



Technology strategy and sustainability of business

Empirical experiences from Chinese cases

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Abstract

Purpose – This paper sets out to review the literature of technology strategy, competitive advantage and sustainability of international business, in particular, the contribution that the enactment of technology strategy can make toward the effective implementation of business sustainability in the post-recession. It examines what kind of role technology strategy plays in Chinese business and how business sustainability could be leveraged through the implementation of appropriate technology strategy. This paper attempts to address various crucial issues in the establishment of a proper technology strategy for the sustainability of the business in the global market place based upon case study of five vanguard Chinese companies.

Design/methodology/approach – This exploratory study primarily adapts a qualitative multiple-case-study method which attempts to understand how Chinese firms perceive the role of technology strategy in their business, to capture the practical terms and concepts underpinning technology strategy and sustainability, and to allow us to have an analysis of the relationship between technology strategy and sustainability of business. Finally, ten propositions concerning “technology strategy and sustainability of business” are to be developed and verified along the theoretical development of the paper and examination of five cases. The nature of the study results that the paper applies qualitative method with a multiple-case-study approach, including Geely, Haier, TCL, Huawei and Lenovo.

Findings – This paper addresses the crucial issues – management of technology as basic function in international business and the close relationship between technology strategy and business sustainability. It showcases the Chinese business paradigm from “imitation to innovation” of how Chinese hi-tech firms built their core competence. This study provides fresh insights for multinational companies in creating competitive advantage through designing an appropriate technology strategy.

Originality/value – Theoretically this research fills the gap of an area of technology management which has been rarely touched. This will have strong implication not only to Chinese companies but also non-Chinese multinational companies.

Keywords China, Core competence, Technology strategy, Technology management and innovation, Business sustainability

Paper type Viewpoint



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1. Introduction

China's success of the market economy with Chinese characteristics has drawn the world's attention. The ever increasing Chinese economy, which has surpassed Japan to become now the second largest economy in the world (Barboza, 2010; OECD, 2003), has made China the economic engine of the world economy. In the current financing crisis and the economic downturn, the Chinese economy has, to some extent, been affected seriously but in a relatively controlled way. The evidence is that the banking sector and large state-owned enterprises remain strong and play a pivotal role in the economy. China's legacy has become popular not only through demonstrating its economic power, but also the "country-specific advantages", "soft capacity", "the hidden dragons", which can be interpreted as Chinese management (Zeng and Williamson, 2003; Adams *et al.*, 2006; Rugman and Li, 2007).

Since the 1980s, strategic management scholars have recognized that "technology" has been an important element of business definition and competitive advantage (Burgelman *et al.*, 2009). Abell (1980) believes that technology adds a dynamic character to the task of business definition. Porter (1983) regards "technology" as among the most prominent factors that determine the rule of competition. Technology strategy is the task of building, maintaining and exploiting a company's technological assets. In the short term, the main function of technology strategy is to recognize the technological resources of a company, both internal and external, and identify those which are basic and distinctive. In the long term, technology strategy concerns the technological capacity building through the acquisition of appropriate technologies, which sustains the company's continuous success. Generic business strategy is concerned with the establishment of competence building through developing what has been referred to as "strategic focus" or "strategic architecture". Therefore, the important issue here is that the company should make sure that their technology strategy meets the generic business strategy in order to have alignment of technology and business as a way of achieving strategic success. No doubt, business successes and sustainability are achieved by those organizations with strong commitment from senior management to innovation through technology and business acumen based on an appreciation of the relationship between technology strategy and generic business strategy.

2. Theoretical aspects of technology and technology strategy

2.1 What is technology?

The UN Conference on Trade and Development (UNCTAD) has provided the following definition:

Technology is bought and sold as capital goods including machinery and productive systems, human labour usually skilled manpower, management and specialised scientists. Information of both technical and commercial characters, include that which is readily available, and that subject to proprietary rights and restrictions.

The word technology usually conjures up many different images and generally refers to what has been described as the "high-tech" or high technology industries (Gaynor, 1996). However, limiting technology to science, engineering and mathematics also loses sight of other supporting technologies. Actually, technology includes more than machines, processes and inventions. Traditionally, it might concentrate more on hardware; however, these days it concentrates more on the soft side as well. Technology refers to

the theoretical and practical knowledge, skills and artefacts that can be used to develop products and services as well as production and delivery systems. Burgelman *et al.* (2009) consider “technology” to be embodied in people, materials, cognitive and physical processes, plant, equipment and tools. Key elements of technology may be tacit, existing only in an embedded form (e.g. trade secrets based on know-how). However, craftsmanship and experience usually have a large tacit component, so that important parts of technology may not be expressed or codified in operational manuals, routines and procedures, recipes, rule of thumb, or other explicit articulations.

2.2 Concepts of technology strategy

Technology strategy is a relatively recent concept which has appeared in the area of technology management. After the Second World War, firms in the USA, such as Westinghouse and General Electric, pursued paths of diversification through internal research and development (R&D) efforts (Narayanan, 2001). Though the concept of technology strategy was not prevalent at that time, the origin of the concept can be traced to the R&D activities and the argument about technology strategy adopted to manage R&D in large diversified firms.

After heated debate on whether China’s technology strategy of obtaining technology by sacrificing its market partly failed, Chinese enterprises are to become less reliant on foreign technology. However, developing countries, such as China, have to understand explicitly that “real core technologies cannot be purchased but can only be achieved by developing ‘indigenous innovation’”[1]. China and Chinese enterprises need more commitment in the fusion of its science and technology with management capacities, in particular the technological capacity to manage innovation and develop and implement a sound technology strategy (De Meyer, 2008). Technology strategy is the pattern of choices that the firms make concerning technology development, technology direction and technology capacity building. However, Porter (1988) describes “technology strategy” as “a strategic instrument for pursuing generic competitive strategies aiming at fundamentally different types of competitive advantages” in trying to establish a conceptual link between technological change and the choice of competitive strategy by the individual firm.

