For the 4th workshop on coopetition strategy

Why some coalitions are more successful than others in setting standards: empirical evidence from the Blu-ray vs. HD-DVD standard war

Zouhaïer M'Chirgui
Euromed Management, CREM, LAREQUAD

Olivier Chanel
CNRS-GREQAM, IDEP

Didier Calcei
Groupe ESC Troyes

Preliminary Version May 17 2010

Abstract

Standard setting coalitions are increasingly relying on rivals firms coming from different sectors and are characterized by simultaneous and/or sequential cooperation and competition between their memberships. This paper examines how firms choose to join one standard setting coalition or another and what are the determinants of its success. We test empirically for network effect, experience effect, and coopetitive effect in the Blu-ray vs. HD-DVD standards war. We find that not any firm could join a standard setting coalition. Rather, standard setting coalition is carefully composed, where the large and founders firms select technologically similar firms (coopetitive effect) to add to the unique innovative capabilities of the coalition.

1. Introduction

Standardization has increasingly been growing the last two decades (Arthur, 1998; Warner, 2005) especially with the convergence of different types of technologies and demand that occur from information technology, media and telecommunications and the resultant broader portfolio of competences. The need for standards is then more interested industries that are concerned with the delivery of data and content, as well as of digitalization, which are characterized by rapid growth rate (Shapiro, 2001a).

In this respect, both competitors and complementary components have incentives to work together to develop, establish, endorse, and promote those standards. There may be many opportunities for cooperation between competitors and complementary components in order to build sufficient support for a new technology, market and standard's success.

Several examples show the need for cooperation to establish successfully new standards such as in the consumer electronics market (Gandal et al., 2000) for the Sony/Philips standards for CD players and disks, Cusumano et al., 1992; Ohashi, 2003 for the VHS standard for video cassette players; Dranove and Gandal, 2003 for the digital versatile disks; Egyedi & Koppenhol 2009 for the document formats ODF and OOXML), in the computer hardware sector (Koski, 1999 for personnel computer;), in the computer software sector (Brynjolfsson and Kemerer, 1996), in the financial sector (Miller and Rao, 1994; Varian and Shapiro, 1999 for ATM) in the communication markets (Augereau and Greenstein, 2001 for 56K modems; Korzeniowski, 1999 for FDDI) and in wireless telecommunications (Leiponen, 2008 for UMTS)

So it is not excluded that companies such as Sony, JVC, Hitachi, Matsushita (Panasonic) and Toshiba, or Sun Microsystems and Microsoft, are closely linked through a series of relationships that are both cooperative and competitive, known as "coopetition" (Nalebuff and Brandenburger, 1996; Bengtsson and Kock, 2000). For example, since 2001 and for four years, IBM, Sony and Toshiba have teamed up together to develop high-performance microprocessor (called Cell). In 2004, Hitachi, Toshiba, and Matsushita have agreed to jointly establish a company to manufacture liquid crystal display (LCD) panels for flat-panel TVs. However, in other side, Sony and Toshiba are fighting in the Blu-ray versus HD-DVD standards war and Sun Microsystems and Microsoft in the document formats standards war[1].

In fact, cooperative agreements among competitors have proliferated in recent years (Padula and Dagnino, 2007; Ghosh and Morita, 2007) and according to some reports 50 percent of new alliances are between competitors (Harbison and Pekar, 1998; Gnyawali and Madhavan, 2001). Although standardisation may lead to voluntary cooperation between players concerned by obtaining a standard that will meet consumer interests, the competitiveness of the firms or interoperability, standardisation processes are also the result of standards wars (Shapiro and Varian, 1999). It is thus not infrequent that an apparently contradictory reason leads the standardisation processes: standardisation is therefore the result of a voluntary cooperation between some of the parties in the standardisation process, but also of intense competition between them.

[1] ODF supported by Sun Microsystems and OOXML supported by Microsoft.

Therefore, coalition formed to support the standard is increasingly relying on heterogeneous actors coming from different sectors forming a community based on strategic interest or valued networked around a leader (the founder(s) of the standard) capable of imposing or communicating its marketing approach or technological standard. Those coalitions involve rivals firms of different business sectors ranging from manufacturers, innovation specialists, integrated firms to distributors and commercial companies. Mixed coalitions of rival firms from different business sectors then form and constitute business ecosystems (Moore, 1996; Iansiti and Levien, 2004). These business ecosystems are characterised by simultaneous and/or sequential cooperation and competition between the members. The underlying idea of these alliances between competitors (alliances which make up specific coalitions) is to avoid a greater threat, i.e. that other business ecosystems emerge and to obtain a cost advantage throughout economies of scale (Barney, 2002).

However, even if standard setting coalition emerges without major obstacles (Schmalensee, 2009) the question rise is on the determinants of its success as well as the decision to choose the coalition. Studies on standardization generally cover two streams of literature: one focusing on the economic basis of the standards (Arthur, 1994; Shapiro and Varian, 1999; Suarez, 2004) and and the other on the processes of standards setting (Greenstein, 1992; Weiss, 1993; Lyytinen and King, 2006). Few works have examined the role of coalitions in the success of standards and why some coalitions are more successful than others in standards setting either theoretically (Axelrod et al., 1995; Foray, 1995; Lukach et al., 2007) or empirically (for example Chiesa et al., 2002 for the multimedia sector; Funk, 2009 for the mobile phone industry; Leiponen, 2008 for wireless telecommunications; Cortese et al., 2009 for the IFRS standard in mining industries). Going along these lines, in this paper we focus on factors that may be assumed to influence the standard setting coalition success and the decision to choose to join a coalition rather than another. We test empirically for network effect, experience effect, and coopetitive effect in the Blu-ray vs. HD-DVD standards war. In other words, in this paper, we consider how (1) the size of participants (2) the prior alliances and (3) the number of direct competitor involved within the coalition in setting standard coalition influence the success of standard.

Our data consisted of companies involved respectively in Blu-ray Disc and HD-DVD coalition initiated at 2007. Our sample consisted of 191 companies supporting the Blu-ray coalition and 136 companies associated with the HD-DVD coalition. From these companies we distinguish 5 groups of firms supporting each coalition. These groups are: format founders and competitors[2], movie studio supports, major movie rental outlets, nationwide retail and major online supports, and miscellaneous companies (Companies listed as Members, Associate Members, or Contributors).

The aim of this study is to contribute to our understanding of the processes and effects of coopetitive standard setting. Although the presence and magnitude of network effects have been empirically demonstrated in the literature (Park, 2004), to the best of our knowledge there has not been any empirical work on Blu-ray versus HD-DVD standard setting coalition and the associated interaction between network effects, and coopetitive effect and social network effect.
The results add to literatures on both technology strategy and policy. Management implications suggest that a broad coopetitive standardization approach is more beneficial than

[2] It includes companies listed as Members of the Board or Managing Members.

concentrating on select few cooperative arrangements. Further, the coopetitive behaviours should considered both downstream and upstream actors.

This paper is organized as follows. Section 2 describes the empirical context of study and review extant literature to derive empirical hypothesis. Section 3 presents the methodology and data. Section 4 exhibits the results. Section 5 discusses results and concludes.

