

THE POWER OF NON-CONTRACTUAL INNOVATION

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Currently, all major IT and telecom firms are busy trying to stimulate non-contractual complementary developments around their own core competences and offerings. But little has been done to explain the logic, strengths, and weaknesses of non-contractual innovation. The literature on open-platform leadership recognises the importance of non-contractual innovation, but only within the limited confines of a normative approach based on two implicit assumptions: that a platform's core and periphery are sharply and easily differentiated and that platforms are always grown and orchestrated from a monolithic core. Through analysis of two cases of decentralised open innovation: the emergence of video rental stores and the emergence of desktop-publishing systems. I argue that these assumptions do not apply to all open platforms. I conclude that by forcing a hierarchical framework onto the analysis, the normative approach underplays the role of non-contractual innovation and turns a blind eye to the radically self-organised and unforeseeable nature of some platforms' success.

Keywords: Contracts; hierarchy; collaboration; coordination; platform; modularity; emergent innovation; innovation strategy.

Introduction

*In their purest forms, markets motivate and hierarchies coordinate.
Have we learned to combine the best of both? (Day and Wendler,
1998, p. 4)*

“Open innovation” is the mantra of the day. Six major books (Chesbrough, 2003a; Chesbrough *et al.*, 2006; Gawer and Cusumano, 2002; Iansiti and Levien, 2004a; Malone, 2004; Von Hippel, 2005) and a good number of articles (Chesbrough, 2003b, c; Cusumano and Gawer, 2002; Iansiti and Levien, 2002, 2004b) published in

the last few years expound on the imperative need to reach outside the firm's boundaries to mobilise not only production and marketing resources, but also inventive acumen and innovative drive. In this paper, I want to emphasise an important element of the open innovation phenomenon that is underplayed in the pertinent literature: the fact that external innovative resources can be accessed through two very different routes or mechanisms — contractual and non-contractual. I also intend to show how decentralised and difficult to manage non-contractual innovation can be.

Our views on non-contractual innovation (NCI) have changed dramatically over a short time. In a few years, we have gone from thinking that it was a metaphysical impossibility, if we thought about it at all, to comparing notes and reading best-selling books about how best to tap its power.

Gawer, Cusumano, Iansiti, and Levien have contributed to putting NCI on the conceptual map, but, in my view, they have not done so in a satisfactory manner. While they describe many interesting cases of NCI, and even expound at length on how best to leverage its power, they do not put the spotlight on this phenomenon. First, they neglect to differentiate between contractual and non-contractual innovation, as if that difference were insignificant. Second, they seem to take for granted that NCI exists and that it matters, but do not explain why it exists and why it matters, as if such an explanation were not needed.

In addition, these authors introduce, explicitly or implicitly, three misconceptions about NCI. First, they choose to take a normative approach to it. As a result, they present it as an essentially manageable process, and it comes across as a deliberate strategy, always controlled, or at least orchestrated, by a focal firm. Second, they imply that NCI is the direct result of “open modular platforms”, without which it simply would not happen. Last, they suggest a neat core–periphery dichotomy, whereby the essential core competences would be kept in-house or carefully contracted, and only the nonessential complementary competences, technologies, and services would be elicited from the market without the use of contracts.

In this paper, I will address these shortcomings of the literature. I will first show that non-contractual innovation is very different from its contractual counterpart. I will then show that a normative approach that presents NCI as a peripheral, nonessential, and manageable consequence of open platforms is an oversimplification that does not do justice to the variety and power of non-contractual innovation processes. This second argument is backed up by a detailed analysis of two cases of decentralised open innovation: the emergence of video rental stores and the emergence of desktop-publishing systems.

Beyond Contracts

The centrepiece of a capitalist economy is the business contract. Contracts come in a myriad of forms and have very varied roles. One of their possible uses is to extend

a firm's innovative power. By means of contracts, a firm (or an individual, for that matter) can come to control many innovative resources that it does not own. Thus, it can exploit business opportunities more rapidly by enlisting, to some degree, the inventive power of the market. A sophisticated contractual economy both results from and feeds a process of progressive specialisation, which is a major source of wealth creation (Langlois, 1992).

As powerful as contracts can be in directing and combining dispersed resources towards profitable uses, they have some drawbacks that are often glossed over by practitioners and theoreticians. An innovation contract, even one based on a modular product architecture, constrains an innovative effort in at least four different ways¹:

- i. By choosing a specific supplier and sharing with it only the pertinent proprietary information, it tends to exclude the rest of the world from contributing to that particular innovative task.
- ii. By narrowly specifying the pertinent deliverables, it tells the supplier not to consider possible improvements that do not relate to the problem, task, or objectives spelled out in the contract.
- iii. By establishing a tight budget and a strict time schedule, it forces the supplier to work in ways that might not be entirely optimal.
- iv. By putting a cap on the supplier's upside profit opportunity, it also puts a cap on its incentive to excel in the task at hand.

By contrast, the system integrator that opens its platform to all comers is giving them *carte blanche* to do what they want, when they want, and to seek as much profit as they can from their contributions. In favourable conditions, non-contractual collaboration can thus be superior to contractual collaboration by offering both more powerful incentives and a greater inventive flexibility to a much larger group of potential contributors. Let me elaborate on the flexibility gains that can be derived from a non-contractual collaboration.

