

Shopping for Buyers of Product Development Expertise: How Video Games Developers Stay Ahead

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Abstract

This paper draws upon the strategy literature to provide a number of insights into what constitute the critical external drivers influencing strategy and the nature of the internal resources firms require to sustain their competitive advantage. The paper reviews the market- and resource-based views of the firm and argues that the activities of buyers directly and indirectly contribute to the innovation process of a firm as ‘signallers’, ‘revealers’ and ‘collaborators’. Examples are drawn from the video games industry which has particular constraints coupled with buyer and innovation demands arising out of fast-changing technologies, markets and resources that have ever-shortening shelf lives; namely, characters, title franchises and gaming/technology platforms. We suggest that, for the video game industry, buyers particularly value firms’ dynamic capabilities, specifically those capabilities that contribute to product creation and product development capabilities of ‘super developers’ over other considerations.

Introduction

Firms face turbulent times in these early years of the twenty-first century. Three substantive factors are apparent. First, a globalising economy has brought about not only opportunities for an expanding global market place but also the growing threat of global competition (D'Aveni and Gunther, 1994). Second, the pace of technological change and new and innovative business models overtly challenge firms. Finally, market segmentation and discriminating buyers have disoriented firms (Grant, 1991). Adoption of low cost or product differentiation strategies is no longer sufficient to keep customers. The only way firms can manage these possible disruptive forces is to incorporate an innovation constituent into their strategic management framework.

There are two constituent parts to an innovation strategy. First, a framework to include external drivers such as barriers to entry and new developments, governance and bargaining power in the value chain and a competitive analysis should be incorporated. We conceptualise value chains as more than mere linear relationships, but rather as systems through which value is added to a product or service *en route* to final users. Second, firms should concentrate on those resources and capabilities that can create competitive advantage, and equip themselves either to respond to or lead change from within. The criteria employed to uncover these resources and capabilities should not be limited only to short term cost variables but ought to include the recognition of future product and technological development potential.

This paper focuses on the unique resources and capabilities that contribute to innovation. Whilst some firms are acutely aware of their available resources and exploit them fully, others rely on the catalyst of relations with other firms. Consequently, this paper uses a value chain framework to demonstrate the function of one particular catalyst; namely, buyers. The argument is made that the activities of buyers directly and indirectly contribute to the innovation process of a firm as 'signallers', 'revealers' and 'collaborators'. Examples are drawn from the video games industry (especially the activities of 'super developers') which has particular constraints coupled with buyer and innovation demands arising out of fast-changing technologies, markets and resources. The key buyers in this sector are the publishers, most notably US-based Electronic Arts; and publisher-console owners such as Sony, Microsoft and Nintendo. Both buyer types procure games development expertise from in-house studios as well as from independent suppliers such as UK super developers (see

below). The buyers are the ‘governors’ of the value chain in that they have the financial resource to develop games and, critically, to market them; these resource needs far exceed those available internally to development companies.

Dynamic capabilities and strategic upgrading

In high velocity markets, it is the resources and capabilities that a firm draws upon to affect change – its dynamic capabilities – that are particularly effective in fostering a competitive position. *Dynamic capabilities* effect change through the creation of new resource configurations (Teece and Pisano, 1994; Eisenhardt and Martin, 2000) and enable the acquisition and application of new knowledge resources (Kogut and Zander, 1992). In their seminal paper, Teece and Pisano (Teece and Pisano, 1994) and elaborated in (Teece, Pisano et al., 1997), characterise dynamic capabilities as being shaped and limited by the firms’ technological trajectories (Dosi, 1982), market position and organisational routines (Nelson and Winter, 1982). Although the very distinctiveness of dynamic capabilities is what provides firms with competitive advantage, they can also exhibit qualities that are familiar across firms. These recognisable routines are often described as good practices. This formulation of good practices, however, should not be seen as ‘one-size fits all’. Common good practices can be found among firms which is useful to identify clusters or work themes. Such themes do not, however, include embedded and often hidden routines and behaviours that are required for successful implementation. The implementation of a good practice requires firm-specific contingencies. It is these adaptations that allow firms to find a unique fit and achieve competitive advantage.

Firms call upon dynamic capabilities and other resources such as capital investment and managerial co-ordination to upgrade firm-specific processes and products, functions (and links between functions) and inter-firm co-ordination and communication web (e.g. supply chain management, marketing relations, etc). Firms can also apply these capabilities to move into new markets and value positions. Finally, firms can decide not to upgrade but, instead, enter into a market transaction by either purchasing the resource and capability if the firm currently does not perform the process or function or outsource existing in-house activities if the decision is not to upgrade. Of course, firms rarely want the resources and capabilities per se; rather, firms value the results from the application of the resources and capabilities (D’Aveni and Gunther, 1994; Greco, 1997; Quinn, 1999).

Firms draw upon two sources for dynamic capabilities: those that are internally managed and controlled, and those that are drawn from external sources. The value chain framework complements this external search as we extend the boundary of the firm. Examples of dynamic capabilities and their location include:

- internal capabilities that are explicit and homogeneous (i.e. resemble good practices) such as product development and strategic decision making (Eisenhardt and Martin, 2000);
- internal capabilities that are tacit and heterogeneous (i.e. contingent) such as knowledge resources (Grant, 1996; Kogut, 1996);
- inter-relationship capabilities including commercial alliances (Lorenzoni and Lipparini, 1999; Eisenhardt and Martin, 2000);
- inter-firm cooperation (Schmitz and Knorringa, 2000; Bessant, Kaplinsky et al., 2003).

Table 1 captures some of the sources available to firms for dynamic capabilities.

Table 1: Location of dynamic capabilities

Source	Comment
Existing internal dynamic capabilities	Including parent and subsidiary organisations and mergers and acquisitions
Direct buyers and customers	Using existing market-based relations
Suppliers	Using existing supply chain relations
Third party	For example, a consultancy firm
Sharing externalities	A cluster viewpoint
Not-for-profit partners	Government, universities, Research & Technology Orgs

The next section explores how firms can use one source – buyer relationships – in the identification of an upgrading strategy.

The role of buyers in the innovation process

Buyers can perform three roles in directing an upgrading trajectory. First, in a buyer-driven value chain (where buyers have significant bargaining power) they signal current and future

value criteria that will influence the direction of an upgrading strategy. Second, buyers can reveal the strategic resources and capabilities which contribute to the creation of value criteria. And finally, buyers can be collaborators in an upgrading strategy. The three possibilities are outlined below.

Table 2: Summary of buyer roles in innovation management

Role of Buyer	Potential upgrading trajectory
Signaller	Changes in the value criteria inform firms of the outcome of upgrading
Revealer	Identifying strategic resources and capabilities for new buyers or market offerings. In high velocity markets, buyers can reveal dynamic capabilities
Collaborator	Inform and contribute to upgrading, e.g. lead-users

The first two roles are implicit in that the information generated only informs firms of the possible upgrading type. The collaborator role is explicit and involved, i.e. the buyer and the firm are aware of and committed to a specific action (but not necessarily a result).