2. Theory and hypotheses

The video storage format industry remains an interesting field for analyzing standards in the area of consumer electronics markets. Whether, the VHS vs. Betamax standard war for video cassette players has witnessed much attention for the literature (Cusumano et al., 1992; Ohashi, 2003), in this paper we focus on the recent standard war in this field between the Blu-ray and HD-DVD respectively originated by Sony and Toshiba. The two companies were joined in mixed games of cooperation and competition throughout the two standards wars. For instance, in the VHS/Betamax war the two companies were allies against the coalition of JVC and Matsushita (Panasonic) and they were the losers, however in the last war they were direct competitors.

Numerous explanations were proposed and discussed by the literature explaining the standard setting success. The most often mentioned determinant are about size (Weiss and Sirbu, 1990; Axelrod et al., 1995) and network effect (Katz and Shapiro 1986; Farrell and Saloner, 1985). Little has been mentioned on network construction (Gulati, 1995; 1998) and coopetitive effect (Bengtsson et al., 2010). Other advantages for standardization such as low integration costs, easy market entry, faster product innovation and availability, and greater return on investment are often mentioned (see for example Suarez, 2004)

- **Network construction**

Prior ties between partner firms (experience)

Over the past decades we have witnessed a tremendous growth in the number of standardization agreements (Warner, 2003, 2005). Strategic alliances represent appropriate means for building and locking-in a market, which evolve into alliance block or alliance constellation (Gomes-Casseres, 1996; 2003). Alliance block membership as an alliance network significantly influences performance (Duysters and Lemmens, 2008) and can be an efficient way of determining the emergence of new standards, new concepts and new operating modes in industries (Cowan and Jonard, 2009).

As a result, standards wars regularly turn into wars between coalitions (Vanhaverbeke and Noorderhaven, 2001). These coalitions unite various companies around a standard: whether they are companies developing the standard, firms developing complementary goods or services, or distributor networks, they all have a common interest in the standard's victory. Coalitions or alliance blocks are then heterogeneous: they come from different sectors supporting horizontal, vertical, and transverse relationships in a dynamic perspective (Hearn and Peace, 2006).

Although several studies have examined the effects or relational and structural embededness on company and alliance performance (see e.g., Gulati and Gargiulo, 1999; Rowley et al. 2000; Gnyawali and Madhavan, 2001), in this study we focus on external networks of cooperation

(Leiponen, 2008). As alliances offer partners the opportunity to learn from and about each other (Inkpen, 1998). Prior experience provides companies more expertise, information, knowledge and capabilities (Gulati, 1998). Following the resource-based view (Barney, 1991; Wernerfelt, 1984), past experience represents a way to accumulate internal knowledge and develop specific competencies. The prior participation in external and precedent coalitions gives then firms the ability to bring to the current coalition their expertise, experience and technologies in more efficient way. Klepper and Simons (2000) show that prior experience and reputation in radio production gave firms an advantage over new entrants in the emerging TV industry. Further, in the game console industry the successful introduction of Sony's Playstation 1 in 1995 against Nintendo's leadership position was strongly and significantly due to its reputation and credibility as emphasized by Gallagher and Park (2002). Therefore, the coalition could succeed to impose its standard and takes advantage of others. In addition, coalition is difficult to manage when partners have diverse interests. Therefore, managing alliances requires specific competencies that can be developed through repeated experience of alliance formation and management (Sampson, 2005; Moatti, 2009). Therefore, we expect alliance experience to positively influence the success of standard's coalition.

HYPOTHESIS 1a. The greater the number of prior alliances and participation in external consortia, the greater the success of coalition's standard.

***Prior ties among the others competitors* (*social distance*)**

Moreover, although prior experience provides companies more expertise, information, knowledge and capabilities, more specifically prior experience with coalition memberships provides more trust and willingness to share knowledge (Tsai and Hoshal, 1998; Levin and Cross, 2004; Singh, 2005). Thus knowledge transmission is likely easy exchanged and diffused, which may improve coalition's ability to influence standards setting. Prior experiences between coalition's memberships bring more efficiency at technical teams, at negotiations level and consequently to standard development (Leiponen, 2008). Prior collaboration with membership of the coalition and especially with direct competitors could indicate the social distance degree (Singh, 2005; Xia et al., 2008). Therefore, from this social network perspective, we argue that prior experience enables influencing subsequent standardisation decisions.

HYPOTHESIS 1b: The greater the number of prior alliances among the others competitors, the greater the success of coalition's standard.

- **Size and network effect**

One striking phenomena associated with standardisation is network effects. Network effects arise when there is inter-dependence between different components or members of an economic system (Hirschman, 1958). More precisely, the consumer electronics market is characterized by virtual network effects (Gandal and Shy, 2001). Virtual network effects exist when the utility of consumers is increasing in the variety of complementary products available for a base product. Network effects may be also driven by large platform leaders (Simcoe, 2008) whom coordinate different memberships. This leads to a dominant platform. But, it is not necessary to have major or dominant firms for the dominant platform (Bresnahan and Greenstein (1999).

Roughly speaking, it is now widely recognized that increasing returns (Arthur, 1994, 1998), network effects (Katz and Shapiro 1986) and installed base (Farrell and Saloner, 1985) are key drivers in standards wars. Both theoretical and empirical evidence suggest that in many markets with standards competition, network effects make the strong grow stronger and can "tip" the market toward a single, winner-take-all standard (Liu et al 2008). Yet, as mentioned by Varian and Shapiro (1999): "*Standards wars are especially bitter in markets with strong network effects, where consumers place great value on compatibility and interconnection with each other. These markets tend to exhibit positive feedback and "tip" to a single winner*". Thus, size or scale effects are deeply associated to these notions as primary drivers for their emergence.

There is a substantial empirical works emphasized the role played by these aforementioned variables in different markets such as video cassette recorders (Cusumano et al., 1992), automated teller machines (Saloner and Shepard, 1995); U.S. telecommunications (Majundar and Venkataraman, 1998), compact disks (Gandal et al., 2000), digital versatile disks (Dranove and Gandal, 2003), 56K modems (Augereau and Greenstein, 2001) and flash memory card (Liu et al., 2008)). One of the arguments put forward by these studies is that the standard's value increases with network size reaching critical mass. In other words, the size of the installed base provides an "extra push" to the chances of standards success.

In addition, alliance or coalition size is a determinant factor in a firm's decision to join a coalition (Weiss and Sirbu, 1990). Firms decide to join the biggest coalition to increase that coalition's standard's likelihood of success (Axelrod et al, 1995; Weiss and Cargill, 1992). Several studies have shown that the network effect (Dranove and Gandal, 2003) and the number of firms in a coalition plays a significant role in reducing market risk (Valdes-Llaneza and Garcia-Canal, 2006; Leiponen, 2008; Aggarwal, Dai and Walden, 2006; Waguespack and Flemming, 2009) and consequently, influences the standard's success (H2a).

In similar vein, the size of firms in the coalition brings power and reputation and consequently can affect the rate of R&D collaboration (H2b). There are some indications in the literature that larger companies have a higher propensity to engage in partnerships than smaller companies (Duysters and Hagedoorn 1995; Mytelka 1991), which could explain their participation in coalition (Duysters and Lemmens 2008). Therefore, we expect that coalition members are key-players in coalitions based on their size. In such cases the absolute as well as the relative size of the coalition is important (Backhaus et al., 2009) and the size of the coalition is more important in the earlier years than in the later years in explaining levels of technology adoption (Majundar and Venkataraman, 1998).

