HOW TO MANAGE LEARNING TENSIONS IN COOPETITION?

THE ROLE OF INFORMATION SYSTEMS

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Abstract. We examine how firms implement specific tools to manage learning tensions in a coopetitive setting. Considering information as a key resource for firms, coopetitors balance between sharing information for the success of the project and protecting information to sustain their competitive advantage. Setting our analysis at an operational level, we stress on the central role of information systems in the management of learning tensions. Drawing from an in-depth case study in the European space industry, we contribute to the existing literature on the management of coopetition by offering a more empirical vision of the issues met by coopetitors. More precisely, we draw lessons on the design of the coopetitive IS at different levels. First, we analyze the structure of the IS and its position within the organization of the partners. We then define the information to be shared in a coopetitive agreement and finally model the structure of a coopetitive information system.

Key words: Coopetition, tensions, learning, information system, space industry

Introduction

Most scholars agree on the paradoxical nature and on the complexity of coopetition (Gnyawali et al, 2008; Yami et al, 2010). Coopetition is a relational mode combining simultaneously cooperation and competition (Clarke-Hill et al., 2003). The simultaneity of these two opposite dimensions contributes to the emergence of tensions intervening at different levels (Bengtsson & Kock, 2000; Gnyawali et al., 2008; Luo et al, 2006). Among these different tensions, we focus on tensions associated to information management issues. While firms entering traditional alliances see in the collaboration an opportunity to learn from their partner (Khanna et al., 1998), the simultaneous presence of competition raises issues on the protection of key information. In a coopetitive framework, learning tensions consist in balancing learning opportunities and risks (Baumard, 2010). Naturally, this tension is even more important in high-technological context (Gnyawali & Park, 2009), because companies pool resources together to enhance their innovation process (Fernandez & Le Roy, 2012).

Until now, too little attention has been paid to the management of coopetitive tensions. Most contributions have set theoretical principles to be followed in order to manage properly coopetition (Bengtsson and Kock, 2000; Poole and Van de Ven, 1989). However, there have been only few empirical studies on the management of coopetition, with the remarkable exception of Fernandez & Le Roy (2012) working on the "coopetition project team" or Herzog (2012). Nevertheless, these first contributions remain at an organizational level and describe structures that allow dealing with coopetitive tensions. In our article, we want to go a step further and see what is happening at a more operational level. More precisely, we aim at studying the management of informational and learning tensions in a coopetitive context. With this regard, the information system appears as the key tool to manage such tensions on a day-to-day basis.

Focusing on tools designed to deal with learning and informational tensions, we study the conception of information systems in a coopetitive agreement. We address the following research question: ***How can information systems contribute to the management of learning tensions in a coopetition context?***

To provide insights on this question, we implement an in-depth case study in the European Space industry. Focusing on a coopetitive agreement between Astrium and TAS, we study how specific managerial tools have been implemented to deal with coopetitive tensions, especially the learning ones. The results of this research show the coexistence of several information systems (IS) at different levels. At the corporate level, a common IS has been created to offer a unique interface to the client the two coopetitors work for. However, at the team level, a coopetitive IS has been created in order to deal with informational and learning tensions. This IS is separated from the rest of the firm to reduce as much as possible informational leaks towards the partner. At the same time, this IS represents a common platform on which team members can use data dedicated only to the project. Once this coopetitive information system described, we specify the nature of the information to share in a coopetitive agreement. Finally, we conclude our contribution by modeling the structure of a coopetitive information system.

The rest of article is structured as follows. First, we begin by reviewing the existing literature on tensions associated to coopetition with a specific focus on learning tensions. We then present our methods and describe the empirical setting in which we conduct our research. In a third part, we show the results of our in-depth case study in the European Space Industry. In the following part, we draw some theoretical conclusions from the case and discuss our results with the existing literature. Finally, we conclude and propose directions for future research.

1. Theoretical background

1.1. Coopetitive tensions

Several definitions of coopetition exist (Dagnino & Padula, 2002; Gnyawali et al, 2008; Le Roy et al, 2010). Most articles on coopetition use Bengtsson and Kock's definition in which they describe coopetition a "*dyadic and paradoxical relationship that emerges when two firms cooperate in some activities, and at the same time compete with each other in other activities*" (Bengtsson and Kock, 2000, p. 412). Our research design is based on a similar approach. Unlike Yami et al. (2010), we define coopetition as a relationship between two economic actors, which combine simultaneously two contrary dimensions, i.e. collaboration and competition. This definition focuses on both the paradoxical and the dual dimensions of coopetition.

Coopetition entails multiple opposing elements and dualities (Clarke-Hill et al., 2003). More specifically, most tensions arise from the combination of two opposite dimensions: cooperation and competition. In such a context, causes of conflict can be either organizational, relational or external (Tidstrom, 2009). These tensions between cooperation and competition can partially explain alliance instability (Das & Teng, 2000). Contrary to a pure collaborative relationship, the simultaneous pursuit of competition and collaboration tends to create more intense and challenging tensions because of the paradoxical situation (Clarke-Hill et al., 2003). These tensions between cooperation and competition can be driven by the conflict between generating "common benefits" and capturing "private benefits" (Khanna et al., 1998). Under such circumstances, organizations aim at combining the advantages from the two opposite dimensions. Behind this combination logic, we observe that competition and cooperation may in fact work as complementary forces (Gimeno, 2004). Thus conflict is not necessarily a threat. Instead, it must be accepted as an issue to manage (Bengtsson & Kock, 2000; Gnyawali et al., 2008; Luo et al., 2006) and whose outcomes can be highly beneficial if managed properly. The competitive

dimension in coopetitive agreement is essential to avoid complacence and to keep the creative tension within organizations (Bengtsson & Sölvell, 2004; Quintana-Garcia & Benavides-Velasco, 2004). The strategic issue is not to choose between competition and cooperation but to manage the tensions between both (Chen, 2008; Clarke-Hill et al., 2003). Thus, in a coopetitive relationship, the objective of the firms is not to reduce the tensions but it is rather to maintain, balance and use them properly (Chen, 2008; Bengtsson et al., 2010).

