

RESEARCH NOTES AND COMMENTARIES

STRATEGIZING INDUSTRY STRUCTURE: THE CASE OF OPEN SYSTEMS IN A LOW-TECH INDUSTRY

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Open systems strategy enables a sponsor to diffuse its technology and promotes standardization in an industry. However, this strategy has been studied in high-tech settings. We hypothesize that, in a non-high-tech industry, a sponsor giving access to its technical knowledge may impact industry structure. Based on a survey of the U.S. tabletop role-playing game (RPG) industry, our results highlight that the introduction of an open system in a sector creates an entry induction phenomenon and that these new entrants adopt more readily the open system than incumbents. Moreover, the average size of the firms in the industry decreases due to vertical specialization.

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The strategy of open systems (Garud and Kumaraswamy, 1993) has attracted mounting attention in the field of strategic management in recent years as a means for a firm to disseminate its technology and to establish a *de facto* standard (Shilling, 1998; Baldwin and Clark, 2003; Chesbrough, 2003; Garud, Kumaraswamy, and Langlois, 2003). This strategy is particularly interesting in network industries built around technological systems, where firms may be able to exploit network externalities (Schilling, 1998; Economides, 2003). The current open-source software movement is an extreme case of such a strategy of open systems (Lerner and Tirole, 2000;

Von Hippel, 2001; *Research Policy*, 2003). But the growing literature on open systems strategies focuses only on high-tech sectors and, more particularly, on IT industries. As Langlois and Robertson (1992), Schilling (1998), Baldwin and Clark (2003), Chesbrough (2003) and Garud *et al.* (2003) illustrate, examples and case studies almost invariably concern technological systems such as computers or software, the Internet, telecommunications systems, stereos, VCRs, or television sets.

In this article, we explore the repercussions of an open systems strategy on the structure of a low-tech industry. By industry structure, we refer here to the traditional elements recognized by industrial economics, i.e., the number of companies in the sector, the number of new entrants, and the size of firms (Waterson, 1990). To this end we studied a niche market within the U.S. toy industry: publishers of pen-and-paper role-playing games

Keywords: open systems strategy; industry structure; new entrants; incumbents; role-playing game industry

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(RPGs).¹ The sector's technological systems comprise the games' rules of play (the core of the system) associated with complementary products collated in books. Until recently, RPGs were not compatible with each other, meaning that players could only use a game's rules of play in conjunction with the complementary products dedicated to it, and vice versa. The 4-year period (1998–2001) of our study witnessed a dramatic shift from multiple networks, unconnected and closed as a result of proprietary strategies, to the connected open network of compatible systems that followed from the introduction of an open system, labeled 'd20,'² by the leader of the sector, Wizards of the Coast (a Hasbro subsidiary).

We selected the RPG industry for three reasons. First, as book publishing is a low-tech activity (OECD, 1995) it provided an opportunity to study open systems strategies in a low-tech sector, in contrast to most of the literature on open systems. Second, all the actors can be identified and only a few firms are diversified. The diffusion of the d20 system through the sector and its consequences on the structure of the industry were relatively transparent and easy to observe. Finally, it gave us an opportunity to avoid retrospective bias by studying an open system in real time during the period leading up to and following its release in 2000. The strategic movements and the diffusion of the system were studied *in vivo* until it had become finally institutionalized.

IMPACT OF AN OPEN SYSTEMS STRATEGY ON INDUSTRY STRUCTURE

Increasing the number of new entrants

Although entry barriers were initially understood to be part of a sector's structural characteristics (Bain, 1956), industrial economics called attention to the capacity firms have to influence the nature and the strength of these barriers (Porter, 1980;

Shepherd, 1990; Tirole, 1988). For the most part, these works envisage reinforcing entry barriers through mechanisms such as cost advantages, capital requirements, distribution access, proprietary assets, and customer switching costs (Scherer, 1980; Porter, 1980). Strengthening these barriers is seen as a means of sustaining competitive advantage. But firms can also weaken entry barriers, voluntarily or not.

