Working Paper

Strategic Posture and Outsourcing: The case of the US express delivery industry

By

Volker Mahnke, Mikkel Lucas Overby & Serden Özcan

No. 18-2004

Institut for Informatik

Handelshøjskolen
i København

Howitzvej 60
2000 Frederiksberg

Tlf.: 3815 2400
Fax: 3815 2401
http://www.inf.cbs.dk

Department of Informatics

Copenhagen
Business School

Howitzvej 60
DK-2000 Frederiksberg
Denmark

Tel.: +45 3815 2400
Fax: +45 3815 2401
http://www.inf.cbs.dk

Strategic Posture and Outsourcing: The case of the US express delivery industry

Volker Mahnke, Mikkel Lucas Overby, Serden Özcan

Copenhagen Business School

IT-enabled innovations are of increasing importance for competitive success in a range of industries including express delivery services. How companies choose to develop associated competences - in-house and/or through outsourcing - is consequential for creating and sustaining competitive advantage. Against the backdrop of the importance of IT-enabled innovation, the key concern of this chapter is to address the crucial question: How do capability development strategies differ between first-movers and late entrants in IT-enabled services. We develop theory based on three explorative case studies – FedEx, UPS and DHL. An analysis of the three companies reveals that governance choices are influenced by a company's attempts to create, imitate, and/or leapfrog IT-enabled innovation in varying technological regimes.

Introduction

IT-enabled innovations are of increasing importance for competitive success. By *innovation* we mean "the generation, acceptance, and implementation of new ideas, processes, products or services" (Thompson, 1965: 36). Innovations are IT-enabled when they blend hardware and/or software assets with business capabilities to generate a novel process, product or service. If adopters of IT-enabled innovation do not command all necessary competence in-house and internal development is slow and costly, 'distributed capabilities' need to be coordinated across firm boundaries in outsourcing relations (Barney & Lee, 2000; Coombs & Metcalfe, 2000; Quinn, 2000). Against the backdrop of the importance of IT-enabled innovation, the key question of this chapter is how do capability development strategies differ between first-movers and late entrants in IT-enabled services.

While the literature agrees on a general level that governance choices with regards to developing capabilities for IT-enabled services are consequential (Argyres & Liebeskind, 2000; Barney et al., 2000; Chesbrough & Teece, 1996; Quinn, 2000) because they have long term consequences and are hard to reverse, it is far from clear how companies choose to develop capabilities for IT-enabled innovation - in-house or through outsourcing. On the one hand, Quinn (2000) asserts that today innovation calls for the complex knowledge that only a broad network of specialists can offer and that companies can profitably outsource almost any element in the innovation chain. Chesbrough and Teece (1996) by contrast argue when it comes to innovation, outsourcing inevitably produces more conflicts of interest than do centrally managed corporations, and those conflicts can hamper the kind of complex, systematic innovation that creates valuable business breakthroughs. While the literature stresses the risks as

well as the possibilities of sourcing IT capabilities, there seems to be a lack of an integrated and systematic analytical approach to the outsourcing decision when it comes to the development of capabilities conducive for IT-enabled innovation (Lacity & Hirscheim, 1993).

This chapter develops theory based on three explorative in-depth case studies – FedEx, UPS and DHL - on why IT-outsourcing strategies differ between innovative first-mover and late entrants seeking to adopt IT-enabled innovations. In particular, an analysis of three companies reveals that governance choices are influenced by a company's attempts to create, imitate, and/or leapfrog IT-enabled innovation in varying technological regimes. The remainder of this paper proceeds as follows. First, we briefly review the relevant literature to develop integrative propositions on the relationship between first and late moving firms and their outsourcing decision. Next, we discuss our methodological approach to theory development and the context of our case research --- the express delivery sector. Third, we comparatively discuss propositions and case findings to suggest implications for theory development and managerial practice. Conclusions follow.

Capability development for IT enabled innovations: Make and/or buy

Several separate literature streams shed light on the question of why capability development strategies differ between companies adopting IT-enabled innovation as a first-mover and late-mover (Freeman & Soete, 1997; Lieberman & Montgomery, 1998). First-mover firms that pioneer the commercialization of IT-enabled innovation, such as online tracking systems, may be able to acquire a reputation as an industry leader; define the product/service category concept (e.g. prototypicality) and shape buyer

preferences for a product/service category; move down the learning curve fast to reduce cost; establish technical standards that late entrants are forced to follow; access superior consumer information under preferential uncertainty and differentiate offerings to segment the customers according to their willingness to pay (Carpenter, Lehman, Nakamoto, & Walchli, 1997; Golder & Tellis, 1993; Kerin, Varadarajan, & Peterson, 1992; Porter, 1983; Schmalensee, 1982).

Another first-mover advantage exists if early adoption of IT-enabled innovation leads to buyer switching costs. Such switching costs are incurred for example when a novel IT-enabled services requires the structuring of client interfaces, clients have to learn the use of particular transaction platforms, and service clients make specific investments in IT systems. In addition, there are incentives for first-movers to build in incompatible systems design elements as this increases switching costs (Katz & Shapiro, 1985) and to actively prevent the development of interface technologies that bridge otherwise incompatible technologies (Greenstein, 1997). First-mover advantages, however, are only available if consumer adoption rates do not outpace attempts at competence development --- either in-house or through outsourcing.

While first-movers may enjoy advantages through an early adoption of IT-enabled innovation, they also face considerable risks and often pay a substantial price for pioneering (Boulding & Christen, 2001). A late adoption of IT-enabled innovation may provide late mover advantages including the ability to free-ride on innovators' R&D through imitation, and making investments in technology infrastructure only after technological and market uncertainty have been resolved. In addition, late-movers are better positioned to perceive and exploit technological discontinuities that provide 'gateways' for leapfrogging. Late-mover's leapfrogging attempts are more likely to succeed, if various types of 'incumbent inertia' inhibit first-movers' adaptive response.

For instance, technology sunk cost (Porter, 1980) or inertia in the first-mover's processes delays flexible adoption of capabilities (Lieberman & Montgomery, 1988).

In the following section we develop integrative propositions linking (a) the literature on firm boundaries and (b) the literature on the nature of technological advance to outsourcing strategies of first- and late-movers.

Capability development and the boundaries of the firm

Outsourcing capability development during the adoption of IT-enabled innovation is broadly defined as a process undertaken by an organization to contract-out the development of IT assets, staff and/or capabilities to a third party supplier who in exchange receives monetary return over an agreed period of time (Kern, Willcocks, & Heck, 2002). Primary theories explaining firm boundaries refer to production costs and transaction costs respectively. Transaction cost economics views the firm as a contractual governance structure and stresses the transaction risks incurred in vendor relations, including unauthorized use of the firm's technology or know-how and ex-post extraction of rents generated through irreversible relationship-specific investments in capability development (Chesbrough et al., 1996; Oxley, 2000). In this view, outsourcing of capability development is constrained by contractual risks in vendor-client relations.

The knowledge-based view (Kogut & Zander, 1992; Penrose, 1959; Teece, Pisano, & Shuen, 1997; Winter, 1987) pictures the firm as a collection of knowledge assets and stresses production cost advantages that stem from specialization in particular routines and capabilities that cannot easily be imitated by competitors. Outsourcing of capability development conducive for IT-enabled innovation will be considered, if

vendors command comparative advantage in supplying capabilities cheaper and better (including the ability to act as transfer mechanisms for industry best practice) compared to the outsourcing firm. However, while outsourcing may help firms to access capabilities that they cannot build in a reasonable time frame themselves, it also gives vendors a window to valuable knowledge that they may leak to other clients including competitors (Levin, Klevorick, Nelson, & Winter, 1987; Mansfield, 1985).

