

Knowledge Management Strategic Context in Technological Trajectories of Firm Influences their Innovation Strategy: Looking at Malaysian Multinational Firm

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ABSTRACT

The paper study on the knowledge management strategic context in technological trajectories of firm influences their innovation strategy. Thus, to make use of technology as a competitive weapon; managers must manage it as a part of the business system. Failure to develop and integrate technology strategy and business strategy is a major contributing factor in the decline of a firm's competitiveness. In a turbulent and rapidly changing environment, every organization faces the challenge of how to best manage its knowledge assets to generate value for the marketplace and obtain competitive advantage. Such advantage derives from special capabilities that are rare, valuable, non-substitutable, and costly to imitate. Historically, the focus was on capabilities involving tangible assets; now, knowledge is widely recognized as the source for competitive advantage, with the tangible assets representing the physical manifestation of but a fraction of this knowledge. As companies scramble to develop strategies for more proactively and strategically managing their knowledge, the field of knowledge management (KM) receives increasing attention from trade organizations and academic journals. From this study it was found that to improve the chances of conclusively demonstrating value to the K-Economy, a new KM implementation in an innovation organization should address issues such as organization's goals and strategies, access tacit knowledge, provide search tools, promote creativity, capture new learning, and build a supportive culture, insufficient communication, failure to integrate knowledge, lack of time to learn, lack of training. A sense there was little personal benefit in knowledge management.

Keyword

Knowledge management, Technological Trajectories, Innovation Strategy, Core Competencies

1.0 INTRODUCTION

Technology is at the core of systems of any company that designed to satisfy customer needs. It gives a company a competitive edge because any corporation with inferior technology cannot compete with corporations utilizing superior technology. Thus, to make use of technology as a competitive weapon, managers must manage it as a part of the business system. Failure to develop and integrate technology strategy and business strategy is a major contributing factor in the decline of a firm's competitiveness. However, technology itself is not sufficient to ensure business success. Good business has to integrate technological innovations with production, marketing, finance and personnel to achieve established corporations goals.

2.0 CHARACTERISTIC OF TECHNOLOGICAL INNOVATION WITHIN THE FIRM

There are four key characteristics of innovative activities in the firm as identified by Pavitt (1990):- Continuous involvement intensive collaboration and interaction among functionally and professionally, specialized groups (R&D, production, marketing, organization and finance). They remain profoundly uncertain activities. Small proportions of R&D projects are turned out to be commercially success. They are cumulative. Most technological knowledge is specific, involving development and testing of prototypes and pilot plants. They are highly differentiated. Specific technological skills in one field may not be applicable to other non-related fields. However Combs (1991) identifies technology within the firm into three categories:-

Critical technologies – those that are central to a company's competitive position, which are proprietary to some degree, and which differentiate it from the competition. Enabling technologies – those that are not proprietary to the same degree, are broadly available to

all members of the industry, but are essential to the efficient design, manufacture and delivery of the company's product or service, and to its level of quality. Strategic technologies – which can be emerging or already existing technologies whose salience arises from their ability to provide new competitive opportunities when combined with or substituted for existing critical or enabling technologies. Knowing characteristics of technological innovations or categories of technology is useful to analyze the technological trajectories.

3.0 TECHNOLOGICAL TRAJECTORIES

Technological trajectories are concerned with the path and directions of technological change. According to *The Regents (1990)*, there are five distinguished major technological trajectories, each with its distinctive nature and sources of innovations, and with its distinctive implications for technology strategy and innovation management as shown below in Figure 1:-

	Supplier-Dominated	Scale-intensive	Information intensive	Science based	Specialized suppliers
Typical core sectors	Agriculture Services Traditional	Bulk materials Automobiles Civil	Finance Retailing Publishing	Electronic Chemicals	Machinery Instruments Software
Main sources of technology	Suppliers Productions learning Design offices specialized supplied	Production engineering Specialized supplies	Software and systems	R&D Basic research	Design Advanced
Main tasks Technology Strategy	Use technology from elsewhere to strengthen other competitive advantages	Incremental integration changes in complex systems Diffusion of best design and production practice	Design and operation of complex information processing systems Development of related products	Exploit basic science Development of related products Obtain complementary assets Redraw divisional boundaries	Monitor advanced user needs Integrate new technology incrementally

Figure 1: FIVE MAJOR TECHNOLOGICAL TRAJECTORIES
(The Regents of the University of California - 1990)

3.1 Supplier Dominated Firms

Technical change comes almost exclusively from suppliers of machinery and other production inputs. The firms are concerned with input costs and the opportunities for firm-specific technological accumulation are relatively modest because it focuses on improvements and modification in production methods and associated inputs. The main task of technology strategy is to use technology from elsewhere to reinforce other competitive advantages.

