Theoretical Models to Classify the Type of Interorganizational Networks in Productive Systems

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Abstract. The purpose of this article is to research the theoretical models to analyze Interorganizational systems and networks in a production chain. To achieve the objective of this study a bibliographic research was conducted to study and selection of indicators of theoretical models found. With the defined indicators was conducted a pilot with five large companies that provide for industrial manufacturers to test and evaluate the research process. In this pilot had the chance to prove the search results to the theory, the chosen production system was the automotive industry and their first-tier suppliers. It is a chain known and established for over 30 years. The IOS type can be classified sequential interdependence, the pattern of use is the exploitation, the type of network is a cluster and the main goal is to improve operational efficiency..

Keywords: IOS · Indicators · Productive systems

1   Introduction

Businesses increasingly are allying other companies to obtain some kind of value in the production chain, be it financial, social, and productive or any other value. These types of partnerships are becoming common in various areas, creating a network level, the great difficulty we have today is how to classify them and verify the benefits of these associations.

According to Mariano et al. [1], collaborative interorganizational networks have become increasingly common; the companies have continuously realized the competitive advantages gained by establishing alliances. Thus, it is important to note that a network can be defined as a set of nodes that bind each other and a collaborative network level can be defined as a set of three or more organizations that are united by means of an alliance in around some purpose

Several authors define what an Interorganizational System. From simple shapes to more elaborate, the IOS feature essential characteristics, both technological and organizational [2]. The use of IOS differs from a traditional information system, as it involves communication networks that push the boundaries of companies.

The purpose of this article is to research the theoretical models to analyze Interorganizational systems and networks in a production chain and apply them in one productive system.

2 Literature Review

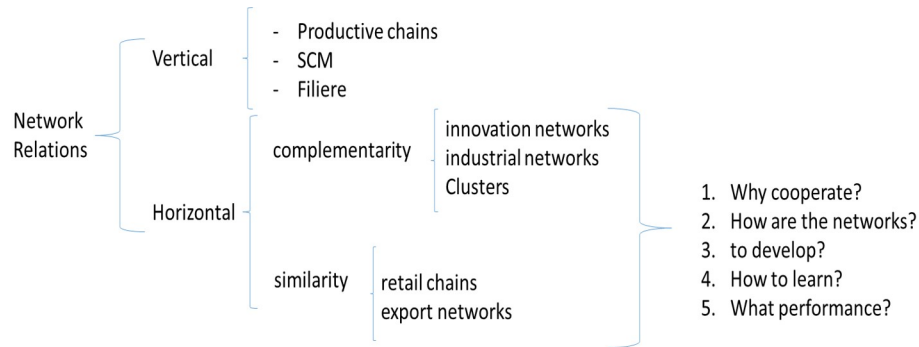### 2.1 Interorganizational Networks

According to Puffal and Puffal [3], "consider based on research conducted on the evolution of interorganizational networks studies field that the past 30 years the interest on interorganizational networks has grown significantly, and produced several studies and publications on the subject and the theme networks interorganizational is a fragmented field, multidisciplinary and his studies being conducted from various theories, from various points of view it is necessary to periodically analyze this field of study and to identify the most discussed topics and the light which theories it is being analyzed". .

According to Pereira [4], "both in practical and theoretical context, the issue of interorganizational relationships is applied to a wide variety of relationships between organizations, for example, joint ventures, strategic alliances, clusters, franchising, supply chains, groups export, interorganizational networks, among others". Interorganizational networks are important in economic life, because facilitate the complex transactional and cooperative interdependence between organizations. Its importance is recognized from the point of theoretical saw, because it can be, and indeed are studied from different theoretical approaches. Thus, studies on networks provide a valuable basis of common interests and potential dialogue between the various branches of social science [5].

According to Baum and Ingram [6], "interorganizational networks can be divided into two classes' analysis: horizontal and vertical networks". The "vertical networks" involve the coordination of activities of suppliers and distributors by a coordinating company, exerting considerable influence on the actions of other actors in the production chain. The "horizontal networks" through similar organizations that combine their activities to achieve collective goals. Figure 1 reflects the main divisions of studies on interorganizational networks [4].

2.2 Interorganizational Systems

Several authors define what an Interorganizational System. From simple shapes to more elaborate, the IOS feature essential characteristics, both technological and organizational [2]. The use of IOS differs from a traditional information system, as it involves communication networks that push the boundaries of companies.

Fig. 1. Divisions of interorganizational networks. Source:[4].

