actor bonds that are used in the cooperative. All this was represented in a shared coordination structure, by management observing and facilitating the members and the system, allowing a decentralized type of control. After the presentation of the idea by management to the cooperative members, the cooperative as a whole more or less decided to take up the system and to use it to support knowledge and information exchange. Which might explain the match between IT system and the business relationships in this cooperative on almost every variable of the two investigated dimensions. The type of interaction and coordination that is appropriated in the system has similar characteristics as the way in which actors communicated and how the interactions were coordinated in the time before the introduction of their group communication system. It does not aim to replace existing successful forms of interaction and types of coordination.

The level of use of the investigated systems are shown in Table 3, and indicate a low level of use for Capgrains' online ordering system: just a few users incidentally use only a few features of the system. Bluegum's group communication system is much more successfully used in the members' business relationships.

[Table 3 about here]

With regard to other characteristics of the cases, most of these are similar to each other. The cases do not differ very much in terms of level of Internet access, and their level of use of other technologies in the cooperative, such as industrial software. Also the expected benefits of the IOS in relation to the activities employed in the cooperatives is high in both cases and the number of meetings that are available to discuss the system and its progress are similar in the two cases. However, some differences between the two cases can be found. First, the number of members in the groups is quite different. Capgrains has about 70 members, versus 45 members in the Bluegum cooperative. Second, the age of the cooperatives varies from 19 years in case of the Capgrains cooperative, to 8 years for the Bluegum cooperative. Thus, the Bluegum cooperative is younger and smaller than the Capgrains cooperative. The findings suggest that the different levels of use of the IOSs depend at least in part on the degree of match between business relationships and IOS. But differences in IOS uptake between the two cooperatives could also be explained by the type and purpose of the IOS. Communication systems such as email often are more readily adopted than other more standardized types of systems such as EDI. Also we could see little economic incentive for the system in Capgrains but more in Bluegum, which could explain the differences between the two.

Discussion

In this paper we elaborated further on Steinfield's request for a more exact interpretation of what a match between network aspects and system characteristics should contain and how this degree of match can be determined. We found that uptake of an IOS requires a match of cooperative and IOS. A set of aspects of actor bonds, activity links and resource ties, was operationalized to

identify a match between the business network and the IOS. As this substance of a match has not been explicitly investigated so far, this paper contributes to a further development of understanding of the influences of business relationships on the use of inter-organizational systems.

However, this study does not explicitly comprise a time element in its analysis. This might be a suggestion for further research, as an ‘interaction effect’ between business relationships and the design features of the IOS can take place over time. This effect takes place when the development of business relationships and the development of the IOS influence upon each other, which will probably influence the degree of match, as the interaction between business relationships and the IOS can bring the characteristics of those two closer towards each other, or on the contrary, drift them apart. For more processual research Markus’s (1984) interaction perspective on system impacts seem interesting, she looks at how the intentions of a system, as embodied in its design features, have resulted from the origins of users’ behavior. In other words, it explains success and failure of IT systems in terms of the relation between users’ behavior and designers intentions that result in the system’s design features. A mismatch of those two, resulting in resistance from users, may result in changed system design features to neutralize the system’s impact. Continuous interaction between users and designers should therefore be central in the development of an IT system. Implying that the existance of a match or a mismatch is only the beginning of an innovation journey. Though, in innovation studies, as in Markus’s approach, it is usually the end –user designer relation that gets the most attention. Given the multi-functional requirements in a business network, we would argue that more parties have to be mobilized in order to accomplish successful IOS development.

