

## **Open standard : role of externalities and impact on the industry structure**

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**Abstract:** Conceding a part of property rights appears counter-intuitive in regards to the Porterian and RBV frameworks. However industrial economics literature and recent examples suggest that this strategy is fruitful to develop network externalities and consequently to impose a standard in network industries. Drawing on the empirical data collected from 193 firms in the U.S. Roleplaying Game industry, we shed light on the role of the sponsor and on the impact of an open property rights strategy on the industry structure.

**Keywords:** Property rights strategy, Standard, Network industries, Network externalities, Open source, Proprietary standard

## **Open standard : role of externalities and impact on the industry structure**

### **Introduction**

In many industries companies struggle to impose their standard. In these “standards wars” (Shapiro and Varian, 1999a), network externalities play a crucial role (Arthur, 1989). They enable firms to impose their technology at an increasing rate or, on the contrary, they impeach its diffusion even if the considered product presents a superior technology (Arthur, 1989). One of the strategy available to exploit these externalities consists in having an open approach (Shapiro and Varian, 1999 a,b), i.e. to allow cooperators (Brandenburger and Nalebluff, 1997) to use freely or at a low cost the standard. This kind of strategy begins to be largely recognized in newspapers, economic magazines (Fortune in 1998), Internet forums, or scientific meetings, especially as far as the high tech sectors are concerned (e.g. Raymond, 1999 ; Di Bona and al., 1999 ; Leonard, 2000 ; Wayner, 2000 ). The most famous and discussed case is Linux which has imposed itself as a credible competitor facing Microsoft’s products.

However, the open approach has rarely been studied *per se*, despite the growing recognition of this strategy. Moreover, this strategy has been mostly evoked for high tech sectors, reducing its potential application in other industries. Consequently, this paper intends to make a contribution to management research on “standards wars” by analyzing two prominent elements related to the open approach: the role of the sponsor<sup>1</sup> of a standard and the impacts of this strategy on the structure of the sector. These two

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<sup>1</sup> According David and Greenstein (1990), a sponsor is an organization that holds a proprietary interest in a design.

elements encompass the implementation phase of the open strategy and its effects on the industry.

The paper begins with a brief literature review on the network externalities and the open standard<sup>2</sup>. The next section lays out our analytical framework and our hypotheses. The subsequent section describes the research design and the data collected. The results of analysis are then presented and discussed. Finally, the conclusion emphasizes the strategic implications of this study and future research.

## **1. Literature Review**

The diffusion of a standard is frequently associated with the concept of network externalities but is seldom linked to property rights strategies and particularly to the open approach of standard. After reviewing the main points concerning network externalities, we present the open approach as one of the potential choice among the property rights strategy. We conclude this part by underlining some of the unexplored perspectives in the literature.

### *Standard and Network externalities*

The concept of externalities has first been studied by Marshall in the 20's. In economics, it refers to the increase or decrease of an agent's utility or profit without a price-coordinated transaction and is consequently considered as a market failure. Drawing from industrial economics, the concept of network externalities has been largely used in the literature on standards to explain the success or failure of products (Le Nagard-Assayag, 1999). More precisely, following Arthur (1989), there are

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<sup>2</sup> We use "open source" terminology, which is largely associated with software industry, to refer to the origin and the extreme form of the open approach of standard. Otherwise, we use the term "open standard".

externalities when the utility of a technology varies with adoptions and when adoptions are themselves subject to network effects. Externalities are especially crucial in markets characterized by increasing returns and situations where consumers need to communicate with each others (Katz and Shapiro, 1992) and producers have to coordinate. Following Garud and Kumaraswamy, (1993), we can name these sectors “network industries”.

The network externalities often enlighten why those who are ahead get further ahead (Arthur, 1996) due to positive feedback. In the standard literature, these feedbacks lie in the positive valorization of product by customers due to the number of preceding adopters (Farrell and Saloner, 1986) or to the number of potential adopters (Katz and Shapiro, 1992).

Several elements can operate separately or jointly to generate network externalities effects for customers and thus, contributing to impose a standard in a market (Le Naggard-Assayag, 1999): the prices of products and complementary products can be low for a large installed-base (impact of scale economies) ; exchanges with others can be facilitated due to the great number of partners (as in the case of audio CD) ; the more a product is sold, the more people benefits from information, geographical availability or after sales services ; a great number and diversity in complementary products can be observed ; finally, the trust in the longevity of the standard is developed.

Shapiro and Varian (1999 a, b) have also drawn several general conclusions from the standards wars they have studied in electricity, television, IT or train industries, to explain success or failures of incompatible technologies. Firstly, imposing a standard requires often to build alliances with other companies to promote the new technology. Secondly, the anticipations of consumers tend to become self-fulfilling prophecy. If

they do not anticipate the success of a technology, this one will fail. So, the sponsor of a new standard has to develop rapidly complementary products to generate positive anticipations. Finally, as the increasing returns exist, the leader has obviously an advantage on its competitors because it benefits from a large installed-base of customers.

In the standards wars, some particular resources and assets play a crucial role (Shapiro and Varian, 1999 a, b). We have evoked the importance of installed-base of consumers, especially when switching costs are important. The sponsor of a standard can also benefit from pioneer advantages to overcome its competitors (Lieberman and Montgomery, 1987). Property rights can enable to defend a position and to insure a control on a technology. Next, production capacities or innovating competencies can potentially provide a competitive advantage to overcome competitors by obtaining the lowest costs or supplying the best technology. Proposing a great number of complementary products can convince the consumers to adopt a technology. Finally, the trademarks or reputation of a firm impact the creation of positive anticipations from consumers.