A key argument in favour of modular contracting is the greater design freedom that it affords to innovative suppliers (Baldwin and Clark, 1997). Since they need to conform only to the minimal constraints imposed by a set of lean interfaces, module suppliers face a universe of potential solutions considerably richer than the one they would face if they were working on a tightly integrated system. Modular contracting thus not only lowers coordination and substitution costs, but also broadens the search space available for invention and business opportunity (Langlois and Robertson, 1992). But it does so only for a select group of certified suppliers — or distributors,

¹The General Public License and other similar licences used in open-source communities are an interesting exception in that, while they involve contractual agreements that limit how the licensee can capture value from its creation, they do not constrain the licensee's creativity in any other way.

as the case may be — and only within the constraints of the contracts that they have signed with the focal firm. Non-contractual collaboration broadens the collective opportunity space in additional ways and directions by adding the flexibility afforded by informal, open-ended, freely flowing interactions to that afforded by modular architectures.

In a rich and dynamic knowledge environment, innovation contracts will tend to be over-specified and thus limit the universe of solutions available, as well as the universe of problems and opportunities identified and deemed worthwhile to work on. By contrast, the strength of networks of non-contractual innovation is their power to mobilise distributed local knowledge not only as regards effective problem solving, but also as regards effective problem seeking (Benkler, 2004; Von Hayek, 1945). The result will be a more open-ended and fertile innovation process.

Bill Gates seems to understand this well. On 10, March 2000, in a speech he gave to the *Game Developers Conference* on the occasion of the launching of the Xbox videogame console, he told the assembled developers, “It’s very exciting to be here today and have the opportunity to announce a whole new platform, one that all of you are going to take in directions that we can’t even imagine” (Takahashi, 2002, p. 219).

Gates’s statement underscored the essence of the non-contractual approach to innovation. Rather than telling a specific group of developers what they should do for the Xbox, by what date and under what terms, Gates was telling the developer community at large, “Here’s a new platform. Here are the keys to its various doors — its open interfaces. See what you can do to help us make it a winner ... And may the market reward you generously for your contributions!” Gates was carrying no “stick”. He was showing potential complementors a nice big “carrot” (an open, fertile platform) and giving them full freedom to decide what to work on, how to do it, and by when.

In summary, then, while contingent claims contracts can be extremely useful for decentralising the execution of routine tasks, they may not be so useful for decentralising the search for innovative solutions, particularly solutions to problems and opportunities that the contractor is far from being able to fully specify. In cases in which uncertainty about pertinent problems and solutions is high and the relevant knowledge is widely dispersed, closing the door to non-contractual innovation is bound to be suboptimal.²

²Yochai Benkler, in a recent discussion of communitarian modes of innovation, expressed the main idea well: “Decentralized systems trade information for control. The more uncertainty there is about the best courses of action for any given agent or group of agents, the more valuable is information relative to the value of control” (Benkler, 2004, p. 320).

Being so open-ended, however, a non-contractual innovation approach may surprise the system integrator either positively or negatively. The upside of this approach is that the market may come up with fantastic contributions that the integrator never imagined. The downside is that the integrator cannot expect a non-contractual open market always to meet its deadlines, targets, and expectations, as a trusty subcontractor would. Sometimes complementors will exceed the integrator's expectations, but at other times they will fail to even approach them.³ At still other times, non-contractual innovators, if given a chance, may transform a complex system quite against the will and plans of the system integrator, as we shall now see.

Beyond Design: Emergence of Video Rental Stores

Gawer, Cusumano, Iansiti and Levien — based on ideas that go back to Clark (1985), Moore (1993), Morris and Ferguson (1993), and Greenstein (1998) — have produced a powerful archetype of the process leading to a successful technological platform. This view tells us that a new platform needs a visionary leader at its centre, a firm inventive enough to build a fertile core and then enlightened enough to make that core accessible to third-party developers, so that they may add a periphery of complementary products and services. Once the emerging platform has demonstrated sufficient value-creation potential, self-organised market processes should take over. The platform leader can then “sit back and see the industry coalesce around” the platform (Gawer and Cusumano, 2002: 99).

There are thus three logical stages to a successful platform's life cycle: the building of the core, the opening up of the core, and the subsequent growth of the periphery.⁴ The first two processes are deemed to be centralised, whereas the last is very decentralised.

Notice the pre-eminent role granted to the focal firm as chief architect overseeing and managing the entire process. It chooses whether and when to open a platform, chooses what to open and what to close, and keeps control over the essential core elements of the platform (Gawer and Cusumano, 2002, p. 9; Iansiti and Levien,

³A recent article in Canada's *Financial Post* provides a good illustration of the fact that sometimes the market fails to match the platform leader's expectations. As the authors recount, frustrated by the inadequate offering of the various machines attempting to compete against Apple's iPod on the basis of Microsoft's digital music format and software, Microsoft is about to embark in the manufacturing of its own iPod-like machine. According to the authors, “None of Microsoft's partners are doing the job that needs to be done, said Michael Gartenberg, an analyst with Jupiter Research, in New York. ... This would not be the first time Microsoft has decided it needed to take control of its own destiny with regard to hardware, Mr Gartenberg added” (Bass and Armitage, 2006: FP1, FP5).

