

Exploring Information Technology and Supply Chain Governance: Case Studies in Two Brazilian Supply Chains

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ABSTRACT

The aim of this study is to investigate how information technology (IT) investment supports and relates to SCG and its conceptions (transactional and relational). The authors conducted exploratory case studies in two large Brazilian companies and two major suppliers, interviewing top supply chain executives. In the first case, they identified a more relational type of governance that was mainly based on the company's relationship with its suppliers which was driven by the desire to achieve a greater market share. IT investments focused on sales and operations planning projects where all systems were being integrated. In the second case, they identified transactional governance as the predominant form. This reflects the presence of a great number of suppliers, low partnership and low supply on time delivery rate. IT investments are being made to achieve more relational governance through expenditure on e-procurement and greater integration with their suppliers using ERP.

Keywords: Brazilian Companies, Case studies, Information Technology Investment, Supply Chain Governance

INTRODUCTION

The introduction of IT in business operations is drastically changing the way supply chains operate, enhancing trust, collaboration and commitment among the members of the supply chain

(Ghiassi & Spera, 2003). The development and continuous success of a supply chain is directly dependent on the IT used by companies (Ross, 2011). The use of these technologies often enables the creation, support and expansion of competitive advantages for these organiza-

DOI: 10.4018/JGIM.2015070104

tions (Sohal, Moss & Ng, 2001). IT becomes important for its ability to support an increase in communication.

Of key importance in the success of a supply chain are the global and long term benefits for all supply chain members. These may be achieved through collaboration and shared information, which may be facilitated by IT used in the supply chain (Gunasekaran & Ngai, 2004). IT use in the supply chain today goes beyond the operational aspects, a notion that is present in various studies of supply chains (Ketchen & Hult, 2007). Current studies embrace additional aspects such as trust, commitment, and power, among other features. Recent studies have highlighted the concept of supply chain governance (SCG) (Raynaud, Sauvee & Valceschini, 2005; Ruben, Boselie & Lu, 2007; Zhang & Aramyan, 2009).

SCG is viewed as covering more elements than those analyzed in supply chain management (SCM). Governance, an issue that has been more studied in the past several years, (Jain & Dubey, 2005), is considered one way to analyze inter-organizational relationships as a multidimensional phenomenon manifested in the structures and process of companies. Chen and Paulraj (2004) pointed out the need for examining the elements of SCG interactively. This will enable the identification of the benefits common in the supply chain because too many studies analyze these elements in isolation (Fawcett, Ogden, Magnan & Cooper, 2006; Gereffi, Humphrey & Sturgeon, 2005; Veen-Dirks & Verdaasdonk, 2009; Wathne & Heide, 2004). Furthermore, there are many critical elements, such as IT, that are necessary for succeeding in the supply chain (Chen & Paulraj, 2004).

There are several studies analyzing IT in SCM (Zhang, Donk & Vaart, 2011). However, only a few studies combined SCG and IT (Bitran, Gurumurthi, & Sam, 2006; Gosh and Fedorowicz, 2008). Bitran, Gurumurthi and Sam (2006) argue that IT comes into play as an enabler and has led to fundamental changes in supply chain behavior and further to the changes in their governance. Gosh and Fedorowicz (2008) pointed

out that IT is used for coordination activities and for information sharing among supply chain members, depending on the existence of a cohesive set of communication-enhancing governance processes. Thus, it is necessary to analyze and think about how IT is being used in SCG activities and processes.

According to Ruiz-Torres, Mahmoodi and Ayala-Cruz (2012) the last two decades have witnessed a change in the role of Latin American countries in the global economy. As a consequence their greater role, Latin American businesses and their supply chains have gained prominence. These authors carried out a review of the supply chain literature about Latin American countries identifying Brazil as the main subject of study. This could be explained by the fact that Brazil is experiencing its fastest economic growth in almost two decades (Businessweek, 2010), achieving sixth place in global economic ranking in 2011, overtaking the U.K (Forbes, 2011). Moreover, according to Forbes (2012), 33 companies from Brazil gained presence on its list the previous year. Thus, the aim of this study is to identify the most prominent SCG conception – relational and transactional in Brazilian supply chains and to investigate how IT investment supports and relates to this type of governance.

We apply a qualitative approach to achieve these objectives. We explored each SCG conception with its respective elements, explored how IT is related to and support each conception, and determined which of the conceptions predominates in each supply chain as well as the role of IT in this scenario. We carried out case studies in two different Brazilian supply chains (automotive and electrical/electronic), covering 6 companies and 10 interviews.

The rest of the paper will proceed as follows: In the following sections we present the theoretical background of this study followed by an explanation of the methodology used presenting the approach to data analysis. This is followed by the findings, discussion and conclusions.

THE THEORIES AND SUPPLY CHAIN GOVERNANCE

SCG is a wider view of the supply chain focusing on more strategic (Cornforth, 2003; Rodrigues & Malo, 2006) and long-term inter-organizational aspects. We can understand SCG as an institutional framework in which the company members of the supply chain are inserted, identifying relational contracts and transactional contracts (Mahapatra, Narasimhan, & Barbieri, 2010). So from a contract view there are relationships among companies (relational conception) and transactions are made using standards (transactional conception). Thus SCG has two different views: one side transactional and in the other side relational.

A significant portion of the literature on governance is focused on control and definition of roles in organizations. However, other theoretical approaches dealing with governance, such as agency theory, stewardship theory, Resource Dependency Theory and Transaction Cost Theory (Argyres & Liebeskind, 1999; Cornforth, 2003; Rodrigues & Malo, 2006) could be used to enlarge the understanding of the concept.