Detaining resources or assets gives advantages to a firm and reveals to be a crucial condition for success. This point appears coherent with the literature on resources-based view of the firm (e.g. Barney, 1986; Amit and Schoemaker, 1993). However the resources do not guarantee success as illustrated in the Postrel's (1990) case study where sponsors failed to generate positive anticipations despite a superior technology. Consequently, the relation between resources and standard diffusion cannot be assumed to be direct. We have to introduce the strategy implemented to deploy these resources to explain the success or failure of a standard. In the next section, we argue that the

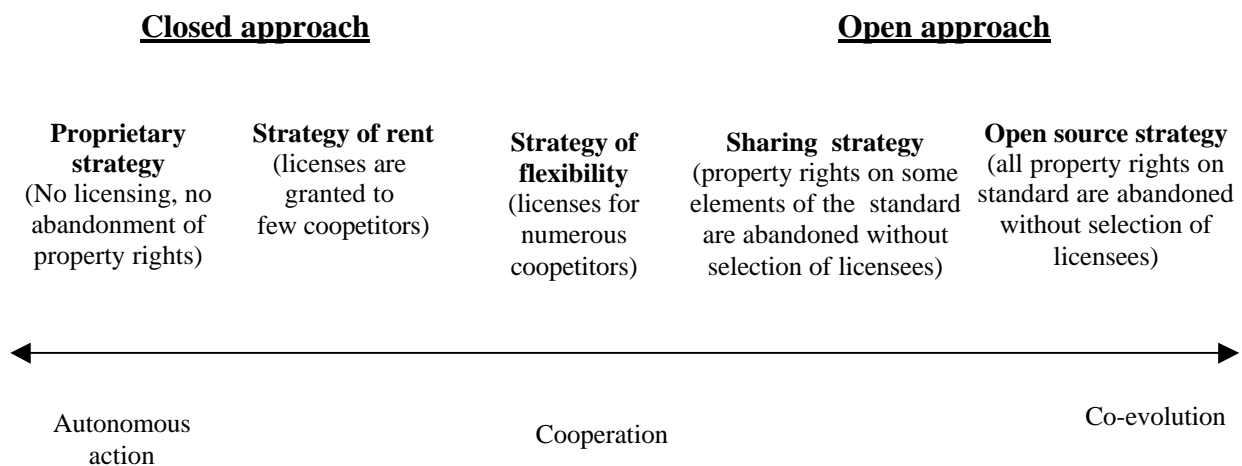
number of complementary products, the control on and the improvements of technology, the partnerships and the positive anticipations from customers depend on the property rights strategy adopted by the sponsor.

### ***The property rights strategies***

We argue that property rights are a fundamental stake for strategic management and that firms implement strategies related to this issue. For example, Gallini (1984) claims that incumbents can license their technologies to deter competitors from investing in their own standard. More generally, Nickerson (1996: 64) supports that licensing is “*an integral part of a firm’s competitive arsenal*”.

We define the property rights strategy as the strategic choices relating to the openness and accessibility of a standard for competitors. These options can be represented alongside a continuum extended from proprietary to open source strategies with several fine-grained choices between these two extremes (Figure 1.). The traditional conception of property rights deals with the proprietary approach. In this case, managers are invited to improve the security of their patents and property rights, and their subsequent strategy is often envisaged from a defensive point of view (e.g. Shapiro, 1990; Fay, 1993). The other extreme of the continuum appears more recently in the literature and is more and more publicized. The concept of open source emerged in 1998 during a meeting of “free software” defenders at Palo Alto. The terminology has been recognized when Netscape decided to make the version of its Web browser an open-source product and when IBM adopted the Apache Web server. As noted by Tuomi (2000), the main characteristics of an open source project is the specific manner to detain and use property rights. Thus, the *Free Software Foundation* definition lays on the abandonment

of property rights. Open source is a matter of the users' freedom to use, copy, distribute, change and improve a product<sup>3</sup>. One of the main innovations in the open source history is the *GNU General Public License* (Stallman, 1999) even if the open source idea has existed since the 60's and the Arpanet project (Licklider and Taylor, 1968).



**Figure 1 The continuum of property rights strategies**

This continuum of strategies requires several comments. First, the property rights strategy of a focal firm can evolve over time (e.g. from a sharing strategy to a proprietary strategy). For example, Intel adopted this dual clock property rights strategy by largely licensing its architecture in a first time to diffuse it before withholding licenses and developing a proprietary strategy (Afuah, 1999). Secondly, we can not attribute a superior performance to a particular strategy. Each of them presents some interests in terms of control on the standard or in terms of diffusion among cooperators. As Shapiro and Varian argue (1999 a, b) the open approach (sharing or open source

<sup>3</sup> We wish to underline that what distinguishes the open source is a matter of liberty, not price. An open source product is not necessarily free and could be sold for money.

strategies) generates bandwagon effects and facilitates the diffusion of a standard thanks to the network externalities. However, the open approach is not linked automatically to economic benefits as suggested by some famous cases as the IBM PC history (Chesbrough and Teece, 1996). On the contrary, the closed approach enables a tight control over a technology and its developments, and insures the appropriation of economic benefits (Mc Kelvey, 2001). As Shapiro and Varian suggest, a firm can also decide to mix an open approach with tight control over improvements or extensions (e.g. strategy of flexibility). Finally, based on Kogut and al. (1995), we can advance that property rights strategies impact differently the structure of the industry and the strategies of the other firms. Exploiting a proprietary standard is an autonomous strategy that leads to disconnect competitors and to create small closed communities of users because it often locks customers into one supplier's technology. On the contrary, an open approach strategy lies on co-evolution and creates a network of connected competitors. Indeed, it allows many suppliers to use the technology and creates consequently interdependencies between different actors.

### *Unexplored perspectives*

The literature on standards and open source suffers from several empirical and theoretical limitations. Firstly, empirical materials dealing with open approaches consist essentially in IT industry case studies where the attention is focused on products such as Linux OS (Raymond, 1999; Tuomi, 2000; Mc Kelvey, 2001) or Java (Garud and al., 1993, 2002). Even if the open standard theme can be linked with the software industry during the 90's, the phenomenon is more general and not observable only in high tech sectors such as software or microprocessors (Wade, 1995, 1996). This limitation leads



to focalize the literature on technical standards and brings two important consequences. The first one is that authors stress the continuous improvements in technical performances of an open standard to explain its success (Von Hippel, 1988; Raymond, 1999; Tuomi, 2000; Dalle and Jullien, 2002). Thus, the success story of Linux is often considered as laying on its technical superiority towards rival products especially Microsoft ones: « *Open source literature has very much emphasized the capability of open source projects to produce reliable and bug-free software, and argued that this is the key difference between open source projects and traditional software development project* » (Tuomi, 2000, p.24). Accordingly, authors generally underline primarily the technological impact of an open approach. The second consequence of the focalization on high tech sectors is that consumers are supposed to be able to choose a product on an objective basis (i.e. a product can be considered better than another on some dimensions). This assumption appears contingent to some technological sectors. If people are able to compare objectively technologies, it is difficult to evaluate diffusion effects due to network externalities. Loosening this assumption of technical comparison enables to observe diffusion effects generated by network externalities. As Wade (1995: 1) argues, “*In industries characterized by positive network externalities, the market success of a technology or design arises not simply because of its technological superiority, but from the level of organizational support that technology attracts*”.