⁴By “opening of the core” I do not mean that the core becomes transparent to all. On the contrary, in a modular architecture, only the interfaces linking the different modules should be transparent.

2004a, p. 158; Morris and Ferguson, 1993). Non-contractual innovators may come to add a great deal of value to the platform, but all that is nonessential “gravity”. The essential work has already been done by the platform leader and its close subcontractors.

While this archetypal view of a successful platform-building process might be useful as a pedagogical or consulting benchmark, it does not always fit the facts. It offers an account of NCI that is much too simple and predictable. Non-contractual innovators do not generally fit the profile of docile agents, willing to be led here or there, waiting to be told how to use their wits. They may be an unruly mob, with an agenda of their own, one that can be a lot more farsighted and inventive than that of any self-anointed “platform leader”. A platform does not look the same seen from the core and from the periphery. When non-contractual innovators are allowed into the platform-building process, it can no longer be assumed that the platform leader will lead and the periphery will follow.

In this section and the next one, on the basis of two innovation episodes taken from recent history, I will propose an alternate, more open-ended view of the platform-building process. First, using the story of the video-cassette recorder (VCR), I will show that NCI can be totally unforeseen and unintended by the focal firm, that it can be the cause rather than the consequence of the opening of a platform and that, far from being a mere source of nonessential complements, it sometimes has the power to transform the competitive dynamics of an entire industrial sector in drastic and surprising ways.

The battle for the home VCR market, pitting a Sony-led coalition against a rival coalition led by Matsushita and its subsidiary, JVC, in the early 1980s marked a watershed in our understanding of competition in high-technology markets. The rapid and total demise of Sony’s Betamax format alerted us to the fact that architectural competition can be totally different from brand-level competition. Most explanations of Betamax’s demise that have appeared in the management literature, however, tend to miss the most interesting part of the story — one that does not fit well the standard theory of the emergence of successful product platforms.

The analysis of the VCR story offered by management theorists is too focused on trying to explain why Matsushita’s VHS format won the battle for market supremacy (Cusumano *et al.*, 1992; Nayak and Ketteringham, 1986). With this focus, they have tended to overlook the more interesting question of why the loser, Sony’s Betamax, had to disappear (Olleros, 1995). As a result, they have missed a number of insights that can enrich our understanding of the role that non-contractual innovators can play in architectural competition.

Before 1980, the VCR market was a very conventional one, dispensing meritocratic rewards to the various options offered, with minimal inertia. Market shares were elastic, ever sensitive to moves by the various contending players,

and the market was wide open to new entrants equipped with superior technologies. Commercial success was therefore precarious, regardless of the market share attained. In such a market, the war between VHS and Betamax — and Philips's V2000 system, and perhaps several other incompatible platforms — would never have ended. The world VCR market would have always been shared by several options, more or less proportionally to their relative merits. Dominant positions would have been contestable — as was Betamax's own short-lived monopoly, prior to VHS's launch — and marginal positions would have been quite sustainable.

After 1980, the VCR market was quickly transformed into one with only two serious contenders (Betamax and VHS) and only two possible long-term equilibriums: world monopoly by one or the other. Hence, at a critical branching point coinciding with the takeoff of the US market, a quick and decisive battle was waged. Beyond that point, the trend towards the chosen monopoly became increasingly self-reinforcing and irreversible, first in the USA and then abroad. The JVC-Matsushita team and its allies hardly had to move a finger to take VHS from 60% of the US market to 100% of the world market. The market, in a way, did it alone.

Who caused this drastic change in market dynamics? Not Sony or Matsushita, nor the big Hollywood studios, but thousands of small, family-owned video clubs, which, by developing a huge and vibrant video-rental market, opened up the VCR system and caused the emergence of the strong network externalities that skewed the market towards a “winner-take-all” dynamic.

And who then proceeded to abandon Betamax? Again, no major player initiated the dump-the-Betamax bandwagon. A relatively small contingent of independent video clubs did that too. Let me explain how this all happened, mostly in the US, in a matter of a few months.

Let us backtrack to the mid-1970s. The VCR, regardless of its format, had originally been designed as a closed, self-contained system. Until about 1980, that is precisely what it was — a machine with only two possible uses: recording and replaying television programmes, and viewing homemade videos. The first use only required that the VCR be compatible with a standard television set. The second use required compatibility between the VCR and a video camera. Since all suppliers of VCRs were capable of supplying compatible cameras as well, this never posed a problem.

Everyone thus expected the VCR market to allow a multiplicity of incompatible closed systems to coexist in a fairly meritocratic regime. Had things stayed that way, every platform leader would have always been able to offer a complete system to potential buyers. As a result, dominant positions would have been contestable, marginal positions would have been sustainable, the market would have stayed wide open to the entry of additional platforms and the war for the VCR market would have never ended. Sony, after losing its leadership position, could have survived

and thrived with 40% of the world market and perhaps even mount a counterattack for world leadership.