Buyers as signallers of value criteria

An important source of value criteria can be an assessment of the preferences of customers. Criteria may include preference metrics such as scale ranking (Kaplinsky and Morris, 2001), an allocation of value points (Hill, 2000), and an algorithm of satisfaction and importance scale rankings (Ulwick, 2002). These measures impart customer specification and other relevant data that can be transformed into viable corporate and manufacturing strategies. For example, a buyer may identify price, quality and delivery as the three most important value criteria for a particular firm’s product. The buyer equally can signal preferences for one year in the future; for example, customisation and brand-name awareness. These latter examples represent an upgrading opportunity.

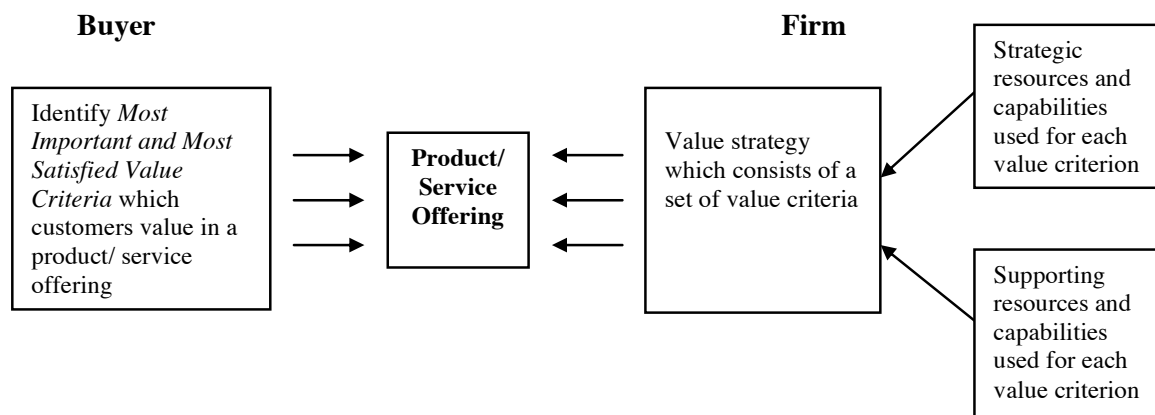
However, there are three dangers of an over-reliance on customer-derived upgrading data. Caution is therefore needed when firms interpret data. First, customers are unlikely to agree on the relative importance of value criteria and this can lead to mixed signals. Second, value criteria are product and process biased; customers rarely mention functional or value chain factors in customer preference surveys. Finally, value criteria rarely provide signals related to particular resources and capabilities. Only the expected outcome is identified. Firms require more information in order to reveal their internal resource assets.

Buyers as revealers of strategic resources and capabilities

Another contentious issue about over-reliance of customer signals is accessibility. Firms have to consider another approach to attract buyers. There are situations when firms will want to offer buyers something new that does not necessarily reveal itself directly in a customer-focus (signalling) strategy. Firms can formulate a strategy partly from their internal fold (i.e. what they do best) (Wernerfelt, 1984; Barney, 1991; Grant, 1991) but first, these strategic resources and capabilities have to be unearthed. Firms may control and own the resource base but it is the customers that ultimately determine whether the outcome of the application of these resources provide value.

Figure 1 below provides a three stage process for identifying strategic resources using information provided by buyers. First, customers identify their priorities based on a set of value criteria. Second, firms identify the resources and capabilities that support the formation of these criteria. Finally, firms prioritise those resources and capabilities that are strategic.

Figure 1: Indirect identification of resources and capabilities by buyers



Buyers are asked to identify the value criteria that they deem important for the selection of a product and to reveal the level of satisfaction of the provision of these criteria. The criteria that are ranked important and with which the customer is highly satisfied, reveal areas in the firm that the customer perceives value and in which the firm excels. This suggests that the corresponding resources could be applied to other buyers in the same market. For those that are deemed not important the corresponding resources could be valuable if they were applied to the formation of another market offering or outsourced. This is a time consuming exercise and firms require expertise to interpret these customer revelations.

This assessment, however, omits two important steps in the formulation of a new offering. First, even after the identification of internal strategic resources and capabilities, what does a firm do next? Customers do not directly value a resource base; rather, they value the *outcome* of the application of resources. A firm needs to consider a strategy identification process (which evolves from the resource base). Second, the ability of firms to transfer this resource base needs to be recognised. Firms make use of valuable and sustainable resources and capabilities to achieve a current competitive advantage but will require dynamic capabilities to reinvent or create new resources and capabilities (Monteealegre, 2002). Buyers can reveal the strategic capabilities which they value – including the good practice or explicit elements of dynamic capabilities (particularly in fast changing markets) – but the outcome of the application of these capabilities in any future undertaking is uncertain. In the role of revealer, buyers do not influence the application of resources. For this to happen, buyers have to become collaborators in the innovation process.

Buyers as collaborators for upgrading

Collaboration inevitably has both market and resource-based elements. Commercial transactions that are measurable are only one of many types of relationship involving buyers and suppliers. Relationships are usually considered part of the make-or-buy decision making process (vertical in-house or horizontal transaction-based). However, this analytical framework does not capture fully the dynamic of knowledge distributed across a network of organisations (Zajac and Olsen, 1993; Lorenzoni and Lipparini, 1999). Moreover, research into inter-firm upgrading has primarily focused on buyers that initiate and control the collaboration of suppliers and where buyers have upgraded suppliers' products and processes (Kaplinsky, Morris et al., 2002). Examples of buyer-firm collaborations include product development such as lead-user activities (von Hippel, 1986) and process improvements (Womack, Jones et al., 1990; Bessant, Kaplinsky et al., 2003).

Before buyer/firm collaborations can take root, firms require the capability to work with buyers beyond single event transactions. This requires the ability to share resources and capabilities in activities where the result is not immediate (or apparent). For example, knowledge assets are critical inputs to the design of customer interactions (Day, 1994). Hence trust and reputation are significant (Sheth and Parvatiyar, 1995). It is clear that firms wanting to access a resource controlled by buyers should both fulfil their current obligations *and*

present buyers with a future market opportunity (Srivastava, Fahey et al., 2001). Buyers understand the value of collaborating by the attractiveness of the proposition.

The buyer/firm framework described above provides analytical insights into the scope and nature of inter-firm relations. First, the quality requirements of a transaction are represented by the buyer's signals; second, the strategic resources of the firm are revealed by means of a communication feedback mechanism for evaluating past and present performance, and finally, the buyers/firm collaboration indicates the degree of interdependency of product innovation. Firms can also use this framework to inform them of their strategic upgrading choices. The information generated by buyer signals, revelations and collaborations has implication for the immediate and future strategies firms develop within their value chain.

The next section discusses the application of this framework to explain the upgrading strategies of 'super developers' in the video game industry (VGI) in the UK. We start with a very brief description of the research themes generated by the sector followed by an overview of the developments in the global video game industry in order to place our research in a suitable historical and technological context.

The video game industry

Research themes

The literature on the global VGI is growing; the focus tends to be on consoles (Asakura and Kutaragi, 2000; Shankar and Baybus, 2002; Schilling, 2003), development processes (Aoyama and Izushi, 2003; Tschang, 2003) and other cultural issues such as gender (Cassell and Jenkins, 1998; Bryce and Rutter, 2003), the cultural form (Cassell and Jenkins, 1998; Kirksæther, 1998; Juul, 2001; King and Krzywinska, 2002; Bryce and Rutter, 2003) and varieties on the theme of violence and the military (Griffiths, 1999; Lenoir, 2002).

