ARE THERE DIFFERENT PATHS FOR DISRUPTIVE TECHNOLOGIES?
ALTERNATIVE TRAJECTORIES TO OPTIMISATION OF DT

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Abstract

In this study, we challenge established recommendations for best practice strategies to technology management, particularly disruptive technologies (DT). We identify more constructive ways of utilising DTs, both in large and medium-sized organisations, and how DTs can become, if managed in a more nurturing context, a capability-enhancing strategic asset with a potential to create an improved business model.

Introduction


The difficulty is not necessarily in anticipating the future technological changes per se, but rather the choices that society makes about which technologies to invest in and what to accept, adopt and reject (Gallaire, 1998, Christensen, 2000). Thus, even if the technical specifications of new technologies are available and understood at the time of introducing the technology, the time required for it to become fully performance-competitive with the established technologies, and the uses that it may get once accepted by the mainstream market, are usually unforeseeable. Furthermore, as the history of DTs demonstrates, the availability of more advanced and radical technology does not assure that its potential will be extended into useful applications, nor that its diffusion reaches those who might use it most productively (Abetti, 2000), thereby increasing the risk associated with the adoption of such advancements.

If the assessment above is true, then organizations introducing or confronting DT must be prepared for a lengthy period of turbulence, which may challenge their very raison d’être. Consequently the unpredictable nature of DT increases ambiguity and insecurity both at the business sector as well as at the consumer level. What follows then, is vigorous discussion about how desirable it is to encourage the technological change process and introduction of DTs given the dangers associated with them (Miller et al., 1998). The concerns are not only technical in
nature, but they emerge also at a social level, including social injustice and its extreme form of social exclusion (Castells and Himanen, 2002).

Threats and opportunities brought about by the continuous need for change and innovation, and the recent world events requiring increased focus on security and resilience (Evans, 2003), make it imperative for firms to revisit their strategies and increasingly focus on efficient introduction, management and exploitation of emerging and disruptive technologies. In another words, any firm’s business strategy should have a strong emphasis on issues associated with technological change.

This issue of technological change and technological advancement is especially important for emerging enterprises, which often have the advantage over large established firms to initiate new industries based on new technology (McKelvey and Texier, 2000) and hence act as motors for innovation and economic development at larger scale. However, the time dimension of the industry life-cycle suggests that these emerging enterprises are typically unable to maintain their competitiveness when the industry matures and the large established firms start to dominate by utilising their economies of scale, specifically in production (Abernathy and Utterback, 1978, McKelvey and Texier, Utterback and Suarez, 1993). Thus, one basic insight of the life-cycle model is that the focus of innovation as well as type of firms innovating changes over time suggesting that the existence and growth of the small firms that initially initiated the industry may be threatened. Typically, in a situation like this, small firms have the choice of either merge with another company, or try to compete. What is common to both of these strategies is that the relationships with other companies become of critical importance. Hence, firms are continuously benchmarking each others to find the most powerful and ideal network partners and enhancing their positions in the networks they are embedded in. Furthermore, in their efforts to keep up with this ever rising performance bar, firms try to develop new managerial practices and unique business models. However, constant emergence and fading of new businesses suggests that successful and sustaining business models are challenging to develop, and more knowledge is needed to guide managers to effectively manage their technologies and disruptive technologies in particular.

This study deals with this opportunity. Based on exploratory case studies of two companies in logistics/transportation industry with different strategies to manage and introduce technologies, this paper aims at challenging earlier recommendations for the best practice strategy to technology management and especially disruptive technologies (DT). Furthermore, it attempts to show how DT can become, if properly managed, a capability-enhancing strategic asset and a medium to improve the business model. In deed, Johnston et al. (2000) have claimed that organisations cannot be successful in managing new technologies if the technology is disruptive to its business model. Evidently the prevailing business models are not appropriate in this respect suggesting that further research on the relationship between DT and business models is needed.

The paper is structured as follows. In the following section, a brief review of focused literature and theoretical framework underpinning the motivating research question is presented. Drawing upon the literature review, the research hypothesis is formulated, followed by a discussion of analytical problems associated with DTs. After brief review of DT in transportation industry, we
present and analyse the case study companies using our assessment framework. The paper concludes with discussion on the different trajectories leading to the DT enabled business model, conclusions and implications for further research.