There is increasing agreement that transaction cost economics and the knowledge based view are complementary in the explanation of firm boundaries (Grant & Baden Fuller, 2004; Langlois & Foss, 1999; Madhok, 2002). In sum then, companies will tend to rely on external partners in the development of IT-capabilities, to the extent that (a) supplier competences are superior; (b) transaction risks are low; and (c) utilization of vendors does not pose severe imitation risks. Thus, we propose:

P1: *Late-movers will outsource to a greater extent relative to first-movers because they face supplier markets that exhibit greater relative competence and higher competition between suppliers.*

The role of technological advancement

While current theories addressing firm boundaries give an indication of why outsourcing strategies differ between first-movers and late-movers, they are far from complete as they treat technology advance and its implications - in terms of competition and economic organization - as exogenous. The literature on technology advance is instrumental in developing more fine-grained propositions.

The performance of a technology has a recognized pattern over time, following an s-shaped diagram called the S-curve (Abernathy & Utterback, 1978). In tandem with a technology's life cycle is its structural evolution. Most technologies evolve from an initial systemic phase to the opposite modular phase and then cycle back. As the technology migrates from one phase to another, the optimal organizational configuration of the firm must also shift if it is to continue to capture value from its innovation (Chesbrough & Kusunoki, 2001). When the technology is systemic, components are tightly integrated and inflexible. Component-system interfaces are poorly defined and ill understood and are often in a state of flux. Consequently, IT engineers/designers encountering systemic architectures cannot for instance accurately measure important functionality attributes and do not yet understand how variation in one subsystem impact overall system performance (Christensen, Verlinden, & Westerman, 2002).

In order for performance improvements to be achieved, systemic architectures require intense 'unstructured technical dialogue' (Monteverde, 1995) and 'iterative' (Von Hippel, 1994) and 'overlapping' (Clark & Fujimoto, 1991) problem solving processes within the firm. Accordingly, the firm's IT development teams need to engage in direct observation; frequent face-to-face discussions, interaction with service prototypes through e.g. computer-based representation (Wheelwright & Clark, 1992) and extensive learning by experimenting (Baldwin & Clark, 1994). In addition, simultaneous development of various subsystems requires that various development efforts be closely paced to ensure the simultaneous attainment of development goals, which in turn necessitate close managerial monitoring and involvement (Teece, 1994). At the systemic phase, vertical integration rather than the market constitutes the most efficient coordinating mechanism (Christensen et al., 2002; Monteverde, 1995).

Gradually, however, the technology migrates towards modularity –giving way to standardization, codification and formalization of accompanying business processes (Worren, Moore, & Cardona, 2002). The decomposition of innovation's architecture encourages vertical specialization and leads to the establishment of networks of vendors with a standard of compatibility (Langlois & Robertson, 1992). The presence of specialized component suppliers implies that firms need not source all components from a single vendor; instead they can mix and match components from multiple sources either in-house or through system integrators (Stremersch, Weiss, Dellaert, & Frambach, 2003) even when the externally compatible components themselves carry systemic qualities[41]. Modularity then allows structured technical dialogue within and across the boundaries of the firm and thereby efficient vertical disintegration (Robertson & Langlois, 1995). Thus we stipulate:

P2: *Late-movers will outsource to a greater extent relative to first-movers because enabling IT is likely to be modular rather than systemic and structured technological dialogue allows for clear interface specification.*

Two types of late-movers

While we expect that late-movers outsource more than first-movers, not all late-movers are alike. Accordingly, attempts at outsourcing capability development will differ[i] between two types of late-movers: (a) technology follower, and (b) technology leaders. Companies with weaker innovative capabilities are often forced to assume a late-mover position, and the best they can hope for is competitive parity with first-movers through successful imitation or external access of capabilities enabling IT services (Cho, Kim, &

Rhee, 1998; Hannan & McDowell, 1987; Lieberman et al., 1998). Accordingly, technology followers will tend to use external vendors extensively to access valuable capabilities if they contribute to fast and inexpensive imitation of a first-mover's service offerings. By contrast, firm with strong innovative capabilities may afford a 'wait-and-see' approach (Dasgupta, 1988; Katz et al., 1985). As Freeman and Soete (1997: 273) explain some companies may

> … not wish to be the first in the world, but neither do they wish to be left behind by the tide of technical change. They may not wish to incur the heavy risks of being first to innovate and may imagine that they can profit from the mistakes of early innovators and from their opening up of the market."

In other words: the opportunity of learning from earlier moving competitors reduces incentives to immediate adoption (Chatterjee & Sugita, 1990), and, given strong innovative capabilities, the chances of successful leapfrogging and imitation increase.

Distinguishing between types of late-movers is not only instrumental to identify imitation and leapfrogging threats that the first-mover is likely to encounter; they also expose the variation in late entrants' capability development approaches to the adoption of IT-enabled innovation. A late moving technology follower will adopt a 'me-too' strategy with the objective of relying heavily on the technology work of first-mover, whereas technology leaders that move late do 'not normally aim to produce a carbon copy imitation of' the IT-enabled innovation introduced by the early entrant (Freeman et al., 1997: 276). On the contrary, they will aspire to leapfrog to the extent their technological strength allows them to do so.

The literature on first-mover advantage posits that an imitative late-mover should enjoy decisive cost advantages to be able to match the lead held by theincumbent firms, provided that the technological advance remains undisrupted for an extended period (Lieberman et al., 1998). Under such conditions, the longer the first-mover's lead-time is, the larger the late-mover disadvantages. Thus, speed to the market becomes highly critical for the imitating late-mover. For instance, Bowman and Gatignon (1996) and Ghosh et al. (1983) demonstrate that the order of entry (the late entrant being an imitator not an innovator) tends to diminish buyer response to price, quality and promotion, leading to the conclusion that imitating late entrants need to cut their prices and spend on promotion to a greater extent than the first-mover to achieve the same market share. This means the firm entering later has to emphasize speed of development and managerial, overhead and process efficiency (through i.e. standardization, flexibility and compatibility with existing technologies) as well as differentiated positioning (Carpenter & Nakamoto, 1989; Christensen, 1997) to offer low-cost (including transaction and learning costs) IT-enabled services. A competitive vendor market in this case will rapidly be able to provide the late-movers with low-cost IT-enabled system building and management due to scale, scope and learning economies derived from demand bundling and bulk purchase of off-the shelf IT tools and programs.

While imitation of best IT practices helps late-movers move up towards the industry's technology frontier, at best it leads to competitive parity not competitive advantage (Barney, 1991) for which a late moving technology leader is unlikely to settle. Empirical evidence shows that late-movers can overtake a pioneer through innovation as innovation in a product or service can reshape the corresponding prototypical category around which consumers form their preferences (Carpenter et al., 1997; Shankar, Carpenter, & Krishnamurthi, 1998). For a late entrant to leapfrog first-

movers, at least the functionality of its IT-enabled service should exceed the value of that of first-mover's (Schilling, 2003). Unless radical innovations are aimed at, leapfrogging rests primarily on the architectural innovations. For example, Christensen (1993) shows that firms entering the disk drive industry based on architectural innovation tended to perform much better than firms that entered based on component innovation. The distinction between component and architectural capabilities (Henderson & Clark, 1990) is important for the outsourcing decision. Component capabilities concern the mastery of developing new functional components for an IT-enabled innovation system such as software and hardware. Architectural capabilities reconfigure such components with business capabilities in new ways. An architectural innovation then significantly changes the relation and interaction between components but leaves the components and inherent core design concepts unchanged. The implications, for late-movers attempting imitation or leapfrogging are as follows:

P3: *Late-movers seeking to imitate will outsource comprehensively -both architectural and component capabilities- compared to innovative late-movers, which will outsource selectively focussing on component capabilities.*

The express delivery market and IT-enabled innovation

This section illustrates our propositions through an examination of make-and/or-buy decisions in the context of capability development for IT-enabled innovations. The research design is based on multiple cases in the same industry, allowing a replication logic whereby we used each case to test emerging theoretical insights (Yin, 1989). This method allows for a close correspondence between theory and data, a process whereby

the emergent theory is grounded in the data (Eisenhardt, 1989; Glaser & Strauss, 1967). This is an appropriate method for our purposes because we are engaged in an exploratory theory building exercise rather than theory testing. Cases serve as a context for theory building, which can be extended to a wider context based on 'analytical generalisation' (Yin, 1989). We provide an in depth techno-history account of three leading express services firms operating in the US in order of innovative entry: FedEx, UPS, DHL. The choice of cases was determined by the wish to reduce influences of exogenous factors. The objective is to use the case studies as a specific context for theory development rather than to describe the company comprehensively. Thus, we will be selective, stressing empirical facts that are relevant to our theoretical argument on the interrelation between strategic postures and outsourcing of IT capabilities, thereby presenting only a partial picture of the complex companies. The setting is the US express delivery services market between 1984 and 2002. We choose the year 1984 as a point of departure as it signifies the date FedEx (then Federal Express) pioneered the electronic data interchange (EDI)-based shipping and tracking system. The solution quickly became the industry norm, maintaining its influence until the mid-1990s. In November 1994 with the launch of fedex.com FedEx once again led the industry to new territories with the web-based shipping and tracking concept.

Industry background

Express package delivery in the US is a $50 billion industry (2002) offering two basic products: overnight air and ground delivery. The former product is the more profitable of the two as well as the larger in terms of market size. FedEx, United Parcel Services (UPS) and Airborne Express (now acquired by DHL) dominate the domestic parcel

market, which at the same time remains the most important geography for all three companies generating over 80 percent of their total revenues. In the air express market alone, FedEx, UPS and Airborne Express control approximately 80 percent market share. The only other large participants competing in the US express market are the US Postal Service (USPS) with its Priority and Express Mail products, Emery Express and the Brussels-based DHL Worldwide.

To date, FedEx has maintained its position as market leader in the US express delivery services with 40 perce nt or more of market share since 1979. In fact the company is generally credited for turning overnight delivery into a multi-billion dollar industry although the USPS pioneered the service with Express Mail in 1970. FedEx began transporting packages in April 1973. Volume picked up rapidly and service was extended. But the company lost $27 million in its first years; then in 1976 it earned $75 million in revenues. Its success quickly drew traditional cargo carriers into the new market. First came DHL in 1977, providing services on only a few selected domestic routes. Emery Air Freight, one of the largest domestic air-cargo carriers, jumped into the battle in 1978. Its initial objective was to carve out a “heavyweight” niche (delivering heavy air cargo the next day) in the overnight services. Airborne Freight Corporation followed in 1980 with a new name: Airborne Express. Then in 1982, the biggest of all private package delivery firms, UPS, moved into overnight delivery at prices that in many cases were half of those charged by FedEx and other major overnight carriers. At the time of entry, UPS was the largest single private delivery firm on most railroads and owned the largest fleet of delivery trucks. Unlike Emery Air Freight and Airborne Express, which initially employed leased aircrafts or made use of commercial airlines to ship parcels (a practice called freight forwarding); UPS owned a large fleet of airplanes and operated out of own hubs. As competition grew and the rapid

build up of air fleets created overcapacity, the average price of overnight delivery declined dramatically (for instance as of 1984, FedEx dropped its rate by 40 percent over two years) while the number of service offerings proliferated. The negative impact of fast paced-price cutting and discounting was soon augmented by the weakness in demand. FedEx revenues rose by an average of 49 percent during each of the years between 1976 and 1981. The company reported a 33 percent average increase in year-on-year revenues between 1982-1984.

Table 1: US Overnight Air Market Shares

	Airborne	FedEx	UPS	USPS	DHL
2001	13%	46%	34%	6%	0,5%
2000	13%	47%	34%	6%	0,4%
1999	13%	47%	34%	6%	0,4%
1998	13%	47%	32%	6%	0,3%
1997	13%	48%	31%	6%	0,2%
1996	13%	49%	32%	6%	0,2%
1995	14%	49%	30%	7%	0,2%
1994	13%	50%	30%	7%	0,2%
1993	13%	50%	30%	7%	0,2%
1992	12%	50%	30%	8%	1%
1991	11%	51%	30%	8%	2%
1990	10%	51%	31%	8%	2%
1988	11%	54%	18%	NA	3%
1986	13%	58%	15%	9%	1%

Source: Healy (2002), Salomon Smith Barney 1998, 1999, 2001, Bear Stearns 15.10.1999

The Wall Street Journal 05.07.1994, 08.01.1998

In-house development of EDI-based tracking technologies: First-mover FedEx

In 1984, FedEx broke new ground in the delivery business by introducing the PowerShip Plus program. With all the economic downturn and heightened competition, the timing of innovation could not have been better. It reflected the founder and the

CEO Frederick W. Smith's philosophy: 'To defend your position, when competitors are coming in and narrowing the market, you have constantly to innovate and improve in order to maintain a leadership position' (Smith, 1997). PowerShip Plus consisted of a PC with two printers located at the customer's site. The PC's processor was DOS-based and manufactured by NEC. The program provided over 25 000 most active customers with proprietary online services including storing of frequently used addresses, labels printing, online package pick-up requests, package tracking, self-invoicing and report compilation. It was directly linked to the IBM mainframe on which FedEx's proprietary Customer Oriented Service and Management Operating System (COSMOS) ran. COSMOS was the company's centralized management software, which managed delivery vehicles, packages and drivers while tracking weather shifts and even traffic jams (It had about forty different functions). It was at the heart of FedEx IT architecture. Every customer service IT system interacted either directly or indirectly with COSMOS. Because PowerShip Plus was targeted at high-volume customers, FedEx paid for the system and its installation costs and provided customer training. A dedicated phone line was the only requirement from the customers. The innovation fuelled FedEx's growth in the overnight express market. The program was so well received that, according to the CIO of FedEx, it quickly became one of the main value-added features that FedEx could offer its customers over its competitors. In 1986, analysts' estimates put FedEx with 58 percent of the overnight market and followers UPS and Airborne with 15 and 13 percent respectively.

FedEx' technology pioneering was not a coincidence. Since its inception in 1973, the FedEx founder and CEO insisted that if FedEx were to compete with UPS - a company that had already been in existence for over half a century - a myriad of state-of-the art information systems be built alongside the air and vehicle networks. As early

as 1979, Smith predicted the basis of competition in the next two decades - IT-enabled innovation: 'Information about the package will soon be just as important as the delivery of the package … the success of FedEx would be built on a bedrock of mobile computers, package-tracking systems, and sophisticated databases' (Smith, reference?). Under a leadership strongly committed to the technology, the company soon began delivering breakthrough innovations. In 1979, FedEx launched the proprietary system COSMOS. COSMOS began as a dispatching system on a Burroughs machine in about 1976 but was rewritten (in Cobol) from scratch by FedEx software developers to run on IBM's special ACP operating system. In 1980, the company released a proprietary wireless data network called Digitally Assisted Dispatch System (DADS) and became the first cargo carrier to move to mobile data terminals and digital dispatch. DADS consisted of a central database (IBM 3081 mainframe); three call centres, 198 local dispatch stations, courier vans and the voice and data links between them. The system led to a staggering 30 percent increase in couriers' productivity the first day it was used. Then came the first version of PowerShip (an Epson system that operated like a postal meter) in 1981 and the PowerShip Plus in 1984 (Paul & Pearlson, 1994). Smith saw it as a major breakthrough:

> 'To be able to deliver a new service you have to innovate. The hub-and-spoke distribution system which lies at the heart of the FedEx network is an example of that sort of innovation. Another way was the way we integrated ground and air systems from the very start…Perhaps even more important was our recognition that, along with time-sensitivity, the ability to track the status of every item at every stage on its journey, from sender to recipient, would be crucial to customer satisfaction. We understood this even before we had the

technological means to do it. As we have developed the means to do it, so information and IT have become central to the FedEx offer, next to our fleet of planes and trucks' (Smith, 1997: 217-218).