But, as the VCR (against everyone's expectations⁵) became primarily a machine for viewing pre-recorded movies, users suddenly had to worry about making choices that would be compatible with their main source of "programming", the nearest video club. In the early 1980s, as more and more video clubs chose to side with VHS, their clients had no choice but to follow suit.

And why did all the video clubs in the world decide to abandon Betamax? Very simply, the small and poorly financed video clubs could not afford to keep supporting two different formats of every film and had little to gain from doing so. As the number of titles to stock ballooned in the USA, American video clubs were forced to choose between drastically reducing their stock of titles and dropping one of the competing formats. In 1980, an important minority of American video clubs decided to let go of Betamax, by then already the second seller, and those local decisions triggered the global snowball dynamic — they sent a clear signal not only to potential buyers of new machines, but also to the Hollywood majors, systems manufacturers and wholesalers, and video clubs that were still undecided (Redmond, 1991, p. 178). The resulting bandwagon soon became unstoppable.

From that point on and increasingly, the loser in the market battle (Sony) became unable to support its platform, since it could no longer offer a complete system. The market (i.e., non-contractual innovators in the form of video rental clubs) had turned its back on any platform that was not the best-selling platform. Thus, somewhat paradoxically, movie-video retailers turned out to be the decisive link in the establishment of a world standard for VCRs because they were the weakest link in the entire VCR value chain. *A priori*, this seems counterintuitive. One would have expected either the VCR manufacturers or the Hollywood majors to have had the greatest impact on the market's dynamics.

Why were the tiny video clubs so crucial to the market's transformation and the establishment of a VHS world monopoly? First, they were so thinly financed and so overwhelmed by the explosive growth of titles to stock that they needed a clear VCR standard more urgently than any other party. Second, their extreme fragmentation left no room for strategic manoeuvres by the Betamax coalition to short-circuit a global bandwagon in favour of VHS.

⁵Sony and Matsushita surely foresaw a video rental market developing. But they could not conceive of the VCR being part of that scenario with Hollywood being so set against the VCR. The understanding among experts at the time was that this particular application would go to the videodisc platform, which, unlike the VCR, had full support from Hollywood, since it did not allow recording or copying by users (Redmond, 1991, p. 182; Wasko, 1995, p. 131). Alas, the failure of the videodisc to take off completely altered that scenario.

Indeed, in the final analysis, Betamax was killed by the extreme fragmentation and non-contractual nature of the video rental market. Had barriers to entry in the video rental market been high from the start, or had this market been co-opted by an established retail oligopoly (say, Sears, Wal-Mart, and a few others), there would have been only a handful of large video rental chains in each country in the early 1980s. In such a scenario, Sony, just like Matsushita and perhaps even Philips, could have established exclusive distribution contracts with several prominent retailers across the world. This would have secured the long-term viability of Betamax almost regardless of its world market share. But the video-rental industry started from scratch everywhere, and barriers to entry were minimal. As a result, Sony and Matsushita faced an extremely fragmented retail market whose allegiance could not be secured by contract. It could be swayed only by the allure of a best-selling brand. Such an allure, on the other hand, this market could not resist. Indeed, it demanded it. When it mattered, only one platform offered retailers the clear prospect of a best-selling solution, and only that platform survived, first in the USA and then everywhere else.

The distributed nature of this market transformation merits emphasising. To the question “Who decided to open the VCR architecture?” the answer has to be “No one in particular.” Certainly not the engineers at Sony, Matsushita, or JVC.⁶ A list of individuals and institutions that played an important role in the opening of this system would have to include, well ahead of the VCR manufacturers and their partners, the following (Lardner, 1987; Wasko, 1995):

- i. Andre Blay, a Michigan entrepreneur, pioneer of sales of movie videos to home users.
- ii. Steven Roberts, President of 20th Century Fox Telecommunications. In the 1970s, Roberts was the only top executive at a major Hollywood studio capable

⁶Someone bent on offering a more conventional interpretation of the VCR story might argue that Matsushita’s faster development of a 4-hour VCR system (an advantage that turned to be critical in propelling VHS to a dominant position in the US market) proved that firm’s superior foresight in anticipating the emergence of the video rental market. The transformation of the VCR market would thus appear as an unsurprising event, intended and engineered by the leader of the winning platform, as the normative model would suggest. The facts, however, do not allow for such an interpretation. Historical accounts tell us that Matsushita was as surprised as Sony by the emergence of this market (see Footnote 5). It turns out that Matsushita developed the all-important 4-hour machine simply because RCA, keen on offering US buyers a machine capable of recording an entire football game, insisted on this as a condition for its backing the VHS platform (Lardner, 1987; Nulty, 1979). Here is yet another example of a decisive outcome triggered by a peripheral player’s pursuit of its own, in this case somewhat myopic, interests.

of seeing the VCR in a positive light. In July 1977 he sold Andre Blay non-exclusive rights to 50 classic films from the Fox collection. Just 6 months later, Blay was selling 30,000 movie videos per week, despite the fact that all other studios were still ignoring him. In September 1980, Warner Brothers decided to create Warner Home Video. Soon after, all the major studios and distributors capitulated to the lure and promise of the new technology. Today, the studios make more money through the video clubs than at the movie theatres.