A second empirical limitation of the literature is that the competition between proprietary and open standards has been neglected (Dalle and Jullien, 2002). Generally, literature focuses on the development of an open standard (e.g. Garud and al., 2002) or compares proprietary systems to explain their success (e.g. Wade, 1995; Shapiro and

Varian, 1999 a,b). Few empirical studies shed light on the coexistence of the two approaches.

On a theoretical level, several limitations appear in the literature. First, despite the interest of professionals and managers for open source strategy in information sectors (telecommunications, software and hardware industries), few academic works have undertaken the study of its real impacts on the structure of a sector. The case study methodology and the lack of quantitative data prevent to observe structural effects and to inform such impacts as the number of new entrants or the disappearance of incumbents according their strategy.

Secondly, the network externalities effects for producers have been neglected in the literature on standards. Authors have rarely developed this point insisting on the network externalities for consumers. However, strategic literature has stressed the crucial role of producers community and the fact that competition occurs hereafter between these communities (e.g. Gomes Casseres, 1994; Wade, 1995, 1996). The mimetic behaviors of producers can be paralleled with those of consumers as their behaviors depend partly on the observed size of the community and the anticipations of the succeeding technology.

Finally, the strategy of open standard appears paradoxical in face of the recommendations of most strategic models (Garud and Kumaraswamy, 1993). Indeed, industrial economics approach suggests that firms have to build entry and mobility barriers (Porter, 1980) and RBV contributors note that one of the cornerstone of competitive advantage lies in the preservation of assets and competences (Peteraf, 1993; Barney, 1991). According these streams of literature, firms have to avoid imitation and open standard strategy could be considered as non efficient. In fact, strategic models

replicate the difficulties of the standard economics. Economics have developed the concept of externalities to account for economical phenomena occurring without a price coordination and thus, being “out” of the market model. Strategic models present the same limitations to understand success due to an open approach in network industries; open approach is out of their model. In these industries, it could be pertinent to abandon a part of property rights and generate network externalities to impose a standard.

These unexplored perspectives lead us to look for a new way to understand how, why and with which effects, an open approach is implemented in a given industry. In order to treat this problematic we have to consider that the open approach is not only a technical tool but also and above all, a strategy to develop interactions aiming to build and organize a community of producers and consumers. Thus, opening a standard is not only a matter of increasing quality but also a way to attract competitors and produce positive feedbacks in terms of installed-base customers or producers, thanks to the generation of positive externalities. But, this strategy requires the availability of specific strategic resources which allow to conceive and implement a property rights strategy increasing the competitive position of a firm. Taking into account these different statements, we propose a contingent strategic model for network industries relative to the property rights strategies.

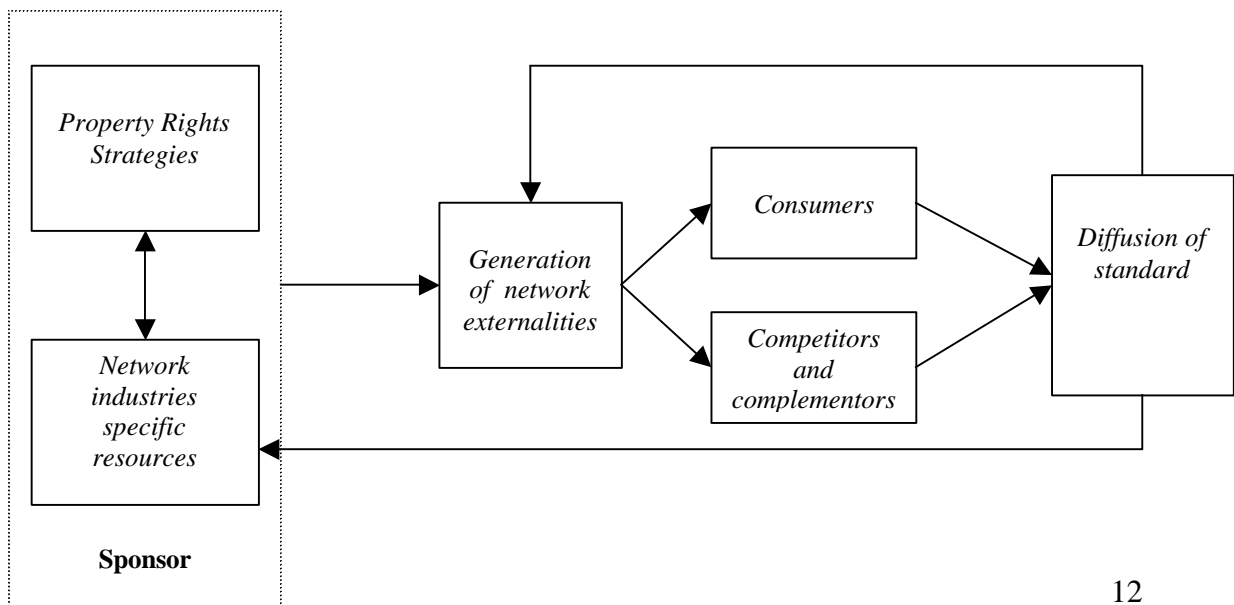
## **2. Conceptual framework and hypotheses**

Based on the preceding developments on network externalities, standards wars and open standard strategies (sharing strategy or open source strategy), we develop a conceptual framework that leads to several hypotheses.

### *Conceptual framework*

Our conceptual framework can be summarized in figure 2. In this framework, the success or failure of a standard in network industries depends primarily on the interactions between the network industries specific resources of a firm (complementary products, installed-base of customers, reputation) and its property rights strategy. A company faces the choice to adopt or not an open approach. In turn, these resources constrain the strategic choices of a firm. According to the strategic choices and the availability of resources, the level of externalities generated for consumers and competitors vary. Consumers and competitors encompass both current and new agents (new entrants and new consumers) as the more network externalities are created in the industry, the more new agents enter in the market (Kogut and al., 1995).

Finally, we can hypothesize that two feedback effects occur. First, the more externalities are created, the more the standard will be a success in terms of diffusion and the more it will feed further externalities for competitors and consumers. Secondly, the more a standard is a success, the more it develops the resources of the sponsor in terms of installed base of consumers, reputation or legitimacy. These two feedbacks explain the potential positive circle benefiting to the sponsor (Arthur, 1989, 1996).



## **Figure 2: Conceptual framework of standard diffusion in network industries**

As evoked previously, the open approach favors the generation of network externalities and consequently the diffusion of the standard, and the closed approach favors the return profits.