2.3 Under-representation of technology management study

Technology strategy is no doubt an important but often ignored link in the strategic formulation system. Compared with the position of development and marketing strategy, financial strategy, human resources strategy, technology strategy appears to be in a fragmented, piecemeal fashion (Li-Hua, 2009a, b). In the meantime, Li-Hua (2010) highlighted the under-representation of technology management. Technology management is a very important issue which should rank alongside other management sub-disciplines such as human resource management and financial management. However, it is under-represented, mainly because of lack of knowledge on the part of the leadership of firms. Also in business and management courses and MBA programmes. The significance of technology content has been neglected due to lack of knowledge of the deans of business schools or management schools. This is very short-sighted, because future business managers need to understand every aspect of the workings of a business: technology, HR, operations, finance and marketing.

3. Design and implementation of technology strategy

Technology, like marketing, financial and human resources, is pervasively important in any organization. Management of technology is a basic business function. Burgelman *et al.* (2009) argue that technology strategy is in the position and has to answer the following questions:

- Which distinctive technological competences and capacities are necessary to establish and maintain competitive advantage?
- Which technologies should be used to implement core product design concepts and how should these technologies be embodied in products?
- What should be the investment level in technology development?
- How should various technologies be sourced – internally or externally?
- When and how should new technology be introduced to the market?
- How should technology and innovation be organized and managed?

It has to be noted that each of these questions is closely related to business strategy and is pivotal to the creation of core competence of firms.

3.1 Technology strategy and business strategy

However, there are fundamental issues to be addressed here. First, what kind of role does “technology” play in business? Second, what kind of role does “technology strategy” play in business? On many occasions, MBA students argued that market demand is crucial and the firms have to produce the products and deliver the services to meet the market demand. The significance of market demand and products no doubt cannot be neglected. However, how could products be produced and services delivered without the application of appropriate technology?

In addressing business strategy, Porter (1985) argued there were three basic generic strategies to any business. They are:

- (1) cost leadership;
- (2) differentiation; and
- (3) focus.

In the super-competitive market, every business needs to choose one of these strategies so as to compete against its competitor and gain sustainable competitive advantage (Lynch, 2000). This is shown in Figure 1.

The low-cost leadership in an industry no doubt has built and maintains plant, equipment, labour costs and working practices that deliver the lowest costs in that industry. However, if we ask how low-cost leadership can be delivered, we have to approach technology strategy. Porter points out that technology strategy is a potential powerful tool for pursuing each of the three generic strategies (Burgelman *et al.*, 2009), but each one needs a somewhat different technology strategy. The diversification of products will help to achieve a cost leadership. And the product technology strategy can assist the firm in obtaining a low-cost strategy.

Differentiation occurs when the products of an organization meet the demands of some customers in the market place better than others. When the organization is able to differentiate its products, it is able to charge a price that is higher than the average

Figure 1.
Porter's generic
business strategy



Sources: Porter (1985); Lynch (2000)

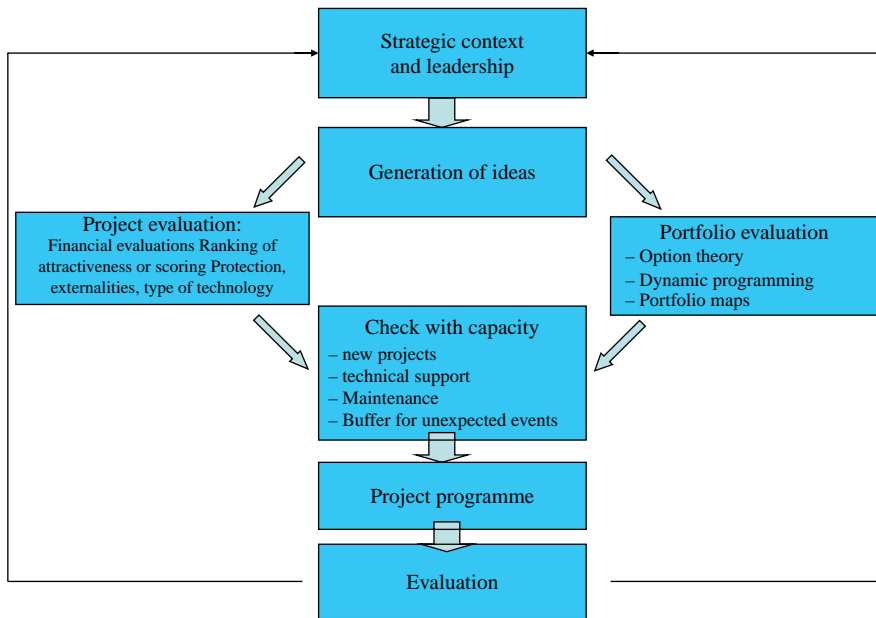
price in the market place. In this regard, the process-related technology strategy may be the key to product performance, which delivers a differentiation (Burgelman *et al.*, 2009). In other words, the differentiation has to be delivered through the implementation of an appropriate process-related technology strategy.

3.2 Determinants of technology strategy

As established previously, technology strategy offers several implications for business strategy. First, it is the translation of the overall strategy of the organization into a coherent set of long-term instructions for investment for the sub-organizations that are active in technology development. Second, it is also the development of technology-based opportunities for the organization to steer future development. Practically technology strategy has been expressed in a set of technical research and development projects that are to be implemented by firms. Therefore, the key decisions in technology strategy are the choice of individual technological projects that will support the firm's overall strategy. De Meyer (2008) develops a framework, which is shown in Figure 2, which specifies that the creation and implementation of a technology strategy is clearly embedded in an organization where there is a clear vision and a strong leadership that sets overall strategic context. A firm may create such a culture where creativity can blossom and innovation can be promoted.