Agency Theory

Agency theory allows us to observe that members in a supply chain relationship have different interests. The principal and the agent, the two pillars of the theory (Jensen & Meckling, 1976), are selling and buying companies that are part of the supply chain. In different relationships they play different roles, but usually the leader, or the most important partner in the supply chain, can be considered the principal. Companies of 1st, 2nd and 3rd tier, for example, are the agents. According to Eisenhardt (1989), this theory is related to the resolution of two problems that occur in the relations between agent and principal: (i) conflicts of desires or goals between the two and (ii) the difficulty or the high cost to the principal to monitor what the agent is doing.

Consequently, governance emerges as a set of practices enacted to ensure control and coordination between these members. Power relations also exist in this type of relationship, where the leader company often establishes rules and conditions that others must follow. In addition, incentives can be used as a way to establish criteria and privileges to the suppliers who stand out from among the others. Therefore, following this theory, it is possible to analyze the elements of the SCG: power relationships (Gereffi et al., 2005), incentives (Veen-Dirks & Verdaasdonk, 2009), coordination (Gereffi et al., 2005) and control (Veen-Dirks & Verdaasdonk, 2009).

Transaction Cost Theory

Transaction Cost Theory postulates that the company is seen as a governance structure serving as a mechanism to minimize transaction costs (Williamson, 1979). The development of different organizational forms seeks to minimize the adverse effects of bounded rationality and safeguard transactions against the exercise of opportunism on the part of the agents involved (Cornforth, 2003). Thus, in the context of supply chain, it was possible to relate the following elements of the SCG: transaction costs, complexity of the transaction, the codification of the transaction and opportunism.

In light of this theory, we find that some companies seek to minimize the costs to carry out transactions with other companies and use devices such as transaction encryption to avoid or minimize the existence of opportunism. The complexity of the transaction is also an important aspect that is related to the cost to transact; the more complex it becomes, the more expensive it is for companies to engage in such transactions. Thus, the elements found in the literature on the SCG related to transaction costs theory are: cost (Ruben et al., 2007), complexity (Ashenbaum, Maltz, Ellram & Barratt, 2009), codification (Gereffi et al., 2005) and opportunism (Ruben et al., 2007).

From these two theories (agency and transaction costs) and the elements identified in the literature regarding SCG, we identified the transactional governance conception.

Stewardship Theory

An alternative approach to agency theory is stewardship theory (Barney, 1990). In this theory, the agent and principal, the suppliers and the leader company, are seen as partners; with interests that are in harmony and shared. From this perspective, managers are not motivated by individual or by organizational goals, but aligned with the objectives of partner organizations (Davis, Schoorman & Donaldson, 1997). Trust (Yu, Liao & Lin, 2006), commitment (Fawcett et al., 2006), integration (Ashenbaum et al., 2009) and collaboration (Fawcett et al., 2006) are key elements, identified in different studies of SCG. These express how the supply chain members can achieve this closer and lasting relationship. These elements point out the sharing of the common goals among companies and the possibility of performing actions aligned with the common goal of the supply chain.

Resource Dependency Theory

According to Resource Dependency Theory, organizations rely heavily on the relationship with the external environment to survive (Pfeffer & Salancik, 1978). A coalition of organizations often forms in order to acquire scarce resources in an uncertain environment (Ulrich & Barney, 1984). Governance is a set of practices to develop the relationship with the external environment in order to obtain all the necessary information and resources to ensure the survival of the organization (Rodrigues & Malo, 2006).

Therefore, the relationships (Zhang & Aramyan, 2009) among the companies become a major element in the context of supply chain, where organizations relate to each other to acquire the needed and desired resources and thus maintain their survival and competitiveness in the market. In addition, the interaction of companies, of which some elements like the capacity

of the suppliers (Gereffi et al., 2005), should be observed to achieve and provide the materials and information that they need. Other elements that contribute to the existence of relations and survival of enterprises are the qualification and flexibility of suppliers (Wathne & Heide, 2004) to respond quickly and accurately to changes in the market. This is important because, organizations that are dependent on environmental resources can become vulnerable (Humphreys, Sculli & Lai, 2001).

From these last two theories and the elements identified in the literature regarding SCG, we identified the relational governance conception. In Table 1 we present a summary of the theories, SCG conceptions and its elements.

INFORMATION TECHNOLOGY AND SUPPLY CHAIN GOVERNANCE

There are a few studies analyzing IT in SCG (Bitran et al., 2006; Gosh and Fedorowicz, 2008) which highlight that IT can act as a catalyst to changes in SCG and could be useful in its different activities and processes. We argue that IT could help and be linked to SCG (and its conceptions) in different forms through the SCG elements presented in the previous section. To accomplish the activities and processes related with SCG, companies could invest in several IT and devices that could be adopted and used to support the relevant activities in supply chain: legacy systems, barcode, electronic data interchange (EDI), enterprise resource planning (ERP), e-procurement, radio-frequency identification (RFID), tracking systems, vendor managed inventory (VMI) and warehouse management systems (WMS) (Patterson, Grimm & Corsi, 2003; Gunasekaran & Ngai, 2004, 2005; Bandeira & Maçada, 2008). In the next section we present how IT is linked with the elements and conceptions of SCG.

Transactional SCG and IT

For Chong, Ooi and Sohal (2009) the IT tools bring efficiency benefits by reducing external

Table 1. Theories, SCG conceptions and its elements

Governance Conception	Theories Used		Elements Identified	
	Theory	Authors	Elements	Authors
Transactional	Agency Theory	Jensen and Meckling (1976); Eisenhardt (1989)	Power, incentives, coordination and control	Ferguson, Paulin and Bergeron (2005); Gereffi, Humphrey and Sturgeon (2005); Veen-Dirks and Verdaasdonk (2009)
	Transaction Cost Theory	Williamson (1979)	Cost, complexity, codification and opportunism	Ashenbaum, Maltz, Ellram and Barratt (2009); Gereffi, Humphrey and Sturgeon (2005); Ruben, Boselie and Lu (2007)
Relational	Stewardship Theory	Barney (1990); Davis, Schoorman and Donaldson (1997)	Trust, commitment, integration and collaboration	Ashenbaum et. al. (2009); Fawcett, Ogden, Magnan and Cooper (2006); Yu, Liao and Lin (2006); Zhang and Aramyan, (2009)
	Resource Dependency Theory	Pfeffer and Salancik (1978); Ulrich and Barney (1984)	Relationships, capacity, flexibility and qualification	Gereffi et al. (2005); Wathne and Heide (2004); Zhang and Aramyan (2009)

transaction expenses with regard to the costs of internal coordination. Moreover, the technology provides a reduction in communication and transactional costs among the members of the supply chain. They also can be used to achieve coordination (Grandori & Soda, 1995).