**Literature Review and Theoretical Framework**

The fundamental question in the field of strategic management is how firms achieve and sustain competitive advantage. To respond to this question, Joseph Schumpeter was the first scholar to conceptualise the general idea of “creative destruction” (Schumpeter, 1934).

Since the pioneering work of Schumpeter, numerous contributions have been made to refine and further develop his theories. The ones most referred to in the recent literature include the ‘five-forces’ (also referred to as competitive forces) model by Porter (1980), the strategic conflict approach by Shapiro (1989), resource-based approach (e.g. Penrose, 1959, Rumelt, 1984), and ‘dynamic capabilities’ approach by Teece et al. (1997). Building upon the idea of creative destruction, Schumpeter was the first scholar to capture the problem of finding the right equilibrium between exploration and exploitation strategies.

Exploitation and exploration strategies are frequently associated with radical and incremental innovations in the literature. The mainstream of the previous contributions have recognised that technological innovation frequently falls into either one of these categories (Afuah, 2001, Day and Schoemaker, 2000, Tushman and Anderson, 1986, Abetti, 1989, Ehrnberg and Jacobsson, 1997, Ehnberg and Sjöberg, 1995), but vagueness of the definition criteria still exists (Abetti, 1989). However, generally speaking, the underlying difference between radical and incremental categories is that whereas incremental innovations are developed with modest advancements to the old technology following the logic of exploitation strategy and preserving the status quo of the industry, radical innovations mainly result from utilisation of exploration strategy and have an industry equilibrium-disturbing character (Afuah, 2001, Perrons and Platts, 2003, Tushman and Anderson, 1986).

In addition to vagueness of definition criteria of incremental and radical innovations, there is significant vagueness in the definitions of disruptive and radical innovations. In deed, there seems to be two different schools of thought: whereas some scholars treat the two terms as distinctive from each other, and claim that a distinction should be made between radical-incremental and disruptive-sustaining antagonisms (Christensen, 2000), some still treat them as synonyms. Hence, as clear criteria are still yet to be determined and agreed upon, we have chosen to view terms radical and disruptive innovations as synonyms.

Organisations, which are confronted with DT – whether they have introduced DT, faced with pressures to offer competitive responses to DT, or faced with the dilemma of adopting or rejecting DT – can usually feel the shake-up brought about by DT at three different, but increasingly interrelated levels:

1. Changes in their external environment
2. Changes in their organisational settings, and
3. Changes in the skill sets required from the members of the organisation to adjust to the new situations (Dierkes et al., 1998).

Furthermore, leadership changes hands in this change process (Utterback, 1994, Christensen, 2000) suggesting that efficient management of technological discontinuities – and DTs in particular – ought to have a profound impact on any firm’s strategy (Perrons and Platts, 2003). Failing to understand the role that technology can take as a key strategic resource of a corporation can impede its becoming a strategic asset if improperly managed (Abetti, 1989). Hence it follows that business strategies of firms can be said to be very sensitive to technological novelties and should be revisited and redesigned according to the changes in their internal and external circumstances. Indeed, a successful strategy to manage DT involves not only deciding the modi operandi of the technological development within the boundaries of the firm’s capabilities, as portrayed in the resource-based theory, but also requires constant surveillance of markets and how entirely new uses and new needs in their external environment might emerge (Miller et al., 1998), as well as what kind of an approach should be used to identify and respond to these challenges.

Hypothesis: Given that the success of a disruptive technology is largely determined by the market, finding the right equilibrium between market penetration and market creation has a potential to improve the overall business performance and result in the generation of the ideal business model.

**Characteristics of Disruptive Technology**

In addition to their industry-disturbing characteristics, Christensen (2000), and Rafii and Kampas (2002) have proposed that DT – when compared to the established technologies – typically offer initially lower performance, less functionality, and lower prices. With such technologies firms are likely to reach those customers whose needs are not satisfied by the products of established firms. These technologies also possess the ability to gradual improvement until they reach the acceptance of larger markets and displace the products of the incumbent firms.