The global video game industry – A brief history

The story of the video game industry is one of changing technology and institutional landscape. The VGI is a relatively young industry characterised by four related features:

- new technological developments;
- entry, rise and exit of entrants;
- introduction and specialisation of activities in the value chain; and,
- the ebb and flow of power relations between three critical players in the industry:

- technology console/platform owners;
- design talent and ‘super developers’; and
- publishers.

The early commercial history of video games inevitably commences with the US military’s computer hardware and networks facilitating both game development and consumption, albeit amongst a privileged few. Steve Russell’s rudimentary *Spacewar* (1962) came out of MIT Labs; whilst the *Odyssey* (eventually manufactured and distributed by Magnavox) was a product of Ralph Baer at Sanders Associates, a US defence contractor. (The US military remains an active participant in the video games industry. *America’s Army* – <http://americasarmy.com> – has 4 million registered online users.)

It is generally accepted that Nolan Bushnell, the founder of Atari is the architect of the global commercial video game industry. Bushnell was responsible for generations of home and arcade gaming hardware and software including the truly seminal game, *Pong* (see Table 4 below). Arcades peaked in the US in 1981 (Japanese arcade technology, however, survived well into the 1990s), but many titles were converted to play on the emerging home technology – home computers and consoles. This period also witnesses the emergence of independent developers and publishers – Activision, for example, was founded by former Atari developers seeking greater ownership and control over their developments (Kent, 2001).

The arrival of Nintendo in the 8-bit technology era presaged the ownership of platforms by manufacturers. Nintendo inserted patented and copyrighted disabling code into their *Nintendo Entertainment System* (NES) to restrict external development activity. Exclusive licences were granted to developers that included clauses limiting their ability to work on competing systems. There were also restrictions to the number of games they could develop annually for Nintendo. Nintendo also contractually obligated its developers to pre-purchase cartridges; effectively increasing their development risk (Schilling, 2003). Sega introduced its 16-bit *Genesis* system in 1989 forcing Nintendo belatedly, in 1991, to upgrade to the *Super NES*. A duopoly ensued over the next five years in which neither system prevailed. The period of the late 1980s to mid 1990s saw familiar publishing names in the modern industry adhering to punitive licensing conditions because the two console companies dominated the global market place.

It was during this period that Electronic Arts (EA), the most influential publisher in the modern era with global revenues of just under US\$3bn in 2004, started to make inroads into the market. EA became a significant games developer when Acclaim (at the time the most significant US games developer) negotiated a parallel development contract with Sega to develop *Genesis* titles in 1990 while also remaining a supplier to Nintendo. This development undermined the sole contracting systems which prevailed at the time and provided EA with the flexibility to form market relationships with other existing game console manufacturers *and* the new entrants that emerged. For example, EA signed a 'sweetheart' deal with Sony on the launch of the PlayStation ensuring a supply of high quality titles (Schilling, 2003). Embracing different technologies and servicing several market relationships simultaneously formed the backbone of EA's strategy in this fast-changing environment.

The Sony *PlayStation* was launched to North American gamers in 1995. Its architecture made games development relatively easy, and favourable licence conditions generated considerable commitment on the part of developers. Its 128-bit successor, *PlayStation 2*, had a powerful graphics processor which had a discernible impact on gameplay. Sony demonstrated that the market could accommodate new console entrants; Sony also shifted the console from the bedroom to the living room further expanding access and with it the software market. These factors brought Microsoft into the market with the launch the *Xbox* in 2001 (Kent, 2001). In 2003, Sony enjoyed a market share of 66 per cent with Nintendo and Microsoft sharing the rest.

Table 3: A brief guide to the development of the video game industry¹

Era	Period	Systems/companies	Notable games of era
Military; (Uni) Utah, Stanford & MIT	1961-71	Magnavox Odyssey Atari	Spacewar Pong
First generation: home cartridge	1972-77	RCA Studio II Fairchild Channel F Coleco Telstar	Baseball; Tic Tac Toe
Second generation: boom	1977-81	Atari VCS/2600 Bally Professional Arcade Magnavox Odyssey 2 Coleco Telstar Arcade Mattell Intellivision	Space Invaders; Asteroids; ET; Astro Battle; Basketball; Shark! Shark!
Third generation: the dark ages	1982-84	Atari 5200 & 800 Coleco Vision Commodore 64 Apple II Vectrex	Pole Position; Dig Dug; Congo Bongo; Kung-Fu Master; Space Fury; Polar Rescue; Cabbage Patch Kids Picture Show; Where In The World Is Carmen Sandiego?
Fourth Generation: 8-bit	1985-89	Sega Master Nintendo Ent. System Atari 7800 (re-release)	Hang on; Missile Defense 3-D; Super Mario Bros. 3; Legend of Zelda; Tetris; Crack'ed
Fifth Generation: 16-bit	1989-93	Sega Genesis (upgraded to + 32X) NEC Turbographix-16 Super NES Atari Jaguar Gameboy (handheld) Atari Lynx (handheld)	John Madden Football; Sonic The Hedgehog; Keith Courage in Alpha Zones; Teenage Mutant Ninja Turtles; Bonk; Doom; Mortal Kombat
Sixth Generation: 32-bit	1993-96	REAL 3DO Multiplayer Sony PlayStation Sega Saturn Philips CD-i	Donkey Kong Country; Cosmic Carnage; Virtual Fighter; Ridge Racer; Crash Bandicoot
Seventh Generation: 64-bit	1996-99	Nintendo 64 Gameboy	Super Mario 64; GoldenEye 007; Gran Turismo; Pokémon
Eighth Generation: Home entertainment	1999-present	Sega Dreamcast Sony PlayStation 2 Xbox GameCube PSP (PS Portable)	Soul Calibur; Gran Turismo 3; Grand Theft AutoII & Vice City; Halo Metroid Prime 2: Echoes

The history of VGI demonstrates that technology software is evolving. This suggests that the industry has yet to enter a mature phase. The early entrants are no longer active in the market while the current market leaders are large technology-based multi-nationals endowed with resources to develop next-generation technologies. Moreover, game console technologies and video games software, while increasingly inter-dependent in terms of marketing and consumer perception, are controlled and managed by separate firms. The early history of the all-inclusive game console gave way to separate technology console firms and software game

¹ Sources: <http://www.roachnest.com/vectrex.html>; <http://www.retro-games.co.uk/>; <http://myweb.tiscali.co.uk/mickfrench/coleco.htm>; <http://www.consolepassion.co.uk/>; <http://www.geekcomix.com/vgh/>; <http://www.classicgaming.com/>

developers. Publishers gained prominence as brokers and this function facilitated cross-platform game titles. The current industry phase, arguably, is one of intellectual property development and management. This process is best exemplified by Sega exiting the console market in 2001 to concentrate on publishing (Dietl and Royer, 2003). Console (platform) owners, game developers and publishers perceive value shifting towards the management and ownership of the copyrighted franchises licensed to – but not owned by – leisure software developers.