Cash and Konsynski [7] present a simple definition of Interorganizational System: "(...) an automated information system shared by two or more companies." Interorganizational systems are built using IT - computers and communication technology, to facilitate the creation, storage, processing and transmission of information. Johnston and Vitale [2] define the IOS:

"As systems, interorganizational systems allow the movement of information across organizational boundaries."

For Chi and Holsapple [9], in the broadest sense, an IOS consists of computer and communications infrastructure to manage the interdependence between companies. Companies need to manage carefully the interorganizational processes in order to access external resources, mitigate strategic uncertainties, and gain competitive advantage [10].

Recent studies have considered the supply chain management (SCM) of an inter ability digitally enabled and seen the IOS as modern systems typical supply chain management [11,12].

2.3   Type for IOS

Kumar and van Dissel [13] classify the IOS based on a typology of interorganizational interdependencies, highlighting the role of IOS in managing inter-firm dependency and force building trust, by reducing potential conflicts aimed at sustained cooperation. The types of interdependencies presented by the authors are:

– Interdependence of set (pooled) - companies share and use common character resources (e.g., the use of a common data center for a number of companies).
– Interdependence Sequential - refers to the situation where companies are connected by a chain, targeted and well-defined relationships where the outputs of a task processor turn into inputs to others (e.g., the customer-supplier relationship over a source current).

Characteristics	Agglomerate	Cluster	Local Productive Arrangement	Social networks
Types of actors involved	Private and public organizations.	Private and public organizations	Private, public, educational institutions, non-governmental organizations, associations, unions and the community in general.	Private, public, educational institutions, non-governmental organizations, associations, unions and the community in general
Form of actors	Organizations	Organizations	Organizations	Organizations and individuals.
Typology	Market	Market and communications	Market, communications and support	Support
Models	Vertical and horizontal	Vertical and horizontal	Vertical and horizontal	Horizontal
Organizations in a given geographical area	concentrated	concentrated	concentrated	concentrated
Types of organizations	Various sectors	A sector or activity	A sector or activity	One or more sectors or activities
Strategy level	organizational	Organizational	Among all the local agents	Among all the local agents
Actions	competitive	Competitive-cooperative	Competitive-cooperative	Cooperatives
Interaction Form	Formal and informal	Formal	Formal	Informal
Essential factors of strengthening	Geographical proximity, similarity of market and regional competences.	Geographical proximity, similarity of market, regional expertise and strong competition.	Close geographic, similar market, regional expertise, strong competition and social cooperation.	Trust, reputation and cooperation
Goal setting	Does not exist	Common goals between partners	Common objectives with all local actors	Common objectives with all local actors
Types of Goals	Economics	Economics	Economics and Socials	Economics and Socials

Fig. 2. Characteristics of the types of networks. Source:[8].

– Interdependence Reciprocal - describes a relationship in which each company outputs are transformed into inputs for other (for example, a team of concurrent engineering with the participation of customers, suppliers, distributors, etc.).

2.4   Usage Patterns of IOS

Figure 4 shows that according to the standard adopted by the company, for the use of IT, exploration or exploitation, are obtained as primary outcome, operational or strategic benefits and benefits as second order, competitive performance. Considering the relationship represented by the arrows, the research conducted by Subramani [14], confirmed not only the connection between operational benefits and performance competitive. Subramani [14] presents two types
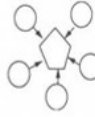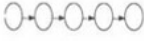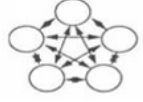
Type of Interdependence	Set of Interdependence	interdependence Sequential	Reciprocal interdependence
Configuration			
Coordinating Mechanisms	Standards & Rules	Standards, Rules, Schedules & Plans	Standards, Rules, Schedules, Plans & Mutual Adjustment
technologies	Mediator *(mediating)*	On along the chain *(Long-linked)*	Intensive *(Intensive)*
Structure	High	Average	Low
Potential for Conflict	Low	Medium	High
Type of IOS	IOS with Information Resources Together	IOS *Value / supply-chain*	IOS networks

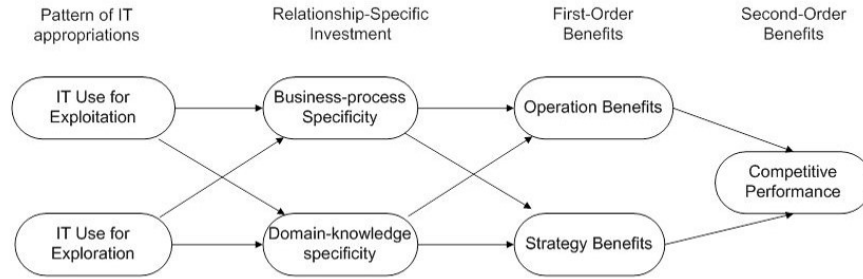**Fig. 3.** Characteristics of the types of networks. Source:[8].