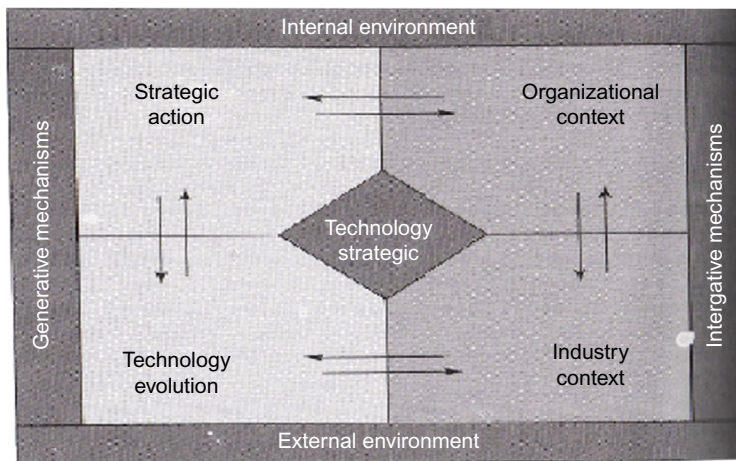
In addressing the determinants of technology strategy, Burgelman *et al.* (2009) focus on aspects of technology evolution, industry context, strategic action and organizational context. An evolutionary process perspective raises the fundamental question of how a firm's technology strategy can be established and actually comes about and changes over time. At strategic level, both the internal and external generative and integrative forces are important evolutionary factors that shape the creation of technology strategy. These factors and concepts are shown in Figure 3.

Technology strategy drives substantive and generic corporate strategies over time, so their relationships are reciprocal. However, the most importantly establishment of technology strategy requires a strong commitment of both financial strategy and human resources strategy. The disparity between financial strategy and human resources strategy, where there is only financial commitment in purchasing technology but no availability of technical expertise, has presented serious problems. For example, there



Source: De Meyer (2008)

Figure 2. A simplified description of technology strategy



Source: Burgelman et al. (2009)

Figure 3. Determinants of technology strategy

were a number of failure cases in China in the 1990s. Because of technology import, land was purchased, equipment was imported and factories were built. It was expected that there should be good operation and production. Unfortunately the machinery was not in working condition and the factories were closed. The external technical experts discovered that the equipment was second-hand and the technology was out of fashion.

However, the crucial point here is that the firm's technology strategy needs to be in alignment with its generic business strategy. And in the meantime, the firm's financial strategy and human strategy need to follow. What should not be allowed is having a huge investment financially without the technological readiness on the HR side. So the firm will suffer the consequence if the firm makes a quick financial decision without understanding the technological aspects or has no technological expertise.

Furthermore, Burgelman *et al.* (2009) establish a capacity-based organizational learning framework as shown in Figure 4.

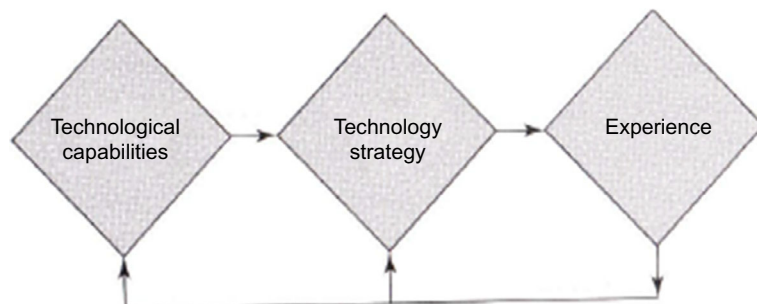
In this figure, technological experiences, technological capacities and technology strategy have established a circle by linking to each other and support each other. Technology strategy is a function of the quantity and quality of the technical capacities and competences. A firm's technological experience achieved in the implementation of technology strategy feeds back to technical capacity and technology strategy. The internal and external forces (Porter, 1985) and resources (Burgelman *et al.*, 2009) shape the evolution of a firm's technology strategy. The evolution of technology along with S-curve (Twiss, 1980; Dosi, 1982; Schilling, 2005) and product life cycle are important reminders for the creation of technology strategy. In terms of the technological capacity building, technology strategy can be realized through the enactment of the key tasks, such as technology sourcing, both internal sourcing and external sourcing, technological leapfrogging, technology transfer and technological innovation.

Therefore, the propositions on the terms of technology strategy and sustainability could be put forward as follows:

- P1. Technology strategy requires not only the technical commitment but also commitment of both human resource and financial resources as it intends to identify the technological resources of the company, including both internal and external resources in the short term, while in the long run it concerns the technological capacity building through acquisition of appropriate technologies, which involves technology transfer and technological innovation.

4. Industrial sustainability of business

Sustainability refers to sustainable development that meets the need of the present without compromising the ability of future generations to meet their needs. In 1995, the formation of the World Business Council for Sustainable Development (WBCSD)



Source: Burgelman *et al.* (2009)

Figure 4.
A capacities-based
organizational learning
framework of
technology strategy

marked the ever first collective efforts towards a business or industry response to sustainability with a presence of 160 international companies from over 30 countries (Paramanatham *et al.*, 2004). The UK's sustainable development strategy (The UK Government, 1999) outlines four objectives in defining "sustainability":

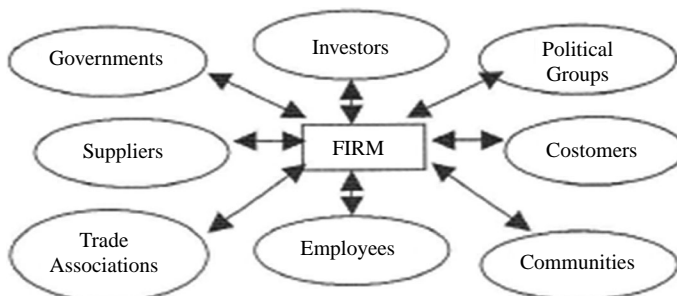
- (1) it has to be social progress recognizes the needs of everyone;
- (2) effective production of the environment;
- (3) prudent use of natural resources; and
- (4) maintenance of high and stable levels of economic growth and employment.