HYPOTHESIS 2a. There is a positive relation between the size of firms involved within the coalition and the success of standard.

HYPOTHESIS 2b. There is a positive relation between the size of R&D expenditures for the total firms involved within the coalition and the success of standard.

Additionally, knowledge of intellectual property rights (IPRs), including patents, copyrights, and trademarks that may directly impact the standard-setting process (Shapiro 2001b), is imperative for establishing any industry technology standard that effectively facilitates widespread commercialization of innovations. Further, patents increasingly address several

competition policy related to standard-setting organizations (Schmalensee, 2009). Standards in the information and communication technology sectors involve often complex technologies and consequently require the use of multiple patented technologies. Digital technology, for example, lowers the cost of reproduction and enables new forms of transmission. This poses threats to copyright industries and market structures that have evolved on the basis of older technologies and definitions of property rights linked to those older technologies. *Companies therefore optimally patent all innovations, and patents become an exact measure of innovative activity*. (Horstmann et al., 1985, p. 838). Therefore, we argue that the coalition which has the large patent portfolios is more likely to achieve higher technological innovation standard which may contribute to its success.

HYPOTHESIS 2c. A positive relation exists between the coalition's stock of technology (dominance technology) and standard success.

- **Coopetitive effects *(Direct competitors & Relatedness)***

Establishing strategic alliances with rivals is perfectly in line with the logic of "coopetitive" strategies in business ecosystems (Dagnino and Padula, 2002; Le Roy and Yami, 2009). Coopetition occurs when rivals both cooperate and compete according to simultaneous and/or sequential multi-dimensional sequences. Standardisation is a relevant example of how the coopetition has evolved (M'Chirgui, 2005). One striking fact in the recent decades is the proliferation of rivals' grouping on single coalition, known also as platform leaders (Gawer and Cusumano, 2008). Rival firms in different sectors group together within business ecosystems (Moore, 1996) to impose a standard against the standards backed by other rival business ecosystems. They cooperate within the business ecosystem and compete for the position of leader(s) within the same business ecosystem and on the markets with products incorporating the standard.

When battling to become a winner in a standard war, companies should try to gain control over an installed base, broadly license their intellectual property and facilitate partner investment in complementary innovation (Shapiro and Varian, 1998). They should also invest in building brand equity as well as manufacturing, distribution and service capabilities (Gawer and Cusumano, 2008). Thus, the dimensions of coopetitive games affect both vertical and horizontal relationships relying on suppliers, complementors, competitors, distributors, etc. This seems particularly important in the context of technological convergence, which is pervasive among computers, telecommunications equipment and digital appliances.
The recent standard battle between Sony's Blu-ray and Toshiba's HD-DVD for high-definition media storage exemplifies such behaviour. Other earlier well-known examples part of this logic such as the famous JVC's VHS versus Sony's Betamax for videocassette recording and Microsoft's Windows versus Apple's Macintosh for personnel computer operating systems. Therefore the present of sufficient number of major rivals from different sectors broadens the installed base and consequently increases the standard's success.

However, because we face two standards only in this paper, the number of competitors cannot be used in the model to test for a coopetitive effect: such number would be a perfect predictor of success for instance. We circumvent this issue by considering the knowledge relatedness or technical distance as an indicator dealing with presence of rivals within a coalition. Technical distance is the degree of dissimilarity in technology knowledge bases between two firms. It is known that a large technical distance is more likely to impede achieving synergies in alliances

(Bleeke and Ernst, 1995; Yang and Lin, 2005) and has a negative effect on absorptive capacity (Cohen and Levinthal, 1990). Standard coalition is basically technology-driven and drawing by multiple alliance business market groups. If there is an important gap of knowledge, relatedness among each companies' group within the coalition conflict can rise and interests increasingly diverse. Differences in performance among competing coalitions can be due to the nature of the technological knowledge they possess and their ability to exploit that knowledge (Steensma and Corley, 2000). Unrelated technologies often require a radical change in the way of organizing research (Kogut and Zander, 1992) and consequently turn to be counterproductive (Dosi, 1988). Thus, too large cognitive distance makes basic mutual understanding unachievable (Gilsing and Duysters, 2008).

However, the opposite may be true in some cases. As the coalition is compounded of different business market actors, each forming alliance groups, this will benefit to overcome any lack of competencies or technologies especially we consider that the founders have made a preliminary selection. Yet, as standard coalition aims to bring together different innovation partners, external knowledge is crucial for innovation because any innovation arises from the recombination of component elements (Kogut and Zander, 1992). Difference in knowledge is then important for learning and innovation (Nelson and Winter, 1982). In addition, the presence of several major complement actors coming from different industries increases the likelihood to reach critical mass quickly through network effects and their technological specialization in groups (Duysters and Lemmens, 2008). Therefore groups with higher technological specialization are likely to be more innovative and make them particularly attractive team members. The groups' knowledge relatedness therefore seems to have an effect on the success of standard coalition. In this paper we argue that important knowledge relatedness affect negatively the likelihood of coalition's success. Therefore we hypothesize:

HYPOTHESIS 3. An important coalition's relatedness decreases the likelihood of success of standard setting coalition

Nevertheless, the degree of knowledge difference should be moderate for each group. Some degree of differentiation in technological capabilities between the companies may enrich the coalition knowledge base and create opportunities for learning (Hitt et al., 1996). Several studies have stressed the importance of cooperation between companies with a minimum degree of similarity in their knowledge-base in order to maintain sufficient absorptive capacity (Stuart, 1998; Tanriversi and Venkatraman, 2005; Goerzen and Beamish, 2005). Others have even split this degree of difference into multiple dimensions arguing the curvilinear effect of cognitive distance on innovation (inverse U-shaped) (Nooteboon, 1999; Nooteboon et al., 2007). Thus, the inter-industry difference between innovating company and its partners can be interpreted as one of the specific dimensions of cognitive distance (Li and Vanhaverbeke, 2009).

3. Methodology (data, model and variables)

3.1 Sample and data

The sample consists of agreement tied by founders Sony (for Blu-ray) and Toshiba (for HD-DVD) to form their standard coalition. The data used for analysis were collected directly from Internet sites and several databases. Two types, namely corporate coalition member sites and sites specializing in the fields of ITC, video, and mass produced electronic goods were

consulted. The search criteria used were alliances, coalitions, and other forms of cooperation between various ecosystem members.
Such a method based on secondary data raises some issues. First, the reliability of secondary data, particularly when it comes from websites, may be difficult to establish (Dochartaigh, 2002). To ensure data is as reliable as possible, we crosschecked various information sources (in particular comparing information found on corporate websites and that found on specialized sites) and decided to reject any not sufficiently reliable information. Further, information was crosschecked from Securities Data Corporation (SDC)'s Alliance Database. Securities Data Corporation (SDC) offers alliance activity beginning in 1984. Secondly, standard sponsors' and co-sponsors' corporate websites are used to disseminate information as well as for communications between these players. To avoid any risk of conjecture inherent in these players' official communications, great care was also devoted to check the reliability of these sources by comparing them with non-corporate websites.