All IT-enabled innovations rested fundamentally on strong in-house application development capabilities and, as the Infosystems magazine observed, many were built 'in far less time than large corporations typically take to put together a garden variety of accounting systems' (date, page). In 1983 alone, the firm spent around 5 percent of its yearly revenue of $1 billion on IT, primarily on development initiatives. In 1985, FedEx employed 600 IT application developers (the entire IT department at rival UPS consisted of 115 people) and was ranked among the top 100 corporate buyers of PCs by InfoWorld/Yankee Group, being the only express courier firm in the list. PowerShip was also a product of in-house experimentation. When FedEx sales people realized that the paperwork requirements of their largest customers were becoming very burdensome, they immediately met with the programmers from IT and came up with an interim solution; a lap-top supplied by FedEx-that ran a simple DOS-based software program that attached to a forms printer. The program used on-screen prompts to request shipping data. Frequent shipping destinations could be stored in a simple linked database. The FedEx management acted quickly on the potential of the first PowerShip version by ordering the development of further built-in functions - above all access to FedEx' IT-driven tracking system. The development project began with the formation of cross-functional teams consisting of sales representatives and technical staff. All software developers were immediately assigned to major business functions to understand internal and external customer needs regarding shipping and tracking. To facilitate instant interaction and to improve problem solving, the management built a

development lab, which from time to time hosted end users, as well. 'It (PowerShip) was originally designed to accommodate some very large shippers' says the head of the development team, 'Once we got a handle on how to manage it, we realized that it probably had a lot of other applications. So we moved it out and just recently pretty much offered it to anybody that wants to use it' (date, reference?).

Outsourced development at the innovative late-mover UPS:

When UPS entered the $2 billion express delivery market in 1982, FedEx and other early entrants knew that they were facing a formidable new challenger. As the COO of FedEx put it: 'UPS will be in the overnight business for a long time. This is not a six-month drill' (date, reference?). The Vice Chairman of Airborne Express also voiced concerns: 'No matter what area they go in they will have an impact because of their size and name recognition' (date, reference?). Yet in the subsequent two years, UPS had little direct effect on business. Now with PowerShip in place, FedEx executives said in interviews that their company offered faster pick up, earlier delivery and superior ability to trace shipments than UPS.

Indeed until the late 1980s, UPS had traditionally relied on customers' confidence in their system to avoid providing tracking information to customers. As Langowitz (1992: 84) observed 'To UPS, given their industrial engineering approach, tracking packages seemed to be an added expense with very little necessity-the system would deliver'. In a New York Times interview, the CEO, Kent Nelson, of UPS called many of the tracking systems overkill: 'It's not to imply that these are not excellent services, but there is a definite cost to them' (date, ref?). Nelson's perspective marked a notable departure from that of the FedEx CEO Frederick Smith: 'The ability to track,

trace and simply manage the large volumes of express items being moved will require automation and on-line integration of customer and carrier to an extent only barely discernible at present' (ref?). The CEO of Airborne Express acknowledged why it made sense to implement tracking and shipping systems:

> Just look at the growth pattern of shipping volume; it grew 45% last year (1985). With that type of growth, a volume shipper can command big discounts. The corporate shippers have become astute and are playing one courier against another…One approach to combat the growing pressure is to offer "non-pricing" enhancements, or offering high volume shippers computer time for printing air billing, in addition to package metering and monitoring shipping activity throughout the shipping process.

In 1985, Airborne Express followed FedEx in enabling large volume customers to access its online computer system FOCUS to check shipment status and obtain computer-to-computer invoicing service. Despite relatively low cost service offerings, UPS' entry had been far from desirable, as acknowledged by the CEO Kent Nelson: 'In 1983, we charged half the price for air delivery that Federal Express did and waited for customers to beat down our door. That didn't exactly happen' (ref?). In late 1985 board members at UPS concluded that that the shipping company was lagging behind FedEx and Airborne in IT. 'The thing we had to do to grow in air was to convince the shipping public that we could provide all the services that the leader- FedEx-has been able to provide. And that can only been done through technology' stated the UPS CEO Kent Nelson in a later interview (date, ref?). The company had no automatic tracking system for its air shipments, a couple of mainframe computers and only 400 PCs. The CIO

Franck Ebrick later recalled ‘It was clear to us that we needed to change to meet customer needs to increase productivity in the electronic age. Federal Express had banks of old mainframes, which the young company had grown with. But UPS, which took pride in personal service, was not yet plugged into the information age’ (date, ref?). ‘If you went into our information services facility in 1985, you went into 1975 in terms of technology’ (date, ref?). Led by the chairman, UPS immediately (when?) launched a five-year, $2 billion technology plan, with package tracking marking the entry point for IT infrastructure, as noted by the CIO Ebrick:

> ‘There were some applications that were really critical to us, but tracking was always the Holy Grail. People were talking tracking this and tracking that. I said, “Look, we don’t have anything in place to do the tracking. We have no network. We have no database. We have no repository packaging. We are several years away from a sophisticated tracking system”’ (cited in Ross, 2001: 3).

The build-up was immense. In 1983, UPS’ Information Services (IS) Group, which was primarily dedicated to accounting, billing and operations reports, totalled 90 people. In 1985, the same group comprised a mere 118 people and spent $40 million, ‘a paltry figure for a corporation with $7.7 billion in revenue’ wrote Business Week. UPS started with 400 PCs in 1985, but by 1989, the company had 20 000 PCs and had installed five IBM mainframes. In 1989, UPS opened up an $80 million computer and telecommunications centre, which linked all of UPS’ computer networks. By 1991, UPS was able to boast a network – UPSNet- that linked six mainframes, approximately 250 mini computers, some 40 000 PCs and an estimated 75 000 handheld units, connecting 1300 worldwide distribution sites.