How could sustainability be achieved? With consideration of corporate governance and corporate social responsibility, Donald and Preston (1995) summarize the stakeholder theories, which are shown in Figure 5.

We can see from the stakeholder model that, as the sustainability issue will affect the stakeholder group, so the managers in the firms need to be prudent in identifying the problems and deal with the relationship between firms and the stakeholders. The contribution of the stakeholder model to the establishment of business sustainability can be exemplified in several aspects. First, there could be a short-term need to respond to the external pressures such as regulation or advocacy groups; second, the core values and competence are embedded in various stakeholder engagements; third, the stakeholder engagement could contribute to the sustainability of business strategy.

From the strategic management point of view, competitive advantage is achieved through the creation of the five qualities: superiority, inimitability, durability, non-substitutability and appropriate-ability, which underpin business sustainability. As established previously, the cost leadership strategy can be delivered through product diversification technology strategy while the differentiation strategy can be delivered through process technology strategy. Therefore, technology strategy provides the foundations of achieving the five qualities. Hence:

- P2. Technology strategy concerns the achievement and creation of superiority, inimitability, durability, non-substitutability and appropriate-ability. These qualities drive the creation of core competence, which is complex, distinctive, difficult to initiate, durable and adaptable to ensure sustained superior performance.



Sources: Donald and Preston (1995); Paramanatham *et al.* (2004)

Figure 5.
The model of corporation
– stakeholder model

5. Research design and methodology

Creswell (2007) argues that qualitative research is sometimes called interpretive research, which is in contrast to a quantitative approach. The goal of qualitative research is to comprehend the complex world of human experience and behaviour from the point of view of those involved in the situation of interest (Krauss, 2005). This implies that the investigator is expected not to have a priori, well-defined conceptualization of the phenomenon but rather this conceptualization emerges from the interaction between the investigator and the participants (Krauss, 2005).

Creswell (2007) classifies case studies as one of the five available approaches for qualitative research, the other four being ethnographies, grounded theory, phenomenological research and narrative research. He defines case study as:

[...] a qualitative approach in which the investigator explores a bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (e.g. observations, interviews, audiovisual material, and documents and reports) and reports a case description and case-based themes (Creswell, 2007).

The nature of this study has required that we will adopt a multiple-case-study-approach. In the meantime we have taken the concepts of Chinese multinational enterprise evolution phases from Teagarden and Cai (2009) as an analytical framework to critically analyse the major activities of management of technology in these vanguard companies. Interestingly we have found that technology management activity has been central and technology strategy is in a superior position.

This paper examines the strategic activities of management of technology in multinational companies and draws upon the experience of those companies employing technology strategy over the past decade and projects what may be needed for China to continue its development and economic growth in the future. It has been advocated that the thorough grasp of strategic management of technology and innovation and development of appropriate technology strategy needs to be fully appreciated in order to achieve business sustainability. The key questions concerned are:

- How well do multinational companies understand technology strategy?
- What kind of role does technology strategy play against the generic business strategy in Chinese companies?
- What is the relation between technology strategy and business sustainability?
- To what extent does technology strategy underpin sustainability of international business?

As mentioned previously, the un-presentation of management of technology in corporate strategy and enterprise management makes firms weak in the creation of competitive advantage. We can easily discover that technology management is central if we have an autopsy of the strategic activities of a firm's operation, i.e. human resource management, financial management, strategic management, and last but not least technology management, which is least understood in many respects in enterprises. This paper examines elements of competitive advantage, business sustainability and technology strategy. Based upon these premises, first this paper ties closely together

theoretical and practical aspects of technology strategy and sustainability of business. Second, it intends to identify what is the relation between technology strategy and sustainability of business. And finally what kind of role technology strategy plays in international business.

5.1 The cases

The five cases chosen are all successful firms through the effective management of technological innovation, though each firm develops its own trajectory in designing and implementing technology strategy. However, there is a similarity that though the founders or CEO of the Chinese firms are not technical experts, the companies were established with certain relevance of technology background when the firms were registered. There is a clear vision and a strong desire of the technology-driven company. The leaders are shrewd entrepreneurs. Also there was a significant shift of their core business as a milestone from providing or delivering technical services to manufacturing technical products in the built-up phase. The technology management path was so-called “3-I pattern”, an acronym of imitation, improvement and innovation (Xu *et al.*, 1998). In other words, it is a path from technology transfer, technological leapfrogging to technological innovation. As far as the business strategy is concerned, it has been upgraded from localization to internationalization then to globalization.

The success of the five firms cannot simply be summarized as being “lucky”, but rather the founders have business acumen and appreciate the “secret of business success” as “technology” that creates sustainable competitiveness nationally and internationally. With critical analysis of these cases, the philosophical aspects of the strategic activities of management of technology in these firms are generalized as the following propositions on the terms of technology strategy and sustainability:

- P4. The case companies (emerging star companies) are technology-based companies. Technology has been approached as a leverage to create core competence. They clearly understand that an appropriate and effective technology strategy plays a pivotal role in their business.
- P5. The case companies are making every effort that their technology strategy meets their generic business strategy.
- P6. In the learning phase, the technology strategy of the case companies focused on localization of products and services by having technology and knowledge absorption and digestion.
- P7. In the built-up phase, the technology strategy concerns technology capacity building by having high efficiency and profitability and a focus on product quality.
- P8. In the internationalization phase, the technology strategy concerns continuous technology capacity building through technology transfer with a mass production and a shift from local and national market to emerging markets with good enough products and services.
- P9. In the globalization phase, the technology strategy focuses on technological innovation driven by its strong R&D activities with their products and services being world class.

P10. In the global dominant phase, the technology strategy has to be revised as needed so as to create the synergy for continuous technology innovation and maintains the first class quality of products and services.

6. Case studies analysis and discussions

The five companies have been carefully studied, which are summarized in Table I. This section presents the critical analysis of the cases in the following strategic themes.