3.2 Scale-Intensive Firms

Technological accumulation is generated by the design, building and operations of complex production system, and/or products. Process and product technologies are developed incrementally. The main sources of technology are in-house design and production

engineering departments, operating experience and specialized suppliers of equipment and components. The main tasks of technology strategy are the incremental improvement of technological improvement in complex products or productions systems, and the diffusion throughout the firm of best-practice methods in design and production.

3.3 Information-Intensive Firms

The main of sources of technology are in-house software and systems departments, and suppliers of system and applications software. The main tasks of technology strategy are the development and operation of complex information processing systems and the development of related product.

3.4 Science-Based Firms

Technological accumulation emerges mainly from corporate R&D laboratories, and is heavily dependent on knowledge, skills, and techniques emerging from academic research. The major directions of technological accumulation in the firm are horizontal search for new and technologically related product markets. The main tasks of technology strategy are to monitor and exploit advances emerging from basic research, to develop technologically related products and acquire the complementary assets to exploit them and to reconfigure the operating divisions and business units in the light of changing technological and market opportunities.

3.5 Specialized Supplier Firms

They are generally small companies and provide high performance inputs into complex systems of production and or information processing, in the form of machinery, components, instruments or software. Technological accumulation takes place through the design, building and operational use of these production inputs. The main tasks of technology strategy are keeping up with the users' needs, learning from advanced users, and integrating technological advances incrementally.

Firms may have more than one trajectory. The above categories summarize significant and persistent differences in the sources of technology from which these firms draw, the types of innovation they generate, and the modes of modification they are capable of. They provide a way of interpreting the long-term stability of the innovation activity of particular firms and particular industrial sectors. And thus the knowledge of these major technology trajectories can improve analysis of companies' technological strategies.

4.0 KNOWLEDGE MANAGEMENT AND TECHNOLOGY STRATEGY

According to Ford (1988) technology strategy is concerned with exploiting, developing, and maintaining the sum of total of the company's knowledge and abilities. The innovation strategies can be categorized into four main categories (Lynn, Gary S.: Mazucca, Mario et al), Customer driven which focus on customers' needs and wants. Process driven, the innovation effort follows a systematic process that begins with idea generation, screening/evaluation, development, testing and launching. Pioneer driven, the key is being first to the market. Learning driven, it emphasis is on subsequent and better-informed step. The technology strategy involves many functions and professions, as well as different views. In the market system, the ultimate measure of success of technology strategy is the ability to satisfy users' needs better than the competitors. For innovations to be successful, they

require quality technical works and strong horizontal linkages among functional departments, with customers and with outside sources of relevant technical expertise. This will involve learning from experience whether internally or externally that requires frequent communication among specialists and functions. The firm's cumulative knowledge and its abilities make up the competencies. Therefore the fundamental concept in the formulation of a technology strategy is core competencies.

5.0 CORE COMPETENCIES

Core competencies are collective set of knowledge, skills and technologies that a company applies to add value for its customers (Khalil, 2000), which determine the company's competitiveness. And a company can improve its competitive abilities by becoming a learning organization (Machado, 1997). Prahalad and Hamel (1990) propose that the core competencies of an organization are the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies to deliver value to customers. Corporations must ensure that their people such as technologists, engineers, and marketers have shared understanding of customer needs and technological possibilities.

Another factor that contributed to the building of competencies is communication, which requires involvement and commitment to working across organizational boundaries. It involves many levels of people and all functions to recognize opportunities for blending functional expertise to achieve competitiveness. Corporate management may reallocate corporate resources by identifying the people who embody critical competencies and move them across organizational boundaries so that competence carriers are not held hostage by some particular SBUs (strategic business units). Transfers for the sake of building core competencies must be recorded and appreciated in the corporate memory or otherwise, the SBUs will be unlikely to assent to skills transfer next time.

Competence carriers should be regularly brought together from across the corporation to trade notes and ideas. The objective is to build a strong feeling of community among these people. Their loyalty should be to the integrity of the core competence area they represent and not just to a particular of businesses. One of the ways is having carefully planned rotation program at employees' early career in the organization. Periodic assignments to cross-divisional project teams may be necessary for both diffusion core of competencies and loosen the bonds to one particular business unit.