MODE OF INTERACTION	Capgrains Cooperative					Capgrains IOS				
Variable	I 1	I 2	I 3	I 4	I 5	I 1	I 2	I 3	I 4	I 5
<i>Actor bonds</i>										
Network of personal relationships				X		X				
Trust, commitment and norms				X			X			
Identification			X				X			
<i>Activity links</i>										
Cooperation and integration/ joint control of activities				X			X			
<i>Resource ties</i>										
Interfaces between resources and joint control of resources				X		X				
Durability and consistency of relation				X			X			
Average score on this dimension	3.83 (relational)					1.67 (transactional)				
TYPE OF COORDINATION	Capgrains Cooperative					Capgrains IOS				
Variable	C 1	C 2	C 3	C 4	C 5	C 1	C 2	C 3	C 4	C 5
<i>Actor bonds</i>										
Control structure					X			X		
Level of formality				X		X				
Internal force for action				X			X			
Actor roles in network/ system development			X			X				
<i>Activity links</i>										
Activity structure and centrality of control				X			X			
<i>Resource ties</i>										
Control over resources and power asymmetry					X			X		
Average score on this dimension	4.17 (emergent)					2.00 (directive)				

Table 1:Capgrains' scores on variables of the two dimensions

MODE OF INTERACTION	Bluegum Cooperative					Bluegum IOS				
Variable	I 1	I 2	I 3	I 4	I 5	I 1	I 2	I 3	I 4	I 5
<i>Actor bonds</i>										
Network of personal relationships				X					X	
Trust, commitment and norms					X				X	
Identification					X					X
<i>Activity links</i>										
Cooperation and integration/ joint control of activities				X						X
<i>Resource ties</i>										
Interfaces between resources and joint control of resources					X					X
Durability and consistency of relation					X					X
Average score on this dimension	4.67 (relational)					4.67 (relational)				
TYPE OF COORDINATION	Bluegum Cooperative					Bluegum IOS				
Variable	C 1	C 2	C 3	C 4	C 5	C 1	C 2	C 3	C 4	C 5
<i>Actor bonds</i>										
Control structure				X					X	
Level of formality			X						X	
Internal force for action				X				X		
Actor roles in network/ system development				X					X	
<i>Activity links</i>										
Activity structure and centrality of control				X				X		
<i>Resource ties</i>										
Control over resources and power asymmetry					X					X
Average score on this dimension	4.00 (emergent)					3.67 (emergent)				

Table 2: Bluegum's scores on variables of the two dimensions

	Capgrains' online ordering	Bluegum's group communication
<i>Amount of users</i>	3 of 15	10 of 15
<i>Frequency of use</i>	Incidentally	Almost weekly
<i>Features of the system that are used</i>	Only to look up prices, only one member really used it for ordering	All
Resulting level of use	Low	High