Coalitions give rise to bipartite networks (Borgatti and Everett, 1997, Newman et al., 2002). Bipartite networks have two types of nodes, in our case individual member companies and standard coalition (set-up by founders). Companies can only connect to founders, not to other companies directly. The total sample consisted of 261 member companies, among which 191 belong to the Blu-ray coalition,136 to the HD-DVD coalition, and 66 belong to both coalitions. The data come from SDC's Alliance Database, Compustat, and Delphion. Data collected cover the period 2000-2008. As the standard war started around 2004 and ended in February 2008, the period duration is appropriate.

3.2 Variables

Table 1 provides an overview on how each variable is constructed and depicts the expected signs based on the hypotheses advanced, and the data source. In the following we describe each variable in detail whereas the corresponding descriptive statistics are provided in Appendix 1.

Dependent variables. The first dependent variable we are going to use deals with the decision to choose to belong to a specific coalition or to both coalitions. It is called **COALITION**. The variable is coded HD if the company chooses to join the HD-DVD coalition, BLU if the company chooses to join the Blu-Ray coalition and BOTH if the company chooses to belong to both HD-DVD and Blu-Ray coalitions.
The second dependent variable measures the companies' ability to influence the standard's success. It is called **SUCCESS**. We focus on coalition relationships as bipartite network. A focus on bipartite network is appropriate because Blu-ray vs. HD-DVD coalitions are characterized by group structures or alliance blocks. The dependent variable is a binary choice variable that takes value 1 if the company belongs to the winning coalition and 0 otherwise.

Explanatory variables. Some hypothesized effects have to be measured by social network analysis. The first variable, called **PASTCollaboration**, is the number of prior alliances concluded by each member of the coalition in the past. As explained in the argumentation leading to Hypothesis 1, these prior ties indicate the level of expertise, information, knowledge and capabilities developed and held by companies over the past. It indicates the experience of memberships of each coalition. Hypothesis 1a suggests that the number of prior alliances held by the companies in the coalition increases the probability of success compared to coalitions that have no much companies with important number of prior alliances. Therefore, we expect a positive sign for this variable.

The second variable, called **SOCIALDistance**, measures the number of prior alliances tied with others competitors belonging to the same coalition. These prior ties are indicators of how well the coalition memberships know each other and the extent to which information asymmetry and indigestibility problems (Hennart and Reddy, 1997) may be assumed to be alleviated. Thus, it indicates the social distance degree (Singh, 2005), which are essential for the efficiency of technical teams and consequently the standard outcome (Leiponen, 2008). We expect a positive coefficient according to Hypothesis 1b. The prior alliance data both the two variables are obtained from the SDC's Alliances database.

The variables **REVENUE**, the number of **EMPLOYEE** and **R&D expenditures** are used as proxy for firm size. Information is available for publicly traded companies and our sample is composed by a large majority of these companies. These data have been collected from Compustat on yearly base from 2000 to 2008. We also compute the percentage change in the Revenue variable from 2000 to 2008 (variable **PERCREV**), which is a proxy of the dynamism of a partner. According to Hypothesis 2a and 2b, we expect the coefficients of these variables to be positive.

Coalition' technological capabilities deal with intellectual property. Therefore we use patents (***PATENT***) to indicate the innovative capabilities and technological dominance of each coalition. We used two database: the Delphion database to collect yearly patent counts for each of the firms, aggregating subsidiary patents up to the ultimate parent level (variable **PATENT-Delphion**). Granted patents were counted in their year of application. Yearly patent counts were created for each company for the period of 2000 to 2008. As Delphion gathers patents from different worldwide patent offices and to avoid patent duplication we have crosschecked patents from USPTO (United States Patent and Trademark Office), Japanese patent offices and European patent offices (variable **PATENT_USPTO**). According to Hypothesis 2c, the coefficients of these variables are expected to be positive.

Finally, the variable **RELATEDNESS** measures the proximity in the SIC codes of coalition' memberships. It is a proxy for coopetitive relationship as well as information asymmetry by assessing dissimilarities in the parties' SIC codes (Villalonga and McGahan, 2005). The computation of the proximity between two SIC codes may differ across authors and we choose the way used by Li and Vanhaverbeke (2009). A difference between two members of a coalition in the SIC's first digit indicates that these two companies have the largest possible difference whereas two members of a coalition with the same first three digits SIC-code are assumed to have a common knowledgebase. The largest difference is measured by 3, and the identical industries are measured by 0. To be more precise, the dyadic relatedness equals 0 if the primary SIC codes of the partners share the same first three digits, it equals 1 if they share the same first two digits, it equals 2 if they share the same first digit and it equals 3 if the first digit differs. We then compute the average Relatedness of each member with respect to all other members belonging to the same coalition. According to Hypothesis 3 we expect the coefficient of the variable to be positive.

Control variables. Because there are some variables not considered in the hypotheses that may still influence coalition success, we controlled for the following variables.
The nationality of the partner: We use dummy variables to distinguish between Asian partners (**ASIE**), North-American partners (**NORTH-AMERICA**) and European partners (**EUROPE**)

The status of the partner. We distinguish 5 groups of partners supporting a coalition: format founders and competitors (**FORMATFOUNDER**)[3], movie studio supports (**MOVIE**), major movie rental outlets (**MAJOR**), nationwide retail and major online supports (**ONLINE)**, and companies listed as Members, Associate Members, or Contributors (**MISCELLANEOUS**).

3.3 Estimation method

The two dependent variables are qualitative, and we are then going to estimate standard Logit models by Maximum Likelihood, with respectively three modalities (for COALITION) and two modalities (for SUCCESS). Because these models are non-linear, the interpretation of a given coefficient deserves attention since its impact on the dependent variable is not obvious. We hence provide the reader with marginal effects in the last column of the table of results. For each explanatory variable in the model, this marginal effect then represents how the predicted probability of the modality explained (i.e, joining HD-DVD, joining Blu-ray, or success of the coalition) changes at the mean values of the explanatory variables.

Table 1: DESCRIPTION OF VARIABLES

Variables	**Measure**			
Dependent variable				
COALITION	COALITION = HD if the company chooses the HD-DVD coalition COALITION = BLU if the company chooses the Blu-Ray coalition COALITION = BOTH if the company chooses both coalitions			
SUCCESS	The company belongs to the winner coalition (=1), 0 otherwise			
Explanatory and control variables		**Hypothesis**	**Sign**	**Source**
Network construction				
PASTCollaboration (experience)	Number of prior alliances concluded in the past by each member of the coalition.	H1a	+	SDC
SOCIALDistance	Number of prior alliances with the others competitors.	H1b	+	SDC
Size and Network effect				
EMPLOYEES	Number of employees of a partner (known every year from 2000 to 2008)	H2a	+	Compustat
REVENUE	Revenue of a partner (known every year from 2000 to 2008)	H2a	+	Compustat
R&D expenditures	Total R&D expenditures of a partner (known every year from 2000 to 2008).	H2b	+	Compustat
PATENT	Indicates the number of patents held by members of coalition during the period 2000-2008. It indicates the technology dominance	H2c	+	Delphion, USPTO, EPO
Coopetitive effect				
RELATEDNESS	Average measure of the proximity in the SIC codes of coalition partners.	H3	+	Compustat

[3] It includes companies listed as Members of the Board or Managing Members.