The use of technologies may be influenced by incentive schemes, including rewards, training and education for users (Gunasekaran & Ngai, 2004). Power is also considered an element in the supply chain, where the technologies used allow for retaining some of the benefits of the existence of that power (Subramani, 2004). According to Gereffi et al. (2005) the key issue in global-scale production is that coordination and control can be achieved without direct participation by individuals.

Another important element of the use of IT in the supply chain is the ability to reduce the incidence of opportunism among members because it increases the cost of opportunism through the adoption and investments in technologies (Park & Yun, 2004). Some technologies create encoding standards which must be negotiated and incorporated within the supply chain. So, depending on the supply chain and

product, more complex transactions are identified and it is necessary to be careful with the usage of these technologies. From the linkage with transactional SCG and IT, we advance the following proposition:

Proposition 1: In transactional governance, IT investments are carried out to achieve the supply chain goals benefiting one company or the leader firm

Relational SCG and IT

IT has a supporting role in relationships among suppliers, buyers, producers, and distributors, benefiting all participants (Maçada, 2001; Mulligan & Gordon, 2002). The integrated processes of management, necessary to improve operations in the supply chain, require an increase in the level of communication between the links of the supply chains. Thus, IT becomes important for its ability to support this increase in communication, enhancing trust, collaboration and commitment among members of the supply chain (Ghiassi & Spera, 2003). Furthermore, IT can enable the integration of information as

Table 2. Theories, SCG conceptions and its elements

Governance Conception	IT Characteristics	Authors
Transactional	IT is used to help companies to gain better terms with other firms, using incentives; coordinate activities; control actions without direct participation by individuals. Moreover, to achieve the expected benefits, IT could be applied to reducing external transaction expenses, communication and transactional costs; reducing opportunism; and creating encoding standards	Gunasekaran & Ngai, 2004; Subramani, 2004; Gereffi, Humphrey and Sturgeon (2005), Chong, Ooi and Sohal (2009), Grandori & Soda, 1995; Park & Yun, 2004
Relational	IT has a supporting role in relationships among companies in the supply chain. IT could be used to integrate processes, making the supply chain more flexible and increasing levels of communication, enhancing trust, collaboration and commitment. IT is also a factor to be considered in assessing the capabilities and quality of suppliers and potential suppliers.	Maçada, 2001; Mulligan & Gordon, 2002; Ghiassi & Spera, 2003; Pereira (2009), Gunasekaran and Ngai (2004), Correia, 2002

well as physical and financial flows between a company and its partners in the supply chain (Rai, Patnayakuni & Seth, 2006). Pereira (2009) discussed important aspects of using IT in the supply chain to better manage information, make the supply chain more flexible and provide greater interconnectivity between systems.

Gunasekaran and Ngai (2004), emphasize the global long term benefit accruing to all parts of a supply chain as a result of collaboration and information sharing, highlighting the importance of the application of IT. IT can help to improve relations with suppliers by ensuring the quality and qualification of their services or products through the reduction of fraud and error (Machado & Oliveira, 2004). Thus, the presence and quality of IT are also factors to be considered in assessing the capabilities of suppliers and potential suppliers, where facilities, equipment and labor are also taken into consideration (Correia, 2002). From the linkage with transactional SCG and IT, we propose the following:

Proposition 2: In relational SCG, IT investments are carried out to achieve the shared benefits on supply chain benefiting all participants