- iii. George Atkinson, a Californian, pioneer of the movie-video rental market, and founder of the first chain of video clubs. His role was critical not only for having proved the enormous potential of the rental market, but also for his leadership of the Association of American Video Clubs in their frequent confrontations with the Hollywood majors. The latter, blind to the fact that it was in their business interest to facilitate the growth of the video film rental market, sought for years to kill that market.
- iv. The United States Supreme Court, which, against the myopia and machinations of some Hollywood studios (Disney and Universal, in particular) decided to affirm, on 17 January, 1984, by a one-vote margin, the legality not only of the sale of videocassette recorders, but also of the sale *and rental* of movie videos.⁷ The dynamics of the VCR market, in the USA and abroad, would have been very different had the rental of video films been outlawed, as the Hollywood studios wanted. Instead of indirect and global, in a sale-only market, network externalities would have been primarily direct and local and a world monopoly would not have been created.
- v. Philips, Pioneer, RCA, MCA, and all the other advocates of the videodisc, which, despite having the full support of Hollywood, failed to get their act together in time to offer the market a common and compelling videodisc platform. Had they succeeded in so doing, the videodisc would have cornered the market for movie-video sales and rentals (as its direct descendant, the DVD, is doing now, more than 20 years later), and the VCR would have stayed a closed system and been a footnote to the videodisc's success.

What lessons can we learn from the VCR story? The main one, in my opinion, is that we need to reconsider the roles ascribed to core and periphery players. The core does not always lead and the periphery does not always follow. Consider what

⁷The legal battle pitted Disney and Universal against Sony, the market pioneer. Thus, one of the ironies of the VCR story is that the firm that ended up going all the way to the US Supreme Court in defence of the right of video rental clubs to exist was Sony, practically the only firm to be negatively affected by their existence.

independent video clubs across the world did for the VHS platform. They single-handedly created a totally new ancillary market that added massive amounts of value to the VCR system. In doing so, they also triggered the move of the VCR market to a new selection dynamic that saw VHS go from being the best-selling platform at a particular time in the US market to being the sole dominant platform across the entire world for over two decades. All of this happened against the expectations and desires of the main principals, Sony and Matsushita, and of the logical candidates to usurp their platform power, the Hollywood studios.

The emerging theory of successful platform building seems to assume that a platform leader will generally have the strategic initiative simply by being the platform's initiator. That certainly was not so in the case of the VCR. The script that the VCR industry followed was not at all the one foreseen or intended by the two main platform leaders. Neither Sony nor JVC/Matsushita had anything at all to do with the industry's entering a new competitive dynamic that caught them both by surprise. Moreover, the challenge to the platform leaders came not from the logical quarter, the Hollywood majors, but from the collective power wielded by a multitude of independent video clubs coordinated only by their common desire to exploit a new and evident business opportunity.

The opening of some platforms fits the archetypal mould well: orderly and rational, managed from the centre, accepted by the periphery.⁸ The opening of the VCR, on the other hand, was a thoroughly chaotic affair, full of misperceptions, myopic choices, legal battles, missed opportunities, and surprising results. At times it resembled a Hollywood business comedy, starring dozens of different actors, the big studios themselves at the centre of the action, and of the inaction.

The VCR story is all about the periphery's refusal to play by the rules set out by the core players (the Hollywood majors in particular⁹). This does not mean that the periphery had an explicit alternative industry blueprint that was followed instead. The VCR story is not about the clash of two contrary plans. It is, rather, about the clash of a well-thought-out plan and an unplanned, self-organised process driven by the desire of many independent agents to exploit some platform potentialities that the platform leaders had not foreseen. The video clubs never foresaw or intended the larger consequences of their actions.

⁸Videogame consoles, for example, opened up in a very orderly and controlled manner in 1982 (Sheff, 1993, p. 87).

⁹Unlike Sony and Matsushita, who had never intended to grab the movie-video market from the videodisc, Hollywood did have a definite and very destructive agenda in mind: first, try to kill the VCR; failing that, try to kill the movie-video rental market. Luckily for us all, and for Hollywood as well, the video rental clubs prevailed.

It is also worth emphasizing that the video clubs played such a crucial role in defining the dynamics of the entire sector not because they were tightly knit, powerful, and well organised, but because they were extremely fragmented, poorly financed, and quite disorganised. The conventional, market-sharing, competitive dynamics broke down simply because the weakest link in the system could not sustain it.

Thus, just as the opening of the VCR system was a totally decentralised process, so was the worldwide standardisation that followed. The emergence of the VHS world standard was not dictated, planned, foreseen, negotiated, or even wanted by anyone in particular. It was the result of a self-organised, indeterminate process, in the best tradition of the emergent dynamics so often observed in nature (think of the construction of a termite colony) or in human society (think of the development and evolution of a natural language).¹⁰

Despite leaving plenty of room for self-organised processes in the growing of a platform's periphery, the normative view of platform building emphasises the power of centralised strategic choices at the core, as a prerequisite to "getting things rolling in the right direction". The VCR story is all about the power of the periphery to decide, in a completely decentralised way, what "the right direction" for a platform really was.