1.2. Learning tensions in coopetition

Through coopetition, firms look for learning opportunities (Baumard, 2010; Clarke-Hill et al., 2003). However at the same time, they have to protect themselves from their partner-competitor which sees in this agreement an opportunity to learn strategic information. Firms worry about their knowledge spoliation (Pellegrin-Boucher, 2010) and strong tensions between learning and protecting core knowledge may emerge (Inkpen, 2008; Walley, 2007).

1.2.1. Learning opportunities

Coopetition is a deliberate strategy of mixing cooperation and competition at different stages and in different arenas in order to achieve better individual and collective results (Bengtsson & Kock, 1999).One of the main objectives of firms is to absorb as much knowledge as possible (Argyris and Schön, 1978). To do so, they adopt mixed strategies based on a combination of cooperation and competition (Clarke-Hill et al. 2003). As pointed out by scholars in strategic alliances, partners are involved in learning races (Hamel et al., 1989). Partners who share the same concerns and the same logic can more easily learn from each other (Lane & Lubatkin, 1998). Thus, collaboration between competitors is in favor of inter-partner learning (Hamel, 1991). Coopetition offers interesting learning opportunities for partners as evidenced by Larsson et al.

(1998, p. 289): "*collaboration and competition are highly assertive learning strategies that aim to absorb as much newknowledge as possible*". An example of learning processes in coopetition has been illustrated through the Sony-Samsung case (Gnyawali et al., 2006). While coopetition triggers radical innovation it harms revolutionary innovation if companies integrate the partner's knowledge in their learning process (Bouncken & Kraus, 2013). So beyond being a powerful driver, learning appears as a key success factor of coopetition.

1.2.2. Tensions between sharing and protecting knowledge

The management of knowledge in coopetition faces a paradox. Partners need to share knowlede to achieve the common goal of the collaboration (Dyer & Singh 1998; Gnyawali & Park, 2011) while they have to protect the strategic core of their knowledge from the competitor (Baumard, 2010). Partners evolve in the same industry and need to develop idiosyncrasic skills and capabilities (Nelson & Winter, 1982). Firms can use the collaboration context to acquire resources from their partners in areas where they have deficiencies (Dussauge et al. 2000). Simultaneously, firms need to make different contributions to the joint project (Dussauge et al. 2000). This dilemma between sharing and protecting knowledge is a major source of tensions in coopetition affecting the learning dynamics (Inkpen, 2008; Walley, 2007). Since partners are also competitors, the learning process becomes highly competitive (Inkpen, 2000).

Inspired by Khanna et al. (1998), we can define learning coopetition tensions as the differences between the company's will to benefit from learning from its partners while trying to limit its commitment in the partnership in order to limit its partner's learning process and the risks of imitation. The learning tension refers to the common tension between long-term and short-term analysis. Long-term perspective encourages collaborative behaviors whereas short-term vision stimulates opportunism (Brandenburger & Nalebuff, 1996 ; De Rond & Bouchikhi,

2004). In a coopetitive setting, as partners can absorb the shared knowledge in the future for their own purposes, the risk of opportunism is even higher (Bouncken & Kraus, 2013). Consequently, in their daily decisions, managers have to decide if they give priority to short-term or to long-term i.e. if they give priority to the common project or to the organization survival. Thus, managers are responsible for the daily information management. They have to decide what information should be shared to ensure the project success and what information should protected from the partner's learning.

From a coopetitive point of view, the tension between the integration and the sharing of knowledge clearly influences the balance between cooperation and competition (Oliver, 2004). Each firm is fully involved in the collaboration while trying to get more value than its partner. Thus, a tension between the creation and the appropriation of the value created arises (Cassiman et al., 2009). Through the collaboration, partners pool resources and knowledge to create value i.e. new resources and new knowledge (Quintana-Garcia & Benavides-Velasco, 2004). The distribution of the value created is highly critical since partners are direct competitors facing the same competitiveness challenges on markets. Consequently, in a coopetitive agreement, each firm tries to develop as much individual skills as possible from the knowledge of its partner. Yet, the learning process is subtle and requires balancing all tensions. If each firm defends its individual interersts against its partner, the coopetition is not sustainable (Gross et al., 2004). To maintain the coopetition, the congruence of mutual benefits should be ensured (Khanna et al., 1998, Chen, 2008).

1.2.3. Learning tensions at the operational level

Lane and Lubatkin (1998) distinguish three forms of learning: the active learning, the passive learning and the interactive learning. Bengtsson & Kock (2000) have observed that the

implementation of a coopetition strategy reduces the distance between partners. This increased proximity promotes exchanges and interactions between organizations. Through repeated interactions, partners exchange more information and knowledge. But in the current hypercompetitive contexte (D'Aveni, 1994), information and knowledge appear as strategic resources (Pfeffer & Salancik, 1978, 2005; Wade & Hulland, 2004). The firm faces a high risk of technological imitation in case of strategic information transfers or in case of imitation of core knowledge. Some asymmetry in the information dotation between the two partners-competitors is a major a threat for the success of coopetitive project (Ingram & Yue, 2008).

Consequently, firms need to implement appropriate managerial tools to simultaneously share information and knowledge required for the project, while protecting other key information. The real tension comes from the unconscious and unintentional dimensions of learning (Argyris & Schön, 1978) which are even more complex to manage in a coopetitive context.