6.1 Stream of management of technology

The critical analysis of these cases has unearthed that clearly there is a stream of management of technology along with other business functions. Based upon a comprehensive examination of the five vanguard companies, adapting a typology of enterprise evolutionary phases from Teagarden and Cai (2009), we have summarized the major activities of MOT which are presented in Table II.

6.2 Technology strategy leverages the creation of competitive advantages and sustainability of business

The critical analyses of the five cases have clearly demonstrated that technology and in particular technology strategy has enabled the firms to create competitive advantage and sustainability of their business. In addition, core competence and the sustainability of their business are embedded in the following aspects.

1. *Founded in 1980s – right time to start the business.* Surprisingly it has been discovered that all the five cases that we have selected were established in the 1980s immediately after the announcement of economic reform and open policy. Geely and Huawei were clearly founded as private companies while the others were with different mixed ownerships, which allow them to overcome the weakness of the Chinese state-owned system. However, one thing that is certain is that all these firms realized the “iron bowl” system no longer existed. Therefore, the firms had to survive by having something different.

2. *The CEOs correctly recognized the large potential of technology.* The founders of these firms all have a common sense that they wish to explore the potential of technology though they were not technical experts. For example, the obsession with technology of Mr Li Shufu at Geely and Mr Ren Zhengfei from Huawei has enabled them in a unique position. Ren was a former PLA man without any technical background. However, people cannot doubt about the helmsman of their technical empires. They have firm determination about what they do and are deeply rooted in and influenced by Chinese traditional philosophy.

3. *The CEOs truly understand the significance of technology strategy.* Theoretically, the term “technology strategy” might be not the same as “marketing strategy” in the mind of these CEOs. However, in the practical term, they truly know the significance of technology strategy – the identification of technological resources and technological capacity building. For example, Mr Li Shufu from Geely believed that the financial resource is very important to a car maker but not sufficient. Technology will enable him to achieve his ambition. He was very friendly to his technical employees and valued highly their research. In 2005 he proposed a strategic objective that his company would produce and sell 2 million cars by 2015. To meet such an ambitious target, he clearly understood that though the home-grown Geely brand was quite strong, it would not be

Case 1: Geely – A Trans-national Love Story

Learning phase
 In 1986, Geely was established by Li Shushu to deal with spare parts of refrigerators. However, in 1996, Geely shifted its business to car manufacturing. Focusing on indigenous innovation with appropriate technology strategy from the beginning Geely made great efforts to contribute to the indigenous innovation of Geely car series JL6360, HQ6360, MR6370, MR7130. In addition, Li Shushu was very friendly to technical talent and keen to identify technological resources. With completion of the production line with a capacity of 300,000 units annually in 2003, Geely became listed company in Hong Kong in 2005

Build-up phase
 In 1998, Geely produced the first car of its own brand. For publicity, Mr Li Shushu sent over 700 invitations. However, very few had interest in attending Geely's promotion event. As a new automaker, after many humiliations in dealing with Xiali, Daewoo, Toyota, etc. Geely realized that even playing the game of price – cost leadership, the company still needs to possess its own core technology. The product diversification technology helps to achieve lower price. However, the acquisition of Volvo will allow Geely to implement a differentiation strategy. It has been dramatic that Geely's acquisition of Volvo seems like a 13 year old handsome boy marrying an 83 years old noble woman. Li Shushu, Chairman of Geely Holding Group is joking that this is something like a poor country boy falling in love with a film star

Case 2: Haier – Reaching Higher and Higher

In 1984, Zhang Ruimin, Chairman and CEO of Haier took over the government controlled Qingdao Refrigerator Plant, which had 100 employees and very poor-quality products. Also the company was on the verge of bankruptcy. To cope with his leading change, he stressed "quality is life" by smashing 76 poor-quality refrigerators with a hammer. Along with the company's technology strategy, he attached great attention to talent management and performance management

Haier has gradually built-up by absorbing new technology and knowledge and improving the quality of its products and services. Performance management is the key of Haier's HR management strategy. Zhang emphasises staff motivation, empowerment, employee rewards and punishment. The system is fully transparent and highly differentiated from HR practices used in other Chinese companies

Case 3: Huawei – From Humble Roots

Established in 1987 initially as a private trading company in a small room in Shenzhen, led by Mr Ren Zhengfei, a former PLA man, deeply rooted with Chinese traditional philosophy, Huawei Technologies Ltd later entered the telecommunication manufacturing industry. From the very beginning, Huawei aimed to build into a world-class and technologically advanced telecommunication manufacturer, specializing in R&D, production and marketing of communications equipment, providing customized network solutions for the telecommunication carriers in optical, fixed, mobile and data communication sectors

Huawei has gained sound development during the past ten years in terms of turnover, technological and human resource and global expansion. In 2001, with 10,000 R&D personnel, Huawei became a global player with a turnover of RMB25.5 billion (\$3.1 billion) and ranked the 16th among the top telecommunication manufacturers in the world. The company is committed to providing innovative and customized products, services and solutions to create long-term value and growth potential for its customers. Huawei's technology has been leading in providing next-generation telecommunication networks. By the end of 2006, Huawei has 61,909 employees spreading across China and more than 40 other countries, of whom 48 per cent are dedicated to R&D

Case 4: TCL – The Road is Less Travelled

TCL was founded in 1980 as a Guangdong-based cassette manufacturer, and became No. 1 telephone producer in China by 1986. In 1996, TCL upgraded its technology and moved into TV production stage, by forming a joint venture with a Hong Kong manufacturer, to produce TV in Shenzhen. Afterwards, TCL started to expand its production capacity and presence in many China's cities, with annual capacity 16 million sets, to cover the whole China market. In 2006, TCL TV annual sales in China increased to 14 million sets, which maintained its No. 1 position