### ***Hypotheses***

Drawing on our conceptual framework, several hypotheses can be elaborated concerning the open standard strategy, its sponsor and the impacts on the industry structure.

### ***Strategy and resources of the sponsor***

As proposed by Shapiro and Varian (1999, a), the sponsor can adopt an open approach by ceding current control over a technology. We have argued that open standard creates potentially important network externalities for both consumers and producers. This suggests that the open approach is an adequate strategy to impose a standard in a network industry.

**Hypothesis 1.** *The open approach strategy favors the diffusion of a standard.*

The second hypothesis relates to the characteristics of the open standard sponsor. This sponsor have to count on a certain volume of network industries specific resources to impose its standard. We assume that tangibles and intangibles resources become strategic when they are valuable for consumers or for coopetitors (Afuah, 2000). For instance, an important installed-base of consumers is a strategic asset to develop rapidly positive network externalities in the market. The reputation of the sponsor is also an intangible strategic resource (Lawrence, 1995) because it constitutes the base for positive anticipations that lead customers and producers to be insured about the standard longevity. Finally complementary products are crucial to impose a standard (Shapiro and Varian, 1999a).

**Hypothesis 2:** *The sponsor of an open standard have to possess network industries specific resources to impose its standard.*

### ***Impacts on industry***

An open standard creates an entry induction by weakening the entry barriers. Indeed, the potential entrants are not facing proprietary incumbent systems and their related incompatibility costs (Farrell and Saloner, 1986) but can develop their products on the base of the open standard without or at low royalties. So, the new entrant has not to develop its own proprietary system, which could be long to develop and needs important investments (Dierickx and Cool, 1989).

**Hypothesis 3 :** *The open standard weakens the barriers to entry permitting new entrants' arrival in the industry.*

Rapidly, the sponsor have to build up an active community of producers to develop complementary products generating confidence in the standard among consumers. We assume that the firms joining the sponsor community are the more recent companies in the industry. Indeed, specific assets and history of incumbent organizations tend to create over time a path dependency (Hannan and Freeman, 1984), technological trajectories (Dosi, 1982) or core rigidities (Leonard-Barton, 1992) that bound them to their standards. Consequently, new entrants are generally the first adopters of new designs (Wade, 1995) and incumbents wait for new entrants adoption before supporting a standard. This differentiate rate of adoption is called “dual clock” by Mitchell (1989, 1991).

**Hypothesis 4. :** *The new entrants tend to adopt the new standard more rapidly than the incumbent firms.*

Concerning the incumbent firms (firms installed before the new standard release), several strategic options appear (Shapiro and Varian, 1999b, p. 208-209). They can try to impeach the standard to become a dominant design because it represents a direct threat for their products. One of the tactics to limit the adoption of a standard is to avoid the compatibility between their products and the new standard one. Another tactic is to counter the new technology by releasing products compatible with it. In this case the firm has to launch better products than those of the sponsor. Finally, another tactic consists in adopting the new technology (not only insure the compatibility) relying on specific assets (installed base of customers or reputation) to overcome the sponsor of the

standard. When a firm is unable to influence strongly the market (i.e. the standard adopted), it faces a great uncertainty. Then an efficient trade-off lies in trying to appear in the same time different from competitors and similar to them, looking both for differentiation and legitimacy (Deephouse, 1999). This last strategic choice reduces the risk to be “locked out”, that is to say to be in “*a situation in which a firm finds itself unable to develop or competitively sell products to a particular market because of technology standard*” (Schilling, 1998, p.269). In this case, the company adopts the new standard but continues to exploit its own standard. This reasoning suggests that this strategy requires important resources to develop simultaneously products based on several standards as transaction costs increase (Williamson, 1985). Indeed, the company needs to develop transactions with customers and competitors belonging to different communities.

**Hypothesis 5**: *Firms which have capacities to develop simultaneously products based on different standards will do.*

### **3. Research design**

The hypotheses were examined in a population of the Role Playing Game (RPG) industry. We present our research field, the history of the open approach in the sector, the sampling design and the data collected.

#### ***Research Field***

The empirical setting is the American RPG industry. For players, the RPG consists in playing and living adventures in a rules frame. It is a social activity played in small



communities in which a Game Master (GM) appropriates a rules system and the description of a universe (heroic fantasy, western, science fiction...) to narrate adventures to the players. These ones embody characters, free to react to oral elements of the GM and to take initiatives. Generally, this community masters only one or two game rules system due to the investments required. Indeed, the GM has to invest heavily in a rule to make his players have fun. He has to buy a rule system which costs around \$10- \$30. But to play, the GM and the players have also to buy a lot of complementary products: scenarios relating adventures, books detailing the universe where adventures take place, additional rules or new types of characters. These products are cheaper than the core rules, are developed faster and require less investments. They are also far much more complementary products than core rules. The GM has also to invest in time because rules take a long time to be assimilated, scenarios have to be read several times and a good GM has to master them sufficiently to face any initiative of the players. Regarding the players, the investment is less important in time or money. However, they develop generally affective feelings towards their characters and their universe. These different factors explain the difficulty for a community of consumers to change rapidly and often the RPG they play.

For companies, the RPG sector is a micro niche of the larger American toy and game industry. About 200 companies operate in the American sector in 2001 even if the RPG industry history displays a very high mortality rate. Since the 70's, about 900 different rules were produced and less than 100 are always played nowadays. The companies are very small sized as the majority of them counts less than 5 employees. However, the leader – Wizards of the Coast, a division of Hasbro – counts about 1500 salaries and its 7 direct followers count only between 10 and 30 employees. The companies sell

essentially rules and scenarios in a paper form and more recently, through downloaded electronic files.

Three important elements have to be noticed on the sector. Firstly, companies have operated with proprietary systems during a long time. Each editor was developing its rules and the dedicated complementary products. Thus, the investments of GMs and players are lost when they decide to switch to an other RPG (high switching costs). Furthermore, network externalities are very important in the sector because the RPG activity requires communication between players and sharing of a common rule. In these conditions, playing a best seller RPG gives a player a greater opportunity to find other playmates. Secondly, the companies mitigate the consequences of their small size thanks to a lot of freelances and exterior partners who participate in the value chain of their activity. For example, freelances are specialized in illustrations and others in the writing of scenarios. Consequently, a firm can easily double its size with freelances. Moreover the activities of printing and retail are operated by others partners. These elements suggest that the RPG sector is a network industry. Finally, the key success factors lie in two elements. The first one consists in the availability of a performing creative team which enables to release regularly original products. The second element lies in supplying players with numerous complementary products. The success of a RPG is largely associated with the number of complementary products proposed. In these conditions, the price does not constitute a primordial factor in buying behavior.