Utterback and Suarez (1993) and Klepper (1996) contend that standardization alters the basis of competition and makes entry more difficult. But open systems strategies that promote standardization are likely to have the opposite effect on the strength of entry barriers (Garud and Kumaraswamy, 1993; Economides, 2003). In fact, such a strategy 'lowers the barriers to entry for those who want to produce components' (Langlois and Robertson, 2003: 103). Moreover, openness confers partial or total access to proprietary knowledge, which can reduce switching and incompatibility costs (Farrell and Saloner, 1986, 1992) and the capital required to operate in a sector. As Schilling (1998) notes, new entrants may be able to capitalize on the research and development of incumbents and so enter at a lower cost. We argue that by giving access to the sponsor's technical knowledge, open systems strategies weaken an industry's entry barriers. Kogut, Walker, and Kim (1995) and Wade (1995, 1996) have identified this entry-inducement phenomenon in high-tech settings. We hypothesize that an open systems strategy in a low-tech sector would similarly favor the arrival of new entrants by weakening entry barriers. However, this holds only if incumbents are not protected by complementary barriers to entry (such as distribution networks) that dissuade potential entrants from adopting the open system (Mitchell, 1989).³

Hypothesis 1: The introduction of an open system in a low-tech industry increases the number of new entrants into that industry.

New entrants adopt the open system more readily

Both incumbents and new entrants have strong incentives to adopt an open system once it has been introduced into the industry. They are not

¹ In this article we are concerned only with pen-and-paper RPGs (also called 'tabletop RPGs'). This category should not be confused with computer role-playing games, which use video, nor with live-action role-playing games where costumed players act out the characters' actions.

² The d20 RPG system is based on published rules of play for which any company may freely release compatible complementary products without paying royalties to its sponsor. We explain the functioning of this system further later in this article.

³ We are indebted to an anonymous reviewer for this remark.

confronted with the transient incompatibility costs that result from proprietary systems (Farrell and Saloner, 1986, 1992). But the appeal of the open system also depends on the firm's competitive position and its confidence that the new system can reasonably be expected to succeed (Katz and Shapiro, 1985, 1992; Shapiro and Varian, 1999). According to Langlois and Robertson (1992), larger firms tend to ignore the open system and rely on their own standards. Moreover, they run a smaller risk of being locked out (Schilling, 1998). Conversely, smaller firms may well be at risk of being locked out, and open systems can generate opportunities for low-performing companies to re-enter the market when their own standard has been rejected (Schilling, 1998).

There are other specific incentives for new entrants to adopt a new open system. By doing so they sidestep traditional entry barriers, such as patents and customer switching costs, and can develop products on the basis of the open system without having to develop their own systems, a process that can be time-consuming and costly (Dierickx and Cool, 1989). In addition, new entrants are not held back by the inertia that incumbents can be subject to. Over time, an incumbent firm's history and specific assets tend to result in technological trajectories (Dosi, 1982) or core rigidities (Leonard-Barton, 1992) that bind it to its own systems (Wade, 1996). This path dependency and the inertia it generates have been identified even in low-tech sectors (Hannan and Freeman, 1989). The upshot is that new entrants are generally the first to adopt new designs (Wade, 1995), whereas incumbents usually wait for new entrants to adopt a standard before they support it themselves, creating a differentiate rate of adoption (Mitchell 1989, 1991).

Consequently, even though there may be strong incentives for both new entrants and incumbents to support an open system in a low-tech industry, we hypothesize that potential entrants preferentially adopt such a system.

Hypothesis 2: In a low-tech industry, new entrants adopt an open system more readily than incumbents.

Decreased average firm size

The introduction and the diffusion of an open system into an industry often breaks down isolating

mechanisms (Wernerfelt, 1984) and creates a connected open network of compatible components (Garud and Kumaraswamy, 1993). In such a network, several firms participate in the development of a technological system, each firm eventually developing one or more of its components (Langlois and Robertson, 1992) or modules (Baldwin and Clark, 2003). By contrast, in proprietary closed systems each firm has to develop all the components of its technological system and is constrained to establishing a more integrated structure.

If we accept that an open systems strategy will spur the arrival of new entrants in the industry, and that these new entrants will be more likely to adopt the open system, we can suggest that these firms will be—on average, and at least in the early stages⁴—less integrated, due to vertical specialization (Langlois and Robertson, 1992). Thus, the introduction of an open system should lead to a decrease in the average size of firms in that industry. This argument is supported by observation of the software sector, in which the introduction of open-source software has led to even individual programmers releasing products or providing services (Lakhani and Von Hippel, 2003; Lerner and Tirole, 2000; Von Hippel, 2001). As the open systems strategy has not been studied before in the low-tech sector, we hypothesize that this argument holds true for non-high-tech sectors as well. This hypothesis supposes that, like high-tech industries, a low-tech industry can be modularized and will allow vertical specialization (Baldwin and Clark, 2003).

Hypothesis 3: The introduction and diffusion of an open system into a low-tech industry is followed by a decrease in the average size of firms in that industry.