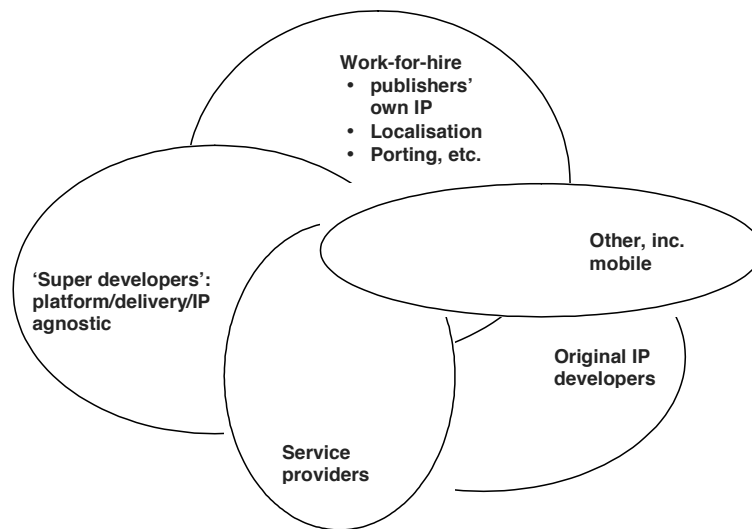
Method

The data for this section were collected as part of a project for the South East England Development Agency, SEEDA (the published report can be retrieved from <http://www.wiredsussex.com/busadvice/whitepapers.asp>). The data were collected between February and May 2003 and involved in-depth interviews with key personnel in nine independent games development businesses in two clusters in the UK. Additional data had been collected the previous year in another six firms located in a third UK cluster. Interviews were recorded and transcribed by the authors. The typology of games development businesses and the value chain frameworks illustrated below are derived from the collected data.

This paper focuses on what we call ‘super developers’. The traditional developer model is one of a small group of creatives – coders, designers and artists – who take character intellectual property (IP) and produce a game for a specific platform (for example, PC). They tend to be single teams working on discrete projects with little expertise in terms of business discipline and financial management. In the modern industry this traditional model is increasingly rare due to factors like globalisation (of markets), complexity (leading to larger team sizes and hence increased development costs) and the high cost of character IP. The truly aspirational developers of the past two decades foresaw the need to create companies that could utilise their array of resources. As one self-styled UK-based super developer notes “The business model of the super developer is one of consolidating the management, design, technology, and supporting resources within a central core to which the development teams acts as satellites” (personal communication with authors). Super developers are characterised by their ‘platform agnosticism’; that is, their capabilities across platform types (including consoles, PCs and increasingly online and wireless) and their aspirations to own character and franchise IP in the short to medium term. However, super developers may also be specialist/niche and/or original IP developers (some have semi-autonomous subsidiaries with

such remits replicating the traditional developer model with the added security of a super developer parent), service providers (for example, testing other developers' products, providing 'middleware' modules), and work-for-hire which involves competition for development contracts from publishers for a fixed sum. The development community is, therefore, diverse in business size, competences and business models.

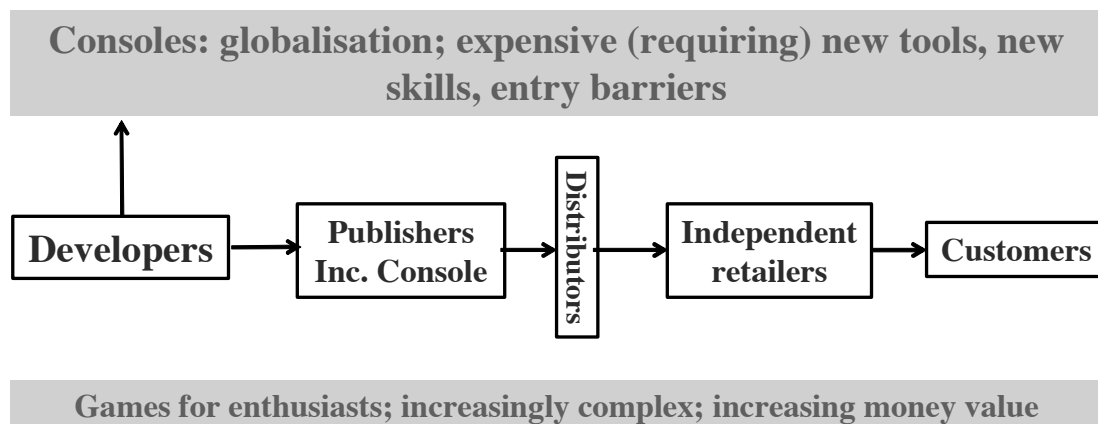
Figure 2: Typology of games businesses



The VGI value chain

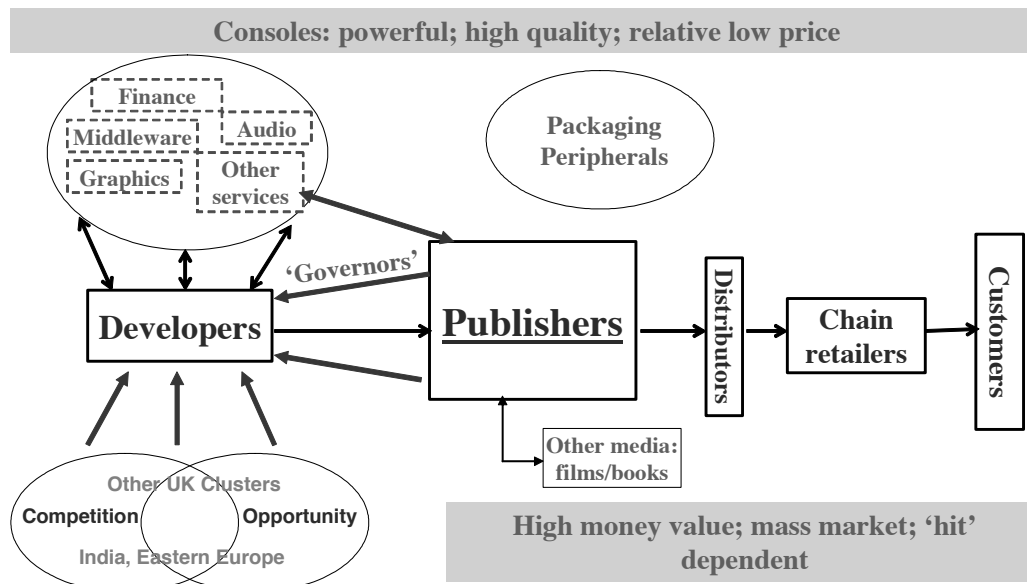
The video games value chain of the early 1990s is represented in Figure 3. It reflects a world in which a specialised development sector emerged, and the onset of a division in publishing between cross-platform global publishers (such as EA) and console platform owners (Sony, Nintendo and Microsoft/Xbox).

Figure 3: Video games value chain early 1990s – the rise of consoles



Over the decade of the 1990s, the major developments were the growing influence of console businesses (and a new dependence by games developers on console owners), the extended development of independent publishers, the growing division of labour in games development, and the emerging power of retailers (Figure 4).