### ***The introduction of an open standard in RPG industry***

Wizards Of The Coast (WOTC) is the RPG business leader. The company created and introduced the first Collectable Trading Card Game (CTCG) in 1993: *Magic, The*

*Gathering*. Thanks to the success of this activity, WOTC has grown from 7 staff members to more than 1500 in the world and its sales reached \$400 millions in 1999. WOTC makes capital of its success in buying TSR in 1998, the company which exploited the most famous RPG (and the first one), *Dungeons & Dragons* (D&D). After acquiring TSR, a work group was set up to elaborate a new strategy for WOTC's RPG activity. This group led by Ryan Dancey, WOTC vice-president in charge of roleplaying games, concludes that the RPG business was divided into multiple proprietary systems limiting its development. In September 1999, Hasbro, a worldwide leader in gaming industry, acquired WOTC. Finally, in march 2000, WOTC announced that the D&D third edition (released in august 2000) would be based on a core rule system named *D20 system*. This system is the first open approach of standard in RPG business because any company can use it to develop their own RPG or scenarios without paying royalties to WOTC. However, WOTC keeps property rights on certain elements of D&D 3<sup>rd</sup> edition. Some rules cannot be reproduced by a coopetitor in the frame of the D20 system so the players have to acquire the D&D 3<sup>rd</sup> edition core rule book to play.

The open gaming movement founder in RPG, Ryan Dancey, claims to be in direct line with the GNU movement and Richard Stallman action for open source<sup>4</sup>. Indeed, Dancey worked several years ago in a company operating in the computer industry, Isomedia, using a Linux platform. As noted by James (2000), « *he [Dancey] was in the ideal place to advocate the open-source ideas he had first learned at Isomedia and apply them to the RPG market* ».

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<sup>4</sup> However, as suggested by a respondent, the best analogy for D20 system is a mix of Windows and Linux and can be considered as a sharing property rights strategy (Cf. figure 1).

### *Sampling Design*

Several reasons justify the choice of the American RPG industry as a research field. The first one is that it is a low tech sector. Contrarily, most of discussions and research about open standard deal with high tech industries, especially with IT. We argue that we have to study the open approach of standard in other contexts in order to enhance the generalization of results. The second reason to choose this field is that the RPG is a niche market where it is possible to identify all the actors in the industry. Diffusion processes are relatively transparent and easy to observe. The third reason is that this field gives us opportunity to avoid retrospective bias by studying an open standard project released in 2000. The strategic movements and the diffusion process of the standard occur at the moment. The last interest of studying the U.S. RPG industry is the importance of this geographical market. RPG has emerged in the U.S. in the 70's and the activity has grown very fast. Nowadays, the American RPG is a institutionalized industry with its professional reviews and associations, 3 millions regular players and its numerous competitors.

Our final sample is constituted by 193 companies. In a first stage, we have elaborated a complete list of RPG editors thanks to Internet sources. To elaborate the population in the industry, we have used several sources of information: professional associations (*Game Publishers Association* and *Game Manufacturers Association*) provide a list of about 100 RPG companies; this list has been cross-checked and completed with an on-line review (*RPGNet*) and a recent website dedicated entirely to D20 companies (*D20Reviews*). These different sources provide a list of 205 American companies which can be considered as exhaustive due to observable saturation effects. During the data

collection phase, we have eliminated inactive or disappeared companies (no Internet links, website or e-mails) to dispose of a final population of 193 companies

### ***Data collection***

To test the hypotheses concerning the diffusion process of the D20 system, the profile of adopters and the influence of resources on standard diffusion, we collected both qualitative and quantitative data.

Qualitative data have been collected on company websites, forums (including *RPGNet*, *RPGA Network*, *Game Spy*, *RPG Planet*) professional and consumer sources (*Wizard's Attic*, *Comics and Games Retailer*, *Gaming Report*) and interviews with key informants in the industry. These data enables to compare the open standard (D20 system) with a proprietary standard and an other open standard, and their respective sponsors.

Quantitative data have been collective on companies' websites which inform the edited products and their date of release. Products variable refers to the type of products supplied by a company. This variable takes three states in our database: a company releases only products based on D20 system (D20 products); a company publishes products based on an other standard, most of the time, their own standards (non D20 products); a company releases both types of products (D20 and non D20 products). We collected also the date of creation of each company and their staff number (full time employees).

A short questionnaire (seven questions) has been elaborated and e-mailed to all companies of the sample (193 firms). To increase the survey response rate, each participant was offered a summary of the study as an inducement to participate. Finally, 51 responses were received (a response rate of 26,6%). This stage showed that the

information collected by questionnaires was congruent with the information available online, insuring that the websites provide valid information. Our results were sent to the participants to the e-mail survey and we encourage their comments. The six detailed feedbacks obtained allow to increase the internal validity of the study since they are congruent with our results. They enable also to enrich our qualitative data with further information concerning hypotheses 1 and 2.

Finally, this stage makes possible to gather complete information about 113 companies (age, number of employees, kinds of products), to dispose of data about age variable for 147 companies and about number of employees variable for 136 cases<sup>5</sup>. In all cases, data about products variable is available (193).

## **5. Data analysis**

### ***Analysis method***

Our study combines qualitative and quantitative design. The qualitative analysis is compatible with an hypothetico-deductive approach as suggested by Miles and Huberman (1984) and aims to test theory (Eisenhardt, 1989).

There were very few disagreements among the data sources. All the factual details relating to standardization process and its effects were congruent and help us to insure triangulation (Yin, 1984).

Hypotheses 1 and 2 have been tested thanks to the comparative method (Ragin, 1987) to discover possible patterns in the interactions between strategies and resources. In this method, diffusion of a standard is treated as the dependent variable. To avoid bias,

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<sup>5</sup> The “age” and “resources” samples present roughly a similar repartition of activities compared to the global population.

Ragin (1987) suggests to use the method of agreement and the method and difference. Consequently, we have to study both success and failures in terms of diffusion. Property rights strategies and network industries specific resources of the sponsor are the independent variables.

This method requires to consider success and failure symmetrically and to include standardization failure cases. Furthermore, we manage in-depth case studies entailing different property rights strategies (to compare closed and open approaches of standard), and high and low level of resources endowment. This allow a systematic comparison between several combinations of strategies and resources.