Organizational sources of tensions can be either operational or normative (Tidstrom, 2009). To manage innovation processes, firms are widely organized by projects (Midler, 1993). As a consequence, the investigation of a coopetition strategy seems particularly relevant at the project-team level (Fernandez & Le Roy, 2012; Walley, 2007). Unlike virtual teams, traditional or hybrid teams are composed of homogenous individuals. They exchange less global but more unique knowledge than virtual groups yielding more intensive learning dynamics than in other teams (Griffith et al., 2003). Thus, investigating learning tensions in presence of coopetition should be very insightful.

1.3. Theoretical gap: managing learning tensions

As pointed out previously, cooperation and competition need to be balanced to preserve the benefits of coopetitive dynamics (Bengtsson et al., 2010). Consequently, managing and balancing

coopetitive tensions become a major objective (Chen, 2008; Clarke-Hill et al., 2003). Thus, we raise the question of how to manage the critical learning tensions identified above? Most previous studies about managing tensions remain at a theoretical level and focus on theoretical principles. Two principles are identified in the literature: the principle of separation (Bengtsson & Kock, 2000; Poole & Van de Ven, 1989) and the principle of integration. Following the separation principle, the management of competition and collaboration must be functionally, temporary or spatially separated (Bengtsson and Kock, 2000; Herzog, 2012; Loebecke et al., 1999; Poole and Van de Ven, 1989). For example, partners can cooperate on one dimension of the value chain, i.e. on R&D, while competing on another dimension, i.e. on marketing activities. The head of the R&D department is responsible for the collaboration whereas the head of the marketing department is responsible for the competition. According to this approach, an individual is not able to integrate the duality between collaboration and competition (Bengtsson and Kock, 2000). Another mode of separation consists in cooperating and competing in distinct interest structures to avoid schizophrenia (Herzog, 2012). Even if the separation principle is highly recommended (Bengtsson and Kock, 2000; Poole and Van de Ven, 1989), it also creates tensions. In the example cited above, conflicts can arise between both departments. The head of the marketing department can consider the head of the R&D department as a "*traitor*" since he collaborates with "*the enemy*". Supporting separation involves tensions within the firm and integration tensions between individuals. These tensions explain why it is clearly necessary for companies to set up organizational and managerial tools to avoid internal divisions and firm implosion.

In this perspective, an integration of the management of competition and cooperation is recommended (Chen, 2008; Luo et al., 2006; Smith & Lewis, 2011). The mission of managers involved in coopetition is thus to find a balance between the two dimensions in order to optimize the benefits of coopetition (Luo et al., 2006). A way to proceed consists in developing a

coopetitive mindset for the effective management of the paradoxical nature of coopetition (Chen, 2008). The reasoning is not to negate the paradox between competition and collaboration, nor to reduce competition or collaboration but to maintain them in a right balance (Garcia & Velasco, 2002; Clarke-Hill et al., 2003). The implementation of relevant managerial tools is then critical to obtain this balance and to preserve it over time (Gomes-Casseres, 1994; Chen et al., 2007; Chen, 2008; Bengtsson et al. 2010).

Until now, most existing contributions on coopetitive tensions have remained theoretical. A few empirical studies provide interesting insights but essentially at the structural or organizational levels. For instance, Herzog (2012) shows how structural factors and product features contribute to coopetition management. But, this study argues that the best way to efficiently manage coopetition is in fact to avoid or suppress coopetition. On the contrary, Fernandez and Le Roy (2012) point out an original structure set up by companies to integrate the management of coopetitive tensions: the CTP "Coopetitive Team-Project". However, this study remains at an organizational level and provides little evidence about the operational and managerial tools implemented by companies in a coopetition context. Bengtsson and Johansson (2012) show that SMEs can balance coopetitive relationships with large firms if they develop alliance portfolio managing capabilities such as the ability to build legitimacy, to enhance agility and to create role flexibility. This study remains focused on the SMEs' point of view and on capabilities. Little evidence is provided about how coopetition is implemented within and between organizations. A gap still exists in the coopetition literature about coopetitive tensions and their managerial implications. The operational level seems particularly appropriate to investigate coopetition tensions (Tidstrom, 2009).

While firms entering traditional alliances see in the collaboration an opportunity to learn from their partner (Khanna et al., 1998), the simultaneous presence of competition raises issues

on the protection of key information. Companies pool human, financial and technological resources into a "coopetition project team" to enhance their innovation process (Fernandez & Le Roy, 2012). However, we still have little information about how team members deal with learning and informational tensions. A theoretical gap exists at the operational level and the information system appears as a key tool to manage such tensions on a day-to-day basis. We address the following research question: ***How can information systems contribute to the management of learning tensions in a coopetition context?***

This gap becomes highly critical considering the importance of learning tensions mentioned above. Several questions have been neglected so far in the literature. How do partners deal with learning tensions at the team level in a coopetitive setting? What kind of operational or managerial tools do they implement to deal with this tension? Since learning dynamics are related with information and knowledge exchanges, a focus on the information system seems relevant.

2. Method

2.1. An in-depth case study

The purpose of this research is to understand how two competitors deal with learning tensions within a coopetitive team. Taking into account this objective, an exploratory research design based on the comprehension of a phenomenon (rather than testing it) seems more appropriate (Charreire-Petit and Allard-Poesi, 2007). An in-depth case study is then recommended (Miles and Huberman, 1994; Wacheux, 1996). The case study allows the investigation of a phenomenon still little studied, at various levels, without being constrained by a preliminary choice of tools or types of data (Eisenhardt, 1989; Yin, 2003). The implementation of a strategy of coopetition and its management can be investigated at two levels of analysis i.e. the organisational level and the

operational level, and we essentially focus our attention on the operational one. The units of analysis are respectively the firm and the project-team.