TCL's production and sales network spreads to dozens of countries and regions throughout the world. The company has gradually built-up by having seven R&D centres, 17 manufacturing facilities, 40,000 sales locations and a centralized management of supply chains. Actually, TCL has also taken advantage of its joint venture with Alcatel to raise substantially its exports of handsets. TCL is also planning to produce 3C handsets in China using Philips. It is planned to reduce overseas employees to 5,200 by the end of 2007 to under the great cost pressure

Case 5: Lenovo – Making a Legend

In 1984, 11 computer engineers from Chinese Academy of Sciences in Beijing, China with RMB200,000 (US\$25,000) in seed money and the determination to turn their research into successful products. It also developed the Chinese Character Card that translated English operating software into Chinese characters. First, it developed products for the domestic market and then it became a distributor for AST from the USA, and later for HP and other foreign branded PCs

In 2003, Lenovo introduced a self-developed collaborative application technology, which heralds the important role Lenovo is going to play in the 3C era (computer, communications and consumer electronics). Lenovo always keep the lowest costs in the industry, best inventory management, but that is far from all strategy of being both the cheaper and the faster. Recognizing the potential of the Home PC market in China, Lenovo wants to introduce the new product generations by building manufacturing capacity to benefit from greater economies in China

(continued)

Technology strategy and sustainability

Table I. Summary of the five cases



| Case 1: Geely – A Trans-national Love Story | Case 2: Haier – Reaching Higher and Higher | Case 3: Huawei – From Humble Roots | Case 4: TCL – The Road is Less Travelled | Case 5: Lenovo – Making a Legend |
|--|---|--|--|---|
| <p><i>Internationalization phase</i></p> <p>Geely has been aggressively penetrating into international market through acquisition of well-known brand. March 29, 2010, Geely, China's No. 10 auto maker, sealed a binding deal to buy ailing Swedish Luxury car brand Volvo from US giant Ford for \$1.8 billion. The deal is China's biggest overseas auto purchase and represents the most ambitious move by a home-grown auto brand. The acquisition will offer Geely a producer with low-end image access to a high-end brand and most importantly the core technology of Volvo it needs to compete with much bigger rivals within China and beyond</p> <p><i>Globalization phase</i></p> <p>Geely's acquisition of Volvo has not only been a milestone in China's automobile industry especially when Chinese automakers are considering overseas expansion, but also pivotal for Geely to establish its own brand and contribute to its technological capacity building by transferring the world leading technology. However, Geely faces huge challenges that the integration of two different enterprise cultures and future operation are keys to Geely and Volvo's marriage as the later employs nearly 20,000 employees</p> <p>China raced past the USA to become the world's top auto market in 2009, with sales surging 46 per cent to a record 13.6 million units. China's key automakers are keen to move to Western markets but lacking appropriate technology strategy and brand recognition. It is obvious that Geely and Volvo deal has strong implication</p> | <p>With 33 per cent of its market share, today Haier Group has been the fourth largest white goods manufacturer in the world. Haier has been a famous brand in China and internationally. Haier has acquired 18 companies which run at a loss. However, these companies had market potential, vitality and technological resources that can be utilized to leverage the growth of the company</p> <p>Haier has established an extensive sales network around the global primarily through its strategic alliances with key partners. Haier has penetrated to the US market by supplying it's small refrigerators to Wal-Mart Stores. Haier has built its core competence by providing the high quality products and services through technological innovation</p> | <p>Haawei's global R&D centres are located in Bangalore in India, Silicon Valley and Dallas in USA, Stockholm in Sweden and Moscow in Russia in addition to those in Beijing, Shanghai, Nanjing, Shenzhen, Hangzhou and Chengdu in China. Haawei's catching up in the wireless area clearly indicates how the gap between Huawei and global leaders has been decreased through its effort in new generation of mobile communication technologies. However, Huawei's foreign contracts have been overwhelmingly in the developing world</p> | <p>TCL's international experience began in 1997, when it started to export CRT TV sets first to the USA and then to Southeast Asia. In 1999, TCL took over Luk's factory in Vietnam with intention to fulfil local demand and further expand Southeast Asian market. By 2006, TCL held 22 per cent of Vietnam's CRT TV market, ranking the second, behind Samsung Electronics of Korea</p> <p>TCL launched its new brand strategy, giving the TCL brand the new meaning of "The Creative Life" To expand manufacturing-based activity to overseas countries, it is observed that TCL adopts two kinds of entry mode: M&A and outsourcing. TTEP was acquired from Luk Industrial; TTEP, TTEP and TTEM were obtained from Thomson, while factories in Indonesia, Philippine and India are all CMS plants</p> | <p>With Lenovo's landmark acquisition of IBM's PC Division in May 2005, the new Lenovo has become a leader in the global PC market, with approximately \$13 billion in annual revenue, and products serving enterprises and consumers the world over. To promote its brand reputation, Lenovo became a worldwide partner of the International Olympic Committee in 2004</p> <p>By acquiring the IBM's PC Division and brand using rights, there exist a nearly perfect fit between these two complementary organizations like brand recognition, market expertise and core resources. There are strong complementarity between IBM PC and Lenovo in brand recognition, market expertise and core resources. As premium global PC brand, the expertise of IBM in business market especially in Notebook products will benefit Lenovo much. As the agreement IBM promised that it will help the new market and sales channel help them to improve the research and development capability</p> |

(continued)