4. Results

4.1. Factors Determining the Decision to choose a coalition

The factors determining the decision to choose to belong to a specific coalition or to both coalitions are explored. The decision is modelled by Maximum Likelihood (ML) using a standard Logit model with three modalities. The dependent variable is COALITION (COALITION=HD if the company chooses the HD-DVD coalition, COALITION=Blu if the company chooses the Blu-Ray coalition and COALITION=Both if the company chooses to belong to both HD-DVD and Blu-Ray coalitions). The results of the best model are given in Table 2 for the HD equation and the Blu equation with some measures of fit (note that the reference is the Both modality).

Table 2 Estimation of the probability of belonging to a coalition (n=108)

Parameter	Estimate	Std Err	Student t	Pr > |t|	Marginal effect
Pr(coalition)=HD					
Intercept	-3.2077	1.644	-1.95	0.051	-
ASIE	-.61840	.75637	-0.82	0.414	.01184
ONLINE	-36.946	.90938	-40.63	0.000	-.11074**
PERCREV	-.23914	.15864	-1.51	0.132	-.00564***
RELATEDNESS	1.4387	.59584	2.41	0.016	.04384**
Pr(coalition)=Blu					
Intercept	3.4970	1.4913	2.35	0.019	-
ASIE	-1.8987	.57913	-3.28	0.001	-.40569***
ONLINE	-1.4939	1.1292	-1.32	0.186	-.28344
PERCREV	.02045	.00919	2.22	0.026	.00819***
RELATEDNESS	-.8500	.62529	-1.36	0.174	-.2247
Log-likelihood: -110.29	Wald test of nullity (8): 4330.44			p-value < 0.0001	
Mc Fadden LRI: 0.1413					

Four variables appear as highly significant in at least one equation: **ASIE**, belonging to a "NationWide retail and major online support" (**ONLINE**), **RELATEDNESS** and the percentage change in the revenue of the company between 2000 and 2008 (**PERCREV**). The

marginal effects indicate how a change of one unit of the explanatory variables in an equation affects the probability of belonging to the corresponding coalition with respect to the modality Both coalition (the reference). Hence, belonging to an Asian country (ASIE) significantly decreases the probability of belonging only to the Blu-Ray coalition (instead of both coalitions) by 40%, and belonging to a ONLINE support decreases the probability of belonging only to the HD-DVD coalition (instead of both coalitions) by 11.7%

The marginal effect of an increase of one percent in the revenue change between 2000 and 2008 (PERCREV) decreases the probability of belonging only to the HD-DVD coalition (instead of both coalitions) by 0.564%, but increases the probability of belonging only to the Blu-Ray coalition (instead of both coalitions) by 0.819%. Finally, the marginal effect of an increase of one in the average RELATEDNESS increases the probability of belonging only to the HD-DVD coalition by 4.38%. Hence, the closer the codes SIC among the member of a coalition (and hence the higher the similarity of the members in the coalition), the lower the probability of belonging to the HD-DVD format only.

4.2. Factors explaining the success of the standard

The factors determining the success of a standard are explored. The decision is modelled by Maximum Likelihood (ML) using now a binary Logit model. The dependent variable is SUCCESS (SUCCESS =1 if the company belongs to the winning coalition, and 0 otherwise). The results of the best model are given in Table 3 with some measures of fit.

Table 3 Estimation of the probability of belonging to the successful coalition (n=108)

Parameter	*Estimate*	Std Err	*Student t*	Pr > |t|	*Marginal effect*
Intercept	7.38465	1.9192	3.85	0.000	-
ASIE	-1.13249	.61654	-1.84	0.066	-.13379**
MISCELLANEOUS	-1.50372	.79979	-1.88	0.060	-.15675**
RELATEDNESS	-1.62011	.65636	-2.47	0.014	-.20262***
PASTCollaboration	-.004903	.00270	-1.81	0.070	-.00613**
Log-likelihood: -45.31	LR test of nullity: 15.77		p-value = 0.0033		
Mc Fadden LRI: 0.1482	Maddala Pseudo R^2:0.1359		% of correct predictions: 80.6		

The overall quality of the model is satisfactory, the two measures of fit are correct and the model correctly predicts the adoption in 87 out of 108 cases (80.56%) with a cut off set at 0.54, a satisfactory result. Four variables appear as significant: ASIE, MISCELLANEOUS, RELATEDNESS and PASTCollaboration. Indeed, belonging to an Asian country tends to significantly decrease the probability of success. Hence, all other things being equal, the marginal effect of belonging to an Asian country decreases the probability of belonging to the successful coalition by 13%, and being one of the companies listed as contributor or associate members (MISCELLANEOUS) decreases the probability of belonging to the successful coalition by almost 16%. The marginal effect of an increase of one in the average relatedness decreases the probability of success by 20%. Finally, increasing the number of Past collaborations of 100 units decreases the probability of belonging to the successful coalition

(SUCCESS) by 0.61%. Hence, the closer the code SIC (and hence the higher the similarity of the members in the coalition), the higher the probability of success.

5. Implications and conclusion

An extensive literature on standardization exists, but it tells us little about how firms choose to join standard setting coalition as well as determinants for coalition success. This study makes an attempt to fill this void by examining the circumstances under which firms prefer joining one coalition to another or even both and the factors that may explain the success of standard setting coalition. We focus on the Blu-ray vs. HD-DVD standard war in the electronic video market. By considering standard setting coalition as bipartite network, this study provides empirical support for the effect of prior alliances, network effect and coopetitive behavior. We find evidence that coalition size and coopetitive behavior are quite important in determining patterns of standard setting success.

The findings with regard to relatedness do indeed correspond to expectations based on coopetitive argument. The higher the similarity of the members in the coalition, the greater the probability of standard coalition success. Furthermore, relatedness leads to greater probability of joining both competing coalition. However, belonging to a particular economic block, in occurrence Asia, is relatively more likely to decrease the probability of standard coalition success.

The finding with regard to the size and network effect points up several aspects. Firstly, being NationWide retail and major online support companies (Online) increases the probability of joining both competing coalition. Secondly, being contributor or associate members (Miscellaneous members) decreases the probability of standard coalition success. Thirdly, it appears at first glance that the size of coalition plays a significant role on the probability of standard coalition success. It seems that founders and major studio supports (as major players) are main drivers for the standard coalition success in the case of Blu-ray versus HD-DVD standard war.
In fact, one key reason why Toshiba stopped developing, manufacturing, and marketing HD-DVD players in February 2008, is that several leading co-sponsors decided to no longer support the HD-DVD format. Hollywood majors gradually abandoned the HD-DVD coalition to join the Blu-ray coalition, which led Toshiba to announce its withdrawl from HD-DVD. Among the Hollywood majors, only Warner Bros and Paramount Pictures abandoned HD-DVD in 2008. Similarly, Microsoft's decision to back HD-DVD and Apple's commitment in favor of Blu-ray are weighty decisions for both alliances in that it concerns two major players in their respective fields. One of the reasons for the DVD Forum's success in imposing DVDs was the presence of major players from various industries in this association (Tellier, 2006). The presence of such players in the coalition is likely to increase the coalition's success by strengthening its ability to impose its standard (Backhaus et al., 2009). However, the results so far are preliminary and not robust enough to conclude on the size effect. That's why further researches and more in depth analyses are (and must be) undertaken.