While FedEx developed all its IT software in-house, UPS frequently turned to external suppliers to outsource component developments. At the start of the restructuring exercise in 1985, UPS hired Andersen Consulting to help reconfigure data architecture plans. Subsequently, it teamed up with several external application development companies, including ConnectSoft (a specialist in Windows applications, electronic mail and on-line service), TanData (a logistics software solutions provider), Geographic Data Technology and MapInfo (digital mapping and tracking software developers). In designing the system that coded and tracked packages and automatically billed customers for customs duties and taxes, UPS also collaborated with Andersen's Management Information consultants. In addition UPS relied heavily on the consulting, software programming and training skills of Novell Networks. Just five years after FedEx's release of PowerShip Plus, UPS rolled out a matching system, called MaxiShip (in 1989). Similar to PowerShip Plus, MaxiShip came with a PC, printers and software that made it easier to create custom shipping manifests and management reports. Yet, it was based on a more modular architecture, which UPS executives viewed as superior to the competing offerings of FedEx: 'A lot of systems impose themselves, but with ours you can play around with the perimeter… It has a different ethos behind its design. Those [FedEx] systems were created to make life easier for itself rather than its customers', noted the logistics systems manager at UPS, 'many companies have gone through the first generation of computers (i.e. PowerShip and Easyship) and got upset with how inflexible they were. We have had to try and incorporate the sort of demands people have now and will have in the future' (date, ref?). By 1993, about 8000 customers were handled through MaxiShip, which was nonetheless still only one third of FedEx's client base. The technology helped UPS enter the online services and narrow down the market/technology gap with FedEx. In 1988, the year before the launch of the

UPS tracking system, FedEx controlled 54 percent of the air-express market and UPS just 18 percent; the following year, UPS's market share leaped to 31%. As the CEO of UPS, Kent Nelson later admitted, the timing of entry could have been better: 'We probably put too much effort into the infrastructure, instead of holding some functions back and addressing more customer projects'. In its quest to "leapfrog not imitate the competitors" as the UPS' Kent Nelson put it, UPS acquired Roadnet Technologies- a transport routing software developer and II Morrow - a maker of aviation and marine navigation systems whose vehicle-location technology was used by UPS in deploying more than 60 000 trucks, in 1987. Both companies were highly instrumental in the development of tracking and shipping technologies.

Imitative late-mover: extensive outsourcing by DHL

When the Brussels-based DHL Worldwide appointed Michael Lanier as the new US CIO in 1990, his task was to rebuild the package handler's domestic information systems operations: 'DHL's US installation consists of a wide range of systems that don't talk to each other… Even more serious is the firm's lack of a cohesive network architecture to link its domestic and international sites and support such strategic applications as package tracking, shipment control and customer service' (Lanier, date, ref?).

While FedEx was creating the overnight-package delivery industry in the US during the 1970s, DHL was doing the same thing internationally. By the mid-1980s, FedEx dominated the US market whereas DHL emerged as the largest international delivery firm controlling over 50 percent of the market. Nevertheless, DHL fell significantly behind in the growing US market by all measures, including market share

and key applications such as package tracking. Moreover, FedEx and UPS invaded the international air express market, leading to a 5 percent drop in DHL's market share and eroding its profitability. One of DHL's strategic responses was to strengthen its presence in the US as it had already been working with the majority of Fortune 500 companies overseas. In 1988, the company moved its information systems activities into its US operating unit and in 1989, launched the EasyShip (DOS based written in Pascal) an integrated shipping processing system that allowed customers to have complete control in preparing and tracking shipments, all from their PC (hardware and software that performed in a similar fashion as Powership and Maxiship).

EasyShip quickly ran into operational challenges. At the root of the problem lay the Unix system that the company had officially adopted upon a mandate from the headquarters. It proved very difficult to incorporate the Unix technology (mainframes bought from Pyramid Technology Corp) into the existing systems - mainframe and IBM's SSP and RPG II on 150 IBM System/36s. Furthermore, the Unix installation was neither robust nor cost-effective enough to support the highly strategic applications planned for launch, in particular those in key areas of customer service and package tracking.

After a brief evaluation of the current technology, the new CIO realized that the company needed a state-of-the-art package tracking and handling system linked to a database and put together 'a revised architectural and technology plan' (date, ref?). The plan entailed reengineering around a Unix client/server system based on IBM RISC Syster/6000. DHL not only reintroduced an IBM mainframe to serve as a database repository, but also entered into a co-sourcing agreement with IBM whereby IBM acted as combined system integrator, co-developer and support provider. DHL paid approximately $15 million to IBM over two years to complete the migration to the new

system and develop and launch several key applications such as package tracking and field systems. In 1994, DHL introduced an agent-based tracking service to communicate with US customers. DHL's system was based on software from Edify Corp and resided on IBM OS/2 servers.

Developing web-based tracking technologies

Soon after came the Internet. In November 1994 FedEx pioneered the web-based tracking concept with the launch of fedex.com. The company used Netscape clients, servers and development tools as a platform for building online applications and derived much of its online functionality from its PowerShip package tracking software. The website included a tracking feature that customers could use to monitor their packages and is widely considered as one of the business world's first interactive Web applications. Jim Barksdale, former CIO and COO of FedEx, and then CEO of Netscape, says, 'It was the first outward and visible demonstration of a practical, productive use of the Internet by a real business for a real business purpose'. Within ten months, approximately 17 000 people were tapping into the company's Web page daily of which 5500 were checking the status of delivery. The site exceeded the one million hits-per-month milestones at the end of 1995. By some estimates, FedEx was soon saving up to $4 million a year. At the time, the founder and CEO Smith noted, 'Federal Express is just one enormous electronic neural system with 100 000 people and a few thousand trucks and planes and facilities appended to it – literally' (date, ref?). The CIO Jones added 'integration of Internet services with our transportation offerings is not an addition to our core business; it is our core business' (date, ref?). FedEx reinforced its Web presence with a number of Web-enabled innovations. In February 1995, the

company launched a limited beta test of FedEx InterNetShip, an application designed to allow customers to process a shipment from a Web site. In late summer, a drop-box locator, enabling users to locate the closest of FedEx boxes, was added to the Web site. In October 1996, the company entered (first-mover among shipping firms) the Internet commerce services business with BusinessLink, a software and services package aimed at midsize businesses that want to sell their products on the Web and have them physically delivered by FedEx. BusinessLink included software to handle order entry and order confirmation, transmitting the order from a buyer's Web browser to a FedEx Web server. The order then went over a secure link to a Windows NT server at the merchant site for fulfilment. FedEx expanded the portfolio of services with the online catalogue and hosting system Virtual Order. Individual customers could also build integrated web sites using FedEx Applications Programming Interfaces. Using such systems allowed FedEx to encourage the growth of unique, content driven Web sites under merchant brands, which would also have FedEx capabilities integrated into them. In 1997, FedEx was receiving an average of 26 000 tracking requests a day and spent $1 billion on IT developments. In April 1998, the company announced the launch of newly redesigned fedex.com and the installation of the one-millionth customer electronic online shipping connection, which included FedEx PowerShip hardware/software shipping system. In 1999, fedex.com handled 60 million transactions per day. FedEx also used the Internet to refine its existing COSMOS system. Under the updated module, whenever a FedEx customer placed an order through fedex.com, the information found its way to COSMOS. The customer would then be able to track the status of the shipment through PowerShip. When initiating coverage on 22 June 1999, Citigroup's SmithBarney transportation analysts wrote

> FedEx is determined to be the technology leader in the air express business and to embed itself in the Internet. Frankly we are impressed with what it has achieved in its technology offerings. From customs clearance to track and trace, Internet commerce strategies, and yield management, FedEx's technology is more advanced than anything we have seen elsewhere. We would note, however, that the technological gap with UPS has narrowed (date, ref?).

Indeed, the advent of Internet opened a new era in UPS' business, as well. One month after rival FedEx got its website up, UPS created its own web page (December 1994). Although the initial web page was static, UPS quickly developed tools that would allow deeper integration into their customer's businesses and service systems. UPS quickly bundled its online services with an innovative set of application programming interfaces that let companies create their own hooks into functions such as package and signature tracking. Called, UPS OnLine Tools (consisting of UPS OnLine Professional, a windows-based system of package tracking and shipment processing; UPS OnLine Host Access, which links customers to a UPS data centre), they acted as the server side of an Internet client/server application (customers could set their e-commerce applications to act as clients to the UPS Online Tools while simultaneously acting as a server to end user's browsers). In 1996, the company spent a huge portion of its $1.2 billion IT budget on development and expansion of these UPS online family of hardware, software, and services. Its IT infrastructure included two data centres with nine mainframes, 250 minicomputers, 90 000 PCs, 77 000 portable computers, 2000 LANs, and 3000 dedicated lines.