Fig. 4. IT use, specific investments in relationships and Supplier Benefits. Source:[14].

of specific intangible assets:

– Business Process Specificity - is the degree to which key business processes from a supplier, and operational processes (administrative and quality control) are particular to the requirement of the focal company in the relationship. The author believes that the business process of specificity is an important factor in performance linked to inter-firm relationship.
– Domain Specificity of knowledge - is the degree that the critical expertise of a supplier, such as the formulation of competitive analysis and strategy and the development of a new product are particular to the requirement of local firm in the relationship. Specificity of domain knowledge is seen in the examples of firms that rely on suppliers for innovation and critical decisions.

3 Research Methodology

To achieve the objective of this study a bibliographic research was conducted to study and selection of indicators of theoretical models found. With the de-

fined indicators was conducted a pilot with five large companies that provide for industrial manufacturers to test and evaluate the research process.

To collect the information needed for the analysis, exploratory research, qualitative was used. Gil [15], the exploratory research aims to provide greater familiarity with the problem, in order to make it more explicit.

Zikmund [16] considers that exploratory studies are conducted to clarify ambiguous issues; research is needed to better understand the dimensions of the problems. The qualitative approach presents a reality that cannot be quantified or measured and involves subjective items of reality research. You can work with data without specific statistical analysis, seeking the understanding of reality [17].

4   Analyses of Results

The several visits and interviews in businesses say that interorganizational relationships are small and largely are limited between the leader of the network and suppliers. These relationships refer only to trade relations. The only application that companies use is EDI.

The characteristics of this network, according to Table 1 of the literature, lies in Figure 5. The theoretical framework of verifies the existence of characteristics of "cluster".

The IOS type can be classified sequential interdependence as the data analyzed according to Kumar and van Dissel [13], refers to the situation where companies are connected by a chain, directed relations and well defined, where the outputs a task processor turn into inputs to others (e.g., the customer-supplier relationship along a current source). These theoretical characteristics could be confirmed in the surveyed companies, because the chain is used for Value / sup-ply-chain.

This group is characterized as an organizational network and second inter Balestrin and Vargs [5]. Interorganizational networks are increasingly important in economic life, because facilitate the complex transactional and cooperative interdependence between organizations.

Subramani [14] proposes a way to categorize EDI ownership patterns in organizations considering that there are two main standards: "Exploitation" or "Exploration". We asked the managers of the companies about which standards the company fits and how the pattern interferes with the company's plans. The result was that 100% of the cases are categorized as exploitation, that is, the goal is to improve operational efficiency.

The Alfa company manager commented: "The EDI is being used only for data transfer, its implementation improved processes and streamlined procedures for programming, deliveries and invoices. Once deployed, there are few changes in EDI. Respondents were unanimous in considering that as benefits of the first order have the operational benefits.

	Companies				
Characteristics	**Alfa**	**Beta**	**Gama**	**Delta**	**Épslon**
Types of actors involved	Private organization	Private organization	Private organization	Private organization	Private organization
Form of actors	organization	organization	organization	organization	organization
Typology	Market	Market	Market	Market	Market
Models	Vertical	Vertical	Vertical	Vertical	Vertical
Organizations in a given geographical area	concentrated	concentrated	concentrated	concentrated	concentrated
Types of organizations	Various sectors	Various sectors	Various sectors	Various sectors	Various sectors
Strategy level	organizational	organizational	organizational	organizational	organizational
Actions	competitive	competitive	competitive	competitive	competitive
Interaction Form	Formal	Formal	Formal	Formal	Formal
Essential factors of strengthening	Geographical proximity and regional competences	Geographical proximity	Geographical proximity, similarity of market and regional competences	Geographical proximity, similarity of market	Geographical proximity, similarity of market and regional competences
Goal setting	by automaker - Network leader	by automaker - Network leader	by automaker - Network leader	by automaker - Network leader	by automaker - Network leader
Types of Goals	Economics	Economics	Economics	Economics	Economics
Type of IOS	**Alfa**	**Beta**	**Gama**	**Delta**	**Épslon**
Configuration	sequential	sequential	sequential	sequential	sequential
Coordinating Mechanisms	Standards, Rules, Schedules & Plans	Standards, Rules, Schedules & Plans	Standards, Rules, Schedules & Plans	Standards, Rules, Schedules & Plans	Standards, Rules, Schedules & Plans
technologies	On along the chain (Long-linked)	On along the chain (Long-linked)	On along the chain (Long-linked)	On along the chain (Long-linked)	On along the chain (Long-linked)
Structure	Average	Average	Average	Average	Average
Potential for Conflict	Average	low	Average	low	Average
Examples of Implementation and Application Technologies	EDI	EDI	EDI	EDI	EDI
Type of IOS	Value or Supply Chain	Value or Supply Chain	Value or Supply Chain	Value or Supply Chain	Value or Supply Chain
IOS standard	**Alfa**	**Beta**	**Gama**	**Delta**	**Épslon**
Exploitation	x	x	x	x	x
Exploration					

(The table has a left-margin vertical label "Networks" for the upper section and "IOS" for the lower section.)