Moreover, past collaboration, or experience, increases the probability to join both coalitions and decreases the probability to standard success. This is not consistent with (or this runs counter) Hypothesis 1a that the number of prior alliances leads to greater probability of standard coalition success. However, it leads to a greater probability of joining both competing coalitions.

Prior alliance between competitors belonging to the same coalition decreases the probability to standard success. In fact, direct prior experience help to solve information asymmetry and mitigate (managerial) indigestibility because proximity in the network of previous alliances promotes stronger reliance on trust and reputation (Gulati, 1998). Thus, we cannot confirm hypothesis 1b.
In sum, we found some clear empirical evidences, going along the same finding by Duysters and Lemmens (2008) that not any firm can join a standard setting coalition. Rather, standard setting coalition is carefully composed, where the large and founders firms select technologically similar firms (relatedness) to add to the unique innovative capabilities of the group. Because of these selection mechanisms, competing for specific partners and their distinct technologies will even enforce the group-based competition in the coalition (Duysters and Lemmens, 2008).

These findings have some implications for management. First, the results seem to be in line with the size as well as network effect for standard coalition success. Thus, firms should instead join the biggest coalition. Second, the results emphasize that a broad coopetitive standardization approach is more beneficial than concentrating on few selected cooperative arrangements. Further, the coopetitive behaviours should considered both downstream and upstream actors. Although the geographical proximity effect has not been studied in this paper, it appears through social distance argument that companies could learn and earn more through cooperation with direct competitors group to build market and set up successful standard. Thus, firms could widen their knowledge portfolio and further strengthen their knowledge base. However one puzzle would rise regarding this last point dealing with firm strategy. As the firms cooperate with direct competitors, the risk of losing its competitive position resulting from outflow of its own knowledge to competitors (Singh, 2004) increases. This is an issue worth future exploration.

Finally, this paper has some limitations. It takes coalition as a bipartite network. This is a handicap to deeply analyses social distance between coalitions' memberships at dyad level and to capture more structural network effects. Another handicap that could arise with bipartite network is the analysis of the role of geographical proximity. It would be interesting to study the geographical proximity effect on the decision to choose one coalition as well as its probability of success. Addressing such issue would require explicitly modeling the dyad relationship in an empirical framework.

Another limit to our work deals with relatedness. Although we have found that the relatedness increases the probability of standard's success, it would be interesting to split the degree of knowledge difference into multiple dimensions (Nooteboon et al., 2007) in order to see whether or not there exists a U-shaped relationship between knowledge relatedness and standard's coalition success.

References

Aggarwal N., Dai Q. and Walden E., (2009) Setting IT standards: the effects of coalition size on the risk and return profiles of participants. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1371638

Arthur W. B. (1994), Increasing Returns and Path Dependence in the Economy, Ann Arbor : University of Michigan Press

Arthur, B., 1998. Increasing returns and the new world of business. Harvard Business Review 74, 100–110.

Axelrod R., Mitchell W., Thomas R.E., Bennet D.S., Bruderer E. (1995), « Coalition formation in standard-setting alliances », Management Science, 41, 9, pp. 1493-1508

Augereau, A. and S. Greenstein (2001), 'The need for speed in emerging communications markets: upgrades to advanced technology at internet service providers,' International Journal of Industrial Organisation, 19, 1085–1102.

Backhaus K. Budt M. Eisenbeiss M. and Muehlfeld K. (2009) How to Win a Standard Contest – The Cases of VHS versus Betamax and Blu-Ray Disc versus HD DVD, *25th EGOS Colloquium*, Barcelona 2009, July 3rd

Barney J. B. [1991], « Firm resources and sustained competitive advantage », *Journal of Management*, vol°17, p. 99-120.

Barney, J. 2002. Gaining and Sustaining Competitive Advantage. Upper Saddle River: Prentice Hall.

Bengtsson M., Kock S. (2000), « "Coopetition" in business networks – to cooperate and compete simultaneously », Industrial Marketing Management, Vol. 29, n°5, pp. 411-426.

Bengtsson M., Eriksson J., Wincent J., 2010 Co-opetition dynamics – an outline for further inquiry. Competitiveness review, vol° 20(2), pp. 194-214

Bleeke J., Ernst D. 1995. Is Your Strategic Alliance Really a Sale? Harvard Business Review, Jan.-Feb.

Borgatti SP, Everett MG. 1997. Network analysis of 2-mode data. *Social Networks* 19: 243-269.

Bresnahan, T. F., & Greenstein, S.. 1999. Technological competition and the structure of the computer industry. Journal of Industrial Economics, 47(1), 1-40.

Brynjolfsson, E. and C. Kemerer (1996), 'Network externalities in microcomputer software: an econometric analysis of the spreadsheet market,' Management Science, 42(12), 1627–1647.

Chiesa V., Manzini R., Toletti G. (2002), « Standard-Setting Processes: Evidence from Two Case Studies », R&D Management, Vol. 32, pp. 431-450

Cohen, M.D., Levinthal, D.A., 1990. Absorptive capacity: a new perspective on learning and innovation. Administrative Science Quarterly 35, 128–152.

Cortese C. L., Irvine H. J. Kaidonis M. A., (2009), « Powerful players: How constituents captured the setting of IFRS 6, an accounting standard for the extractive industries », Accounting Forum

Cowan R., Jonard N., 2009. Knowledge portfolios and the organization of innovation networks. Academy of Management Review, 34(2), 320-342.

Cusumano M. A., Mylonadis Y., Rosenbloom R. (1992), « Strategic Maneuvring and Mass-Market Dynamics: The Triumph of VHS over Beta », Business History Review, 66, pp. 51-94.

Cusumano, M., Gawer, A., 2002. The elements of platform leadership. MIT Sloan Management Review 43 (3), 51.

Dagnino G. B, Padula G. (2002), « Coopetition Strategy: a New Kind of Interfirm Dynamics for Value Creation », Actes de la 2e Conférence EURAM, Stockholm.

Dochartaigh N. O. (2002), The internet research handbook: A practical guide for students and researchers in the social sciences, Sage, London

Dosi, G., 1988. Sources, procedures, and microeconomic effects of innovation. Journal of Economic Literature 26, 1120– 1171.

Dranove D. and Gandal N. (2003) The DVD-vs.-Divx Standard War: Empirical Evidence of Network Effects and Preannouncement Effects, *Journal of Economics & Management Strategy*, 12(3): 363-386.

Duysters G., et Hagedoorn J. [1995], « Strategic groups and inter-firm networks in international high-tech industries », Journal of Management Studies, vol°32, n°3, p. 359-382.

Duysters G. & Lemmens C.,2008. Alliance block composition patterns in the microelectronics industry UNU MERIT Working paper series 2008-060

Egyedi T.M. & Koppenhol A. 2009. Competing De Jure Standards, Good for Innovation?, presented at *the European Academy for Standardization (*EURAS) 2009

Farrell J. and Saloner G. (1985) Standardisation, Compatibility and Innovation, *RAND Journal of Economics* 16(1): 70-83.