Figure 4: The contemporary VGI value chain



The dependency relationships that emerged in this period define the global industry. The publishers are the key actors – governors – through their control over the key industry resource: characters and franchise licences (IP). These range from Hollywood franchises such as *The Matrix* (where the crossover between media was particularly evident and germane); books (e.g. *Harry Potter*); sport franchises based around players (e.g. EA’s *Tiger Woods PGA Tour 2004*), managers (e.g. EA’s *Total Club Manager 2005*), and format owners (e.g. *Fifa football/Formula One 2003*). The publishers, therefore, are the buyers who provide the majority of funding for games development which enables them to set the parameters to which all other stakeholders have to perform (next-generation console games will cost in the region of €m each). They also act as the major gateway to consumers. Most independent developers have to make pitches to publishers to win the rights to develop this IP. They do this by presenting working models which demonstrate not only what the developers might do with the characters in terms of story and ‘gameplay’, but also demonstrate various technological and managerial capabilities. The console platform owners act as gatekeepers to their own technology in granting development licences and limiting access to development

kits. Where all console platform owners are publishers, not all publishers are platform owners.

Retailers are also increasing their influence in the value chain. Despite the digital nature of the product, the predominant distribution medium is the boxed CD ROM sold increasingly in non-specialist chain stores such as electrical and food retailers. Consequently, they can determine the visibility of the product for the mass market. It is, therefore, very important that publishers have a direct link to buyers to ensure the profile of a title once it is released.

It is also clear that UK and European developers are subject to pressures from other regionally-clustered businesses both domestically and with newly emerging 'coding' countries such as Hungary and India. Developers, therefore, occupy space where the barriers to entry are relatively low (comparable to what manufacturing companies have experienced in relation to outsourcing to China).

Games developers in the UK and elsewhere in Europe are themselves in transition in order to attract work from global publishers (the publishing powerhouses are located in North America, France and Japan). The ability successfully to secure projects is increasingly dependent on the creation of a development brand-name (individual firms or groups of firms). Brands signify a range of attributes and capabilities that include maturity and durability (i.e. the developer has financial resources and a critical mass of transferable talent to support and complete the project); robust business processes; competent management; and platform agnosticism (can develop for the majority of platforms). It also indicates a track record of successful titles in their portfolio and being selective in their choice of publishers for whom they are willing to develop IP (i.e. not all publishers are equal and working with or for the right partner in the past is a positive selling attribute for future work).

Transactions between publishers and developers are project based. Whilst this behaviour suggests market adherence in the alignment of resources to suit buyer needs, super developers show themselves not to be quite so transparent and dependent. This disinclination to be dominated by any one buyer is partly due to the way publishers govern developers. Despite developers originating considerable character and franchise IP, publishers govern these suppliers on a project-to-project basis and put limited obligation on past relationships. As one developer expressed it, "[t]he character can just walk away from us." (Interview with authors, 18 February 2003).

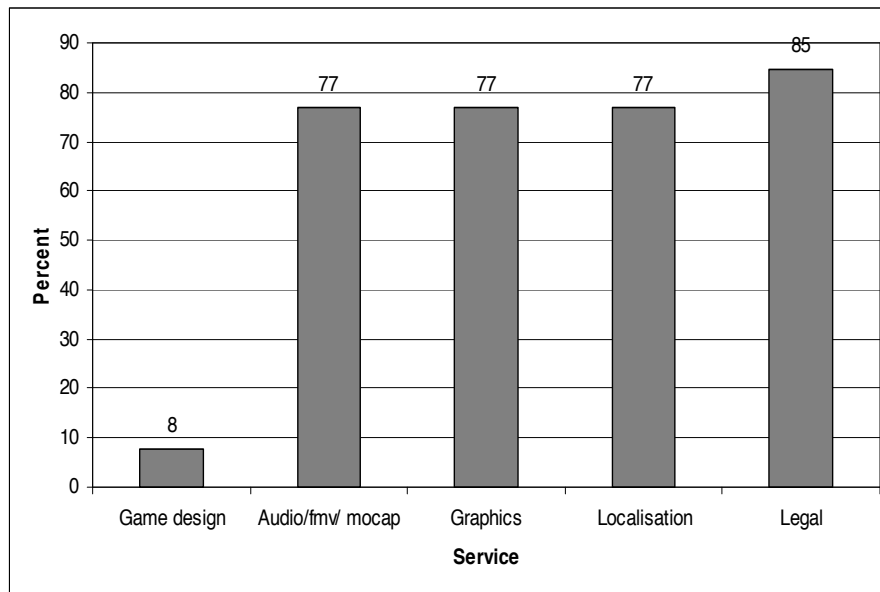
Buyers as revealers

This situation also puts buyers in the role of revealers: buyers continuously focus on the current and potential – and not previous – capabilities of developers to create new characters for the marketplace. To illustrate this point, the nine super developers in our sample have, over time, come to appreciate the long-term value of (and need to acquire) own character and franchise IP. One firm audaciously achieved this through the purchase of a traditional paper-based comic book claiming development rights to some 700 characters in the process.

The shift away from a small niche market to mass market products promoted by publishers, retailers and platform owners has generated high value characters in tandem with high expectations from end-users (gamers). Competition among the different titles (including titles managed by the same publisher) feeds this demand for new products. This has led to ever-shortening product life-cycles, product ‘hit dependency’ and pressure to reduce lead times. Moreover, development costs are rising for each generation of games – mass market titles generally ran on budgets in excess of €3m in 2003. For global publishers, the significant factor is not the cost of development, but rather the ability to launch a title on time. This is important because many titles are film/sporting event tie-ins, or earmarked for seasonal markets. It is the loss accruing to failing to meet launch dates rather than the cost of development per se that developers need to manage.

However, these costs are significant for developers and it has the effect of locking developers into strict contractual funding relationships with publishers in order to access resources. This has the effect of limiting the scope of companies to perform most developmental activities in-house (as was traditionally the case). This steers companies to consider options to outsource and buy-in game engines (the base code on which all other game features sit) and other essential technologies such as tools, audio and motion capture (see Figure 5 below). Business functions such as legal services, by contrast, have traditionally been outsourced.

Figure 5: Outsourced Services and Functions



One possible out-sourcing strategy is to include more value-added developmental work in middleware (automation modules). The extension of middleware could lead the development process towards *modularity* which would reduce costs (i.e. sharing engines and tools), provide some flexibility (modular customisation) and reduce lead times (accessing and integrating ready-made modules to speed-up the process).

In our study we explored developers' attitudes towards middleware modules. Some industry stakeholders are upbeat about middleware utility. As one global games company noted:

[I]f you look at a title like [GTA] Vice City, it took [£]12 million in its first week in the UK, it did [£]70 million in its first week in the US, they built it in 9 months. They... built it using [middleware]...You buy a physics engine, you buy a graphics engine, you buy a sound engine, it's content. Content is king. (Interview with authors, 26 February 2003)

Working with middleware modules, therefore, can significantly improve process efficiency, reduce costs and lead times and enables developers to concentrate on content rather than technology.

This observation is important because there are times when market conditions suggest that the modularisation approach to title development is absolutely right for all stakeholders. The

GTA concept² was well developed and the market could carry a variation on the theme that was not radically innovative relative to previous releases.

That said, for publishers and developers to embrace this modularisation approach for all titles may be unwise. The success of *Vice City* was not derived absolutely from its perceived originality or ‘gameplay’, two prerequisites for successful titles (though it certainly had attractive design features for players). A significant factor in its success was arguably its seductive violent narrative content coupled with the publisher’s ability to exploit the franchise brand. Moreover, the modularisation approach suits in-house development by publishers who have varying levels of development capacity. Consequently, both buyers (publishers) and developers share a belief in the value of employing a mixed approach which balances the exploitation of market opportunities with maintenance of innovation and creativity capabilities for the longer-term (both in-house and across the independent sector).