The core competencies are a combination of multiple technologies (hard and soft), collective learning (multilevel, multifunctional) and capacity to share (across business and geographical boundaries). The core competencies are necessary but not enough for survival in dramatic changes of environment, which is known as new economy. The new economy of globalization brings complex challenges that firms have to confront as identified by Prahalad (1998):- Incorporate new bundles of technologies – the knowledge stream needs to blend with traditional technologies. This means that managers have to work with a new logic Change of composition of teams, Team members are from multiple cultures and they must learn as a group. Collaborating and transferring knowledge across multiple business units and geographical locations, This is actually the

redeployment of core competencies across a number of applications at high speed.

6.0 COMPOSITION OF NEW COMPETENCIES

The integration of a firm's existing knowledge base with new technology will lead to the creation of new competencies. Prahalad (1998) identifies two broad elements that create the system of competencies:-

- i. People embodied knowledge – both tacit and explicit
- ii. Capital-embodied knowledge – both proprietary and vendor-based

This combination of both people-embodied and capital embodied knowledge represents the totality of the competence base within an organization as shown in Figure 2.

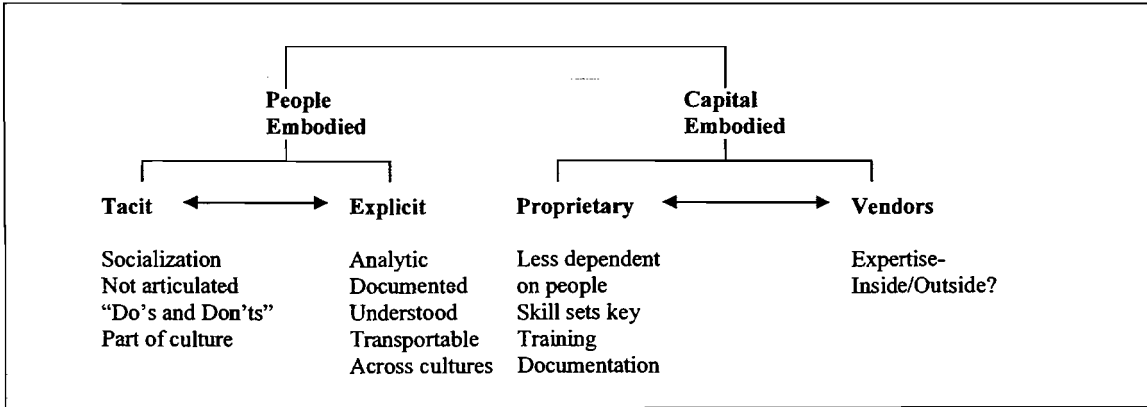


Figure 2: Composition of Competencies (Prahalad, 1998)

7.0 BUILDING NEW COMPETENCIES

Building new competencies and protecting existing competencies are difficult organizational tasks. Prahalad (1998) suggested a minimum program that includes:-

Investment in extensive socialization within the firm. Areas that need training would include interpersonal competence, intercultural competence, and diversity competence (race, gender and intellectual). Development of language skill Language skills are important because they are critical aspect of competence transfer Extensive documentation It is critical to transfer from the tacit to explicit. Extensive documentation is to ensure standardization within the firm. It is commonly occurrence in highly decentralized firms. Extensive commitment to training, in both the analytic and experiential side of management.

These four basic areas will form a basic framework for constructing program to manage new competencies to meet the challenges of new economy.

8.0 BUSINESS AND TECHNOLOGY STRATEGY

The core of the strategy is based on the vision, the mission, and the objectives and goals that need to be realized. The operating units of an organization execute the strategy according to established policies. A vision is vital component in the core of strategy because it gives a business direction to lead to. A vehicle that moves the business toward the fulfillment and attainment of its vision would be a strategy. The purpose of business strategy is to gain a sustainable economic advantage while the technology strategy is to gain a sustainable technological advantage, which provides a competitive edge. The two strategies must be closely linked and highly integrated. Organizations that know how to link their technology strategy with their business strategy will be more competitive in the global marketplace.