Foray D. (1995), « Users, standards and the economics of coalitions and committees », Information Economics and Policy, Volume 6, Issues 3-4, pp. 269-293

Funk J. L. (2009), « The Co-evolution of Technology and Methods of Standard Setting: The Case of the Mobile Phone Industry », Journal of Evolutionary Economics, vol. 19, n°. 1, pp. 73-93

Gallagher, S., Park, S., 2002. Innovation and competition in standard-based industries: a historical analysis of the US home video game market. IEEE Transactions on Engineering Management 49 (1), 67–82.

Gandal, N., Kende M., and Rob R., 2000. The Dynamics of Technological Adoption in Hardware/Software Systems: The Case of Compact Disc Players. RAND Journal of Economics, 31: 43-61.

Gandal N. and Shy O., 2001. Standardization policy and international trade. Journal of International Economics 53, 363–383

Gawer A. and Cusumano M. A. (2008) How Companies Become Platform Leaders MIT Sloan Management Review, vol49(2), pp 28-35

Ghosh A. and Morita H., 2007. Competitor Collaboration and Product Distinctiveness (with Hodaka Morita), available as SSRN working paper WPS# 926488

Gilsing, V.A.,Duysters,G.M.,2008. Understanding novelty creation in exploration networks—structural and relational embeddedness jointly considered. Technovation 28,693–708.

Gnyawali, D. R. and Madhavan, R. (2001) Cooperative networks and competitive dynamics: s structural embeddedness perspective, *Academy of management Review*, 26, 431-445.

Goerzen, A., Beamish, P.W., 2005. The effect of alliance network diversity on multinational enterprise performance. Strategic Management Journal 26, 333–354.

Gomes-Casseres, B. (1996) *The Alliance Revolution: The New Shape of Business Rivalry.*Cambridge, MA: Harvard University Press.

Gomes-Casseres, B. (2003) Competitive advantage in alliance constellations. Strategic Organization Vol 1(3): 327–335

Gooding, R. Z. and J. A. Wagner (1985). 'A meta-analytic review of the relationship between size and performance: The productivity and efficiency of organizations and their sub-units', Administrative Science Quarterly, 32, pp. 462-481.

Greenstein S.M. (1992), « Invisible hands and visible advisors: An economic interpretation of standardization », Journal of the American society for information science, 43(8), pp. 538–549

Gulati R. [1995], « Social structure and alliances formation patterns: a longitudinal analysis », *Administrative Science Quarterly*, vol°40, p. 619-652.

Gulati, R., 1998. Alliances and Networks. Strategic Management Journal 19, 293–317.

Gulati, R. and Gargiulo, M. (1999) Where do interorganizational networks come from? *American Journal of Sociology*, 104(5), 1439-1493.

Harbison J.R. and Pekar P., 1998. Smart alliances. San Francisco Jossey-Bass.

Hearn G. and Pace C. (2006) Value-creating ecologies: understanding next generation business systems. *Foresight* 8(1): 55–65.

Hennart J.F. Reddy S.. 1997. The choice between mergers/acquisitions and joint ventures: The case of Japanese investors in the United States. *Strategic Management J.* 18 1—12.
Hirschman, A. (1958). The Strategy of Economic Development. Yale University Press, New Haven, CT
Hitt, M.A., Hoskisson, R.E., Johnson, R.A., Moesel, D.D., 1996. The market for corporate control and firm innovation. Academy of Management Journal 39, 1084–1119.
Horstmann et al., 1985 Horstmann, I., MacDonald, G., Slivinski, A., 1985. Patents as information transfer mechanisms: to patent or (maybe) not to patent. Journal of Political Economy 93 (5), 837–858.
Iansiti, M., Levien R. (2004), The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability, Harvard Business School Press
Inkpen, A. C., 1998 "Learning and Knowledge Acquisition through International Strategic Alliances." *The Academy of Management Executive* Vol. 12, No. 4: 69-80.
Katz M. L. and Shapiro C. (1986) Technology Adoption in the Presence of Network Externalities, Journal of Political Economy 94: 822-841.
Klepper, S., Simons, K., 2000. Dominance by birthright: entry of prior radio producers and competitive ramifications in the US television receiver industry. Strategic Management Journal 21, 997–1016.
Kogut, B., Zander, U., 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. Organization Science 3, 383–397.
Korzeniowski, P. (1999), 'Sun setting on FDDI,' Business Communications Review, 29(4), 47–50.
Koski, H. (1999), 'The installed base effect: some empirical evidence from the microcomputer market,' Economics of Innovation and New Technology, 8, 273–310.
Le Roy F. and Yami S. (2009), Coopetition and Entrepreneurship, *International Journal of Entrepreneurship & Small Business* 8(1): 1-5.
Leiponen A. E. (2008), « Competing Through Cooperation: The Organization of Standard Setting in Wireless Telecommunications », Management Science, vol. 54, no. 11, pp. 1904-1919
Levin, D., R. Cross. 2004. The strength of weak ties you can trust: The mediating role of trust in effective knowledge transfer. Management Sciences. 50 1477-1490.
Li Y. and Vanhaverbeke W., 2009. The effects of inter-industry and country difference in supplier relationships on pioneering innovations. Technovation 29. 843–858
Liu C.Z., Slaughter S.A. Smith M. D. 2008 Standards competition in the presence of Digital conversion technology: an empirical analysis of the Flash Memory Card market. Electronic copy available at: http://ssrn.com/abstract=1021352
Lukach R., Kort P.M., Plasmans J. (2007), « Standard-Creating Coalitions in Oligopoly within Differentiated Products and Variable Network Density », Working Paper Series, University of Antwerp
Lyytinen K., King J. (2006), « Standard making: A critical research frontier for information systems research », MIS Quarterly, 30, pp. 405–411
M'Chirgui Z. (2005) The economics of smart card industry: towards coopetitive strategies, *Economics of Innovation and New Technology* 14(6): 455-477.
Majumdar S.K. and Venkataraman S. 1998. Network Effects and the Adoption of New Technology: Evidence from the U.S. Telecommunications Industry, Strategic Management Journal, Vol. 19, No. 11, pp. 1045-1062
Miller, G. and S. Rao (1994), 'Point/Counterpoint. Is the ATM forum an impediment to interoperability?,' Data Communications, 23, 115–116.

Moatti V. 2009 Learning to expand or expanding to learn? The role of imitation and experience in the choice among several expansion modes European Management Journal (2009) 27, 36– 46

Moore J. F. (1996), The Death of Competition – Leadership and Strategy in the Age of Business Ecosystems, Harper Business

Mytelka L. K., (1991), *Strategic partnerships and the world economy*, Pinter Publishers, London.

Nalebuff B., Brandenburger A. (1996), La Co-opétition, une révolution dans la manière de jouer concurrence et coopération, Village Mondial

Newman MEJ, Watts DJ, Strogatz SH. 2002. Random graph models of social networks. *Proceedings of the National Academy of Sciences* 99(supplement 1): 2566-2572.

Nooteboom, B. (1999). Inter-firm alliances: Analysis and design, London: Routledge.

Nooteboom, B., Vanhaverbeke, W., Duysters, G., Gilsing, V., van den Oord, A., 2007. Optimal cognitive distance and absorptive capacity. Research Policy 36,1016–1034.

Ohashi, H. (2003), 'The role of network effects in the US VCR market, 1978-1986,' Journal of Economics & Management Strategy, 12(4), 447–494.