Johnston et al. (2000) have also examined the DTs and their characteristics in mobile commerce industry. They point out, that an often forgotten, yet important, feature of DTs is relativity: what is disruptive to one firm or industry, may be sustaining to another. Furthermore, the overall success of a technological innovation is not only determined by its ability to meet technical specifications (technical success), but also how well it is accepted by the market (commercial success) and whether it provides an adequate return on investment (financial success) (Abetti, 2000). Hence, given these several enabling and disabling factors affecting the success of the disruption, the disruption can be said to be possible, but not assured (Rafii and Kampas, 2002). What is common to all DTs, however, is their potential to substitute an existing product class or act as the genesis for brand new industries (Tushman and Anderson, 1986). Historical examples of such market creation technologies and products include Kodak’s personal camera, Bell’s telephone, Sony’s portable radio, Apple’s personal computer, and eBay’s online marketplace (Christensen and Anthony, 2003, Tushman and Anderson, 1986).
Analytical Problems concerning Disruptive Technology

As the definition of DT implies, all such advancements are novel and unique. Christensen (2000) illustrated this by exploring the limits of the technology S-curve, and concluded that “DTs emerge and progress on their own, uniquely defined trajectories” (ibid. p.46). What follows is that this uniqueness creates an analytical problem of ex-ante and ex-post comparisons of success and failure factors of DT in relation to established technologies. Despite this difficulty, many attempts have been made to address such factors, many of which deal with technological innovations (Marquis, 1969, Levi, 1998, Roberts, 1991, Hippel, 1988, Kelly and Kranzberg, 1978, Abetti, 2000).

Disruptive Technologies in the Logistics and Transportation Industry

History is rich of great examples of advances, each occurring through a single discovery which quickly replaced the old products and techniques. The examples include metalworking, gunpowder, printing and cash money, all of which have had a profound impact on the economy and society through industry shake-ups (Cooper and Schendel, 1976), and changes in market and industry leadership (Utterback, 1994).

It is often said that society has advanced further in the last 50 years than it did in the previous 2000 years. This is reflected in the number of scientific, engineering and medical advances that have occurred in this period. The transportation industry has been a beneficiary of many of these developments suggesting that the industry is largely built on technological innovation. By its nature, it is very capital intensive, encouraging the introduction of new technologies, many of which have had the characteristics of DT. This makes the transportation industry an interesting sector for examining the impact of introduction of new technologies on firm performance and to test our hypothesis. The two case studies that follow illustrate the revolutionary and evolutionary effects that new technologies can have on different aspects of the transportation industry.

Effects of new technologies on Two Firms in the Transportation / Logistics Industry

In this section we examine in more detail the effects that new technologies have had on two firms in the logistics/ transportation industry. We illustrate two different strategies to manage new technologies and show how these technologies can be used as strategic asset to enhance firm’s competitiveness. Based on the case study analysis and our assessment framework we propose a model which can be especially applicable to small businesses when they are developing their business models.

The first case firm, United Parcel Service, is an almost 100-year-old company with vast global operations centred on the transport of goods. At UPS, it is seen that the adoption of advanced technology is an enabler for a better business model. By contrast, Octopus Card, on the other hand, is a small 10 year-old Hong Kong company whose service facilitates the transport of people. With Octopus Card, the technology used to operate the system is itself a DT, hence representing a very distinctive setting and view of technology management from UPS case.
United Parcel Service Inc.

United Parcel Service Inc. (UPS) was founded in 1907 in Seattle, Washington, as a private messenger company. Today, UPS is the world's largest delivery company. In 2002, its revenues and shipments totalled US$31 billion and 4.8 billion packages and documents (equal to 13.3 million items everyday), respectively. It has a fleet of 88,000 delivery cars, vans, tractors and motorcycles, 581 company-owned and chartered aircraft and 1,748 facilities worldwide with a workforce of 357,000. In short, it is a global leader in supply chain services managing the flow of funds, goods, and information to 200 countries (UPS 2002 Annual Report).