Our empirical material is composed of primary and secondary data. The primary data collected comes from 51 semi-structured interviews conducted with CEOs, head of departments, project managers and team members. All the interviews were conducted face to face (except for few call conferences). The interviews were recorded and then transcribed as soon as possible to preserve the quality of the data (Romelaer, 2005). In order to preserve the confidentiality of our interviewees and their companies, the names of individuals and firms will not be mentioned in the verbatim. The interviewee will be named through its function within the innovation project. Firm A and firm B will be used to make a distinction between the two partners. The secondary data collected comes from internal reports (contracts, presentations, meetings reports etc.) and external documents (press review, industry reports etc.). The data were coded according to the recommendations of Miles and Huberman (1994). The whole reasoning was based on an abductive mode. Phases of empirical investigation were alternated with theoretical reviews. Two stages could be differentiated in the analysis process. The first round of coding followed the literature to identify the inter-organizational relationships in the industry, their drivers, the tensions and their management and the outcomes. This first round was thus essentially deductive. A second inductive round of coding was then undertaken to reveal sources, dimensions and features of coopetitive tensions and their management. NVivo 8 software was used to set up the content analysis and to design arborescence.

2.2. The manufacturing European sector of telecommunications satellites

It has been noted that the likelihood of observing coopetition increases in high-tech industries (Gnyawali et al., 2006). According to this argument, the in-depth case study has been conducted

within the European space industry. We focus our attention on the manufacturing sector of telecommunications satellites for two reasons. First, with more than 57% of the turnover[1], it represents the most important sector of the whole space industry. Second, it is the most competing sector of the industry. Five manufacturers, three Americans (Boeing Space System, Lockheed Martin, Space Systems Loral) and two Europeans (TAS and Astrium) compete on the international market. They are fierce competitors as they answer the invitations to tender of space agencies on institutional markets and of private telecom operators on both local and international markets.

Unlike the European aircraft industry organized around a single manufacturer, the European space industry is structured around two leaders: Astrium and TAS. Even if they define themselves essentially as competitors, collaborative relationships are developed between these two firms, facilitated by the colocation of their subsidiaries in the suburbs of Toulouse (South of France). Our attention focuses on an innovation programme jointly developed by TAS and Astrium within the sector of the construction of telecommunications satellites. The project called Yahsat is carried out according to a coopetitive strategy.

2.3. Yahsat: an exemplar case of coopetition

In August 2007, Al Yah Satellite Communications Company (Yahsat), a subsidiary of Mubadala, contracts with Astrium and TAS for the manufacturing of a dual system of telecommunication satellite. The global value of the programme is about 1.8 billion dollars. Yahsat becomes the most important space programme in the world.

The alliance between the two European manufacturers was driven by the presence of a common American competitor and by the importance of the risks associated with the programme.

[1] Report of GIFAS 2010-2011

Thanks to coopetition, Astrium and TAS have been able to propose a better offer to the client than their American competitor. In other words, coopetition allowed them to win the market. In the industrial division of the programme, Astrium is responsible for the development of the platform while TAS is responsible of the payload manufacturing. As the risks represent a fundamental issue on this programme, it was convenient for the partners to divide them. The rule of "risk sharing on no fault basis" formalizes the firms' commitment to assume jointly all the risks and liabilities at all the stages of the project. This basic rule represents an important difference with the classical vertical collaborative relationships. The actors are not simple subcontractors anymore: they become real horizontal partners.

3. Findings

3.1. Financial information and learning issues at the corporate level

When Astrium and TAS decided to cooperate on this satellite programme, they became co-prime contractors. Due to this common governance scheme, partners agreed on a specific rule to share all the industrial activity. The agreement specifies how activities must be shared between firms: partners should be responsible for the same volume of industrial activity such that half of the global activity is assigned to each partner. Tasks considered as technically "challenging" should also be equally distributed. Beyond the industrial dimensions of the agreement, financial issues represented a major difficulty during the negotiation process.

As a consequence, an evolution of IS was required to fit with the specificities of the partners' agreement. For TAS and Astrium, information about margins and internal costs are highly strategic and confidential. They are impossible to share, as highlighted by a controller of the project:

"I intervene on the totality of the share made by A as I must calculate the factory price of A. I do not know if you have noticed when you arrived but it's written, "A staff only". In this part of the corridor, my team and I, we must be really separated from the rest of the team because we manage all internal costs. As we are in the same markets, they cannot… they should not know our costs because otherwise they could offer the same price."

But the financial logic also constrains the industrial sharing. Since each partner is assuming an equivalent share of risks, it requires obtaining an equivalent proportion of the industrial activity. These financial aspects appear as a major source of tensions during the division of the industrial activity, as explained by a programme controller:

"After comes the financial dilemma. So we took the overall share. It was separated based on activities. And to be sure to be joint and several on the completion of certain events giving rise to payments, the payment is divided into small pieces between the companies. For example I have an event like "I have to deliver this recorder". This recorder is going to be delivered by TAS. But for X to say this recorder "I am jointly and severally", the payment of this recorder will be divided in two. (...) In the spirit that's it, it's 50-50, joint and several whatever the events, precisely to avoid disconnection. "

In fact, partners need to define and agree on a common price before the meeting with the client while sharing the minimum of confidential data. The problem comes from the fact that private telecommunication operators are not in favor of coopetition strategies between their suppliers. Coopetition makes them feel insecure essentially because they think that in the absence of competition between manufactures, firms will not give their best. Thus, for Yahsat, Astrium and TAS had to convince the client of the benefits of coopetition even for him. The client finally accepted the collaboration between Astrium and TAS but with one condition, having a single interlocutor. The operator clearly refused to deal with both companies at the same time and this requirement contributed to changes in the architecture of the IS.