Complex systems are not necessarily shaped by platform leaders following some sort of platform blueprint. They can be just as decisively shaped by peripheral entrepreneurs in small and large firms, as well as by the legislators and the courts of law, among other institutional forces.

In the end, the VCR story should boost our confidence in the sometimes inscrutable logic of the market. After all, if the suboptimal agenda of the massive platform leaders was upstaged by the collective effort of thousands of tiny peripheral players, it was simply because the latter offered more value to everyone. This story did have a Hollywood ending, after all.¹¹

¹⁰The establishment of the VHS world monopoly was a self-organised process since there was no central agent orchestrating individual choices, but it was not a pure case of "emergence". Strictly emergent processes arise from purely local interactions and learning (Johnson, 2001). This was not the case for the VHS monopoly. The fact that the global result of the battle (i.e., the overall trend in the distribution of market shares) was public knowledge even as the battle was in progress, accelerated immensely the standardisation bandwagon.

¹¹Here is another ironic twist in the VCR story: Hollywood, the great foe of the VCR, and even greater foe of video rental clubs, has become their greatest beneficiary. Hollywood made all the wrong assumptions and all the wrong choices — first, siding with the videodisc, then campaigning against the VCR, then campaigning against the rental of tapes — and yet came out the biggest winner. Today, Hollywood revenues from the home-video market are almost three times higher than are box-office receipts.

One final lesson I would like to draw from the VCR case has to do with the prominent role played by retailers in the transformation of the VCR market. If NCI is generally underplayed in the literature, innovation by retailers is nowhere to be seen. This blind spot needs correcting, and the VCR case is a good one to argue this point.

Just like complementors, retailers are free agents interested in riding on a winning platform. If a few large players happen to dominate a retail market, the challenge of enticing some of them to favour a particular technological platform will not be very different from that of enlisting the support of some key complementors. But when retail networks are very fragmented, as they often are in worldwide mass markets, these two challenges become very different, as can be seen in the VCR case. As Sony learned, too late for its own good, the chances of survival of a losing platform in a mass market will depend crucially on whether or not exclusive retail deals can be secured before the battle for market domination goes into overdrive. Alas, as the VCR battle of formats began to unfold, the market for movie-video rentals — the ancillary market that no platform leader had foreseen — started calling the shots, and its fragmented structure left no opening for the losing platform to negotiate a survival niche. Betamax was dead.

Some of these intriguing elements of the VCR story (namely, the power of non-contractual innovators to contribute critical elements of a winning package and to transform the architecture and dynamics of a platform) are also present in the early history of desktop publishing. Just as non-contractual innovators unexpectedly opened up the VCR and triggered a decisive winner-take-all battle of standards, non-contractual innovators unexpectedly and quite independently came up with all the elements of a totally new application for personal computers just in time to save a powerful new machine that was desperately looking for a profitable niche, the Apple Macintosh.

Despite its surprising twists and turns, the evolution of the VCR platform still fitted the normative archetype to the extent that it did have an unambiguous core and an equally unambiguous periphery. The VCR story leads us to question the presumed readiness of peripheral players to follow the operational framework set-up by an enlightened platform leader. As we shall see next, the story of the invention of desktop-publishing underscores the importance of self-organised, open-ended innovation processes even more. It not only questions who is the effective leader in a platform's evolution, it even questions whether we can assume that there will be an unambiguous core and an unambiguous periphery in a given platform, to begin with.

Beyond Hierarchy: Emergence of Desktop-Publishing Systems

Few platforms in recent history have offered more opportunity value than the original Apple Macintosh. Unfortunately for the Macintosh, and for the world, few companies in recent history have been as reluctant to share their platforms as

Apple has been. The irony of the Macintosh story is that this most famous of closed platforms was saved from oblivion — not once, but twice — by non-contractual innovators. Here’s how it happened.

In January 1984, Apple launched the Macintosh, the first computer with a graphical user interface aimed at the mass market. The Macintosh was an impressive machine, and so were two other pieces of complementary hardware that Apple launched a few months later: LaserWriter, one of the first laser printers targeted for the mass market, and AppleTalk, a simple but dependable LAN system, meant to allow the local sharing of the expensive laser printer by several Macintosh.

Unlike AppleTalk and the Macintosh, the LaserWriter was not quite an in-house Apple creation. Canon provided the critical piece of hardware, the printer’s engine, and a tiny firm called Adobe provided the critical piece of software, PostScript, a powerful new page-description language and driver for computer printers. PostScript allowed for complex high-resolution graphics and scalable outline fonts, and it enabled the printed page to look almost identical to what appeared on the computer screen. It managed this in part by making printers smart, offloading the burden of computation from the terminal to the printer itself (Piffner, 2002).

Both Canon and Adobe had fully developed their basic products before hearing about the Macintosh or the LaserWriter. Their contract with Apple only required them to adapt their technologies to the particular specifications of the LaserWriter. The fact that these independent firms had developed two of the critical pieces of the larger system that was to save the day for Apple already rated as very good luck. But more was to come, as we shall see.