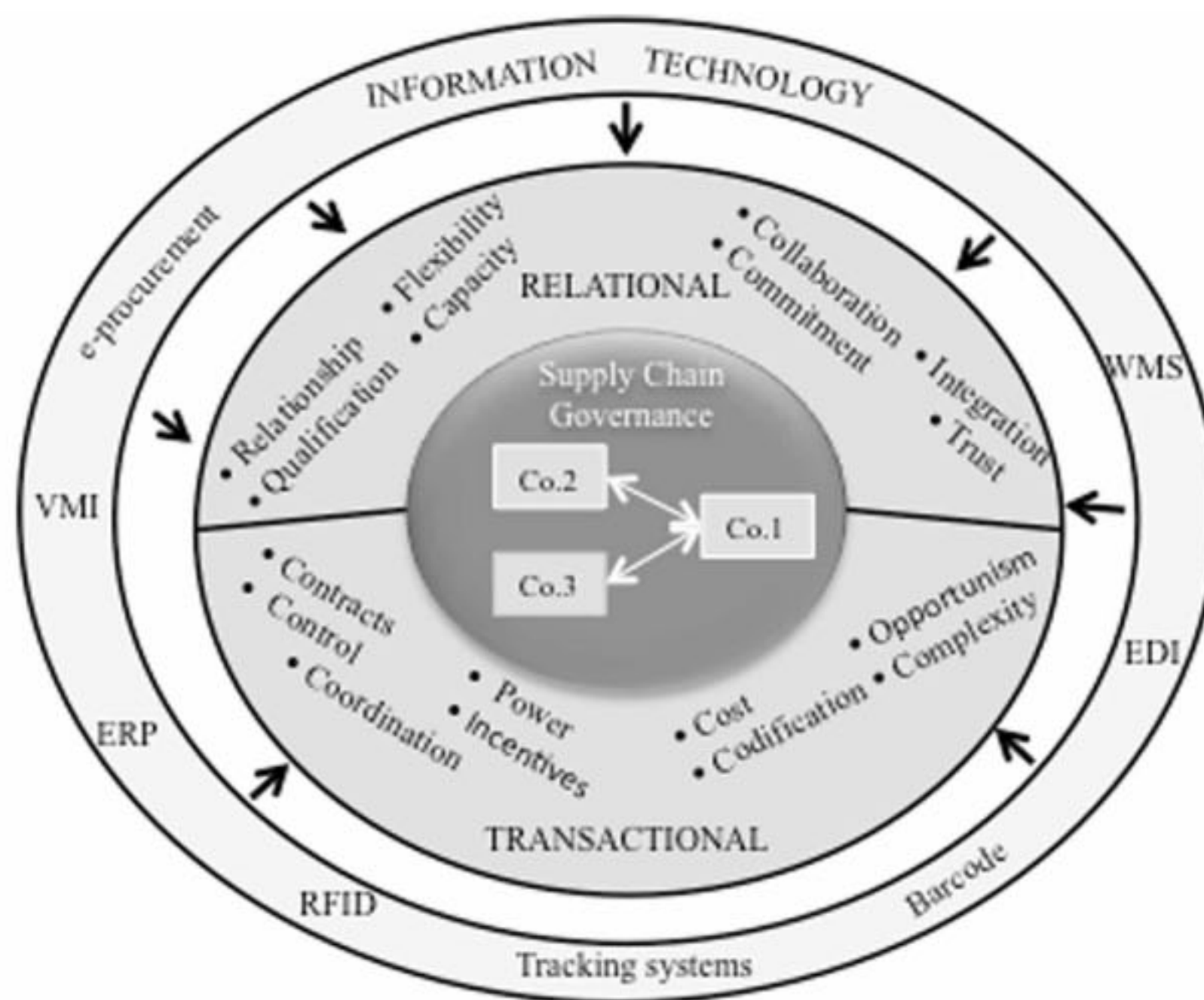
In Table 2 presents a summary of the SGC conceptions and the related IT characteristics.

From the identification of three different SCG conceptions, its elements and how IT support and are related with these elements, we propose the research model (Figure 1) to be applied in two different supply chains in Brazil presented next section.

METHOD

This qualitative and exploratory research is based on two case studies in six different companies. A qualitative approach is most suitable since it seeks to explore and describe the complexity of a situation and provide an in-depth analysis of the interaction in situations with multiple variables (Richardson, Peres, Wardeley, Correia & Peres, 1999; Yin, 2009). We conducted the research in two large companies from important sectors of the Brazilian economy (automotive and electrical/electronic manufacturing industries), each with two major suppliers that are of clear importance to the company. Interviews were conducted between November 2010 and May 2011 and held with the top supply chain executives in each company, individuals that have a lot of experience and have been working in the supply chain area for many years. They also have knowledge of IT investment and its use in the supply chain. The interviews, which were taped and transcribed, lasted one hour and thirty minutes on average.

Figure 1. Research model



Some characteristics of the respondents were taken into account in order to select them, such as their length of time working with the supply chain, length of time at the current company and knowledge about the subject of the study.

Another important feature of this research is that the companies all have a large and structured supply chain with hundreds of products and suppliers. Table 3 shows a summary of the information from each case, respondents (position, length of time in supply chain / time working at the current company in years and months), some characteristics of the companies (classifications, participation of each supplier in the work of the large company and participation of the large company in the work of each supplier) and duration of interviews.

Approach to Data Analysis

The theoretical research and research model in the previous step were used as the basis of the case study protocol, which is designed to guide the researcher when collecting data for a case study (Yin, 2009). In a case study, the

protocol plays an important role in ensuring reliability, providing information so that the research, repeated under the same conditions, obtains the same results (Riege, 2003; Yin, 2009). Thus, the protocol used in the case study was developed taking into account the elements of SCG and IT studied by the different authors mentioned in the literature review. The questions in the protocol were used to identify how the elements of SCG governance are perceived and applied in supply chain arrangements, and how IT is invested in and used to support and relate these elements.

We use a positivist pattern matching approach (Yin, 2009). This method consists of three steps. First, a theory is specified as a predicted pattern of events. We presented the SCG conceptions derived from different theories and how IT could support and are related with these conceptions theoretically. We also advanced two different propositions about these themes. Then, in a case study, information on all events were collected and also stored in a pattern. As a final step, both patterns are matched by

Table 3. Summary of the information from cases

Supply Chain	Companies	Respondents (Working in SC / Current Company)	Characteristics	IT in Supply Chain	Duration of Interview
1 Auto- motive	Large Company	(A) Supply Chain VP for America Region (3,5y/3,5y)	One of 60 largest companies in Brazil. Subsidiary of one of the world's 200 biggest companies	ERP, systems developed internally, legacy system (to management, transportation), EDI, tracking systems, investments in VMI, portal via web, DCP and email	2 hours
	Suppliers	(B) Plant Director (13y/1,4y) and Logistics Manager (N/A).	Supply 100% of some products to the large company, and the large company represents 40% of their billing	EDI, systems to manage the supplier, storage, production programming, portal and email	1 hour and 40 minutes
		(C) Logistic Manager (4y/6m), Quality System auditor (N/A), Relation with supplier Manager (8y/5,5y), Project Manager (13y/3y)	Supply between 10 to 25% of some products to the large company, and have about 70% of the Brazilian market of some products	EDI, ERP, Portal, internal systems and e-mail	1 hour and 20 minutes.
2 Electrical/ Electronic	Large Company	(D) Supply Chain Manager (11y/5y)	Among the 20 most proactive companies in Brazil Part of a group among the world's 200 biggest companies	portal via web, e-procurement, ERP, manufacturing systems, system to collect data, barcode, and email	1 hour and 50 minutes.
	Suppliers	(E) Sales Director (N/A)	Supply 100% of some products to the large company, and the large company is 12-20% of their billing	ERP, internal systems, email, portal	1 hour and 30 minutes
		(F) Sales Director (4,5y/2y)	Supply 100% of some products to the large company	Portal and email	1 hour and 20 minutes

Source: Amanha Magazine, Exame Magazine and Forbes

analysing whether the events in the case study pattern are in line with the events in the theory pattern or propositions.