The first step for Astrium and TAS was to appoint a unique interlocutor (either TAS or Astrium) to manage the client interface. This agent would become in charge of the simultaneous management of information flows between the manufacturers and the client, and between partners. The designation of this agent clearly disturbed the equity of the relationship between Astrium and TAS. Astrium's good reputation in the Middle East markets led to its appointment as the agent. In concrete terms, Astrium receives the full payment for the client depending on the progress of the programme. Instantly, half of the payment must be given to TAS regardless its effective industrial production. From an informational perspective, a good IS should be able to facilitate commercial and financial information transfers between first, the client and Astrium i.e. the agent, and second, between Astrium and TAS regardless the client.

3.2. Technical information and learning issues at the team level

Whereas at the corporate level, commercial and financial information are very sensitive, at the team level, the strategic information is more technical. As explained above, the space industry is structured around projects. Two levels of commitment can be distinguished in the programme. The first level is the management team known as the Project Management Office (PMO). The PMO governs the programme and coordinates all the industrial work packages. The PMO is an integrated team responsible for the progress of the programme and for the marketing of the product line. Managers of this structure are fully dedicated to the programme. A second level of commitment is composed of smaller working groups involved to technically support the PMO. These experts take simultaneously part to different programmes.

In this coopetitive setting, Astrium and TAS have used the same structure. Despite the competitive dimension of their relationship, both partners pool human, technical and financial resources to create a common and unique team dedicated to Yahsat. The project-team appears as

a micro-firm. Within this micro-firm, issues related to the sharing and the protection of technical information seem particularly critical as evidenced by a programme manager:

> *"It's engineering people who say 'we don't want to give it because it is our core business and we do not want to give this type of information'. So we start discussing to know how we can extract useful information or to know how to reach the information communication objective set without disclosing too much know-how."*

The acquisition of information allows firms to acquire knowledge. Based on this new knowledge they can develop skills and know-how that could be used as a powerful strategic weapon in the future. As a programme manager explained, Astrium and TA tend to limit the visibility of their strategic information:

> *"It is clear. We try to avoid giving a total visibility or giving information that does not refer to the project to the other manufacturer."*

Paradoxically, to make the cooperation fruitful and to be sure that the project team will reach its objectives, some information and data have to be shared between Astrium and TAS. A programme manager evidences our argument:

> *"There is little information that we can keep in-house because we do not know how to build the programme alone."*

Keeping this balance between sharing and protecting information is a real objective for team members. Moreover, additional tensions arise from the organization of the programme itself. Managers involved in the mixed governance structure, i.e. the PMO, face higher difficulties than managers involved in traditional internal programmes. They simultaneously need an access to their internal information from TAS or Astrium and to the programme databases. However, no transfers should occur between the two information systems. As a consequence, managers have to

pay attention to these potential and dangerous exchanges. For team members from TAS, the difficulty is even higher than for team members from Astrium. The project team is located in Astrium's plants. Team members from TAS are far from their parent company. Thus, it becomes even more difficult for these managers to have access to their own internal information system. A programme manager shares his experience to illustrate this difficulty:

> *"First, we have limited access to our own information system, because, at home, they think we're out. (...) I can't communicate with Cannes (TAS French subsidiary) in the same way as they do here within Astrium."*

Going back to the needs at the IS level, we note that within the project team, the coopetitive information system has to meet complex requirements. On the one hand, the information system should facilitate the exchange of information required to ensure significant progress at the programme level. On the other hand, the information system should allow team members to access information from their respective parent firm while protecting each partner from risky transfers of strategic and confidential information.

3.3. Implications for the elaboration of the information system

3.3.1. Implications at the corporate level

In order to manage the learning issues at the corporate level, a mixed structure has been established. This structure is supposed to deal with the tensions between sharing and protecting commercial and financial information. In this mixed structure, each company maintains its internal project control function regardless the partner. This strict separation between project control functions limits potential transfers of highly strategic information such as financial data.

In order to provide an overall control of the programme a specific information system is established at the corporate level. This information system called RMA *Responsibility Matrix*

Assignment is also helpful to deal with the billing aspects of the programme. Since Astrium is appointed as the agent, it becomes in charge of this new information system. The new information system allows exchanges of the required information to establish an overall price for the client, while preserving at the same time the confidentiality of internal data about cost structures. A programme manager responsible for the new IS illustrates the role of the IS though the example of the *factory sale price*, i.e. the internal price exchanged by TAS and Astrium:

> "*The prices of companies are set, at a given time, in relation with internal costs. Each company defines a procedure to exchange prices without necessarily sharing the details of their cost structures to be sure that there is no relation between the price and the internal cost. We want to be sure to agree on what we call a factory sale price, a FSP. And, once we have exchanged this FSP, we can submit it to the client."*

The information system implemented overcomes two main difficulties induced by the coopetition context. First, the new information system allows the sharing of the accounting and financial data required for the formulation of the joint tender. These exchanges of data occur out of sight of the customer. No transfer through the client can be allowed. The confidentiality of strategic data such as the internal cost structure is totally secured. Second, the information system allows direct interactions between the client and the agent i.e. Astrium, as required by the operator. Through the information system, the agent can instantaneously pay the equal share to TAS regardless the industrial production. Astrium is paying on TAS events and reciprocally. The partners' agreement assuming jointly all the risks and liabilities is thus respected.