To test hypothesis 3 and 4, we use the rate of companies creation and standard adoption to compare two periods: 2000-2001 (D20 system was launched in 2000) and the previous two-years period, 1998-1999. A two-years period is sufficiently long to observe the impact of the introduction of the D20 open standard on entry induction and adoption of standard.

Finally, we have considered that size of companies is a good proxy for capacities to develop simultaneously products based on different standards (hypothesis 5). Indeed, in a creative activity like RPG edition, the most important resource is human. The number of employees is strongly associated with the number of projects and products a firm can release. Size of companies scales from 1 to 1500 salaries (WOTC). As 1500 employees is a very extreme data compared to other companies, the leader has not been considered in statistical tests implying the number of employees. Correlation coefficient between the age and human capacities is 0,301 making the two variables non redundant.

We present the results in two parts distinguishing hypotheses related to the property rights strategy and the resources of the sponsor, and hypotheses related to the impact of an open approach on the industry structure.

***Results: Strategy and resources of the sponsor***

*Hypotheses 1 and 2*

To avoid retrospective bias and *a posteriori* interpretations concerning the success of D20 system, we compare this system with other game systems. We use qualitative data to contrast D20 system with two other standards:

- A proprietary standard (Gurps), released in 1986 by one of the WOTC follower, Steve Jackson Games -SJK- (created in 1980). Royalties are due to use core rules to publish another RPG or complementary products and SJK remains proprietary of the core rules. Gurps has been successful in the market since several thousands of core rules books were sold and 4 editions have been launched in 15 years. However, the 200 complementary products using Gurps system were published only by SJK.
- An open source (Dominion Rules), was launched in September 2000 by Dominion Games -DG-, created in 1995. This system is an open source since it can be copied, modified and distributed by anybody. As D20 system, Dominion Rules is supported by a world-wide, non-exclusive and without royalties license. Moreover, Dominion Rules is distributed online and is free (for comparison D&D core rule book cost 20\$ at the end 2001). Because it costs only 6 U.S.D., Dominion Rules has been downloaded by several



thousands of customers but only few complementary products have been released among which half was edited by individuals.

Hypothesis 1 implies that open standard (open source or sharing strategy) is a successful strategy in network industries. The performance of the different standards are contrasted in terms of targets and speed of diffusion (Table 1.). D20 system has been very successful since 700 000 core rules books have been sold in one year, a very fast diffusion. Moreover, in November 2001, 230 D20 complementary products were released by more than 80 other companies. This performance is far superior to all other proprietary standards (as Gurps) and tends to stress the superiority of an open property rights strategy. However, the comparison with an other open standard, Dominion Rules, illustrates the fact that open standard is not a successful strategy *per se*. Their product has been successful among players who download freely the product, but no companies develop and invest in complementary products due to a lack of profit perspectives. Thus, the Dominion Rules community stagnates since one year which implies that hypothesis 1 is not supported.

Hypothesis 2 implicates the comparison between sponsors as far as the endowment in network industries specific resources are concerned. WOTC is a very known company which operates a leader game, Dungeons & Dragons, and so relies on a very consequent installed base of consumers. The first edition of Dungeons & Dragons has encountered a very large diffusion among players since 4 millions of this product have been sold all over the world in about 10 years. Moreover, the D20 system draws benefits from the numerous complementary products available just after its release thanks to the positive anticipations developed by complementors on the success of the new standard.

Comparatively, Dominion Games have far less resources in terms of reputation, complementary products and installed base of customers. Steve Jackson Games presents an intermediary situation which can be explained by a relatively long exploitation period (15 years) that enables the company to constitute a large installed base of customers all over the world (core rules book is translated in 8 languages) and to publish many complementary products. But all these have been released by SJG. These contrasted resources enable WOTC to generate rapidly huge network externalities. For consumers, the new standard gives opportunity to benefit from a great number of complementary products and to invest time and money in a credible product. For producers, it gives access to a very large market and to develop products for a viable standard. These empirical elements tend to support hypothesis 2.

Finally, the three situations are contrasted in table 1 and illustrate the determinant role of an open approach strategy to draw benefit from important network industries specific resources. Indeed, the main difference between WOTC and SJG does not lie in the volume of resources (even if it is favorable to WOTC) but in the property rights strategy adopted (Table 1.). This suggests that the volume of sponsor's resources is not sufficient to explain the success of a standard even if the Dominion Games example underlines that a minimal level of resources is required to support successfully an open approach. It is the way resources are deployed to generate network externalities both for consumers and producers, through a property rights strategy, that induces the success of a standard. With roughly similar level of resources, companies obtain better performance (in terms of standard diffusion) with an open property rights strategy.

|   | <b>WOTC</b>  | <b>DG</b>   | <b>SJG</b>  |
|---|--|---|---|
| <b>Property rights strategy</b>   | <i>Sharing strategy<br/>(open approach)</i>                      | <i>Open source<br/>strategy<br/>(open approach)</i>           | <i>Proprietary<br/>strategy<br/>(closed approach)</i>                     |
| <b>Network industries<br/>specific resources</b><br>(reputation, installed base<br>of customers,<br>complementary products) | <i>Very important</i>  | <i>Weak</i>   | <i>Important</i>  |
| <b>Generation of<br/>Positive network<br/>externalities</b>   | <i>Very important for<br/>producers and<br/>consumers</i>        | <i>Weak for<br/>producers.<br/>Moderate for<br/>consumers</i> | <i>Important for<br/>consumers<br/>No externalities<br/>for producers</i> |
| <b>Standard diffusion<br/>(performance)</b>   | <i>Fast and very large<br/>among producers<br/>and consumers</i> | <i>Fast, moderate<br/>and limited to<br/>consumers</i>        | <i>Slow, large but<br/>limited to<br/>consumers</i>                       |

**Table 1. The diffusion of standards in RPG business**

***Results: Impact on industry structure***

Our sample displays a mean number of 4 employees and a mean age of 4,72 years. Only 13 companies were set up in the 70's and the 80's, which illustrates a rather strong rate of death in this population and the difficulty to maintain in the sector on the long term.