To create and store these patterns, we use pattern codes that are ones that identify an

emergent theme, pattern, or explanation that the site suggests to the researcher (Miles and Huberman 1994). To Pare (2001) pattern coding is, for qualitative researchers, an analogue to the cluster-analytic and factor-analytic devices used

Table 4. Excerpts of transcripts, examples of codes and example of analytic units

Excerpts of Transcripts	Examples of Codes	Example of Analytic Units
Case 1 – Company A - Supply Chain VP “There are situations that I have to convince the company to lose money because of the level of service. Look at that these situation... I am saying if I push this company over, they will reduce the level of service and both of us will lose so I accept some things that in another situation I won't accept to have a good and long term relationship”.	Example of a good relationship with loss to Company A	Relationship
Case 1 – Company C - Logistic Manager “So... we are one of the possible suppliers to Company A for other products and business opportunity show our qualification”.	Qualification is to be possible to have other opportunities and supply other products	Qualification
Case 2 – Company D - Supply Chain Manager “E-procurement provide access to information about supplier transaction, specifying products, quantities and prices reducing complexity of this transactions”.	E-procurement to facilitate access to information about supplier transactions	IT and Complexity of Transactions
Case 2 – Company E – Sales Director “The portal is important to codify the information to talk the same language and create patens on exchange of products and information”.	Portal helps to codify transactions using the same language and patterns	IT and Codification

in statistical analysis. Pattern coding reduces large amounts of data into a smaller number of analytic units and helps researchers build a cognitive map, an evolving schema for understanding what is happening locally. From transcriptions we use content analysis, which consists of discovering the core meanings within the communication whose presence or frequency of appearance may have some meaning for the chosen objective of analysis (Bardin, 1977) to create these codes. In Table 4 we present some examples of this analysis and the code creation. From this analysis we reduce these codes into a small number of analytic units: SCG elements (for example, opportunism, control, integration and relationship), IT investments, IT and SCG elements (for example, IT and collaboration, IT and commitment, IT and power). These codes were created in each case that is presented in the next section.

FINDINGS

This section presents the analysis of the two case studies included in this research. The cases are analyzed separately, showing the conceptions of SCG, their elements and how IT is related to and supports these conceptions, in accordance with both the concepts and the authors presented in the literature review. The questions encompass how the respondent defines each elements of SCG and how it is exercised in the supply chain, and how IT is related to this process. Finally, we identified the predominant SCG conception based on the responses and documents presented.

Case 1

The first case study (companies A, B and C) was conducted in a large automotive company (A) that is one of 60 largest companies in Brazil and is a subsidiary of one of world's 200 biggest companies. Two major suppliers were visited comprising a dyadic relationship: one company supplies interior systems and automotive exteri-

ors (B) and the other supplies hydraulic steering pumps and its components (C). Company A is a subsidiary of an automotive company that sold more than two million vehicles around the world in 2011. According to information from the companies' website, the group had solid and growing sales, highlighting the importance of the Brazilian market - the second biggest for the group. Company A had 3 factories in the south of Brazil producing 250.000 units in 2011 of three different models of vehicles as well as more than 300.000 motors in the same period. Market share in this period grew by more than 12%, according to the respondent. Supplier B is vital to Company A, because it supplies 100% of some products and the large company represents 40% of their billing. Supplier C is also important to Company A, because it comprises about 70% of the Brazilian market for some products and supplies between 10 to 25% of hydraulic steering pumps and its components to the large company.

Our analysis generated 272 codes in Case 1 from the transcriptions like those examples presented in Table 4. From these 272 we grouped them into 36 codes (for example, relationship, collaboration, commitment, coordination, IT and relationship, IT and integration, IT investment).

Supply Chain Governance in Case 1

In transactional governance for the analyzed companies, the transaction costs are all the costs of transporting and moving the material, as well as of producing and developing new products. Incentives are related to the possibility of opening up new business between companies B and C and company A. For example, company C delivers one product to company A, and now they are negotiating the possibility of delivering another product, a steering box, which represents a great deal of business to company C. Power is related to the bargaining power and the size of the companies; and the largest company (A) holds most of the power in this supply chain. However, the suppliers (B

and C) do have bargaining power because some products are 50-100% delivered by these companies. We identified that compared with other organizations in the same industry, company A is growing in terms of its market share. Control of the three companies involves creating, following and monitoring the key process indicators such as delivery, logistics incidents, and delays. The complexity of transactions for company C is related to the products that are provided by the company. To company B, transactions elements are related with "... the organization has a way to deliver to Company A the right quantities, on time, in the right truck, with quality products, in the right packaging, while maintaining low cost. We identified in three companies that opportunism involves taking advantage of a circumstance or situation, but no example of opportunism was identified in Case 1.

For company A, in relational governance, according to Supply Chain VP "...relations define business survival and the companies can't stay isolated. One company which doesn't have a good relationship prevents the industrial park from working". We identified that company B has had some quality problems in the past and company A helps by enhancing employees' capacity to improve quality, visiting the company and collaborating to improve the process and the product. Moreover, company B is in a process to supply other products to company A, and it has been identified that company B has the quality and capacity required by A. Another point is the flexibility of supplies, which is a crucial point in the automotive industry as stated by the respondents. Several examples were given, companies B and C accomplished their activities, and company A helped them with information, flexibility with deadlines and demands.