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|---|--|--|--|--|
| <p><i>Global dominant phase</i></p> <p>How does Geely digest Volvo's sophisticated technology? Could Geely obtain Volvo's core technology? Could Geely protect Volvo's brand and technology? Li Shuhsu has been very careful however extremely innovative in dealing with the un-organic growth of Geely and the strategic relationship between Geely and Volvo. He has made it explicitly that the relation between the two is not father and son but that of brothers and partnership</p> | <p>Haier has used a three – pronged approach to globalization that includes an appropriate technology strategy, combining design and quality production and the marketing competences as the core of its global branding strategy. By the end of 2006, Haier has owned 240 corporate subsidiaries and 18,000 sales outlets throughout the world. Haier focuses on technological innovation by having five R&D centre</p> | <p>The re-designing its technology strategy along with the strategic restructuring and image rebuilding are essential for Huawei to transform itself into a major global player. In April 2005, Huawei, along with eight other global giants such as Cisco, Siemens, and Lucent, became the priority suppliers of British Telecom for its "21 Century Network." In 2006, the logo was redesigned: the symbol of Huawei was changed from 15 rays to eight beautiful flower petals, further indicating Huawei's effort in merging with the main stream culture thus improving its image as a global leader</p> | <p>With a global sale of US\$5.8 billion in 2007, and serving more than 100 million consumers worldwide, TCL has become more ambitious in the global market. The corporation is comprised of four business units – multimedia, communications, home appliances and techno electronics. It also has two affiliated business networks: real estate and investment and logistics and services</p> | <p>Lenovo strives to be a new world company that makes the world's best-engineered PCs for its customers. With its head-quarter moving to the USA, Lenovo has become a global business leader. It designs innovative and exciting products and services to meet the customers' needs. Lenovo's mobile phone division is one of its fastest growing businesses. Mostly known for its PCs, Lenovo now also claims 7 per cent of the Chinese market – the world's largest cellular market—after Nokia, Motorola and Samsung</p> |

Table II.
Stream of technology strategy and activities of management of technology in the case firms

| Case 1: Geely | Case 2: Haier | Case 3: Huawei | Case 4: TCL | Case 5: Lenovo |
|---|--|---|---|---|
| <p><i>Learning phase</i></p> <p>Dealing spare parts of refrigerators</p> <p>Shifting its business from delivering technical services to car manufacturing</p> <p>Focusing on indigenous innovation</p> <p>Being very friendly to technical talents</p> <p>Keen to identify technological resources</p> <p><i>Built-up phase</i></p> <p>Take great challenges against its competitors</p> <p>Develop its own core technology</p> <p>product diversification acquisition of Volvo to achieve Differentiation strategy</p> <p>Focus on technological capacity building</p> <p>Realize its technological ambition</p> | <p>Refrigerator manufacturing</p> <p>Highlight quality issue</p> <p>Focus on technology management</p> <p>Strong technology strategy</p> <p>Looking after technical talent</p> <p>Performance management</p> | <p>Established as a technology-focused company</p> <p>Manufacturing telecommunication products</p> <p>Specializing in R&D</p> <p>Providing customized network solutions and technical services</p> <p>Technology-driven innovation</p> | <p>Cassette manufacturing</p> <p>Focusing localization first</p> <p>Up-grading its technology to TV production</p> <p>Technology transfer through JV</p> <p>Focus on technology management</p> | <p>Shred technical entrepreneur</p> <p>Focus on indigenous technological innovation – Han card technology</p> <p>Turning research output into technical projects</p> <p>Technology strategy meets its generic business strategy</p> |
| <p>Build up by absorbing new technology and knowledge</p> <p>establish new technology platform</p> <p>Emphasizes staff motivation, empowerment, employee rewards and punishment</p> <p>Being fully transparent and highly differentiated</p> <p>Continuous technological capacity building</p> <p>Aggressively penetrating into international market</p> | <p>Providing innovative and customized products, services and solutions</p> <p>Create long-term value and growth potential for its customers</p> <p>Technology up-grading</p> <p>From localization to internationalisation</p> <p>Dedicated to R&D</p> <p>Appropriate technology strategy</p> <p>Pro-active in international market</p> <p>Firm its position at home</p> | <p>Gradually built-up by having R&D centres, manufacturing facilities, and sales locations</p> <p>A centralized management of supply chains. Actually, technology acquisition through JV</p> <p>Technology up-grading</p> <p>Build strong knowledge platform</p> <p>International expansion</p> <p>Technological capacity through acquisition</p> | <p>Take cost leadership</p> <p>Best inventory management</p> <p>Differentiation strategy as well</p> <p>Aggressively pushing into international market</p> <p>Un-organic development through acquisition</p> <p>Focus on technological capacity building</p> <p>Technological capacity through acquisition of world famous brand</p> <p>Focus on technological innovation</p> | |

(continued)

| Case 1: Geely | Case 2: Haier | Case 3: Huawei | Case 4: TCL | Case 5: Lenovo |
|---|--|--|---|---|
| <p><i>Internationalization phase</i></p> <p>Aggressively penetrating into international market</p> <p>Un-organic growth through acquisition of well-known brand</p> <p>Clear vision</p> <p>Strong leadership</p> <p>Most outstanding case in 2010</p> <p>Creating competitive advantage through acquisition the state-of-art-technology</p> <p>Technological leadership</p> | <p>Brand building</p> <p>Capacity building through acquisitions both at home and abroad</p> <p>Leverage its growth through technology</p> | <p>Technological catch-up</p> <p>Market share not only in developed world but developing world</p> <p>Global penetration</p> <p>Continuous technological capacity building</p> <p>Acquire more technological resources</p> | <p>Creating core competence through technology transfer</p> <p>Confidence in competing against its competitors</p> <p>Focus on quality</p> | <p>Manage global talents</p> <p>Awareness of different culture and diversity</p> <p>Clear vision</p> <p>Strong technological leadership</p> |
| <p><i>Globalization phase</i></p> <p>Brand building and international visibility</p> <p>Achieve overseas expansion</p> <p>Technological leapfrogging</p> <p>Integration of Western and Chinese cultures</p> <p>Technology transfer</p> <p>Appropriate technology strategy</p> <p>Managing global talents</p> <p>Global ambition</p> | <p>Built its core competence by providing the high-quality products and services through technological innovation</p> <p>Product innovation versus process innovation</p> <p>Outstanding global strategy</p> | <p>Technology-driven innovation</p> <p>Radical versus incremental innovation</p> <p>Competition against its global competitors</p> <p>Outstanding technology strategy</p> | <p>New brand strategy</p> <p>Inspire innovation and creativity</p> <p>Technological capacity through M&A and outsourcing</p> <p>Global penetration</p> <p>Imitation, improvement and innovation</p> | <p>Brand recognition</p> <p>Not only market share but mindshare</p> <p>Outstanding global strategy</p> <p>Competence enhancing versus competence destroying innovation</p> <p>Improve the research and development capability</p> |

Table II.

sufficient to satisfy the market demand and most importantly the customer's need. What Geely needs is to turn the low-end product image to a high-end product brand. Therefore, an appropriate technology strategy is the solution. Geely needs to build its most advanced technology platform through technology capacity building by having the most state-of-art technology and the well-known brand. Geely's acquisition of Volvo has enabled Geely to achieve Mr Li Shufu's ambition of being a global full-fledged car manufacturer.