As in the previous technology cycle, the first-mover and innovative and imitative late-movers - FedEx, UPS and DHL, respectively - followed different

approaches to IT development associated with internal versus external collaboration. In the words of Business Week magazine, '[while] FedEx forced customers to adopt its proprietary software…and shunned alliances until recently, UPS jumped into partnerships with giants such as Oracle and IBM' (date?). UPS had indeed become aggressive in establishing multiple relationships with e-commerce applications services providers like Open Market, Pandesic, SAP, Lotus, and NetDox Inc. and Tumbleweed software. UPS also established tie-ins with search engine vendors such as Yahoo. 'We don't believe we are software developers', said UPS E-commerce chief, Mark Rhoney, criticizing the arch-rival FedEx's in-house development approach: Companies making that gamble 'are trying to go a bridge too far' (date, ref?). The UPS Vice Chairman and Executive VP Mike Eskew added,

> There were people out there, like IBM and Andersen and Harbinger, and hundreds of other folks that we've done alliances with, that did an awful lot of things better than we did. That really put us in the lead. Our competition wanted to do it all themselves, and that really gave us a leg up as we built these things. It was a good move for us (cited in Ross, 2001: 4).

DHL joined the Web fray almost eight months after the pioneer FedEx (in July 1995) with an IT budget outspent over four-to-one by FedEx and UPS. The initial site was too static as it was structured as a collection of hard-coded HTML pages and did not offer any tracking service (In fact until 1997, DHL did not add any Web-tracking service to the site and instead provided the same information through an integrated voice response system). Soon after the company decided to change everything, the home page, linked pages, navigation and all links to legacy systems and initiated a

reengineering project with the sole purpose of developing a Web-centric infrastructure. Even two years later, in 1997, the magazine Information Week wrote 'Three biggest shippers-FedEx, UPS and DHL let their customers track their packages over the Web. Of the three, DHL's Web-based service has been the weakest' (exact date?). When the first phase was completed in June 1998, DHL released its online shipment tracking system that empowered the customers with functions such as requesting courier pickup, shipment tracking, reporting and supply ordering. Called DHL Connect, the system had a 'hybrid design', being partly Windows-based and partly Internet-based. It integrated client software with the World Wide Web. IBM helped create DHL Connect, including the development of Java program.

FedEx moves to outsourced development

In 1998, the once unthinkable happened: UPS delivered about 55 percent of all cyber shopping purchases, the US Postal Service (USPS) handled 32 percent and FedEx Captured only 10 percent. FedEx was steadily losing market share to UPS even in segments where it had a commanding lead. For instance in the overnight service, UPS's volume grew faster than that of the market leader FedEx between 1996 and 2001. Besides, the Internet was driving new businesses to the latter. UPS was the shipper choice for eBay and Amazon.com. Worse, not only the intense competition but also IT itself in particular e-mail and fax was eating into FedEx' overnight delivery revenue. Most of the business documents that had traditionally been sent by overnight delivery were now being sent electronically. In May 2001, Business Week magazine summed up 'UPS moved quicker into FedEx' turf than FedEx moved into that of UPS. And with Smith's early romance with computers gave him critical traction on the Internet, the

technology is now undermining the choicest part of FedEx' operations: Overnight delivery, which makes up 50% of its revenues.' (exact date?) FedEx was the first big transport firm to launch a Web site with tracking and tracing capabilities but it failed to retain first-mover advantage as the FedEx founder and chairman Frederick Smith acknowledged 'It was very clear to me that this [Internet] was going to change the whole way that people interacted with each other. What I didn't understand was how rapidly it would be adopted' (date, ref?).

These developments increasingly pushed FedEx to choose outsourcing as the method of obtaining competences required to produce, enhance and maintain IT-enabled innovations. In an unusual bid, the company let its internal IT work with SAP to develop a shipping application, formed an alliance with Interworld Corporation- a provider of enterprise-class e-commerce software systems and hired Lokion Interactive as content manager of the Web site fedex.com. In 2001, FedEx signed a development deal with wireless application provider W-Technologies to offer customers to wirelessly track shipments, determine the status of a shipment and email that information to multiple e-mail accounts. W-technologies expanded the tracking capabilities of fedex.com to handheld devices.

Discussion

The following discussion confronts our propositions with the case findings (see table 2). While cases support our propositions, the analysis of outsourcing during the adoption of IT-enabled innovation at FedEx, UPS, and DHL suggests also three additional themes for theory development. The first theme relates to systematic differences in the decision situation between first and later movers along three dimensions: Adoption risks,

supplier competence, and transaction risk. If adoption risks are high - in the sense that consumer's speed of switching from one particular service offering to an IT enabled service offering is unknown - first-movers considering outsourcing need to trade-off R&D risk sharing with vendors and the simultaneously increased likelihood of imitation via vendors. Late-movers do not face such trade-off as their objective is to match or leapfrog first-mover advantages. Here external supply of component capabilities does not increase competitive risks and by implication increases the likelihood of sourcing IT competences externally.

First-movers, who consider outsourcing, need to account for unspecified interfaces in the early phase of technology development due to unstructured technological dialogue. Late-movers do not face such difficulties if technology has moved from the integral to the modular phase. Simultaneously, due to unstructured technological dialogue transaction risks are higher for first-movers compared to late-movers. By contrast late-movers can control for transaction risks because structured interfaces allow for more complete contracting with multiple competent suppliers (Poppo & Zenger, 1998). By implication, late-movers face lower transaction risks and can take full advantage of vendor's comparative advantage unconstrained by complications of unstructured technological dialogue and other transaction risks (Christensen et al., 2002). In addition, due to limited vendor scale, scope, and learning economies in the early phase of market development, first-movers considering outsourcing are constrained in finding competent and specialized vendors. Late-movers face such difficulties to lower degree. In sum then, differences in decision making parameters between first and second movers substantiates our assertion that boundary choices differ accordingly.

The second theme explores the inter-play between decision makers' uncertainty over the nature of technological advance. Technological volatility increases decision makers' uncertainty over whether technological advance is competence destroying or enhancing. First-movers considering outsourcing need to trade-off performance disadvantages of being locked into obsolete technology (where technological change is destructive) with differentiation advantages (where technological change is enhancing). As shown in the case of FedEx, perceptions of technological change and its impact are coloured by the path dependent history of internal capability development: Misperceptions of technological change are the result of myopia leading to competence traps (Levinthal & March, 1993).

Late-movers' objective seeking to imitate or leapfrog is to minimize risk of being locked in obsolete technology and to recognize new technological developments early that the first-mover may overlook. For example, imitative late-movers will make new partnering arrangements only after technological uncertainty and demand uncertainty has resolved, as the DHL case illustrates. In addition, as the successful leapfrogging attempt by UPS shows, being engaged in a wide net of external vendors helps avoid competence traps due to exposure to diverse external knowledge sources. Late-movers attempting leapfrogging, provided they command innovative capabilities, are better positioned to recognise technological breakthrough, and can tailor timing of vendor partnering accordingly.