In this case, we identified a more relational governance scheme that was mainly based on the company's relationship with its suppliers. Company A is making efforts to qualify their suppliers (B), improve their capacity, and take action to create new business with company C through closer relationship and collaboration. These actions were carried out in order to expand

the company's place in the Brazilian market and achieve a greater market share.

IT and Supply Chain Governance in Case 1

In this case, we found some investment in and use of IT to support activities in the supply chain such as ERP, systems developed internally, legacy systems, EDI, tracking systems, VMI, portal via web, DCP and email. For company A a project has been developed in the company called Sales and Operations Planning (S&OP). As stated by the respondent, S&OP is a methodology for managing the supply chain, in which one big problem has been information flow across the company. Thus, the organization is integrating its systems and trying to eliminate the legacy and internal systems.

Regarding transactional SCG, according to respondents, there is a relationship between IT and reduce transactional costs that is achieved using technologies such as ERP and data warehouse. IT, such EDI, among companies A, B and C is important to create codes and standardize information shared to help in areas such as quality-control and times of delivery. It was also identified that IT is not used in the element of opportunism. ERP are related to complexity of transactions, but there are many parallel systems and information is dispersed in Companies A, B and C. In terms of control, in Company A, it used technologies to track vehicles, products and level of services of Companies B and C. The coordination is achieved using internal systems developed in-house, but according to respondents, it was not used completely among companies. There were no investments and use of IT in relation to power and incentives.

Thus, according to the respondents in relational SCG, several IT elements and information are not integrated, and tools and systems have been developed internally. There is one portal, via the web, in company A to facilitate communication with companies B and C. However, IT is not used to integrate the organizations in the supply chain. Company A is making some investments and efforts in one project called

S&OP to integrate the process and system and diminish the internal and legacy systems. The respondents highlighted the fact that IT is very important for supporting the relationship among the organizations in the supply chain. Company A uses an internal technology to help develop supplier capacities. Moreover, EDI was used to support the relationship and collaboration between Companies B and C. Company B uses more email, the portal and EDI, while company C mainly relies on email, ERP and EDI. The use of these technologies by Companies B and C result in supplier qualification which is a pre-requisite for collaborating and relating with Company A.

IT investments, in this case, are related to the S&OP projects. All systems are being integrated. They are being developed in-house. - These investments are improving supplier relationships, emphasizing the relationship between IT and relational governance, the predominant governance type in case 1.

Case 2

The second case study was conducted in a large electrical/electronic manufacturing company (D) and two major and important suppliers (E and F). One of these suppliers produces plastic injection molding (E) while the other supplies and produces styrene, polystyrene, and ethylbenzene (F). Company D is part of a world group that has factories in 170 countries, with 43 thousand employees, and of this 1500 in Brazil. According to information from the companies' website, Company D is a leader in the sector in the Brazilian market. This company has 2 factories in Brazil, one which is the biggest and most modern of the group. These factories produced on average 1.1 million units per year, according to the executive. Both suppliers - B and D - are very important to Company D because they supply up to 100% of certain products. It is noteworthy that Company D represents 12-20% of the billing from Company E and Company F. It is a big player in the Brazilian market for products like styrene, polystyrene, and ethylbenzene.

The analysis initially produced 252 codes in Case 2 from the transcriptions like those examples presented in Table 4. From this 252 we grouped into 35 codes (for example, transactional costs, capacity of suppliers, coordination, IT and costs, IT and integration, IT use).

Supply Chain Governance in Case 2

First of all, we need to clarify the relationship among the companies D, E and F. There is a triangular relation among these three companies, where company F provides material to E, which processes and delivers to D. For the respondent from company F: "...the strategic negotiation is made direct with company D, but the operational is direct with E."

With regard to transactional governance, we identified that according to the respondent from company D, transaction costs are related to inefficient communication or a transaction's failure to work. In the case of company E, transaction costs arise when company D doesn't get the product on time and this is related to the product and supplier development and project cost. For the respondents, the codification of the transaction pertains to all products in the supply chain, the delivery and the exceptions. To company E, codification consists of determinations about price and volume where both companies talk the same language and the commercial relation doesn't undergo change. The transaction in the supply chain is complex because everything is interconnected. The respondents stated that this complexity is related to the processes and nature of the product in different supply chains. Opportunism, for the respondents, is taking advantage of some situation. Sometimes opportunism is reflected in the exchange rate because international business and its impact on supply chain stimulate to receive fewer products than the companies actually received, for example. There is a balance of power between companies D and F because both are big companies; company D has held considerable power over E, although this has been diminishing in the last several

years. Control to company D is monitor price, quality and deliver from company E, but there was no evidence of this in the case of company F. With respect to coordination, company D talks and communicates with the other companies in the supply chain to avoid delays and mistakes in delivery and, according company E's Sales Director, "... keep the supply chain working and working well...". The respondents felt that incentives are required to maintain good work among the companies in the supply chain. We identified some particular incentives, such as the possibility to create a new business, and to increase the business portfolio offered by company D to company E.

In relational governance, as stated by the respondents, the relationship determines business survival. To company E there has been an increase in communication and meetings involving executives from both companies D and E in the last few years. The collaboration between companies D and E is increasing. In the past it was bigger still, but events led to a decrease in the collaboration, according to company E, because "...in the past company development was in one industrial park which after they moved to another place far away, decreased our collaboration". However, in the recent years the collaboration was restored and both companies have developed new products together. Indeed, the respondents indicated that collaboration is increasing between the three companies, particularly technical and commercial collaboration. We identified an effort among the three companies to create capacities that would benefit all involved. This effort affects the flexibility of these companies because they can correct mistakes and respond faster to changes in the market. Another point is related to qualification. Company E is the most qualified supplier to company D.