THE U.S. ROLE-PLAYING GAME SECTOR

Presentation of the RPG sector

In 1973, Gary Gygax and Dave Arneson created *Dungeons & Dragons* (D&D), the first ever RPG (Fine, 2002). This hobby is 'an activity in which a group of people (called the players) creates and

⁴ In later stages, the size of firms may increase as a result of competitive selection and the accumulation of resources.

role-plays characters in a world devised by one other participant, called the Game Master, who describes the results of their actions as well as the actions themselves of everything and everybody else in this created world' (Kociatkiewicz, 2000: 71). Players and the Game Master follow rules of play, collated in books, to create characters and to direct the players' actions. The game consists of a storytelling adventure generally involving three to six people (mostly males of ages 15–35) who take on the roles of selected alter egos and interact orally with other players around a table for often many hours. Players need only pen and paper to keep a record of the adventure and a set of dice to determine the outcome of specific events, such as testing their skills or fighting in combat.

Following its release in 1974, D&D's fame spread rapidly. By word of mouth it soon became a cult hobby across the globe, particularly in schools and universities. D&D's success was phenomenal: translated into more than a dozen languages and sold in 50 countries, it spawned a large number of imitators and competitors. This brought new entrants into the field and led to the emergence of a new industry centered on RPGs. Today an estimated five million people worldwide play an RPG at least once a month—half of them in the United States—with the industry seeing an aggregate revenue of around \$200 million annually.

The RPG sector comprises numerous very small publishing companies. These firms release products in the form of books that contain a game's rules of play, descriptions of fantasy settings and backgrounds, or adventure scenarios. Together, these modules constitute an RPG. The RPG can be considered a technological system, as its modules have to be compatible to be used together. Traditionally, each incumbent develops its own set of rules and complementary products to create a system that is incompatible with the technological systems released by competitors. As game rules are not standardized, buyers have to pay for several books (the game's rules of play⁵ as well as complementary products) to play each RPG. The books are sold in small, specialized stores and over the Internet for around \$25 for the core of a system and around \$10 for complementary products.

⁵ A game's rules of play are the core of an RPG. They set out the mechanisms and rules players need to create characters and manage their actions (fighting, bargaining, riding) as they follow adventures within each game.

The industry structure has historically been characterized by low entry barriers, due to the low capital requirements to enter this publishing activity. Like writing a novel, creating an RPG primarily requires time and a good imagination. Low entry barriers encourage numerous new entrants, increasing the proliferation of RPGs,⁶ which are incompatible owing to their proprietary, closed systems. However, high switching costs for consumers⁷ make it difficult for a new entrant to secure customers, who are locked in by the incumbents' RPGs. These characteristics lead to most publishers having only a small installed base of customers—resulting in low profitability and a small average size of firms.

In the 1990s, competition in the form of substitutes targeting the same customers induced an exogenous shock that dramatically worsened the poor performance that endogenous characteristics had entailed in firms in this industry. The videogame boom began, alongside other new hobbies including trading card games.

In March 2000, the company Wizards of the Coast (WOTC), the uncontested leader of the sector and owner of D&D, announced the release of the third edition of its RPG, under an open license labeled the 'd20 system.' Through this open systems strategy, the sponsor (WOTC) explicitly aimed to promote reciprocal compatibility between RPGs to boost demand and profits via the institutionalization of standardized rules of play, shared by competitors. This constituted the first open system in the sector, drawing overtly from open-source principles inspired by the software industry. The d20 license grants a perpetual, royalty-free, worldwide and non-exclusive right to use, modify, reproduce, and distribute on the market the open content of D&D's rules of play. WOTC gave its competitors access to the greater part of its rules system, but certain specific rules and its trademarks and logos remained

⁶ Ryan Dancey, vice-president of Wizards of the Coast, noted in 2000: 'Every one of those different game systems creates a 'bubble' of market inefficiency; the cumulative effect of all those bubbles has proven to be a massive downsizing of the marketplace. I have to note, highlight, and reiterate: The problem is not competitive 'products,' the problem is competitive 'systems'.'

⁷ Wizards of the Coast's 1999 market survey involved 65,000 respondents, from which a sample of 1000 was studied in depth via a 100-question analysis. Their results found that it took 5 years for a player to learn and master the core rules of a specific RPG (giving rise to high switching costs) and highlighted both the fragmentation of the market and the poor performance of RPG publishers.

proprietary. The immediate consequences of this open systems strategy were threefold. First, any company could release its own products based on D&D's rules of play. Second, the d20 license created an umbrella trademark ('d20') for compatible RPGs—whatever the publishing company, any product using the d20 system must be labeled with the WOTC's d20 logo, to indicate to consumers that it is compatible with other d20 products. Third, as a handful of specific D&D rules remain the property of WOTC, any firm using the d20 license to develop its own products must include a note on the cover of its products that it 'requires the use of a Roleplaying Game Core Book published by Wizards of the Coast, Inc.' Consequently, although the d20 license constitutes an open systems strategy, it does not prevent the sponsor drawing revenues from the sales of the core D&D book.