***Hypothesis 3***

Does the implementation of an open standard spur new entrants on penetrating the sector ? The 2000-2001 period has seen 78 new entrants when this number was only of 20 during the 1998-1999 period (table 2). Even if some companies settled during the 1998-1999 period have probably ever disappeared, the difference (about 4 times more creations) is highly significant and enables to support hypothesis 3. The chi-square test is highly statistically significant (chi-square  $_{0,999} = 10,8 < \text{chi-square}_{\text{calculated}} = 12,35 ; p = 0,0004\%$ ).

| <i>Periods</i>   | <b>New entrants</b> | <b>Incumbents</b> | <b>Total</b> |
|------------------|---------------------|-------------------|--------------|
| <i>2000-2001</i> | 78                  | 69                | 147          |
| <i>1998-1999</i> | 20                  | 49                | 69           |

**Table 2. : New entrants in 2000-2001 and 1998-1999**

*Hypothesis 4*

Do most of these new entrants adopt the open standard ? From a descriptive point of view, we can notice that among the 78 new entrants in the 2000-2001 period, 51 are adopting the D20 system (some of them couple this open standard with other proprietary systems and also develop Non D20 products). A chi-square test supports significantly hypothesis 4 ( $p = 0,000\%$ ) (Tables 3). So, new entrants adopt more rapidly the new standard than incumbents.

|                 | <b>New entrants<br/>(2000-2001)</b> | <b>Incumbents<br/>(2000-2001)</b> | <b>Total</b> |
|-----------------|-------------------------------------|-----------------------------------|--------------|
| D20             | 44                                  | 2                                 | 46           |
| NON D20         | 27                                  | 48                                | 75           |
| D20 and NON D20 | 7                                   | 19                                | 26           |
| <b>Total</b>    | <b>78</b>                           | <b>69</b>                         | <b>147</b>   |

**Table 3 : Incumbents and new entrants activities**

We can underline that 27 new entrants do not adopt the new standard. This figure corresponds roughly to the number of new entrants during the 1998-1999 period (20). Consequently, we can compare the two periods and consider that no exogenous variable

has changed drastically the economical context of the industry and we can attribute the other new entries to the D20 implementation

Hypothesis 5

Hypothesis 5 implies that firms face crucial strategic choices : they can refuse to adopt the new emerging standard; they can completely turn their lines of products in D20 products (for example the case of WOTC), or they can continue to exploit their standard and, in the meantime, release new D20 products. We have hypothesized that this last choice appears as the most rational because it differentiates the company and minimizes the risks of being locked out. However, this choice requires capacities to launch several different lines of products, especially human capacities.

To test the hypothesis 5, we undertake an ANOVA to compare each activity (“D20 companies”, “Non D20 companies”, “D20 and Non D20 companies”) with the two others. The descriptive statistics and results are displayed in tables 4 and 5.

| <b>Activity</b>            |               | <b>Age</b> | <b>Human capacities<sup>a</sup></b> |
|----------------------------|---------------|------------|-------------------------------------|
| <b>D20</b>                 | Mean          | 1,087      | 2,86                                |
|                            | N             | 46         | 37                                  |
|                            | Std Deviation | 1,681      | 1,86                                |
| <b>NON D20</b>             | Mean          | 5,473      | 3,54                                |
|                            | N             | 75         | 70                                  |
|                            | Std Deviation | 6,412      | 2,79                                |
| <b>D20 and<br/>NON D20</b> | Mean          | 9,000      | 6,64                                |
|                            | N             | 26         | 28                                  |
|                            | Std Deviation | 9,543      | 7,17                                |
| <b>TOTAL</b>               | Mean          | 4,724      | 4,00                                |
|                            | N             | 147        | 135                                 |
|                            | Std Deviation | 6,709      | 4,15                                |

a : Wizards of the Coast is excluded from the sample, due to an extreme value

**Table 4 : Age and human capacities according activity :descriptive statistics**

|                         | <b>Comparison D20 /<br/>NON D20</b> | <b>Comparison<br/>D20 / D20 and NON D20</b> | <b>Comparison<br/>NON D20 / D20 and NON<br/>D20</b> |
|-------------------------|-------------------------------------|---|---|
| <b>Age</b>              | <i>F = 20,600</i><br><i>0,000*</i>  | <i>F = 30,291</i><br><i>0,000*</i>          | <i>F = 4,470</i><br><i>0,037**</i>                  |
| <b>Human capacities</b> | <i>F = 1,766</i><br><i>0,187</i>    | <i>F = 9,487</i><br><i>0,003*</i>           | <i>F = 9,591</i><br><i>0,003*</i>                   |

*Level of significance : \* p < 0,01 ; \*\* p < 0,05*

**Table 5 : Comparison of the different groups according activity**

**(Fisher test and level of significance)**

The ANOVA results are congruent with those of hypotheses 3 and 4. The companies adopting only the new D20 system are younger (a mean of 1,087 year) than non adopters ( $p = 0,000$ ) or than companies coupling D20 system with other proprietary systems ( $p = 0,000$ ). As far as the age is concerned, there is also a significant difference between the “Non D20” adopters and the companies adjoining D20 system with their own systems ( $p = 0,037$ ), even if the two categories encompass companies present in the market since a long time (a mean of 5,47 years for “Non D20 companies” and a mean of 9 years for “Non D20 and D20 companies”).

There is no significant difference in human capacities between the “Non D20 companies” and the “D20 companies” ( $p = 0,187$ ). This result was foreseeable since we predict that only well endowed companies with human capacities could be able to develop jointly two or more standards. However, we observe statistically significant differences between “D20 companies” and “Non D20 and D20 companies” ( $p = 0,003$ ),

and between “Non D20 companies” and “Non D20 and D20 companies” ( $p = 0,003$ ). This last result concerning the comparison between “Non D20 companies” and “Non D20 and D20 companies” shows that human capacities enable firms to overcome the inertia and the drawbacks of age concerning technological trajectories.

## **Discussion**

The study underlines the interaction between resources and property rights strategy in network industries. The invalidation of Hypothesis 1 invites to consider potentially the open approach as a successful strategy. Indeed, as Khalak (2000) argues, even if an open source product is free of charge, it must still gain a critical mass. Consequently, the hypothesis 2 sheds light on the determinant role of network industries specific resources (installed-base of customers, reputation, legitimacy). Those detained by Wizards of the Coast make the difference in implementing a new standard in the RPG industry compared with other attempts to implement an open standard (i.e. Dominion Games).

Moreover, this research might be the first to test empirically the impact of an open approach of standard on an industry structure. This property rights strategy impacts profoundly the structure of the sector. It enables the penetration of a lot of new entrants (hypothesis 3) by weakening the entry barriers. This strategic initiative has been successful as the majority of new entrants adopt the open standard. This result is congruent with preceding research in different industries providing external validity. For example, Arora (1997) illustrates the impact of property rights regimes on sector structure in the chemical industry. Kogut and al. (1995) also support the relationship between network externalities and entry induction. We wish to underline that the open

standard strategy implemented by the sponsor (WOTC) was designed to create proactively an entry induction to support its standard (D20 system). Contrarily to the economical literature which considers the externalities as an emerging and unintentional phenomenon, the strategic approach proposed here insists on the voluntary dimension of the externalities. Finally, firms able to grasp the opportunities associated with the new standard counterbalance their past technological trajectories thanks to human capacities (Hypothesis 5).