Mitchell (1985) believes that the first step toward integrating business and technology strategies is to get the business and technical sides of corporate management to agree on a common set of priorities. According to Mitchell (1992), the technical community tends to hold the view that technical achievements by peers around the world often provide a more reliable guide to the future than do formally documented business forecasts. By contrast, the business planning community usually looks at markets and other external trends as a more obvious and direct source of business opportunity. The two perspectives need to be reconciled. Broad consensus and understanding must exist between business and technical managers throughout a company.

Michael Porter (1985) advocates that technology strategy should be based on optimizing efficiency of the value chain which to offer customer long-term value. He proposes that a technology strategy be formulated using the following steps: Identify all the distinct technologies and sub-technologies in a value chain. Identify potentially relevant technologies in other industries or under scientific development. Determine the likely path of change of key technologies. Determine which technologies and potential technological changes are most significant for competitive advantage and industry venture. Assess a firm's relative capabilities in important technologies and the cost of making improvement. Reinforce business-unit technology strategies at the corporate level.

Technology strategy must be consistent part of overall business strategies. Stacey and Ashton (1990) come out with generic business strategies that have important technology components.

9.0 CONCLUSION

For the firm to Generic Business and enhancing technology trajectories, firm must have knowledge management in market competence. It means what value to offer to the customer. Company, must make product Differentiation for example distinguish the firm's goods or services from those of its competitors on the basis of either superior performance or unique features. It will come with low cost product- create advantage by being able to consistency underprice the competition in the market-place. In term of market scope: which market boundaries to target. It must be supported by largest Market Share- seek dominant market position through wide breadth of product coverage or entry barriers to competitors It must developed specialized niche player - restrict competition in a limited market segment by focusing company products on narrow, specialized customer needs, delivery mechanisms or creating barriers to competition. Market Timing: When to introduce

innovations, it must become first mover - enter new product-market before other competitors to gain early position and returns: establish early reputation as technology leader and work to maintain lead. Wait and Improve - enter a new product after first movers have completed initial penetration and worked out the product and market bugs: strive to gain advantage with attractive follow-on product or process improvements. These generic approaches are to gain advantage form on the basis of identifying the particular elements of technology strategy that will be most beneficial to the firm. The 'First Mover' strategy will imply that emphasis be put on developing and quickly introducing 'leading edge' technology into a firm's products ahead of competitors. The 'Low Cost Producer' strategy, on the other hand, will mean a heavy emphasis on efficient, automated, highly reliable process technology that will reduce total manufacturing cost.

The setting of technology strategy will be constrained by unique company character and needs. Therefore, it is necessary to integrate technology and business decisions through development and implementation of a corporate technology strategy, which focuses on creating competitive technological assets to generate valuable returns to business as a whole. Are the Malaysia companies ready to practices the issues that had been discuss.

REFERENCES

- Coombs, R. & Richards, A. (1991). Technologies, products and firms' strategies, *Technologies Analysis and Strategic Management*, 3, 77-86.
- Coombs, R. & Richards, A. (1991). Strategic Control of Technology in Diversified Companies with Decentralized R&D, *Technology Analysis and Strategic Management*, 5, 385-396.
- Ghosal, S. & Barlett, C. (1987). Innovation Processes in Multinational Corporation, *Strategic Management Journal*, 8, 425-439.
- Pavitt, K. (1984). What We Know About The Strategic Management of the Technology, *California Management Review*, 32, 17-26.
- Prahalad, C.K. & Hamel, G. (1990). The Core Competencies of The Corporation, *Harvard Business Review*, 41, 14-22.
- Prencipe, A. (1997). Technological Competencies and Products' Evolutionary Dynamics: A Case Study From The Aero-Engine Industry, *Research Policy*, 25, 1261-1276.
- Rosenbloom, R. & Cusumano (1987). Technological Pioneering and Competitive Advantage: The Birth of the VCR Industry, *California Management Review*, 24, 51-76.
- Tidd, J., Bessant, J. & Pavitt, K. (1997). *Managing Innovation: Integration Technological, Market and Organizational Culture*. _____: John Wiley & Sons.
- Teece, D. (1986). Profiting from technological innovation: implication for integration,

collaboration, licensing and public policy,
Research Policy, 15, 285-305.

- Teece, D. & Pisano, G. (1994). The Dynamic Capabilities of Firms: An Introduction. *Industrial and Corporate Change*, 3, 537-556.
- Tellis, G. & Golder, P. (1996) First to Market, First to Fail? Real Causes of Enduring Market Leadership. *Sloan Management Review*, 65-75.