Table 3: Level of use in the cases

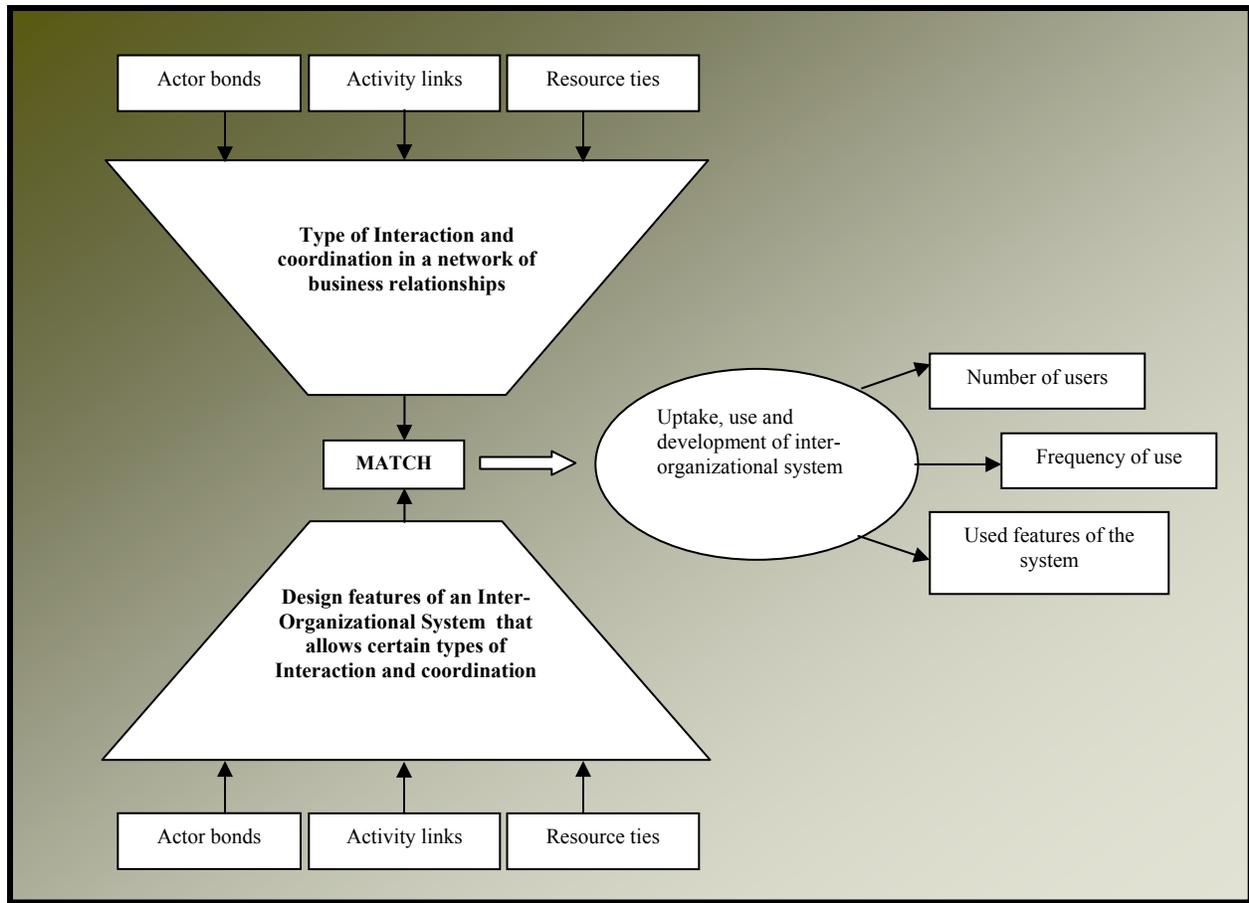


Figure 1: Uptake of IOS in business relationships

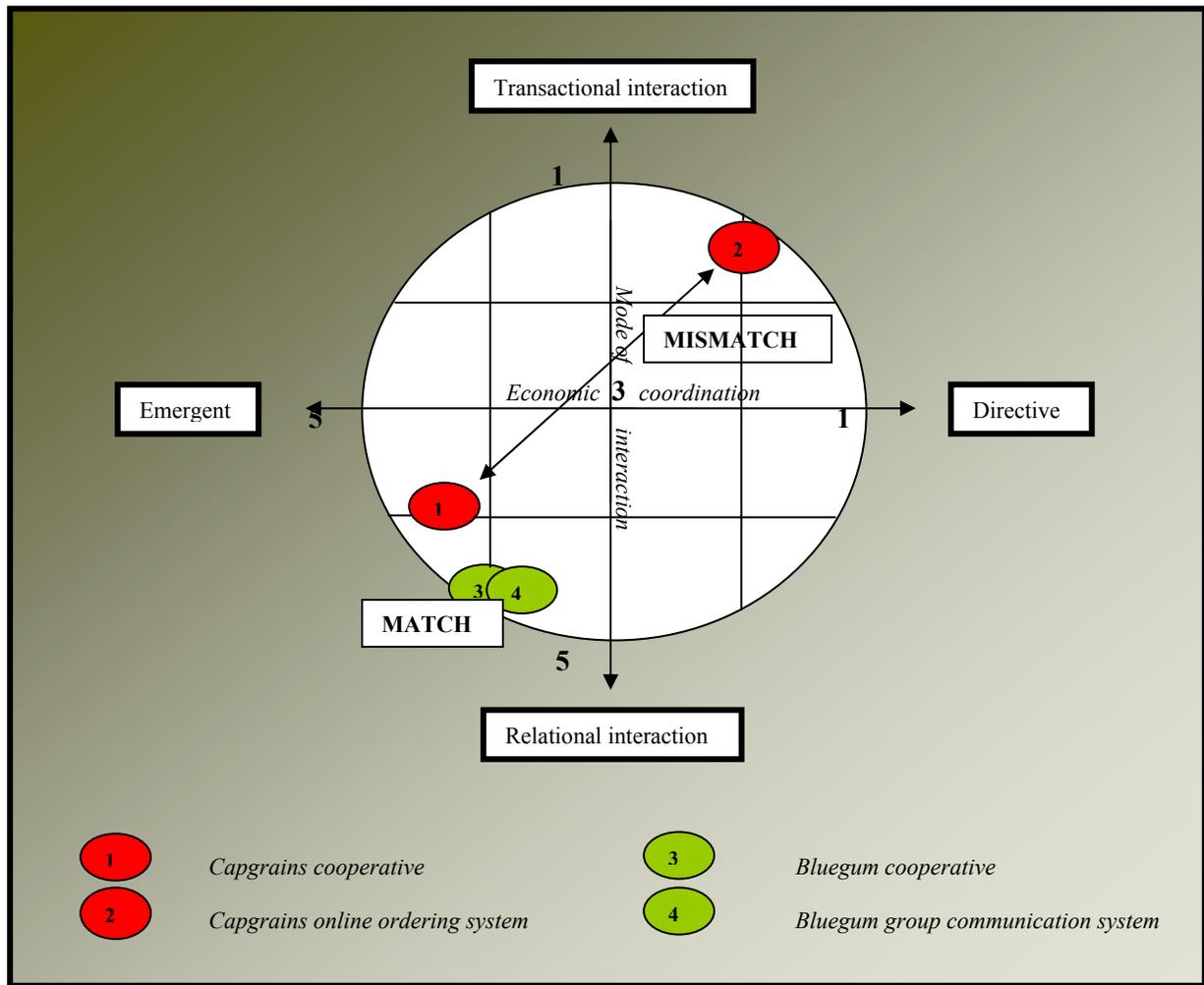


Figure 2: Degree of match between business relationships and IOS

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Appendix 1

The variables with which a characterization on the dimension of interactions will be determined for the business relations in the cooperatives, and for its IOS.

	Indicates transactional interaction when the network consists of/ the system creates	Indicates relational interaction when the network consists of/ the system creates
Actor bonds		
Network of personal relationships	No personal relationships, only interest in the transaction	Strong personal relationships, actors direct interest and attention to each other
Trust, Commitment and Norms	Uncertainty in relationship, no long term orientation towards relationship, absence of norms	Will to engage in cooperative activity, long term orientation toward relationship, consensus by relational norms
Identification	No social or business identification by shared aspects.	Concern for collective processes by shared aspects (history, representation, language)
Activity links		
Cooperation and integration/ joint control of activities	A single transaction, no joint investments made No joint control of activities, no integration of activities	High interdependence because of repetitive activities and investments made. Interdependence of activities increases because of joint control through relationships
Resource ties		
Interfaces between resources and joint control of resources	No interfaces between resources, actors are not linked by resources No joint control of activities, no integration of resources	Deep interfaces because of combination of resources Interdependence of resources increases because of joint control through relationships
Durability and consistency of relation	Short term relations, no relational continuity	Relational continuity over time by solidarity and cohesion

The variables with which a characterization on the dimension of coordination will be determined for the business relationships in the cooperatives, and for its IOS.

	Indicates emergent coordination when the network consists of/ the system creates:	Indicates directive coordination when the network consists of/ the system creates:
Actor bonds		
Control structure	No central authority, but control is spread over the group of actors: bottom up	A single authority for decision making and controlling the actors' activities and resources: top down
Level of formality	Low formality, ad hoc decision making and problem solving	High formality, institutionalised procedures for decision making and problem solving
Internal force for action	Actors pursue own interest when acting	Actors are assumed to act on the basis of norms
Actor roles in network/ system development	Based on own initiative: roles are left deliberately ambiguous and overlapping	Predefined coordination by management or a central set of actors
Activity links		
Activity structure and centrality of control	Low level of integration of activities, high level of self control	High level of integration of activities, with a central controlling actor
Resource ties		
Control over resources (such as information, technology, expertise) and power asymmetry	Same levels of access to and use of information, technology and expertise	High variations in levels of access to information, technology and expertise resulting in asymmetry of use of power