Sample and data

For the purpose of this study we have compared the structure of the RPG sector before and after the introduction of the d20 open license. Our comparison is between the 2-year periods of 1998–99 (before the introduction of the d20 license) and 2000–01 (after the introduction of the d20 license). These periods can legitimately be compared, as the U.S. market segment encompassing RPG products did not witness a drastic evolution over these 4 years.⁸ After collecting qualitative data on the industry from RPG publications (*Comics and Games Retailer*, *D20 Magazine*, *Dragon Magazine*) and Internet websites (D20 Reviews, Game Manufacturers Association, Game Publishers Association, GameSpy, Gaming Report, RPGA Network, RPGNow, RPG Planet, Wizard's Attic), we established an exhaustive list of the 193 active U.S. companies publishing RPGs and compiled a database comprising three firm variables: age, size (number of employees), and technological system adopted (the open system vs. proprietary systems). These data were collected from company websites.⁹ We collected information

⁸ According to the Toy Manufacturers Association, the turnover of this segment was \$1732 million in 1999 and \$1661 million in 2000.

⁹ We also sent a short e-mail questionnaire to all of the companies within the sector, receiving 51 responses (a response rate of 26.6%). These responses demonstrated that the information collected by questionnaires was congruent with the information available online, assuring us that the websites provided valid

on the age variable for 147 companies and on the size variable for 136. Data on the technological system adopted were available for all 193 cases. Our statistical analysis comprises the quasi-totality of the population in the industry.

Results

We hypothesized that the introduction of an open system in an industry would favor the arrival of new entrants (Table 1). Hypothesis 1 was strongly supported by our chi-square analysis. The 2000–01 period saw 78 new entrants into the RPG sector, with only 20 new entrants in the 1998–99 period ($c^2 = 12.35$, significant at the 0.01 level).

Of the 78 new entrants in the 2000–01 period, 51 adopted the d20 license (Table 2). This proportion was markedly greater than for incumbents, strongly supporting Hypothesis 2 ($c^2 = 17.89$, significant at the 0.01 level). New entrants were found to adopt the new open system more readily than incumbents. These new entrants were essentially players and former freelancers operating within the sector who saw the d20 as an opportunity to avoid the prevailing development costs and switching costs for players, and so decided to launch their own company. It should be noted that some firms,

Table 1. New entrants in 2000–01 and 1998–99

Period	New entrants	Incumbents	Total	Average size of firms (number of employees)
2000–01	78	69	147	2.76
1998–99	20	49	69	5.02

Table 2. Technological systems adopted by incumbents and new entrants in 2000–01

	New entrants	Incumbents	Total
d20 System	44	2	46
Proprietary System	27	48	75
Both d20 System and Proprietary System	7	19	26
Total	78	69	147

information. We then sent our analysis of the evolution of the sector to these participants and encouraged their comments. The detailed feedback they provided was congruent with our analysis and increased the internal validity of the study.

both new entrants and incumbents, coupled the open system with development of their own proprietary game's rules of play. Moreover, 27 new entrants did not adopt the d20 license. This figure corresponds roughly to the number of new entrants during the 1998–99 period (i.e., 20). This confirms that the two periods (1998–99 and 2000–01) are comparable and that no exogenous variable has drastically modified the economic context of the industry. We can then attribute the new entries in the RPG industry in 2000–01 to the introduction of the d20 license per se.

We hypothesized that the diffusion of an open system into an industry should lead to a decrease in the average size of companies in that industry. Our ANOVA result strongly supports this hypothesis ($F = 8.739$, significant at the 0.01 level). Indeed, even though RPG companies have traditionally been very small, their average size became even smaller after the diffusion of the d20 system (reducing from an average of 5.02 down to 2.76 employees).

DISCUSSION

This research may be the first to test empirically the impact an open systems strategy has on the structure of a low-tech industry. The validation of our three hypotheses implies that introducing an open system into an industry favors new entries into that sector by weakening entry barriers for firms adopting the open system. This adoption by new entrants in turn spurs the diffusion of the open system. The combination of new entries and the diffusion of the open system leads to a decrease in the average size of companies within the sector, at least in the early stages. We were able to clearly observe new entries, as there are no other major barriers to entering this sector. By contrast, entry inducement could be less significant in the case of a high-tech sector with additional entry barriers such as a sizeable capital requirement.