Padula G. and Dagnino G.B., 2007. Understanding the rise of coopetition: the intrusion of competition in a cooperative game structure. International Studies of Management and Organization.

Park, S. 2004. Quantitative Analysis of Network Externalities in Competing Technologies: The VCR Case. *Review of Economics & Statistics*, 86(4) 937-945.

Rowley, T., Behrens, D., Krackhardt, D., 2000. Redundant governance structures: an analysis of structural and relational embeddedness in the steel and semiconductor industries. Strategic Management Journal 21(3), 369-386.

Saloner G. and Shepard A., 1995. Adoption of Technologies with Network Externalities: An Empirical Examination of the Adoption of Automated Teller Machines. RAND Journal of Economics 26, 479-501.

Sampson, R. C. (2005) Experience effects and collaborative returns in R&D alliances. Strategic Management Journal 26, 1009–1031.

Schmalensee, 2009. Standard-Setting, Innovation Specialists, and Competition Policy. Electronic copy available at: http://ssrn.com/abstract=1219784

Schumpeter, 1934

Shapiro C., 2001a Setting Compatibility Standards, Cooperation or Collusion," in Dreyfuss, R., Zimmerman, D.L., and First, H. (eds.), *Expanding the Boundaries of Intellectual Property*, (Oxford University Press, Oxford), pp. 81-102.

Shapiro C. 2001b Shapiro C. In: Jaffe A, Lerner J, Stern S, editors. Navigating the patent thicket: cross-licenses, patent pools, and standard-setting. Innovation policy and the economy, vol. I. Cambridge, MA: MIT Press; p. 119–50.

Shapiro C., Varian H. (1999), « The art of standards wars », California Management Review, 41(2), pp. 8–32

Shapiro C. Varian H., 1998; information rules: A strategic guide to the network economy. Harvard Business School Press.

Simcoe T., 2008 "Standard Setting Committees," Working Paper, Rotman School of Management, University of Toronto, available at http://www.rotman.utoronto.ca/timothy.simcoe/papers/SSOCommittees_v2.pdf

Singh, J. 2004. Multinational firms and knowledge diffusion: Evidence using patent citation data. D. H. Nagao, ed. Proc. Sixty Third Annual Meeting (New Orleans) Acad. Management (CD). Academy of Management, 1543-8643

Singh J., 2005 Collaborative Networks as Determinants of Knowledge Diffusion Patterns. Management Science, Vol. 51, No. 5, pp. 756-770.

Steensma, H.K. and K.G. Corley (2000), 'On the performance of technology-sourcing partnerships: the interaction between partner interdependence and technology attributes', *Academy of Management Journal*, 43 (6), 1045–67.

Stuart, T.E., 1998. Network positions and propensities to collaborate: an investiga- tion of strategic alliances formation in a high-technology industry. Adminis- trative Science Quarterly 43, 668–698.

Suarez F. (2004), « Battles for technological dominance: An integrative framework », Research Policy, 33, 271–286

Tanriverdi, H., Venkatraman, N., 2005. Knowledge relatedness and the perfor- mance of multi-business firms. Strategic Management Journal 26 (2), 97–119.

Tellier A. (2006) Les stratégies de régulation dans la vidéo à domicile", Revue française de Gestion, vol. 32, pp. 123-140.

Tsai, W., S. Ghoshal. 1998. Social capital and value creation: The role of intrafirm networks. Academy Management Journal, 41 464-476.

Valdes-Llaneza A. Garcia-Canal E. (2006) Direct Competition, Number of Partners and the Longevity of Stakes in Joint Ventures, Management International Review 46(3): 307-326

Vanhaverbeke W. Noorderhaven N. (2001) Competition between Alliance Blocks: The Case of the RISC Microprocessor Technology, *Organisation Studies*, 22(1): 1-30.

Varian and Shapiro, 1999. The art of standard wars. California Management Review, Berkley, winter, 41, pp. 8-32

Villalonga B. et MacGahan A. M. [2005], « The choice among acquisitions, alliances and diverstitures », *Strategic Management Journal*, 26, p. 1183–1208.

Xia J., Tan J., Tan D., 2008. Mimetic entry and bandwagon effect: the rise and decline of international equity joint venture in China. Strategic Management Journal, 29, pp. 195-217.

Waguespack and Flemming, 2009 Waguespack D. M. Fleming L. (2009) Scanning the Commons? Evidence on the Benefits to Start-ups Participating in Open Standards Development, *Management Science* 55(2): 210-223.

Warner A. (2003) Block alliances in formal standards setting environments, *Journal of IT Standards and Standardisation Research* 1(1): 1–18.

Weiss M. (1993), « The standards development process: A view from political theory », Standard View, 1(2), pp. 35–41

Weiss and Cargill, 1992 Weiss M. Cargill C. (1992) Consortia in the standards development process, *Journal of the American Society for Information Science*, 43(8): 559–565.

Weiss, M. Sirbu, M. (1990) Technological choice in voluntary standards committees: An empirical analysis, *Economics of Innovation an New Technology* 1: 111-133.

Wernerfelt B. (1984) A resource-based view of the firm, Strategic Management Journal, 5, pp. 171-180.

Yang, H and Lin, Z (2005), "Interfirm Distances as Channels for External Resources: The Choice Between Alliances and Mergers & Acquisitions", (Academy of Management Proceedings, BPS, pp. I1-6)

APPENDIX 1 – Descriptive statistics (n=261)

Variables	Mean	Stand.- Dev.	Min.	Max.	Missing
SUCCESS (=1)	0.731807	0.44387	0	1	0
COALITION=HD	0.268199	0.44387	0	1	0
COALITION=Blu	0.478927	0.50052	0	1	0
COALITION=Both	0.252874	0.43549	0	1	0
ASIE (=1)	0.635036	0.48319	0	1	124
NORTH-AMERICA (=1)	0.270073	0.44563	0	1	124
EUROPE (=1)	0.094891	0.29414	0	1	124
FORMATFOUNDER (=1)	0.088123	0.2840177	0	1	0
MOVIE (=1)	0.057471	0.233188	0	1	0
ONLINE (=1)	0.026820	0.1618672	0	1	0
MAJOR (=1)	0.011494	0.1067981	0	1	0
MISCELLANEOUS (=1)	0.819923	.3849895	0	1	0
PATENTS_Delphion (overall number on 2000-2008)	9563.713	23136.37	0	122330	118
PATENTS_USPTO (overall number on 2000-2008)	712.6014	2784.297	0	18013	118
RELATEDNESS (average)	2.25662	0.45066	1.575	3	117
SOCIALDistance (number)	9.970874	23.9081	0	112	158
PASTCollaboration (number)	43.66372	92.6538	0	542	148
EMPLOYEES in 2000 (in thousands)	54.14218	141.4445	0.055	1244	166
EMPLOYEES in 2008 (in thousands)	63.65561	217.2417	0.055	2100	159
REVENUE in 2000 (USD millions)	7317.768	20296.18	0	192003	151
REVENUE in 2008 (USD millions)	17093.12	62444.13	.833	546274.1	134
R&D expenditures in 2000 (USD millions)	320.3533	741.1186	0	4006	171
R&D expenditures in 2008 (USD millions)	504.9435	1205.05	0	8164	153
PERCREV (in percentage)	303.689	16.2871	-85.98	16511.76	153