In this case, we identified transactional governance because of what company D characterizes as a great number of suppliers, low level of partnership, and low supply-on-time delivery rate. Power relations among the companies in this case are sometimes not clearly delineated. Within the company, there are ef-

forts to increase the number of suppliers, thus creating a stronger partnership through long term agreements.

We identified some actions to increase the collaboration among the three companies (A, B and C) through meetings, developing new products together and more communication using a technical and commercial collaboration. There has been an effort to bring about some changes in the company, moving it towards a more relational form of governance.

IT and Supply Chain Governance in Case 2

In this case, we found that some types of IT were invested in and used to support the activities in the supply chain. These include portal via web, e-procurement, ERP, internal systems, manufacturing systems, systems to collect data, barcode systems, and email

Company D is making some investments such as e-procurement and ERP in some of its systems, in order to integrate the processes among the companies in the supply chain. Now, the technology that is most used by the company is the portal, to monitor and control the supply chain, to provide more information and incentive to the suppliers, and also enable more flexibility and collaboration among them. ERP is used mainly in transactional aspects such as efforts to minimize cost, minimize the complexity of transactions and codify transactions. This technology is also used to control the activities in the supply chain and increase trust among the companies because the data is protected. Thus, according to the respondent from company E, IT is used more today in transactional contexts. The relationship between companies D and F is not technology-intensive.

Finally, IT investments are being made to achieve a more relational governance through expenditure on e-procurement and greater integration with their suppliers using ERP, which nowadays is used in a more transactional way.

DISCUSSION

This section focuses on the results of the case studies using SCG and IT literature. We identified, through analyzing six different companies, how IT supports and is related to the conceptions of SCG in the two cases.

In the first case – automotive - we observed companies making use of internal systems, in part to coordinate activities and processes. However, the case study did not find any evidence of investments in IT that are related to or support power and incentives. IT investments, such as ERP and data warehouse, help companies A, B and C to reduce transactional costs. Moreover, the use of codes and standards made possible by technologies, such as EDI, help companies in different ways improve their quality, accuracy of quantity, and maintain low transactional costs.

However, we identified a more relational type of governance (Ferguson et al., 2005; Wathne & Heide, 2004; Yu et al., 2006) in Case 1, in which the large company (A) is making efforts to obtain a greater market share. According to the Supply Chain VP from Company A "... sometimes we have to lose some money to get more business and market share helping suppliers and us in the future, based on a solid and long agreement relationship". This objective is being accomplished with a relational perspective, creating new business and opportunities with the suppliers (B and C), using collaboration, trust, and qualifying the suppliers and improving their capacity. In this case, the investments on IT are to integrate the process among the supply chain and substitute the internal and legacy systems. According to Kobayashi, Tamaki and Komoda (2003) substituting the legacy systems could improve the integration of the processes among organizations in the supply chain. Furthermore, investments in systems such as ERP could help the companies in this supply chain to be more integrated (Akkermans, Bogerd, Yücesan & Wassenhove, 2003) to achieve a high relationship, and collaboration. All companies in Case 1 use EDI, which supports building relationships and collaboration. This is in accordance with Webster (1995),

who highlights the power of EDI in supporting collaboration and resolving conflict in a supply chain. In regards to the qualification and capacity of suppliers in Case 1, it was identified that Company A used some internal tools to support and maintain the capacity of Companies C and D, since they had some problems in the past and Company A helped maintain the relationship. The qualification, according to respondents, is achieved by investments in technologies that Company A is using or in which it is investing. Case 1 exhibited more relational governance among Companies A, B and C through the use and investments in IT, such as ERP, EDI, and substitution of legacy systems.

In the second case, the portal is used to monitor and control the supply chain, to provide more information and incentive to the suppliers, and also enable more flexibility and collaboration among them. We found that there is more transactional governance (Ashenbaum et al., 2009; Gereffi et al., 2005; Ruben et al., 2007) because according to the Supply Chain Manager from Company D "... we now have a focus on transactions and more specific, we focus on delivery rate, costs and we have many suppliers. To the Sales Director from Company C "there are high costs now to new clients and suppliers because we have to codify all products... this is a problem to reduce the number of suppliers now".

We observed that company D is making efforts to create a more relational partnership with long-term agreements. There are some investments in IT such as e-procurement and ERP to diminish current problems and accomplish this objective. This are in accordance with Chang and Wong (2010) that affirm that e-procurement is a solution that facilitates business purchases using the Internet, putting producers and suppliers in contact. ERP provides business information structure for different companies, allowing flexibility to adapt before the changes faced by the business (Akkermans et al., 2003) allowing a closer relationship between organizations through the integration of different business activities of the supply chain. Here we identified that the IT are helping the company to be

more relational instead of transactional through investments in technologies like e-procurement and in changing the way that the companies are using ERP. The portal used by the companies has an important role in this objective to achieve a better and more open relationship among the companies in this supply chain with the reliable information sharing. Boyson, Corsi and Verbraeck (2003) stated that the portal provides the necessary tools to everyone involved and allows links of the supply chain to work together.

We also observed that the large companies (A and D) use more IT than the suppliers because they have different suppliers and need tools to relate and coordinate the activities among the members of the supply chain. The suppliers in some cases just supply for one company or have a less complex supply chain. Thus they often don't invest and use more IT in their activities; rather, they tend to rely upon the IT provided by the large company. In Table 5 the summary of the SCG and IT in the analysed cases is presented.

We found evidence in both cases of IT investments that support and are related to the conceptions of SCG (transactional and relational). Thus Proposition 1 was supported in Case 2 and Proposition 2 was supported in Case 1. The evidence is summarized in Table 6.

There are several implications of this study. Relational governance is a goal for the companies which are aiming to increase the market share. We can infer that relational governance is related with a more mature supply chain in which the companies trust each other and when there is much collaboration among them. Sometimes this relationship started by a qualification and followed by the flexibility of the suppliers to supply and attend to the necessities of the companies in the supply chain. Power exercised is related to the size of the companies in the supply chain and is related with market share. According the executive from Company A there are in Brazil four companies with 78% of market share, thus the power from Company A related with its suppliers (sometimes they supply to all companies) is defined by this other big companies.