In the RPG industry, the introduction of an open system has been successful as far as diffusion is concerned. However, diffusion of the d20 license does not imply a systematic increase in the individual performance of firms, whether sponsor, incumbent, or new entrant. As new entrants adopt the open system, they become competitors both for the sponsor and for incumbents, creating fierce intra-standard competition (Quélin *et al.*, 2001). Further

research could contrast the survival rates of firms, both new entrants and incumbents, in the mid-term, according to whether they adopt the d20 license or not.

The success of the diffusion of the d20 license relies on strong incentives for the different participants in the industry. For the sponsor (WOTC), the incentives to launch such an open system essentially lay in the crisis situation the entire sector confronted in the 1990s exacerbated by its fragmentation, in the opportunity to gain access to a larger installed base of customers following the decrease in switching costs that standardization would bring about (Farrell and Saloner, 1986), and in the development of complementary products compatible with its own products. Incumbents and new entrants have the same incentives to adopt the d20 as the sponsor, but also benefit from the sponsor's reputation. As a leader, WOTC generates positive expectations about the success and the longevity of the new standard (Katz and Shapiro, 1992). Moreover, the d20 trademark and logo provide a rapid means of differentiation in a market characterized by a crowded supply. We imagine that these incentives would particularly hold true for incumbents with a weak competitive position and for new entrants who have not developed their own brand and installed base of customers. However, another specific incentive plays a crucial role for the adoption of the d20 license by new entrants. By adopting the open system, new entrants benefit from the leader's investment in the development of a game's rules of play and do not have to develop their own full set of rules, which means they can enter at a lower cost (Schilling, 1998). These incentives explain the rapid diffusion of the open system through the RPG sector and particularly its massive adoption by new entrants. But for incumbents, these incentives are moderated by their relative competitive position and their inertia. Some firms too, whether new entrants or incumbents, may choose a proprietary strategy from which to create their own technological system. These moderated effects may explain why some companies have chosen not to adopt the d20 license.

Beyond the specific case of the RPG sector, our research provides new insights in several areas. The first concerns open systems strategies. Our study shows that application of this new kind of strategy is not limited to high-tech sectors, and particularly to IT industries. Moreover, our

survey demonstrates that an open systems strategy might be employed purposefully to create an entry induction phenomenon, by giving others access to knowledge that has previously been proprietary (Garud and Kumaraswamy, 1993; Kogut *et al.*, 1995). The wave of new entries in the RPG industry is an emerging effect of the openness of the d20 license that WOTC introduced to standardize its industry. Operating as free riders, new entrants draw benefits from the open system sponsored by an incumbent, but in the meantime generate organizational support and create bandwagon effects. This suggests that a sponsor is not constrained to looking for organizational support only among incumbents, but might also obtain this support by acting to promote the access of new entrants into the sector. One refreshing consequence is that new entrants are not only rivals of incumbents (e.g., Baumol *et al.*, 1982), but also potential allies. This support could enable a sponsor to impose its standard by modifying the structure of its industry. We propose that the advantages of the open systems strategy lie precisely in its capacity to modify industry structure.

Secondly, the case of the RPG industry shows that the nature and the strength of entry barriers are dependent on structural conditions (Bain, 1956) and the actions of incumbents (Porter, 1980; Tirole, 1988; Shepherd, 1990), but also on the strategies adopted by the new entrants themselves. In the RPG industry, the introduction of an open system was an action of an incumbent that had an impact on entry barriers (especially switching costs), but the strength of these barriers depended on the strategy implemented by new entrants. A new entrant adopting the open system faces weak entry barriers compared with a firm choosing to develop its own entire technological system. Consequently, entry barriers are not equal for each new entrant but are dependent on the business model it adopts. The new entrant's strategy to some extent determines the entry barriers it faces. In other words, entry barriers are in part endogenous to new entrants, as they are affected by both the incumbents' and the new entrant's strategies¹⁰.

Finally, and more generally, this article participates in the debate over the relationship between industry structure and the strategies of firms. Our findings have deepened this relationship by

illustrating the effect a specific strategy (open systems strategy) can have on an industry's structure. Thus, we encourage researchers to continue exploring the long-established industry structure/strategy debate—a debate that is infinitely renewed by the strategic creativity of firms.

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