The final theme explores the inter-dependence of boundary decisions and the creation and defence of first-mover advantages. Our evidence shows that varying degrees of outsourcing have implications for creating and defending first-mover advantages. FedEx, the first-movers in both EDI and web-enabled tracking systems -in the beginning of a TLC - refrained from extensive outsourcing for three reasons. First,

supplier markets remained underdeveloped (Willcocks & Fitzgerald, 1994) and technological uncertainty increased the risk of contractual failures (Williamson, 1975). In addition, extensive outsourcing would have increased the risk of imitation by latecomers leading to competitive parity. While the first-mover initially confronts interdependent interfaces, where 'unstructured technical dialogue' occurs, moving along a particular TLC, first-movers will tend to in-source (outsource) early on (later on) IT related component processes as the TLC proceeds and marginal improvement possibilities level out. Interestingly, first-movers facing technological discontinuity and competence destroying competition will encounter performance penalties if integrated in obsolete competences (Afuah, 2001), as will first-movers outsourcing too late in the development of a particular life cycle. By implication, the timing of outsourcing arrangements and their antecedence as well as the avoidance of first-mover's cognitive biases will constitute a crucial area of future research to actively pursue.

While the three themes discussed above inform theory development that moves beyond the current discussion in the literature, they also have implications for managerial practice. The practical implications of this paper are to move beyond simplified recommendation in the literature either stressing risks (Chesbrough et al., 1996) and possibilities of outsourcing (Quinn, 2000) in the context of adopting innovations respectively (cf. the discussion of transaction cost economics and the knowledge based view respectively). While classifying risk and benefits of outsourcing remains important not all benefits and risks are equally relevant for first and late-movers in the adoption of IT enabled innovation. Recognizing the role of technological advance (competence enhancing vs. competence destroying) and attempted strategic posture (first-mover, imitative or leapfrogging late-mover) mediates both risks and available benefits in important ways.

	Propositions	FedEx	UPS	DHL
P1	Late-movers will outsource to a greater extent relative to first-movers because they face supplier markets that exhibit greater relative competence and higher competition between suppliers.	FedEx was the first entrant into the overnight package services market. It was also the first company to offer IT-enabled tracking and shipping services to the customers. By handing out free hardware and software and providing customer education, FedEx converted the market into an electronic one. Yet, it did so through strong in-house IT capabilities.	UPS lacked the infrastructure and competences to internally build and implement the tracking system and hence immediately turned to the market. Yet it wanted to leapfrog rather than imitate FedEx, and thus had to develop in-house competencies in the process of outsourcing. To that end, the firm acquired two software development firms. By the end of 1980s, the US vendor market was well developed and EDI had gained acceptance.	DHL also chose to rely on vendor market expertise, as the company did not have the necessary IT muscle in the US. At the same time, it ran into significant infrastructure problems that it was unable to solve internally. DHL did not face any imitation risks.
P2	Late-movers will outsource to a greater extent relative to first-movers if enabling IT is modular rather than systemic because structured technological dialogue allows for clear interface specification.	The project started as "skunkworks" but once its potential was realized, FedEx management formed cross-functional internal teams as it needed to define new functionalities and improve performance. Unstructured technical dialogue was key for the innovation enhancement	The enabling IT was more modular than four years previously when FedEx built its tracking and shipping application. UPS chose multiple contracting approaches with a number of technology vendors, which provided various components of the system. It followed open standards.	DHL too benefited from modularity and in fact one of the first decisions was to overhaul the closed and inflexible infrastructure in favour of a more modular
P3	Late-movers seeking to imitate will outsource comprehensively - both architectural and component capabilities- compared to innovative late-movers, which will outsource selectively focussing on component capabilities.		Leapfrogging the pioneer was the objective of management which meant that innovation along functionality was the key as FedEx had built a sizeable installed based in its three-year head start and acquired a reputation for creating the express package delivery. UPS chose selective outsourcing of components while retaining the architectural development of the system in-house.	DHL sought to imitate rather than expand the technology frontier in the industry. One reason was that it was serving on a few routes for some 2500 large customers. DHL hired IBM as a system integrator and system developer. In a two year contract, IBM renewed the infrastructure and developed major applications.

Conclusion

This paper has argued that IT-enabled innovations are of increasing importance for competitive success in a range of industries including express delivery services. How companies choose to develop associated competences - in-house and/or through outsourcing - is consequential for creating and sustaining competitive advantage. The key concern of this paper was to address the crucial question: how do capability development strategies differ between first-movers and late entrants in IT-enabled services? We developed theory based on three explorative case studies – FedEx, UPS and DHL, and the analysis of three companies revealed that governance choices are influenced by a company's attempts to innovate, imitate, and/or leapfrog IT-enabled innovation in varying technological regimes. Importantly, the nature of technological advance as well as strategic posture attempted influence transaction costs and possibilities of tapping into comparative advantages of outsourcing vendors in the adoption of IT enabled innovations.

References

Abernathy, W. J. & Utterback, J. M. 1978. Patterns of Industrial Innovation. Technology Review, 80: 40-47.
Afuah, A. 2001. Dynamic Boundaries of the Firm: Are Firms better off being Vertically Integrated in the Face of a Technological Change? Academy of Management Journal, 44(6): 1211-1228.
Argyres, N. & Liebeskind, J. (Eds.). 2000. The Role of Prior Commitment in Governance Choice: Oxford University Press,.
Baldwin, C. Y. & Clark, K. B. 1994. Modularity-in-design: An Analysis Based on the Theory of Real Options. Harvard Business School Working Paper, Cambridge, MA.
Barney, J. 1991. Firm Resources and Sustained Competitive Advantage. Journal of Management, 17(1): 99-120.
Barney, J. & Lee, W. (Eds.). 2000. Multiple Considerations in Making Governance Choices: Implications of Transaction Cost Economics, Real Option Theory, and Knowledge Based Theories of the Firm: Oxford University Press.
Boulding, W. & Christen, M. 2001. First Mover Disadvantage. Harvard Business Review, October: 20-21.
Bowman, D. & Gatignon, H. 1996. Order of Entry as a Moderator of the Effect of Marketing Mix on Market Share. Marketing Science, 15(3): 222-242.
Carpenter, G. S. & Nakamoto, K. 1989. Consumer Preference Formation and Pioneering Advantage. Journal of Marketing Research, 26(August): 285-298.
Carpenter, G. S., Lehman, D. R., Nakamoto, K., & Walchli, S. 1997. Pioneering Disadvantage: Consumer Response to Differentiated Entry and Defensive Imitation. Working Paper, Northwestern University.
Chatterjee, R. & Sugita, Y. 1990. New Product Introduction under Demand Uncertainty in Competitive Industries. Managerial and Decision Economics, 11: 1-12.
Chesbrough, H. & Teece, D. 1996. When is Virtual Virtuous? Organizing for Innovation. Harvard Business Review, January-February: 65-73.
Chesbrough, H. & Kusunoki, K. (Eds.). 2001. The Modularity Trap: Innovation, Technology Phase Shifts and the Resulting Limits of Virtual Organization: Sage Publications.
Cho, D.-S., Kim, D.-J., & Rhee, D. K. 1998. Latecomer Strategies: Evidence from the Semiconductor industry in Japan and Korea",. Organization Science, 9(4): 489-505.
Christensen, C. 1997. The Innovator's Dilemma - When New Technologies Cause Great Firms to Fail. Boston: Harvard Business School Press.
Christensen, C. M. 1993. The Rigid Disk Drive Industry: A History of Commercial and Technological Turbulence. Business History Review, 67(4): 531-588.
Christensen, C. M., Verlinden, M., & Westerman, G. 2002. Disruption, Disintegration and the Dissipation of Differentiability. Industrial and Corporate Change, 11(5): 955-993.
Clark, K. B. & Fujimoto, T. 1991. Product Development Performance: Strategy, Organization and Management in the World Auto Industry. Boston, MA: Harvard University Press.
Coombs, R. & Metcalfe, S. (Eds.). 2000. Organizing for innovation: Coordinating distributed innovation capabilities: Oxford University Press.
Dasgupta, P. 1988. Patents, Priority and Imitation or, the Economics of Races and Waiting Games. The Economic Journal, 98(389): 66-80.