Technology management

UPS did not reach its current position by accident. From its earliest days it quickly adopted new technology to maintain its competitive market position. In fact, in its first few years it was the beneficiary as well as a victim of new technologies. As telephone technology became more widespread, its original business of delivering messages was almost destroyed. In another words the company was faced with disruptive technology. However, the automobile allowed it to greatly expand the geographic scope of its package delivery business, hence enabling the firm to take advantage of new technological advancement.

Today, with 13.3 million packages to track and 7.9 million requests to process daily, UPS needs both to supply accurate information for their delivery services and have a reliable network infrastructure to transfer this information quickly and effectively. Hence, UPS’ latest information technology project is the development of an end-to-end wireless network. This project, with a budget of $127 million, will take 5 years to complete. By the end of the project, each driver’s handheld DIAD, a device that records and uploads delivery information to the UPS network, allowing customers to track in real-time the status of their shipments, will be connected to six different wireless networks - infrared, WiFi, Bluetooth, the satellite-based Global Positioning System (GPS), and two cellular networks, CDMA1x and GSM/GPRS enabling drivers to connect to UPS’ worldwide network from the customer’s site.

Even though UPS spends about $1.5 billion dollars per year on technology, its innovative technologies mainly represent “qualifiers” that allow it to compete in this industry. For example, the U.S. Postal Service has also adopted its own automated tracking package technology. UPS’ main private sector competitor, Federal Express Corp., has developed a similar handheld device called FedEx PowerPad. Therefore, UPS’ order winners still remain price and a timely delivery service.

Impacts of new technology

UPS is an example of how new technologies can help a company to improve its operating performance. The company still basically provides the same service it did in 1907 – delivering packages for customers. However it is using advanced technology to improve the way it operates its primary business and to leverage those skills and infrastructure to move into other related lines of business. UPS has developed software applications and mobile devices with the support of wireless networks for shipping and tracking services. Its software applications work on a
common platform with a single database, enabling it to optimise the route and load plans faster in order to surpass its competitors.

UPS’ software applications generate reports for managers that allow them to better plan and control the delivery routes. Better planning and route control result in time saving and more efficient use of resources.

**Octopus Card**

In the mid-1990s, the two passenger rail companies in Hong Kong – the Mass Transit Railway Corporation (MTRC) and Kowloon-Canton Railway Corporation (KCRC), wanted to adopt a modern ‘smartcard’ system. To maximise the potential of the new system and reduce the development costs each company faced, they asked the other three major public transport operators in Hong Kong at the time - Kowloon Motor Bus, Citybus and the Hong Kong and Yaumati Ferry - to join their venture.

A company called Creative Star Limited was established in 1993 to manage the development and implementation of the smartcard. It is a private, non-profit organisation that settles accounts between the Octopus system and the member operators and merchants. The Octopus system was launched in September 1997.

Octopus Card has a unique marketing position, as it is both a product and a process technology. As a product, there was no standard technology platform at the time of its introduction and hence the technology behind Octopus Card consists of a proprietary system of radio frequencies. Having begun as a replacement of magnetic cards, the Octopus Card created a new method of payment and evolved into a process enabling easier purchase transaction of transportation services and goods.

**Defeat of Mondex**

The Mondex smartcard system was launched in Hong Kong in 1997. It had the backing of two large and powerful organisations – Mastercard and the Hong Kong and Shanghai Banking Corporation (HSBC). It promised a revolution in the way consumers paid for ordinary goods and services. Over 100,000 people applied for a card in its first two months on the market. The number of merchants accepting Mondex reached into the thousands. It appeared to be on the way to great success.

However, on 31 March 2002, HSBC announced to its Mondex cardholders that the Mondex card program had been discontinued, only five years after it was launched. The reason was that the Octopus card was introduced which provided an innovative electronic payment service, reducing the need to handle cash. Compared to Octopus, the Mondex card was cumbersome and slow to use. The more sophisticated technology required for the Mondex platform was no match for the simplicity and ease of use of the Octopus, the latter system therefore achieving market acceptance and eventual commercial success. A similar situation was reported in the telecommunication industry by Abetti (2000).
Impacts of DT

At UPS, it is seen that the adoption of advanced technology is an enabler for a better business model. With Octopus Card, the technology used to operate the system is itself a DT. From a narrow view, given its origin as a transport payment system it could be said that Octopus has largely displaced the magnetized paper and plastic ticket system. However the full value of the technology is only now becoming apparent.