4. *Technology strategy meets with generic business strategy.* Behind the remarkable success of these firms, the geniuses have a clear vision and in-depth understanding of the strategic relationship between technology strategy and generic business strategy. Mr Ren Zhengfei from Huawei recognizes "technology" as the most important factor in achieving Huawei's success. Ren focuses on technological innovation by employing more research-oriented staff, 48 per cent of whom are dedicated to R&D in over 40 countries. Lenovo's landmark acquisition of IBM's PC Department has enabled the company to become the third largest PC manufacturer in the world. This not only allowed Lenovo to have market share and mindshare but also enabled Lenovo to possess the most state-of-art technology from IBM.

5. *Technological transitions.* It has been a milestone that the CEOs of the vanguard companies have successfully led the technological transitions – from providing technical services to manufacturing technical products and from manufacturing low-end products to manufacturing high-end products as well. Mr Zhang Ruimin from Haier emphasized the significance of product quality by promoting "quality is life" and smashing 76 poor-quality refrigerators with a hammer in order to achieve his strategy of making high-end products, while Mr Li Shufu from Geely shifted his core business from providing spare refrigerator parts to car manufacturing with indigenous innovation in 1996 after ten years of exploration.

6. *From technology transfer to technological innovation.* It has been interesting that with appreciation of the "magic power of technology", these firms approached "technology" through technology transfer by having joint ventures with multinational companies or through technical collaboration in the learning phase and built-up phase. TCL has enjoyed its successful experiences in having joint ventures collaboration with firms from Hong Kong and some other countries. Lenovo had good technical collaboration and knowledge sharing with IBM even before Lenovo's acquisition of IBM's PC Department. Having established their competitive position in the global market, they have now focused on technological innovation which enables them to produce the world-class quality products and sustainability of their business.

7. *Charismatic business leaders.* The CEOs of these vanguard firms have genuinely distinguished themselves as charismatic business leaders of a unique kind of the technical companies. They are shrewd entrepreneurs and confident as the helmsman in their "technological empires". While many observers suspect what is the end of a love story between "a poor handsome young man and a princess" – a vivid expression of Geely's acquisition of Volvo, however Mr Li Shufu has provided the answer by saying "in this acquisition, the relationship between Geely and Volvo is the relationship between brothers, not that of father and son". Therefore, we are right to expect "a happy marriage".

6.3 Validity of the propositions

With integration of the theoretical aspects previously established, analysis of all the five cases results in good evidence to support the propositions generalized.

Internal validity. The evidence obtained from the cases has strongly demonstrated that these propositions are valid, which sustains the internal validity. Cases 1 and 5 are even more appealing and persuasive that their appropriate technology has led to the acquisition of the world leading companies. Superficially it is a purchase of world famous brands; as a matter of fact, Lenovo has obtained the most state-of-art technology in the PC manufacturing industry while Geely enjoyed the same successful experience which sets up a model in China's car manufacturing industry. Nevertheless, these propositions are sustainable as evidenced by the Chinese experiences.

External validity. However, these ten propositions are also verified by cases from other countries as well, such as the USA. The technology-focused companies currently in Silicon Valley remain strong and unwavering while the banking giants on Wall Street collapsed one by one. Microsoft is a classic case of "technology strategy meeting generic business strategy". In 1975, Bill Gates co-founded Microsoft based on the belief that every desktop would one day have a PC and he would like to see the Microsoft software to run in these machines (Cusumano, 2009). He configured such a great idea and played a huge role in making this vision come true. The cases of Amazon, Yahoo and Google prove these propositions as well. The founders are determined and very smart. Most importantly, they focus on technology-driven innovation.

7. Conclusion and policy implication

The burst of the financial bubble has led people to re-consider the sustainability of business. This paper has linked together the concept of technology strategy and sustainability of business in the post-recession. It has achieved the objectives by identifying the major activities of management of technology in the Chinese vanguard companies and examining the strategic relation between technology strategy and sustainability of business. More generally, this study has sought to characterize the process of technology management in Chinese firms and the features of China's technology strategy – 3-I patterns – imitation, improvement and innovation. In other words, it has established the concept of China's technology strategy from technology transfer to technology innovation.

20 years ago, management scholars forecasted that despite the ambition and a strong desire to do so, Chinese companies would not join the ranks of multinationals by this millennium (Teagarden and Cai, 2009). However, their forecast failed. There are more remarkable examples which have squeezed themselves into the ranks of top companies in the world. Specifically, this study of the five cases has demonstrated that technology strategy leverages the creation of the five qualities, i.e. superiority, inimitability, durability, non-substitutability and appropriate-ability, which underpin business sustainability in contrast to the collapse of the flawed business model on Wall Street. Theoretically, this contributes to business and management that technology management as a basic business function has to be given great attention along with other functions, such as HR, financial and marketing strategy. Management scholars may find this as theoretical evidence in dwelling the strategic relation between technology strategy and business sustainability. In practical terms, many companies which want to catch-up with these vanguard cases should be well advised to respect the

“magic power of technology” and that technology strategy can enable them to achieve the position of a successful and full-fledged global competitor.

Note

1. Remarks of Hu Jintao of President of China and Chinese Communist Party General Secretary.

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