Super developer attitudes to middleware

The historical craft legacy of leisure software development lingers which may be one reason why market pressures have not prevailed. Still, some developers take a pragmatic view of the inevitable ascendance of middleware engines and tools. As one developer explained:

[t]he main reason [for not using middleware] is that there isn’t really anything which would replace anything we’ve got without leaving chunks of work that would need to be done to get back to where we are with [our in-house technology]. Some games companies have a gut reaction [against] using other people’s technology just because people like doing it themselves. It’s more of a legacy cultural thing. For us it’s purely a matter of how much it’s going to cost to get it working and get the game finished. So far it’s never been cost effective to use middleware. (Interview with author, 14 February 2003).

Arguably, as the complexity of the next generation console technology increases, middleware modules will offer ‘solutions’ for games developers. However, the limitation of middleware is its ubiquity and the diffused knowledge in and around it:

And I don’t think that adds value. Every one of those individuals has to take a profit margin. Middleware can’t work on a ‘well, we’ll just do that because we need it for a game’, they’ve got to take a margin. And most businesses that I think of are probably

² GTA stands for Grand Theft Auto (see <http://www.rockstargames.com/grandtheftauto/>). The game is narrative driven and involves third-party ingratiation with the criminal fraternity through – largely – illegal acts including stealing cars, drug trafficking and murder.

going to make a 50 per cent margin on the costs, because they've got all the other costs of marketing and promoting it. So, they have to take money, if your whole project is composed of middleware where are *your* costs? Where's *your* margin? Everybody knows how much it costs you to buy this engine, to buy this sound drive, to buy all these things, buy in these resources. Do you do a mark-up? How does the business model work? (Interview with author, 17 March 2003)

Equally, buying-in resources like game engines leaves developers exposed. If they seek to avoid being mere aggregators of component technologies, their key resource is their library of core technologies – *and the minds behind them*. One firm in the sample encountered this dilemma in the development of a Triple A title for a global publisher. They pitched on the basis of their proprietary technology only to find that it was inferior and not fit for the task: “we did get beaten up by [the publisher]”. Whilst the pressure of the project deadline pointed towards buying-in a game engine to complete the title, to have done so would have been short-sighted. On reflection, the developer conceded:

I'm glad that we do have our own technology. One of the reasons for that is because in placing products with publishers and with five teams we have a lot of mouths to feed. So we have to be on top of things when we are signing new projects...we were forced to bring our technology up to speed. (Interview with author, 21 May 2005)

In other words, this developer elected to spend considerable resources developing a new engine for the particular title and to retain this engine as a core proprietary technology to be enhanced and used for subsequent projects in the title portfolio across five teams. Indeed, they established a core technology team to manage this. It also set them apart from other developers in subsequent pitches and enabled them to leverage this technology in negotiating favourable terms on new projects.

The management team saw the dangers in restricting the agenda to delivering on the project at the expense of developing the intellectual and technological competences of the business as a whole and being subject to lock-in. Another developer expressed it thus:

[Proprietary technology] It's family silver. If you say, 'we've got something that all these other guys haven't, they're all buying off-the-shelf stuff. They're all same, same, same; me too, me too, me too...' Once you are sold into [middleware] you are stuck. You've got [middleware], and all the other guys have got [middleware], and

what's your advantage when you go to publishers? (Interview with author, 14 March 2003)

Finally, there is the issue of process efficiency. This was expressed particularly eloquently by two developers. First:

Does it give us competitive advantage? Yes, because we can optimise everything. Towards the end of the project we can take [stock] of all of our libraries and turn the whole lot into an assembly. (Interview with author, 18 February 2003)

Second:

All that a middleware engine does is shift complexity. So you start off looking like you are solving the problems but then all the problems pile up at the end of the project. Whereas if you don't start with a middleware engine, you end up with a tonne of problems at the beginning, which is where you have got the most time and flexibility, and then you solve the problems at the end of the project and you just have to get on and deliver the project. Most projects done with middleware engines have huge problems at the end if you track them compared to having problems at the beginning if you haven't got the technology in place. (Interview with author, 17 March 2003).

The ultimate risk in following middleware or modularisation strategy, consequently, is that developers may become mere aggregators of others' technology which would in the long term lose the interest of buyers. Buyers have not only signalled their preference for innovative products but, by continuously supporting developmental projects, buyers have revealed to developers that new products are their strategic strengths. And underpinning new product development are access and control of character IP and technological competences. Buyers, moreover, have also revealed the weakness inherent in middleware through their expressed value criteria including technology innovation, gameplay and originality (TerKeurst, 2003). Although pressures to reduce developmental costs remain a business priority, publishers, for the time being, are willing to accept high developmental costs so long as the 'innovation' criterion is met.

These data from super developers whose core development is in the UK, illustrate not only the importance of strategy being informed by both market- *and* resource-based views, but also the maturity of this particular 'new engineering' knowledge-intensive sector in its response to globalisation and pressures from within the value chain. The approaches to

middleware procurement and utilisation act as a proxy for strategy informed by resource exploitation where pure market-based strategies would give short-term advantage only. Indeed, one of our cases demonstrates in particular how close some management teams get to succumbing to pressure from buyers to deliver products at the expense of the health of the business as a whole. Super developers are clear about what mix of resources make them such, and how the mix contributes to their sustained global presence. They resist exhortations to buy-in core technologies on the grounds that they inhibit both creative and process innovation and, by definition, modules are neither rare nor non-substitutable. Moreover, innovation in technology and creativity is the hallmark of the British leisure software industry – ‘Britsoft’ – which is perceived to be undermined by middleware solutions. Whether this resistance to modularisation continues, in light of growing complexity, only time will tell. But super developers, on this evidence, define themselves as technology businesses and not as module aggregators.

One further signal is that developing for next-generation consoles, middleware will feature heavily. Electronic Arts (EA), for example, has signalled this by actually purchasing Criterion Software, owners of ‘Renderware’. But to suggest that middleware use will always be a requirement is another matter. For example, other publishers are unlikely to endorse Renderware under EA’s ownership. Super developers’ seeking to do business with other publishers will need also their own technology or a facility with other middleware products to develop for them.

Buyers indicate innovation as the critical value criterion and knowledge resources are the critical assets for the creation of new leisure software products. This does not mean that pressure on the cost base is dissipated; rather, the innovative nature of the product is recognised and the buyer is willing to pay higher rents for this value. Process efficiency is increasingly a given (and is embedded in brand) in relations between buyers and developers. The pace of change in this industry is such that the demand for new products with innovative features is greater than the demand for lowering costs. Whilst middleware can provide savings to the cost structure, it cannot, at this time, deliver on the innovative features demanded of new products. This is not the case in other industries where longer product life cycles dominate and where buyers value improving process efficiency.