3.3.2. Implications at the team level

At the team level, the integration and the colocation of the project team established physical boundaries to information transfers. However, this separation from the rest of the organization is not sufficient to manage exchanges of technical information within the project-team. A new

information system has been implemented to ensure the sharing and protection of confidential data. Previous collaborative experiences have encouraged TAS and Astrium to create a dual information system. First, a specific common and shared IS is created for the integrated team project. The objective is to facilitate exchanges of technical information required for the development of Yahsat. The head of the Telecommunications Business Unit from one of the manufacturers explains the setting up process of the common database:

> *"When developing a satellite we have what we call a database in which we store all the vital data, technical information about the platform. Regarding technical data, there are data coming from Astrium and from Thales. So they have to create a common database with common software, a common database to manage the specifications of the programme. So they used the DORSE tool. It means something common that they both have access to, essentially regarding the technical aspects of the programme."*

In addition, the new system allows team members to access to their respective information system. A programme manager insists on the dual dimension of the information system created on purpose:

> *"It's as if I was home. I would have the same ability to access the information that I have in my office. We have the XXXX system, hopefully! So my PC is connected to a line that goes directly into the building next door, there at Astrium. So I'm on a network that is at Astrium. I have access to Astrium data that are actually data of the Yahsat project and, at the same time, I have access to Thales data."*

3.3.3. The architecture of the coopetitive information system

To conclude, we observe that to deal with the tensions raised by this coopetitive context, several information systems coexist. Beyond the internal IS that existed before the launch of the coopetitive program, two information systems have been created for the project. These two IS have been designed to take into account the simultaneity of the cooperative and competitive behavior and to avoid any informational leaks. The IS set to meet the customer's demand and the

IS implemented at the team level have clearly been designed to foster the collaborative dimension of the process while remaining careful on potential leaks. On the opposite, the presence of the internal IS of the two parent companies and the limited access to them for managers clearly shows the presence of competitive tensions. The Figure 1 shows how these different IS are related to one another and depicts the different informational flows.

[*Insert Figure 1 about here*]

Our results highlight learning tensions at two levels: organization and team levels. At each level, a specific type of information appears as the major source of tension. At the organizational level, the tension comes from sharing and protecting financial data. Partners should agree on a common price in front of the client without sharing any information about the internal cost structure or about their margins. At the team level, the critical information is more technical. Partners accept to share information about already known mistakes and errors to limit the risk of failure of their new project. But at the same, partners refuse to share data and details about how they have solved these issues. Table 1 summarizes the results.

[*Insert Table 1 about here*]

4. Discussion

In this part, we draw several theoretical conclusions from our case study and put them in perspective with the existing literature on the management of coopetitive tensions. More precisely, we begin by discussing how our results fit with the separation/integration principles developed by Bengtsson & Kock (2000). We then study the balance between sharing and protecting information by analyzing what kind of information can be shared. Finally, we draw

some insights concerning the flows of information and the structure of a coopetitive information system.

4.1. **The co-existence of the separation and integration principles**

We explained earlier that most contributions on the management of coopetition remained at a theoretical level. They listed several principles that should be respected such as the separation of competitive and cooperative activities (Bengtsson and Kock, 2000; Herzog, 2012; Poole and Van de Ven, 1989) or on the contrary the integration of these opposite tensions (Chen, 2008; Luo et al., 2006). However, at the exception of Fernandez & Le Roy (2012)'s contribution, no empirical work has tried to test whether these principles were actually respected or not. Drawing from the coopetitive setting in which Astrium and TAS evolve, we observe how the IS implemented by the firm fits with these principles.

In the findings part and more specifically in the Figure 1, we showed the complexity of the IS created by the two firms. We observe indeed the existence of several information systems. First, at the global level, we have the internal IS of each firm that existed before the launch of the coopetitive project. Second, at the corporate level, a common IS has been created to meet customer's demand of a single representative. Third, at the team level, we observe the creation of an IS dedicated to the coopetitive project. Considering that the internal IS already existed before the project, we focus on the two other IS: the one for the client and the one for the coopetitive team.

The first observation we can do about these IS is that they are actually separated from the previous ones. Both common IS are autonomous and have been designed in order to avoid leaks towards the parent companies. This first statement tends to confirm the separation principle. This principle poses the necessity to separate cooperative and competitive activities at the

organizational level (Bengtsson & Kock, 2000; Poole & Van de Ven, 1989). The reasoning behind this principle is that individuals are not able to deal with paradoxical situations and must categorize themselves as competitors or allies (but not both at the same time). With two separate IS, we clearly see that the IS has been designed to be organically separated from the existing organization.

However, within the coopetitive IS, we observe a high level of integration of the information. Even if the information transferred/copied to this IS has followed a very tough selection process, once it is on the coopetitive IS, it can be used by all the managers of the coopetitive team. Whatever the origin of the information, a manager of this team will be able to use it for the project, but will not be able to transfer it to the other employees of his parent company. Within the coopetitive IS, we follow the integration principle consisting in balancing tensions and accepting the paradoxical nature of coopetition (Chen, 2008; Luo et al., 2006; Smith & Lewis, 2011).

The analysis of this coopetitive IS is particularly relevant because it goes beyond the traditional debate concerning the management of coopetition. It does not confirm or invalidate one of the principles. It shows instead that both principles may be present at the same time, but at different levels.

4.2. On the nature of the information to share

In the various quotes presented in the case, we observe that the nature of the information to share appears as a crucial issue for managers. Almost every time the question of the nature of information is raised, managers mention learning and protection issues. They behave as if selecting the information they share was a way to protect themselves from the partner. This idea has already been highlighted by Baumard (2010) who details the stakes of learning tensions in

coopetitive settings. He notes that a firm has to balance between learning risks and opportunities. The firm will supply enough information to ensure the success of the cooperation but at the same time, it avoids revealing too much information to its competitor. If this article represents one of the first steps towards understanding learning tensions in coopetition, our case allows us to go a bit further.