Eisenhardt, K. 1989. Building Theory from Case Study Research. Academy of Management Review, 14(4): 532-550.
Freeman, C. & Soete, L. 1997. The Economics of Industrial Innovation: Pinter.
Ghosh, A., Neslin, S. A., & Schoemaker, P. W. 1983. Are There Associations between Price Elasticity and Brand Characteristics. American Marketing Association (AMA) Educator's Proceedings, (Chicago IL: AMA): 226-230.
Glaser, B. G. & Strauss, A. L. 1967. The Discovery of Grounded Theory - Strategies for Qualitative Research. New York: Aldine de Gruyter.
Golder, P. N. & Tellis, G. J. 1993. Pioneer Advantage: Marketing Logic or Marketing Legend? Journal of Marketing Research, 30: 158-170.
Grant, R. M. & Baden Fuller, C. 2004. A Knowledge Accessing Theory of Strategic Alliances. Journal of Management Studies, 41(1): 61-84.
Greenstein, S. M. 1997. Lock-in and the Costs of Switching Mainframe Computer Vendors: What Do Buyers See? Industrial and Corporate Change, 6(2): 247-273.
Hannan, T. H. & McDowell, J. M. 1987. Rival Precedence and the Dynamics of Technology Adoption: An Empirical Analysis. Economica, 54: 155-171.
Henderson, R. & Clark, K. 1990. Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. Administrative Science Quarterly, 35: 9-30.
Katz, M. L. & Shapiro, C. 1985. Network Externalities, Competition and Compatibility. The American Economic Review, 75(3): 424-440.
Kerin, R. A., Varadarajan, P. R., & Peterson, R. A. 1992. First-Mover Advantage: A Synthesis, Conceptual Framework, and Research Propositions. Journal of Marketing, 56(October): 33-52.
Kern, T., Willcocks, L., & Heck, E. 2002. The Winner's Curse in IT Outsourcing: Strategies for Avoiding Relational Trauma. California Management Review, 44(2): 47-69.
Kogut, B. & Zander, U. 1992. Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. Organization Science, 3: 383-397.
Lacity, M. C. & Hirscheim, R. 1993. The Information Systems Outsourcing Bandwagon. Sloan Management Review, 35(1): 73.
Langlois, R. & Robertson, P. L. 1992. Networks and Innovation in a Modular System: Lessons from the Microcomputer and Stereo Component Industries. Research Policy, 21: 297-313.
Langlois, R. N. & Foss, N. J. 1999. Capabilities and Governance: The Rebirth of Production in the Theory of the Firm. KYKLOS, 52: 201-218.
Levin, R. C., Klevorick, A. K., Nelson, R. R., & Winter, S. G. 1987. Appropriating the Returns from Industrial Research and Development; Comments and Discussion. Brookings Papers on Economic Activity, Washington: 783-832.
Levinthal, D. A. & March, J. G. 1993. The Myopia of Learning. Strategic Management Journal, 14(Special Issue, Winter): 95-112.
Lieberman, M. B. & Montgomery, D. B. 1988. First-Mover Advantages. Strategic Management Journal, 9(Special Issue): 41-58.
Lieberman, M. B. & Montgomery, D. B. 1998. First-Mover (Dis)Advantages: Retrospective and link with the Resource-Based View. Strategic Management Journal, 19: 1111.
Madhok, A. 2002. Reassessing the Fundamentals and Beyond: Ronald Coase, Transaction Cost and Resource-Based Theories of the Firm and the Institutional Structure of Production. Strategic Management Journal, 23: 535-550.

Mansfield, E. 1985. How Rapidly Does New Industrial Technology Leak Out? Journal of Industrial Economics, 34(2): 217-223.
Monteverde, K. 1995. Technical Dialog as an Incentive for Vertical Integration in the Semiconductor Industry. Management Science, 41(10): 1624-1638.
Oxley, J. (Ed.). 2000. Learning versus Protection in Inter-firm Alliances. New York: Palgrave Macmillan.
Paul, D. L. & Pearlson, K. E. 1994. Federal Express: The Role of IT in Customer Service, University of Texas at Austin Case Study.
Penrose, E. 1959. The Theory of the Growth of the Firm. Oxford: Basil Blackwell.
Poppo, L. & Zenger, T. 1998. Testing alternative theories of the firm: Transaction cost, knowledge-based, and measurement explanations for make-or-buy decisions in information services. Strategic Management Journal, 19: 853-877.
Porter, M. E. 1980. Competitive Strategy. New York.
Porter, M. E. (Ed.). 1983. The Technological Dimension of Competitive Strategy.: JAI Press, Inc.
Quinn, J. B. 2000. Outsourcing innovation: The new engine of growth. Sloan Management Review, Summer: 13-28.
Robertson, P. L. & Langlois, R. 1995. Innovation, Networks and Vertical Integration. Research Policy, 24: 543-562.
Ross, J. 2001. United Parcel Services: Delivering Packages and E-Commerce Solutions, MIT Working Paper.
Schilling, M. A. 2003. Technological Leapfrogging: Lessons from the US Video Game Console Industry. California Management Review, 45(3): 6-32.
Schmalensee, R. 1982. Product Differentiation Advantages of Pioneering Brands. American Economic Review, 27(June): 349-365.
Shankar, V., Carpenter, G., & Krishnamurthi, L. 1998. Late Mover Advantage: How Innovative Late Entrants Outsell Pioneers. Journal of Marketing Research, 35(February): 54-70.
Smith, F. (Ed.). 1997. Federal Express: the Supremely Packaged Warehouse in the Sky: HarperCollinsBusiness.
Stremersch, S., Weiss, A. M., Dellaert, B., & Frambach, R. T. 2003. Buying Modular Systems in Technology-Intensive Markets. Journal of Marketing Research, 15(August): 335-350.
Teece, D. (Ed.). 1994. Design Issues for Innovative Firms: Bureaucracy, Incentives and Industrial Structure: Oxford University Press, 1998.
Teece, D., Pisano, G., & Shuen, A. 1997. Dynamic Capabilities and Strategic Management. Strategic Management Journal, 18: 509-533.
Thompson, V. A. 1965. Bureaucracy and innovation. Administrative Science Quarterly, 10: 1-20.
Von Hippel, E. (Ed.). 1994. "Sticky Information" and the Locus of Problem Solving: Implications for Innovation": Oxford University Press, 1998.
Wheelwright, S. & Clark, K. 1992. Revolutionizing Product Development. New York: The Free Press.
Willcocks, L. & Fitzgerald, G. 1994. A Business Guide to IT Outsourcing. London: Business Intelligence.
Williamson, O. E. 1975. Markets and Hierarchies. New York: Free Press.
Winter, S. G. (Ed.). 1987. Knowledge and Competence as Strategic Assets. Cambridge (MA): Ballinger.

Worren, N., Moore, K., & Cardona, P. 2002. Modularity, Strategic Flexibility and Firm Performance: A Study of the Home Appliance Industry. Strategic Management Journal, 23: 1123-1140.
Yin, R. K. 1989. Case Study Research-Design and Methods. London: Sage.

[i] Central to this variation is the firm's "strategic orientation", which bears a significant impact on its entry timing decision (Snow & Ottensmeyer, 1990; Schoenecker & Cooper, 1998). As strategic orientation is a function of not merely capabilities and resource profiles but also organizational attributes, firm history and management attitudes, later entry does not necessarily always imply comparatively weak innovative capabilities and a lack of critical resources on the part of entrant.