Table 4: Summary of middleware utility and disutility for buyers and super developers

Bought-in middleware utility	
Buyer/Publisher	rapid time-to-market swift exploitation of fashionable/lucrative franchise reduced costs enables concentration on content and design enables large amounts of art assets to be modelled and archived reduced risk
Super developer	enable rapid and potentially lucrative work-for-hire projects providing resources to maintain integrity of core development teams
Bought-in middleware dis-utility	
Buyer/Publisher	restricts innovation danger of generic game mechanics
Super developer	reduces developers to status of aggregators increases development <i>process</i> complexity and risk increases transparency of project costs reduces product differentiation

Explicit buyer dimensions

The super developer strategy discussed above has the buyer in the role of revealer of the value inherent in the knowledge that underpins the game engines, amongst other technological capabilities. In other words, buyers value the dynamic capabilities of the super developers. This is not surprising as product life cycles are immensely short in the games market. Super developers, therefore, maintain and leverage core proprietary technologies in order to differentiate themselves from others seeking to develop the buyers’ original character and franchise assets. Whilst middleware utility is appreciated, for super developers, its use makes it difficult to add value to publisher assets, at least for current generation products. The product service offering, therefore, is informed by super developers’ value strategy. This is determined by a combination of matching the known value criteria of publishers with the strategic imperative of the super developer which involves development of high-value assets both internally (proprietary technology) and externally (characters and franchises). It is not exclusively market led. Super developers give themselves the option to choose what – and for whom – to develop.

Buyers contribute along all three dimensions: signalling, revealing and collaborating. The focus of this paper has been on revealing. Hence a few explanatory paragraphs on signalling and collaborating functions is necessary.

Signallers

Buyers of video games – publishers – are essentially contract managers who offer IP development for tender to contractors. However, they purchase licences from IP owners such as book publishers and Hollywood studios. The decision to offer IP for tender is based on extensive research on global gaming and gaming trends (many games, characters and franchises are culturally specific). Consequently, inherent in the tender offer, is the output of this research that gives a raft of indicators to developers about the industry.

Collaborators

As collaborators, publishers and console owners may be integral members of the development team. In the case of Microsoft Xbox this serves a number of functions. As a new entrant in the console market, it enables Microsoft to build relationships with content providers. Collaboration enhances capability for both platform owners and development studios. Collaborative relationships also deliver a timely product and improve quality (one feature of the collaboration is ongoing testing of product versions) and prevent or limit feature creep (too many features being added). Microsoft seduced developers in the first instance by offering its development kits free of charge in exchange for development licences to complement its in-house effort.

In addition, Microsoft created an Advanced Technology Group which functions to ensure product quality through technical support, architecture, network and performance auditing, hosting and organising events and liaison with or on-site support for technology managers within development companies. As one developer noted:

In my experience with Microsoft I have found them to be extremely confident regarding the future of Xbox...but I've also found them amazingly humble, enough to constantly sit back and listen and learn from all the developers around them in North America and Europe who know how to make games. This is ultimately why they remain a force now and in the future. They listen, learn and advise, but never preach. However, there is always an underlying ruthlessness in everything they do. (Hawley, 2003)

In some respects, Microsoft is using its superior market position in the value chain as both supplier (technology console) and buyer (publisher) to upgrade their own technological capabilities. The super developer, aware of this learning strategy, may not be willing to impart design and development capabilities to their buyer (Thomke and von Hippel, 2002) but may not be in a position to deny this development from occurring.

Summary and conclusions

Table 5 summarises the buyer framework of the super developers and the publishers in the UK video games industry.

Table 5: Buyer roles and corresponding strategy frameworks

Buyer role	Examples from UK VGI super developers
Signaller	Publishers offering tenders for character development; for example, characters featured in a Hollywood franchise. Through due diligence.
Revealer	Re-use, enhancement and development of proprietary ‘engines’ and other development tools.
Collaborator	Publishers providing technical support relating to platforms, development process (e.g. Microsoft Xbox Advanced Technology Team).

This framework is not, we suggest, only applicable to digital industries such as video games. Indeed, the authors were alerted to its significance in empirical work with a cluster of companies in the South East of England who design and manufacture pumps for the water and medical sectors. In the video game industry particular insights arise from at least five factors. First, the nature of a customer (the buyer as a governor of the value chain); second, the fast changing technological capabilities of the platforms on which the products are ‘ported’; third, the innovation demands of publishers and game players; fourth, the ephemerality of the game (the product life is very short); and fifth, the strategic sense of super developers with an ability to act on both explicit signals and implicit revelations from clients.

All firms can compete and upgrade by following market-based and/or resource-based frameworks (or a combination of both). From a market-based view, firms will identify their market position before aligning their internal resource base. From a resource-based view, a strategy evolves from the internal resources that are strategic (i.e. valuable, rare and

transferable). Industry forces can influence the choice of strategy while internal resources reflect the ability to:

- respond directly to these forces to effect change, and
- re-configure and move to a new offering (Spanos and Lioukas, 2001).

Besides commercial transactions, buyers can contribute in three different ways in the innovation process: as signallers, revealers and collaborators (see Table 6 above). In our sample of UK video games super developers, buyers:

- signal their demand for innovative products above other value criteria;
- reveal to the firm which resources and capabilities are strategic;
- collaborate over new products and technologies.

Each buyer strategy has the potential to provide firms with sustained competitive advantage and, while direct buyer collaboration suggests higher rents will be earned for firms leading from a strategic resource base, no route should be ignored. Satisfying buyers in the short-term requires the fulfilment of value criteria specifications. In the long term, the speed of technological change raises the need for firms to *lead rather than respond* to demand, albeit against the backdrop of the formulation of a strategy being time dependent. Strategic resources and capabilities have first to be identified. A viable strategy can evolve from this resource base. Finally, collaboration can benefit both buyers and firms so long as the potential opportunity is clear.

Applying this to an analysis of strategic management in the video game industry, data from UK super developers demonstrates that the challenge is to muster and channel resources into delivering on the value criteria specified by publishers, however contradictory they may be. Whilst the short-term imperative is to deliver titles on time and budget, this can only be done in the context of a medium- and long-term innovation strategy involving the development of new IP, enhancement of software technologies and production and business processes.

Super developers, we argue, command resources that are strategic; namely, those which are valuable, rare (skilled labour) and transferable (expertise and know-how). For super developers, valuable resources include technology IP (game engines); rare resources are exemplified in skilled labour – coders and designers; and transferable resources encapsulate expertise and know-how (diffused between development teams). The key resource is labour which creates value primarily through coding and design. Coders create the valuable

proprietary technology. Designers compose the form of the game with its layers and gameplay.

The three strategy frameworks present opportunities for all firms in value chains, and are not mutually exclusive. Should it be desirable to move out of the current market and apply their capabilities to other types of media or for an entirely new buyer chain, innovating with existing buyers may not be appropriate as market dependencies could hinder such movement. Notwithstanding this caution, buyer data present firms with potential intelligence on which to base upgrading decisions for competitive advantage. In applying this model to a new-engineering business environment, where knowledge is the defining resource, it is clear that sustainability may depend absolutely on managers' foresight and ability to reconfigure internal resources against the logic of the market and *short-term* buyer preferences. This requires firms to attain a high level of capabilities to collect, analyse and articulate new strategies and, increasingly, capabilities to implement quickly these new strategies. How firms develop these capabilities is a neglected area and future research is required, particularly in high velocity sectors such as the video game industry. However, UK super developers have shown themselves to be adept at aligning their strategy with the development and ownership of character and franchise IP – the key resource in the sector.