More precisely, we think that the nature of the information shared within the IS also contributes to the management of coopetitive tensions. Based on our case, we draw lessons concerning the nature of information to share and protect. Considering that information is a key resource for the organization (Pfeffer and Salancik, 1978, 2003; Wade & Hulland, 2004), the question of which information should be shared must be raised. When selecting the resource to share in a coopetitive agreement, we can rely on the distinction between homogenous resources (that create value independently of the resources they are combined with) and heterogeneous (whose value creation depends on the presence of other resources) proposed by Alchian & Demsetz (1972). Adapted to coopetition, a firm has a strong incentive to share heterogeneous resources which can't be easily appropriated by a competitor (Bengtsson et al., 2003).

Going back to the nature of information to share, we can observe that coopeting firms will have an incentive to share "heterogeneous information" (or not appropriable information), that is to say information whose value is rather limited when used alone. Concerning financial information, the only information shared between the two coopetitors is the factory sale price, which doesn't have much value without the internal costs. Concerning technical information, everything is done to give information limited to the scope of the project and that can't be exploited in other circumstances. For instance, the use of aggregate data is a very good way to cooperate at the project level while remaining careful about potential leaks. It appears thus that

firms in a coopetitive setting have a strong incentive to share information useful for the cooperative dimension of the project but whose leakage would not be too harmful.

4.3. Modeling information flows within a coopetitive information system

Drawing from our case analysis and from the elements discussed previously, we propose to model information flows within a coopetitive IS. A first representation of the coopetitive IS was given in Figure 1. The objective of this first figure was to put in perspective the different IS and the flows of information from a static point of view. In this part, we propose to go a step further by identifying the kind of flows of knowledge in a coopetitive information system.

From the case, we observed the co-existence of several IS: the internal ones that existed before the coopetitive programme and the IS dedicated to the project. In addition, we also noted that not the totality of the information was shared in the coopetitive IS. More precisely, we highlighted that non-confidential or aggregate information only was shared for the project, to reduce to the minimum leaks towards the parent companies. However, despite these attempts to protect information, members of the coopetitive team admit the presence of learning effects based on the information shared by the partner.

Based on these observations, we propose the following modeling of informational flows. We essentially distinguish strategic information that must remain confidential and shared information in the coopetitive project. These elements are summarized in the Figure 2.

[*Insert Figure 2 about here*]

It is interesting to note that the opportunities of learning are rather limited in this system. Indeed, everything is done to avoid informational leaking between the two internal IS. The only source of information for learning comes from the information that has been voluntarily shared by the firms

on the common IS. In other words, by separating the common IS from the internal ones, partners have implemented a robust structure in which learning tensions are reduced to the minimum.

5. Conclusion

Considering that most articles on the management of coopetition remained at a theoretical level, we contribute to the existing literature by giving an opportunity to offer a more empirical vision of the problem. By studying information systems in a coopetitive setting, we not only describe and analyze a tool implemented to manage coopetition, but we also seize an opportunity to discuss the theoretical principles (separation and integration) set previously. Concerning these theoretical principles, we find that the implementation of the coopetitive IS respects simultaneously both principles, while they were presented as opposed in the literature. A first contribution consists in repositioning the debate concerning the separation and integration principles by showing the possibility for them to co-exist but at different levels. In parallel, we also analyzed the nature of the information shared by the firms in a coopetitive agreement. Considering information as a key resource, we have drawn a parallel with previous contributions that studied resources to share in a coopetitive setting. Thus, our second contribution poses that the information shared is characterized by lower levels of value creation when it is not combined with other resources. Consequently, even if the information is leaked, the partner won't be able to create much value from it because it doesn't have the other complementary resources (that are not shared). Finally, we proposed a mapping of information flows within the coopetitive IS. By doing so, as a third contribution, we observed that opportunities of learning are rather limited in this system, as everything is done to avoid informational leaks between the two internal IS. The only source of information for learning comes from the information that has been voluntarily shared by the firms on the common IS.

Inevitably the findings of this study are constrained by several limitations that are as many directions for future research. A first limitation comes from the lack of study of the interactions that may occur between the IS and the organization. We have essentially focused our attention on the design of the IS, but its integration with the coopetitive team or with the rest of the managerial tools has not been fully analyzed. Consequently, a first way of improvement could be to see whether we can observe similarities with other managerial tools implemented in a coopetitive setting (such as the coopetitive team for instance). A second limitation comes from the nature of the object studied, the information system. Even if we studied coopetition at a managerial level, we did not push enough the operational level of the implementation of an IS. Especially, analyzing the technological design of the coopetitive IS could be very promising. In addition, our strong focus on learning tensions represents a third limitation as we have left apart other coopetitive tensions. Studying other tools or devices implemented to manage other coopetitive tensions could be very fruitful. Finally, we note that we studied the coopetitive IS while the project was still operating. A last direction for future research would be to study what happens to a coopetitive IS when the project is over.

Considering all these directions for future research, we believe that there is still a lot to understand on operational tools dedicated to the management of coopetition.

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Figure 1. The structure of information systems in coopetition