The study gives also evidences on the role of externalities generated towards producers. The open standard creates positive network externalities for consumers by making rapidly a lot of complementary products available. But the open approach plays essentially a role in the network externalities for producers. The strength of this effect is linked directly with the characteristics of the sponsor who expands considerably the market for the incumbents and new entrants adopting the new standard. This result departs from the marketing and industrial economy literatures which focus attention on the externalities for consumers. In the RPG sector, producers benefit from four crucial different externalities: new entrants take advantage of weakened entry barriers; each producer gains access to a mass market, whatever its size; each producer benefits from the reputation of a system promoted by an uncontestable leader; finally, each of them brings some complementary products but disposes also of a large line of complementary products.

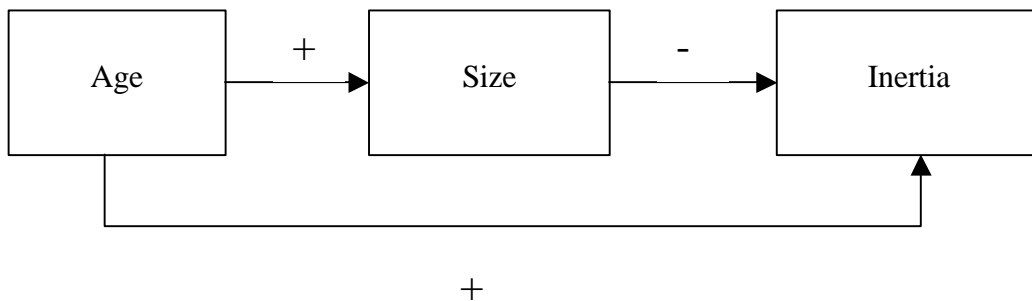
Concerning the sponsor, the generation of network externalities for producers favors the first steps of a standard implementation. A strong early organizational support for a



design attracts new entrants increasing the number of complementary products. However, the sponsor should have several crucial resources and the competences to valorize them in order to create positive anticipations. This point departs from the famous Linux case because of the impossibility of technological excellence in the sector we have studied. We have loosen the assumption of the possibility of a technological comparison. Thus, the so commented Linux case could be only specific to a particular context where permanent technological improvements provide the means to overcome an initial drawback in network industries specific resources.

An other interesting result of this research consists in illustrating two paradoxes. First, those who are potentially the most dangerous competitors for WOTC, due to their capacities, tend to adopt the D20 system. Consequently, they participate in the success of the new standard and risk to cannibalize their own standard. In fact, their decisions seem rational in the short term: they avoid to be locked out (Schilling, 1998) and will present probably better performances than non D20 adopters. But in long term, this decision could reveal dangerous for their own standards. This result differs from Garud and *al.* (2002) who argue that “*an irony of the open process is that powerful incumbent firms may withhold support by not joining the bandwagon developing around the emerging standard*”. This divergence can be explained by the strategic position of the standard sponsor: Sun was a challenger in the Garud and *al.* study; on the contrary WOTC is the market leader. This shows that when a company cannot influence the market by contributing significantly to the emergence of a standard, it chooses most of time to avoid to be locked out, splitting its own capacities into two standards.

The second paradox illustrated in the study refers to the relation between age and capacities. Companies which have survived since a long time have accumulated enough capacities to diversify their lines of products. In this case, age enables indirectly to overcome inertia. On the contrary, the process of capacities accumulation has not been long enough for a part of the incumbents which are “stuck in the middle” and can not overcome the inertia due to age. The process underlined here can be represented by figure 3. The bureaucratization emerging over time favors inertia of an organization and consequently reduces its adaptability. However, by increasing the size of the organization, the “age” variable allows the accumulation of capacities (especially human in our case). These capacities counterbalance the negative effect of age and reduce inertia, enabling companies to allocate a part of their resources to the development of products based on a new standard.



**Figure 3: Relation between Age, Size and Inertia**

These relations contrast with the literature on bureaucratization that assumes a progressive structuration of an organization. In this view, age and size generate inertia. In our study, the small size of the different firms (less than 30 staff members) makes

bureaucratization model inapplicable. So, until a particular threshold (that this study could not identify), it appears that size facilitate adaptation.

Several limits and further research can be proposed to conclude this paper. The first limit relates to the fact that we have not taken into account the free lances to estimate human capacities of firms. Yet, in a weakly integrated sector, resources resides largely outside the firm and internal employees are only a part of these resources. However, these free lances work equally for small structures and larger leaders; so the bias is reduced. A second limit lies in the evaluation of performance. We have estimated it thanks to the diffusion rate of the standard. However, the diffusion of a standard is not a sufficient condition to guarantee financial performance of the sponsor as the case of the IBM architecture and its clones demonstrates. Consequently, an open standard strategy can be associated with economical failure at middle term (Chesbrough and Teece, 1996). We are not able to estimate the return profit for WOTC.

Concerning adopters of the D20 open standard, their performance depends on two contradictory processes that should be further deepened. The first process has a positive impact on economic performance. The fast increase of the D20 companies community enables firms to sell their products at large scale taking advantage of positive externalities. However a competition phenomenon should occur at middle term as the number of companies adopting the standard takes off. Indeed, size of the community has a positive impact lying in access to a large market and a negative effect, over time, driving to an increase competition between companies in the community as suggested by the density-dependence theory (Wade, 1995, 1996). In other words, the competition

drifts from an inter-standards rivalry to an intra-standard one (Quélin and *al.*, 2001). As entry barriers are weakened by open standard strategy in an industry, the stake for new entrants is to maintain themselves and insure longevity.

The RPG industry case illustrates our strategic model on standard diffusion in network industries. However, the open standard strategy seems to be non efficient for the Porterian and RBV frameworks as these streams encourage to build entry barriers and to avoid imitation. On the contrary, our empirical study shows that the open approach of standard can become an efficient property rights strategy in network industries where standards wars are a crucial stake. These insights encourage to loosen some assumptions from traditional strategic models in numerous sectors (e.g. telecommunications, software) and particularly the idea that a strategic action is efficient or not, whatever the nature of the industry. Thus, it seems there is a need for contingent strategic models instead of broad ones.

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