Fig. 5. Summary of responses.

5 Conclusion

Theoretical models presented in the conceptual framework allowed to establish indicators to analyze the type of IOS, IOS use pattern and network Features to set the type. As secondary outcomes were able to identify the benefits, used standards and objectives.

In this pilot had the chance to prove the search results to the theory, the chosen production system was the automotive industry and their first-tier suppliers. It is a chain known and established for over 30 years. The IOS type can

be classified sequential interdependence, the pattern of use is the exploitation, the type of network is a cluster and the main goal is to improve operational efficiency.

These indicators should be tested with other production systems and more players to check their efficiency. As a future project, we can incorporate the analysis of social networks to verify the structural characteristics of the network as centrality, grouping etc.

References

1. Mariano, E.B., Guerrini, F.M., Rebelatto, D.A.d.N., et al.: Análise da Relação entre Estrutura e Desempenho de Redes Interorganizacionais Colaborativas. Gestão & Produção 19(3), 471–479 (2012)
2. Johnston, H.R., Vitale, M.R.: Creating Competitive Advantage with Interorganizational Information Systems. MIS quarterly pp. 153–165 (1988)
3. Puffal, D.D.P., Puffal, C.W.: A Evolução do Campo de Estudos de Redes Interorganizacionais: Uma Análise de Publicações Internacionais das Relações entre Empresas. Revista Brasileira de Gestão e Inovação (Brazilian Journal of Management & Innovation) 1(3), 63–86 (2014)
4. Pereira, B.: Estrutura de Relacionamentos Horizontais. Porto Alegre, Tese (Doutorado em Administração)–UFRGS (2005)
5. Balestrin, A., Vargas, L.M.: Evidências Teóricas para a Compreensão das Redes Interorganizacionais. Encontro de Estudos Organizacionais 2 (2002)
6. Baum, J.A., Ingram, P.: Interorganizational Learning and Network Organization: Toward a Behavioral Theory of the Interfirm. The Economics of Choice, Change, and Organization pp. 191–218 (2002)
7. Cash, J.I., Konsynski, B.R.: IS Redraws Competitive Boundaries. Harvard Business Review 63(2), 134–142 (1985)
8. Cruz, J.A.W., Martins, T.S., Augusto, P.O.M.: Redes Sociais e Organizacionais em Administração. Curitiba: Juruá (2009)
9. Tsui, E., Chi, L., Holsapple, C.W.: Understanding Computer-mediated Interorganizational Collaboration: A Model and Framework. Journal of knowledge Management 9(1), 53–75 (2005)
10. Zhao, K., Xia, M.: Forming Interoperability Through Interorganizational Systems Standards. Journal of Management Information Systems 30(4), 269–298 (2014)
11. Rai, A., Patnayakuni, R., Seth, N.: Firm Performance Impacts of Digitally Enabled Supply Chain Integration Capabilities. MIS Quarterly pp. 225–246 (2006)
12. Zhang, C., Xue, L., Dhaliwal, J.: Alignments Between the Depth and Breadth of Inter-organizational Systems Deployment and their Impact on Firm Performance. Information & Management 53(1), 79–90 (2016)
13. Kumar, K., Van Dissel, H.G.: Sustainable Collaboration: Managing Conflict and Cooperation in Interorganizational Systems. Mis Quarterly pp. 279–300 (1996)
14. Subramani, M.: How do Suppliers Benefit from Information Technology use in Supply Chain Relationships? Mis Quarterly pp. 45–73 (2004)
15. Gil, A.C.: Como Elaborar Projetos de Pesquisa. São Paulo 5, 61 (2002)
16. Zikmund, W., Babin, B., Carr, J., Griffin, M.: Business Research Methods: Cengage Learning. H4 B (2012)
17. Metodologia da Pesquisa: C]onceitos e Técnicas, author=da Costa, Marco Antônio F and da Costa, Maria de Fátima Barrozo, year=2009, publisher=Interciência