References

- Aoyama, Y. and Izushi, H. (2003) Hardware gimmick or cultural innovation? Technological, cultural and social foundations of the Japanese video game industry. *Research Policy*, **32**(3), 423-444.
- Asakura, R. and Kutaragi, K. (2000) *Revolutionaries at Sony. The making of the Sony PlayStation and the visionaries who conquered the world of video games*. McGraw-Hill, New York.
- Barney, J. (1991) Firm Resources and Sustained Competitive Advantage. *Journal of Management*, **17**(1), 99-120.
- Bessant, J., Kaplinsky, R. and Lamming, R. (2003) Putting supply chain learning into practice. *International Journal of Production Management*, **23**(2), 167-184.
- Bryce, J. and Rutter, J. (2003) The Gendering of Computer Gaming: Experience and Space. In *Leisure Cultures: Investigations in Sport, Media and Technology*, ed S. Fleming and I. Jones. pp. 3-22. Leisure Studies Association.

- Cassell, J. and Jenkins, H. (1998) *From Barbie to Mortal Kombat: gender and computer games*. The MIT Press, Cambridge MA.
- D'Aveni, R. A. and Gunther, R. E. (1994) *Hypercompetition: managing the dynamics of strategic maneuvering*. The Free Press, New York.
- Day, G. S. (1994) The Capabilities of Market-Driven Organizations. *Journal of Marketing*, **58**(October), 37-52.
- Dietl, H. and Royer, S. (2003) Intra-system competition and innovation in the international videogame industry. *Innovation: management, policy and practice*, **5**, 158-169.
- Dosi, G. (1982) Technological paradigms and technological trajectories. *Research Policy*, **11**, 147-162.
- Eisenhardt, K. M. and Martin, J. A. (2000) Dynamic capabilities: what are they? *Strategic Management Journal*, **21**(10-11), 1105–1121.
- Grant, R. M. (1991) A resource-based perspective of competitive advantage. *California Management Review*, **33**(3), 114-135.
- Grant, R. M. (1996) Toward a knowledge-based theory of the firm. *Strategic Management Journal*, **17**(Winter Special), 109–122.
- Greco, J. (1997) Outsourcing: The New Partnership. *Journal of Business Strategy*, **18**(4), 48-54.
- Griffiths, M. D. (1999) Violent video games and aggression: A review of the literature. *Aggression and Violent Behaviour*, **4**(2), 203-212.
- Hawley, P. (2003) Product Development and Process. In *Creativity is Not Enough: Global Best Practice in Digital Game Publishing*, ed J. TerKeurst. pp. ICave/DTI, Dundee.
- Hill, T. (2000) *Manufacturing strategy: text and cases*. Irwin/McGraw-Hill, Boston, MA.
- Juul, J. (2001) Games Telling Stories. A brief note on games and narrative. *Game Studies*, **1**(1)
- Kaplinsky, R. and Morris, M. (2001). *A manual for value chain research*. Institute of Development Studies, University of Sussex.
- Kaplinsky, R., Morris, M. and Readman, J. (2002) The Globalisation of Product Markets and Immiserising Growth: Lessons from the South African Furniture Industry. *World Development*, **30**(7), 1159-1178.

- Kent, S. L. (2001) *The ultimate history of video games: from Pong to Pokemon - the story behind the craze that touched our lives and changed the world*. Prima Publishing, Roseville, CA.
- King, G. and Krzywinska, T. (2002) *Screenplay*. Wallflower Press, London.
- Kirksæther, J. (1998) *The Structure of Video Game Narration*. <http://cmc.uib.no/dac98/papers/kirksaether.html#author> Accessed 13 January 2003.
- Kogut, B. (1996) What firms do? Coordination, identity, and learning. *Organization Science*, **7**(5), 502-518.
- Kogut, B. and Zander, U. (1992) Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, **3**, 383-397.
- Lenoir, T. (2002) Fashioning the Military-Entertainment Complex. *Correspondence: An International Review of Culture and Society*, **10**(Winter/Spring), 14-16.
- Lorenzoni, G. and Lipparini, A. (1999) The leveraging of interfirm relationships as a distinctive organizational capability: a longitudinal study. *Strategic Management Journal*, **20**(4), 317-338.
- Monteealegre, R. (2002) A process model of capability development: lessons from the electronic commerce strategy at Bolsa de Valores de Guayaquil. *Organization Science*, **13**(5), 514-531.
- Nelson, R. and Winter, S. G. (1982) *An Evolutionary Theory of Economic Change*. Belknap Press, Cambridge, Mass.
- Quinn, J. B. (1999) Strategic outsourcing: leveraging knowledge capabilities. *Sloan Management Review*, **40**(4), 403-433.
- Schilling, M. (2003) Technological Leapfrogging: Lessons from the US Video Game Console Industry. *California Management Review*, **45**(3), 6-32.
- Schmitz, H. and Knorringa, P. (2000) Learning from global buyers. *Journal of development studies*, **37**(2), 177-205.
- Shankar, V. and Baybus, B. L. (2002) Network Effects and Competition: An Empirical Analysis of the Home Video Game Industry. *Strategic Management Journal*, **24**(4), 375-384.
- Sheth, J. N. and Parvatiyar, A. (1995) The evolution of relationship marketing. *International Business Review*, **4**(4), 397-418.

- Spanos, Y. E. and Lioukas, S. (2001) An examination into the causal logic of rent generation: contrasting Porter's competitive strategy framework and the resource-based perspective. *Strategic Management Journal*, **22**(10), 907–934.
- Srivastava, R. K., Fahey, L. and Christensen, H. K. (2001) The resource-based view and marketing: The role of market-based assets in gaining competitive advantage. *Journal of Management*, **27**(6), 777–802.
- Teece, D. and Pisano, G. (1994) The dynamic capabilities of firms: an introduction. *Industrial and Corporate Change*, **3**(3), 537-555.
- Teece, D. J., Pisano, G. and Shuen, A. (1997) Dynamic capabilities and strategic management. *Strategic Management Journal*, **18**(7), 509–533.
- TerKeurst, J., Ed. (2003) *Creativity Is Not Enough: Global Best Practice in Digital Game Publishing*. IC Cave,
- Thomke, S. and von Hippel, E. (2002) Customers as innovators: a new way to create value. *Harvard Business Review*, **80**(4), 74-81.
- Tschang, F. T. (2003). When does an Idea Become an Innovation? The Role of Individual and Group Creativity in Videogame Design. Proceedings of *Druid Summer 2003 Conference: Creating, Sharing and Transferring Knowledge*
The role of Geography, Institutions and Organizations., Copenhagen,
- Ulwick, A. W. (2002) Turn Customer Input into Innovation. *Harvard Business Review*, **80**(1), 91-97.
- von Hippel, E. (1986) Lead users: a source of novel product concepts. *Management Science*, **32**(7), 791-806.
- Wernerfelt, B. (1984) A Resource-Based View of the Firm. *Strategic Management Journal*, **5**(April-June), 171-180.
- Womack, J. P., Jones, D. T. and Roos, D. (1990) *The Machine that Changed the World*. Rawson Associates, New York.
- Zajac, E. J. and Olsen, C. P. (1993) From transaction cost to transaction value analysis: implications for the study of interorganizational strategies. *Journal of Management Studies*, **30**(1), 131–145.