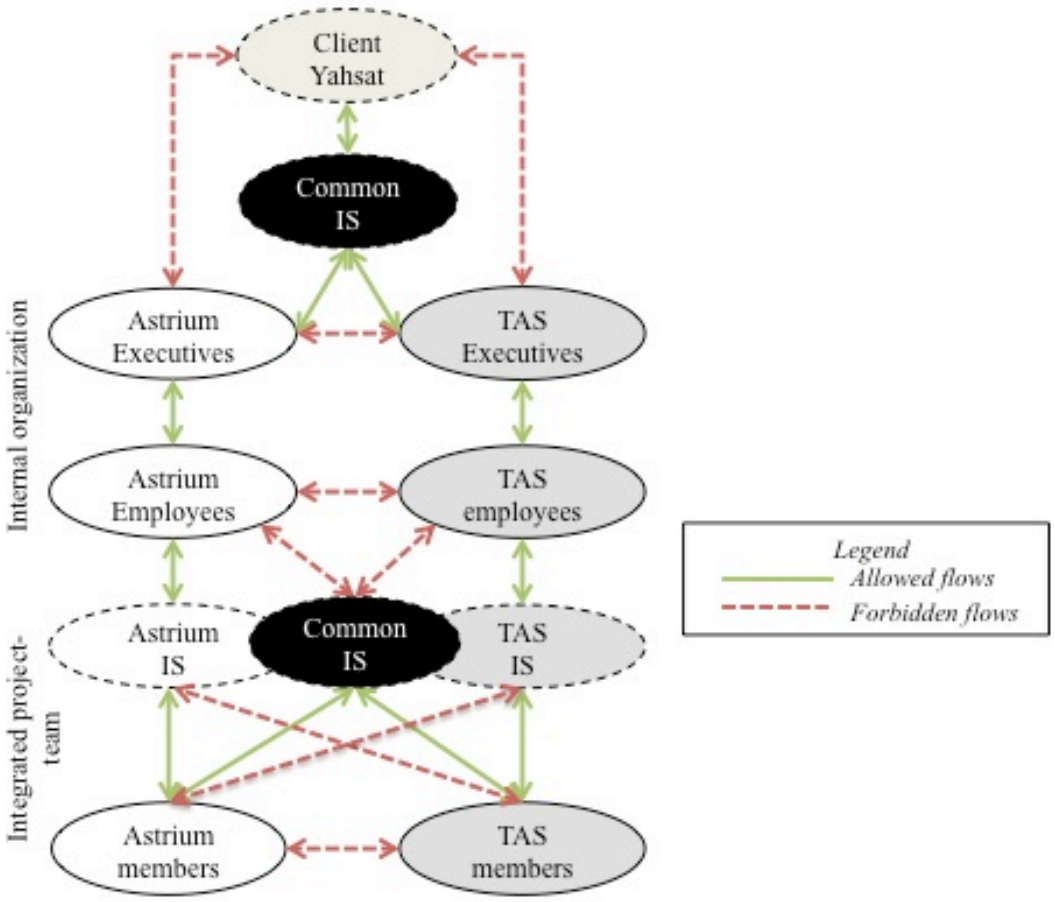

Figure 2. Nature of the information flows within the coopetitive information system

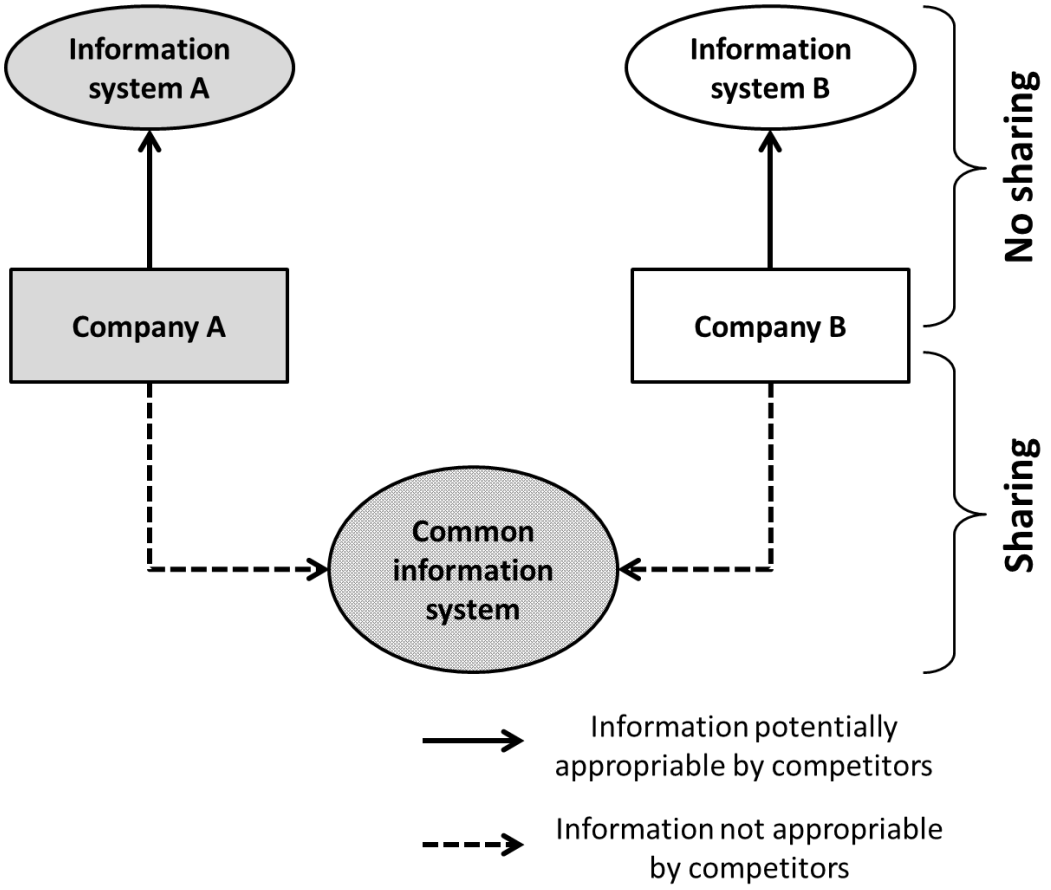

Table 1. Nature of the information shared and tensions' characteristics

Level of analysis	Nature of information	Tensions
Corporate	Financial	*Sharing*: data to establish a common price *Protecting:* margins & internal costs structure
Team	Technical	*Sharing:* information about previous errors & mistakes *Protecting:* details & data about solutions considered to solve errors & mistakes