The original vision of Apple for the new machine was the “Macintosh Office” project. All three elements, the Macintosh, the LaserWriter and AppleTalk, were meant to cluster around a central computer, a file server that would provide not only printer sharing but also routing and file sharing. Unfortunately, Apple soon realised that it would likely take 3 more years to develop a suitable file server. The Macintosh Office project was cancelled in 1986, and file sharing and routing were left to third parties, which did not quite rise to the challenge (Carlton, 1997, p. 25).

And so it was that, despite the considerable potential of the new system, for almost 2 years the market remained thoroughly uninterested. The Macintosh platform had three serious problems: a high price (almost \$3,000 for every Macintosh, plus \$7,000 for the LaserWriter), very limited hardware expandability (it neither had a hard disk drive nor could support adding one easily), and a dearth of application software,¹² particularly of the kind that would differentiate it from the ever

¹²Because the Macintosh was entirely designed around a graphical user interface, text-mode and command-driven programs had to be completely rewritten, an undertaking that many software developers found too challenging and risky.

more dominant IBM PC platform. Slashing prices to the level at which the market was likely to take off was not a reasonable solution, Apple would have been losing money on every system sold. Clearly, the Macintosh needed a high-end niche, one willing to pay \$7,000 for a printer. But to get it, it needed some powerful new software, and it needed that software urgently.

Luckily for Apple, just when things were starting to look so dismal that Steve Jobs was dismissed from the company he had founded, the very same market that did not accept the Macintosh Office offered Apple something better. In the nick of time, another tiny software company, Aldus, came up with exactly the missing piece — PageMaker, a words-and-graphics electronic pagination program. Once adapted to the Macintosh and to the PostScript-driven LaserWriter, this software package allowed Apple to create the high-end niche that it so badly needed: desktop publishing, a profitable new market that soon was populated by thousands of companies happy to pay \$3,000 for a personal computer and \$7,000 for a printer. Historical analyses concur that Aldus and Adobe saved not only the Macintosh but also Apple from sinking irremediably (Carlton, 1997; Malone, 1999).

Several elements of this story are worth emphasising. First of all, and at the risk of belabouring the obvious, notice that neither Canon nor Adobe nor Aldus produced their critical pieces of the Macintosh desktop-publishing system under contract from Apple. All three eventually struck contracts with Apple, of course, but this does not detract from the fact that the inventive and innovative initiative was fully theirs, not Apple's.

Second, notice that we are talking here of the impact of non-contractual innovators not on a wide-open platform (say, the IBM PC), but on the famously closed Apple Macintosh platform. The last thing that Steve Jobs would have chosen to do was to put the destiny of his pet machine and his company in the hands of three independent companies with which he initially had no contractual links, but that is exactly what happened — and, in the case of Aldus's rescue operation, it happened quite late in the game. Equally ironic is the fact that Apple never learned the moral of this story. Although generally user-friendly, Apple has yet to become a complementor-friendly company.

Third, this story leaves us with the distinct impression that non-contractual contributions to a platform are not necessarily peripheral. Indeed, we are left wondering what is “core” and what is “periphery” in a dynamic distributed system such as the one that converged to form the desktop-publishing market. Any core–periphery dichotomy, in this case at least, seems quite arbitrary and unfair.

Which was the core element here: the Macintosh, the LaserWriter, PostScript, or PageMaker? We have been taught to think of the computer as core and of the printer as peripheral, but the LaserWriter was every bit as radical, and as essential to the new system, as the Macintosh was. In fact, both were computers, and of the two, the

LaserWriter was the faster, more powerful machine (with a Motorola 68000 CPU running at 12 MHz), which partly explains its much higher cost.

Paul Brainerd, the main force behind PageMaker and the person who coined the term “desktop publishing”, would be quite justified in thinking that his creation was the core element of the new system and that the Macintosh was simply the kind of enabling technology bound to come along one day to help him make his vision a reality. As for PostScript, at least one commentator considers it “perhaps the most influential software program in personal computer history” (Malone, 1999, p. 386).

Two Types of Non-Contractual Innovation

So far, I have written about NCI as if it were a uniform phenomenon, equally self-organised across sectors and time periods. The evidence that I have presented in the previous two sections, however, clearly indicates that this is not so. There are two different types of non-contractual complementarities, and therefore two types of NCI; one is induced by the launching of a focal platform, whereas the other is radically self-organised. Video rental clubs are a good example of induced NCI: while their efforts were, to a large extent, self-organised, nothing could have happened without the prior successful launch of the VCR. Rental clubs came to complete and transform a platform that already had a solid presence and substantial value, including some opportunity value that the platform leaders had not planned to exploit.

At the other end of the spectrum, we find radically self-organised complementarities that are totally unintended, such as the convergence of digital photography and the Internet. While the natural synergy between these two systems is undeniable, either one would be viable without the other and, more relevant to our argument, neither one was developed with the other one in mind.¹³

Somewhere between these two extremes — the directly induced and the totally coincidental complements — we find self-organised complementarities such as the one between the Canon printer driver, Adobe’s PostScript, and Aldus’s PageMaker. Each of these innovations was initiated independently of the Macintosh/LaserWriter project and may well have thrived, though not so rapidly, even if the latter had never happened. But all three were clearly intended for an industrial landscape widely expected to include machines like the Macintosh and the LaserWriter. This kind of

¹³A similar example is the unplanned synergy between the electric freezer and the microwave oven. The latter languished for years while searching for a ‘killer application’ that could awaken people to its potential as a complement of, rather than a substitute for, the conventional oven. This finally happened in a most unexpected way with the widespread acceptance of frozen foods in countries in which many homes had an electric freezer (Van Dulken, 2002).

systemic convergence is not coincidental, but it is still radically self-organised. It is also extremely common, and it is surely a critical component of technological advance in many dynamic industrial sectors (cf. Christensen *et al.*, 2004).