Table 5. Summary of the SCG and IT in the cases

Supply Chain Governance	Case 1		Case 2	
	Highlight	IT in SCG	Highlight	IT in SCG
Transactional	<ul style="list-style-type: none"> - It is related to delivery goods to Company A maintaining low costs. - Opportunism is taking advantage of situations - Power and bargaining power is relative - Control by monitoring key process indicators 	<ul style="list-style-type: none"> - IT investments to reduce transactional costs using ERP and data warehouse. - EDI to use codes and standards among A, B and C. - IT is not related to opportunism, power and incentives - ERP supports complexity of transactions - Investments in EDI to control activities - Coordination using internal systems 	<ul style="list-style-type: none"> - Transactional costs as related to inefficient communication - Focus on transactions, delivery rate and many suppliers - Related to monitoring and controlling the supply chain - Balance of power between D and F 	<ul style="list-style-type: none"> - ERP to minimize cost, minimize the complexity of transactions and codify transactions - Use the portal to monitor and control the supply chain
Relational	<ul style="list-style-type: none"> - Company A is making efforts to achieve more market share in Brazilian market - Creating new business and opportunities among companies A, B and C 	<ul style="list-style-type: none"> - Investments on IT to integrate the process among the supply chain - Substitute the internal and legacy systems - Investments on ERP - Use of EDI to build stronger relationships and collaboration - IT is a pre-requisite to qualify the suppliers 	<ul style="list-style-type: none"> - Company D is making efforts to create a more relational partnership with long-term agreements - Collaboration between companies D and E is increasing 	<ul style="list-style-type: none"> - There is IT investments to achieve a close relationship to suppliers - Investments in e-procurement and ERP - Use the portal to achieve a better and more open relationship

Table 6. Summary of evidences of propositions

Proposition	Evidence
Proposition 1 – In transactional governance, IT investments are carried out to achieve the supply chain goals benefiting one company or the leader firm	Proposition 1 is supported in Case 2 (companies D, E and F). Company D exercised its power in the past, in order to reduce costs and the complexity of transactions. IT was used in these companies mainly to reduce the costs of transactions, to create standards and codes, and to create transparency in transactions. IT used to accomplish these activities included ERP and e-procurement.
Proposition 2 – In relational SCG, IT investments are carried out to achieve the shared benefits on supply chain benefiting all participants	This proposition is supported in Case 1. IT was invested and used mainly to have a relational SCG. Some IT, such as, ERP, EDI and substitution of legacy systems is used and invested by Companies A, B and C to achieve a better relationship, to improve integration, achieve more collaboration, create and maintain trust, qualify and develop capacity of suppliers. Only evidence of IT use and invested to achieve commitment among this companies was not found.

Different technologies can be used in different conceptions of supply chain governance. ERP is used in a transactional way to minimize costs and control the companies in the supply chain. When it is more mature the relationship among the companies in the supply chain they make efforts to integrate several process and activities using this technology. The portal is used by the companies to monitor and control the supply chain, to provide more information and incentive to the suppliers, and also enable more flexibility and collaboration among them.

Thus, in both cases, SCG reflects the companies' current objectives and ways that IT investments can help them achieve their objectives (Gunasekaran & Ngai, 2004) - which involve improving the integration and relationships between companies and their suppliers.

These findings are in accordance with the study of Dyer (1997), which concluded that Japanese companies do not control activities in the supply chain through legal contracts, but instead rely on self-enforcing safeguards such as relational aspects and low maintenance costs. Suppliers were more willing to make investments based upon promises from the automaker, without a written contract, which points to a more relational governance among Japanese companies. On the other hand, this study found evidence of a more transactional governance of US companies. This involves higher costs of transactions, more suppliers, more complexity of transactions, and safeguards against opportunism; such as patent infringement and sending proprietary design blueprints to competitors.

The use of an efficient system of buyer-supplier relationship, which they share a sense of common objectives, gave Japanese supply chains an advantage over their US equivalents (Hoyt & Huq, 2000), highlighting the findings of this study, for Brazilian companies, that a relational SCG is present when companies have shared interest and can give up from high and immediate profits, aiming to have long term benefits. On the other hand, transactional governance is present when there is a leader and company that exercises its power on relation-

ships among companies in the supply chain. Moreover, using and investing in technologies such as ERP, e-procurement, EDI and portal jointly analyzing different aspects of companies in the supply chain (buyers and suppliers) could help these companies achieve and maintain a more competitive supply chain.

CONCLUSION

The aim of this study has been to identify the predominant forms of SCG in the supply chain – relational or transactional - and indicate how IT investment supports and relates to the ways in which these types of governance were accomplished. Therefore, this study contributes to the literature by providing a discussion of two propositions as well as evidence indicating that: (1) relational governance should be a goal for companies to achieve more market share and could be related to a more mature supply chain. (2) IT investments can help different companies in the supply chain to achieve a closer relationship with their suppliers by enabling collaboration, integration, trust, flexibility, and qualifying suppliers.

The following limitations to the research were identified: (i) the use of case studies does not allow the results obtained from the research to be generalized to other companies, though it facilitates the exploration and deepening of the theme, which was the aim of this research and (ii) we have used just 1 tier in the research, which was analyzed by two different suppliers from one large company.

For future research, we suggest conducting a survey of the technologies that are most widely used by companies in their supply chain and attempting to discover the technologies' applications in different conceptions of the SCG. Further studies can identify and validate the various types of IT used in the SCG in companies from different countries as well as the way(s) they influence the performance of these organizations.

ACKNOWLEDGMENT

The authors would like to thank the financial support from National Counsel of Technological and Scientific Development (CNPq) and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), Brazil.

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