The Octopus system is not particularly advanced compared to some of the technologies available today but it is one of the most successful smartcard systems in the world. It has impacted on the whole national socio-economical system through its co-operation with the main public transport operators in Hong Kong by developing a single smartcard system. In many countries, different public transport operators develop their own smartcard technologies but these are often incompatible with each other, thereby restricting their adoption (Abetti, 1989). This inhibits the generation of dominant design and its spread into different contexts, thereby decreasing the likelihood of other follow-on innovations (Nooteboom, 2000). In contrast, every major public transport system in Hong Kong now uses the Octopus Card. Thus the Octopus Card has created a systems disruption, and is anticipated to give push to many other innovations in different sectors.

Following the life cycle of technological innovation described by Nooteboom (2000), the use of the Octopus Card has spread far beyond its initial purpose. In addition to the uses in public transportation system, it is slowly becoming a standard payment method as well. Other businesses using it include car parks, photograph booths and other vending machines, and enabled by each cards’ unique identification (ID) number, some residential estates are now using Octopus as the respective complexes’ security access card. In line with Nooteboom’s model (ibid.), the Octopus Card technology seems to exhibit more of the exploitation characteristics. This differentiation and fragmentation of the original technology can then lead to the “cleaning-up stage” where new innovations are created through reconfiguration of the established technology. Thus, the challenge for Octopus is to find the balance between market penetration and market creation.

Assessment Framework

To understand and assess the impact that DTs can have on companies, we put forward an ‘Assessment Framework’, based on contributions by Lievano (1999) and Christensen (2000). Whereas the ‘Prototype Markets and Strategies’ model (Lievano, 1999) suggested that the formulation of the appropriate business and technology strategies should be based on matching technologies to market characteristics, our Assessment Framework is a reverse of such a process, incorporating Christensen’s ideas of the product life cycle and product-process matrixes.1

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1 Detailed description of the theoretical background of the Assessment framework, and tables on Market Positioning of Technologies (adapted from Christensen, 2000, and Lievano, 1999), and Business Strategy, Competitive Position and Operational Performance Objectives for Different Market Participants (adapted from Christensen, 2000, and Lievano, 1999) are available from the authors upon request.
The first step in the Assessment Framework is to position the technology of the firm in an appropriate market or industry. The second step is to assess the ‘fit’ and success of the firm’s business strategies in the market and the operating performance objectives that must be met, using the Assessment Framework as a guide. Based on the information presented on Octopus and UPS, and using this Assessment Framework, we can measure the success of companies in terms of their introduction of technologies.

**Octopus**

In terms of market positioning, we placed Octopus at the ‘High-End’ as it possessed the characteristics of a product at the introductory stage of a typical product life cycle. Firms operating in this category would have order winners similar to Octopus - uniqueness and speed of introduction (to all mass rapid transport commuters). In addition, Octopus’ ability to expand out of its transport fare market demonstrates its ability to create new product/market combinations. The attainment of the operational performance objectives such as speed, quality and flexibility have been experienced by Octopus.

The Assessment Framework emphasises Octopus’ strengths. In addition, it highlights the DT’s potential in encouraging the creation of new markets or businesses beyond those originally planned or expected. This element of surprise will be discussed and incorporated in our DT optimisation model below.

**UPS**

While Octopus is in the high-end market, UPS competes in a mature market. In order to surpass its competitors, UPS relies on advanced technology to integrate its operating processes to provide faster and more accurate delivery services. This technology provides a new method to serve its customers. The return on investment from adopting new technology is not just the higher productivity that results (and hence lower costs), but also the incremental sales revenue that this superior performance attracts. It also opens up opportunities to penetrate into new geographical markets and lines of business. It is this business philosophy that has turned UPS into one of the world's largest delivery service and global supply chain solution providers.