The current literature on technological platform development leaves minimal room for self-organised innovation processes. The ever-present managerial mindset leads most authors to ignore innovative efforts that cannot be at least induced, if not orchestrated, by a platform leader. The resulting view of platform development is thus inescapably hierarchical and relies heavily on a sharp distinction between the platform's core and its periphery. Unlike the periphery, the core is supposed to be prior, stable, and contractual. Ideally, it should also be somewhat self-contained, in the sense of including all the essentials of the system. By opening up the core in a controlled manner, the platform leader establishes the operational framework for peripheral players.

As we have seen, the VCR case shows that even when there is a prior, stable, contractual and self-contained core (the VCR-cum-video-camera system), this hierarchical idealisation is too simplistic. Against all odds and expectations, video rental stores not only succeeded in forming a hugely profitable and dynamic periphery but, in the process, transformed the architecture of the system and the competitive dynamics of the entire market. The desktop-publishing case is even more radical in its implications. It suggests that the very idea of a core-periphery hierarchy can be off the mark in some cases.

Radically self-organised innovation processes, such as the one that put together the first desktop-publishing system, are not hierarchical but heterarchical (Hedlund, 1986; Iannacci and Mitleton-Kelly, 2005). They do not follow any one actor's blueprint or vision. Rather, they emerge from a protracted sequence of moves and countermoves by various independent players whose constraints, preferences, and expectations become increasingly entwined, as their visions and destinies converge and crystallise into a functional whole. In the process, business opportunities take shape in quite indeterminate ways, since they can be fashioned not only by the logic of optimal collective choices but also by the illogic of strategic blunders, negative-sum games, and missed opportunities (Hench and Sandberg, 2003).¹⁴

We need to make room for radically self-organised innovation processes for the sake of conceptual completeness, but also for the sake of good management. The reductionist view of NCI espoused by many management writers could be operationally adequate in some cases, but it conveys a distorted view of industrial

¹⁴Even induced innovation processes often operate within very indeterminate frameworks. As already indicated, had the videodisc advocates done a better job of aligning their expectations, preferences, and constraints, back around 1980, they would have owned the movie-video rental market and the VCR would have been a historical footnote by comparison.

reality that will often lead to myopic decisions, closing some doors that should be left open or attempting to orchestrate processes that should be left to follow their own pace and logic.

Inventive entrepreneurs in a vibrant, decentralised economy do not generally need to be shown the way to the future by a self-anointed platform leader. They are quite capable of seeing it coming. John Warnock (Adobe's founder) and Paul Brainerd (Aldus's founder), in particular, were certainly the kind of industrial visionary adept at "skating to where the money will soon be" (cf. Christensen *et al.*, 2004). Steve Jobs matched their vision and was in every way their peer. But he was in no way their leader.

Conclusion

Strategy is becoming, to an increasing extent, the art of managing assets that one does not own (Iansiti and Levien, 2004a, p. 1).

In some industrial sectors, the management of external resources has become the new frontier of innovation management. In this paper I have argued that, while much has been written about innovative firms crossing the property line and subcontracting some of the activities or processes critical to their innovation, too little has been said about a more revolutionary phenomenon — firms going over the contract line and eliciting the requisite external resources and competences without the need for contracts of any sort.

The main purpose of the paper has been to argue that only non-contractual markets can be truly open-ended, leveraging to the maximum the decentralising power of modular architectures. An innovation network is not radically decentralised when it is made up of financially independent agents, but when every one of those agents enjoys the freedom to decide what it can contribute to the collective effort and in what terms. Only non-contractual markets can provide this kind of design freedom. Only such markets can expand the innovative space well beyond the limits imposed by a platform leader's imagination and financial resources. Paraphrasing Iansiti and Levien's above quotation, we can say that in some high-technology markets, strategy is becoming, to an increasing extent, the art of eliciting and mobilising external resources that one cannot, or should not, subcontract.

A subsidiary, but no less important, argument has been that the emerging view of non-contractual innovation as peripheral, non-essential, and manageable is an oversimplification. Non-contractual innovators sometimes have the power not simply to add enormous value to an open platform, but even to dictate the terms under which the platform will be opened up and allowed to thrive. Furthermore, in some

cases, the very distinction between a platform's core and its periphery turns out to be quite arbitrary and misleading.

The current, dominant model of platform formation offers a normative, hierarchical view of a process that often is distributed and open-ended. Just as this conventional model downplays the difference between contractual and non-contractual innovation, it also downplays the difference between orchestrated and self-organised non-contractual innovation. The result is a homogenised and domesticated view of a brave new world that is richer and more surprising than some authors might lead us to believe.

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