**DT Optimisation Model**

Octopus Card’s example of breeding a new business model from a DT, thereby creating a new revenue model entirely different from its original intent, suggests that it has created a systems disruption through its multiple uses. A major surge of innovation is now expected from these uses beyond the transport industry. Combined this with UPS’ progressive introduction of technologies that strengthens its market position, allow us to plot a new direction of interaction between market creation and market penetration, where the benefits of both can materialise. As depicted in the Figure 1, by tracking and merging the separate paths taken by both companies, it is possible to generate a scenario for a new business model enabled by technologies being embedded in both products/services and processes.
According to our analysis, the transition to the disruptive technology optimisation business model can follow one of the three trajectories: vertical-horizontal (V+H), horizontal-vertical (H+V), or a direct path as represented by green arrows in Figure 1. The V+H and H+V trajectories consist of two steps, the main difference being in the sequence in which these steps are taken, whereas the direct approach is a single movement process. Next chapters will provide a short discussion of each of these trajectories.

**Vertical-horizontal (V+H) Trajectory**

As suggested by its name, the vertical-horizontal (V+H) trajectory towards the DT optimisation business model begins with a firm first expanding its business vertically through changes in technology stock, i.e. in the assets of the firm in the form of technology incorporated in specific components; machinery, skill sets, organisational rules and information (Esposito and Raffa, 2001). As this new stock enabled by DTs often serve a narrow niche market, require significant investments, can lead to increased path dependency, large firms may be reluctant to allocate resources to such initiatives (Christensen and Overdorf, 2000).

As discussed above, the main characteristics of this trajectory is that it is based on expanding the technology stock either in form of new market/product combinations, or in form of incrementally improved existing applications before a clear sign of the market readiness for such technological performance is received. This has two important implications for businesses:
From small businesses’ perspective the V+H trajectory is risky, as it implies that the firm is exposed to significant R&D investments over technology, which may not be accepted by market as such.

From large established firms’ perspective there is a risk, that the emerging market is not viewed as attractive one before and hence the firm is reluctant to make its horizontal movement. The market then is likely to be invaded by quicker new entrants. This is because even though the technical competencies to produce the DT would exist, many larger, incumbent firms often have tight, tacit customer relationships which may blind them to the value creation enabled by DTs as some of the DTs may risk customer's own core capabilities.

Given that this path is, as discussed, tightly related to quality improvement, this trajectory would be most useful in industries with well defined boundaries, but where quality attributes change over time, e.g. most consumer goods and services (Lievano, 1999). Furthermore, the trajectory requires organisational culture, which allows managers to accept lower gross margins. According to (Christensen and Overdorf, 2000) small businesses are more likely to possess such a culture compared to their larger counterparts.

**Horizontal-vertical (H+V) Trajectory**

Whereas following vertical trajectory (V+H) involves business expansion through technology stock and structural strategies, the horizontal (H+V) trajectory involves deploying *infrastructural* strategies and concentrating on the technology as *flow* i.e. firm's capacity to diffuse technology from and to the external environment. Sensing and responding to market needs, enabled by efficient use of communication channels, are essential to the success of this strategy (Esposito and Raffa, 2001). In another words, “[…] transfer [of technology] must be seen as active and interactive process which involves the multiple creation of knowledge and technology. Actors have to actively participate in the process and create knowledge specific to their need and intended uses” (McKelvey, 1996).

In the modern business environment, increasingly characterised by the trend to focus on the core capabilities and hence increasing the need for networking, this issue of proper and efficient communication gets a critical value. Not only the firm has to sense and respond to its customer needs, but it also has to understand the capabilities of its suppliers to dovetail their processes with the DT.

The supply systems are frequently characterised as an intense network of relationships between firms, often facilitated by the customer. Given the quasi-integration between supplier and customer, the issue of circulation of technology between these two become critical (Esposito and Raffa, 2001). Furthermore, the dependence on co-opetitors suggests that these relationships can be a major competitive advantage to a firm and incentive to expand into new technological areas (McKelvey and Texier, 2000), but they may render useless if the DT renders either one party’s capabilities obsolete (Afuah, 2001) by, for instance not fitting in the firm’s existing applications (Christensen and Bower, 1996). Hence, given such dependence, the DT that impacts the

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capabilities of a firm ought to have an impact on the performance of its suppliers and vice versa. It is critical, therefore, that firms are aware of the impacts of DT on and the capabilities of their suppliers, and does not only look out the opportunities provided by DTs that potentially have a direct, positive impact on its own capabilities, as some of these technologies may have a capability-obsolescing influence on its suppliers resulting in the decreased performance of the supplier system. Hence, in the face of DT, a firm should analyse, whether it would be more advantageous to stay with their current supplier or switch to a new supplier whose capabilities do not suffer from obsolescence (Afuah, 2001).

Looking at the same issue of the impact of DT to the supply system from another perspective, when facing a crisis, the customer may pass its difficulties onto suppliers and, in particular, to the firms that have invested most in the relationship. This is because these suppliers have usually made relationship-specific investments leading to increased dependency on one key customer. To avoid such dependence, the suppliers could direct their own specific technologies to a few customers in different sectors but with similar technologies (Esposito and Raffa, 2001).

Given that the performance of suppliers has such a critical role in determining whether the vertical movement, i.e. creation of new market/product combinations, is successful, an increased attention should be paid to the technology flow and efficient use of communication channels. Once the capabilities of all co-opetitors are assessed and safeguarded, the vertical movement is more likely to be successful.

Hence, analogously with the V+H trajectory, H+V trajectory is most suitable in industries with well defined boundaries, but with changing quality attributes, as the attention to the co-opetitor adjustments may require significant amount of time, which would be a major hindrance to successful performance and introduction of DT in industries characterised by rapid technological development or convergence. However, distinctive from V+H trajectory, H+V trajectory would be more suitable to larger firms because of the great emphasis on the infrastructural issues that typically require significant resources.

**Direct Trajectory**

Following direct trajectory requires simultaneous application of the vertical and horizontal paths, significant amount of management will power, highly disciplined workforce, and access to substantial funding is required. The risks are high, but so are the rewards, as market share is captured from established firms whilst new markets and business areas are created. In addition, many of the drawbacks of the V+H and H+V paths can be avoided by following direct trajectory. The examples of firms that have successfully adopted this trajectory include eBay and Yahoo!.

It should be emphasised that this strategy have a high potential to disturb industry immediately. As the basic strategy in the direct path is creating new product/market combinations, it is most suitable to industries with increasingly blurring, or otherwise weakly-defined, boundaries and in which competitive advantage is based on innovation, e.g. “high-tech” goods and services (Lievano, 1999). Furthermore, direct trajectory favours new entrants as they can take advantage of fundamentally different skills and expertise and gain sales at the expense of formerly
dominant incumbent firms, all of which are prerequisites for successful introduction of new technology.

Conclusions and Suggestions for Further Research

History has repeatedly shown that DTs offer incumbent enterprises opportunities to strengthen and penetrate their market position whilst providing new product/market combinations to emerging enterprises. As business models based on sustaining innovations do not tend to create new growth platforms (Christensen and Anthony, 2003), a firm wishing to make the strategic choice to shape an innovation into a disruptive growth business should enter new markets with a strategy based around disruption, commercialising simpler, more convenient product that sells for less money than what is currently available and appeals to a new or unattractive customer set. This strategy based on initiating a major technological change is also likely to enhance firm’s ability to grow more rapidly than other firms (Tushman and Anderson, 1986).

The two cases from the transportation/logistics industry, demonstrate that disciplined implementation of appropriate marketing strategies and proper identification of key operational objectives are keys to the successful utilisation of new technologies. In another words, the paths that our case study organisations have followed show that technology-embedded processes and products create opportunities for generating new business models that have the advantages of both market creation and penetration.

Thus, the case studies presented here support our earlier-stated hypothesis and challenge the conclusions of previous research by suggesting that, in addition to the experimentation and exploitation strategies discussed in literature, in the face of DT, the best practice model may well be a mixture of the two strategies with the ultimate goal of minimising the negative impacts and maximising desirable consequences. We have named this the “DT optimisation model”.

While the two case studies provide initial evidence and support for our hypothesis, further research is needed to test if the findings in other industry sectors confirm these initial conclusions. Hence, we seek to explore other case companies, and to determine whether the DT Optimisation Model is valid and applicable in other industries as well.

References


