WINDOWS OF OPPORTUNITY AND TECHNOLOGY VECTORS

Professor H. Alan Raymond

Head – Business

University of Technology

Private Bag

Lae, PNG

hraymond@dbs.unitech.ac.pg

ABSTRACT

The mapping of firm specific technology vectors is important in describing the competitive structure of specific competitive industrial arenas and deciding which windows of opportunity to target. Such vectors can provide an assessment of the relative speed and timing at which the firm or its competitors may access various windows of opportunity, related to specialty, niche, mass and commodity markets. Such mapping would allow firms to better assess their strengths and weaknesses in a technologically competitive ecosystem, as well as target relative opportunities. This carries on the important work of Anderson, Hamel, and Porter in the area of technology strategy. Examples are drawn from the VCR, disk drive, and the network industries. The mapping of technology vectors and their integration in strategy development may help Australian and Asian firms more appropriately target markets and related windows of opportunity.

Researchers have investigated the disruptive effects of technology vectors on market specific technology (Christensen 1997), often obsolescing the dominant product design (Anderson, Tushman 2004). The technology vector, thus, disrupts the business of the related firm. The question arises as to why some firms such as Intel, Cisco or Apple take advantage of such disruptions to further innovate and extend the technology vector to gain new markets and why such firms as Remington Rand, Cray or Unisys suffer from such disruptions and either are unable to recover, or at best marginally recover and limp

along. To examine this question it is proposed to examine the technology vectors of three well known technologies video recording and playback, computer and disk drive, in terms of the industry vector, the firm vector and the technology specific vector.

Technology vectors generally follow a trajectory which indicates a growing aggregate market value, the technology is at first a laboratory interest without a commercial application, and it then becomes commercially viable as specialty item, often custom made, with very few applications. As the technology evolves it results in products that serve a few niche markets, then products that serve sophisticated (first mover) high mass markets, then affluent medium mass markets, the low mass commodity market.

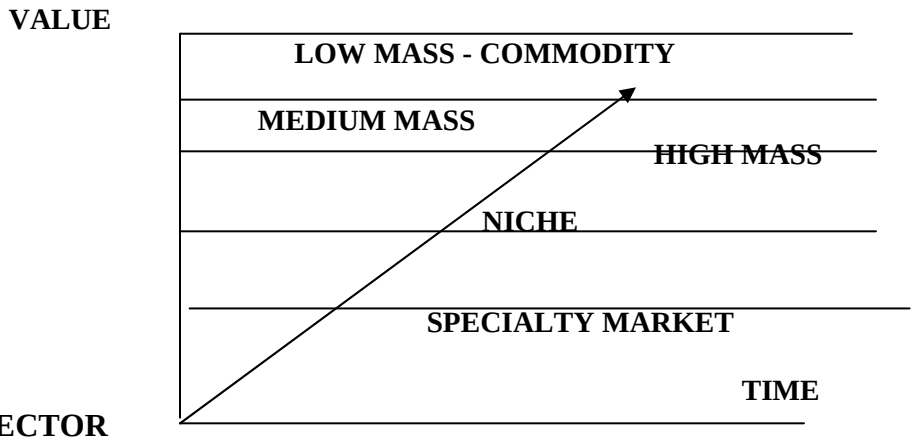


Fig.1

INDUSTRY VECTOR

This trajectory value is based upon both the cost of the product and its performance utility. The cost of the product is initially very high and its performance utility very low, then as the cost falls and the performance improves its application may move from a few specialty applications to several applications which may constitute a niche market. As the value increases, as the cost falls and performance utility increases, aggregate markets expand. For example, when the computer was invented it was as large as a small house and had very few applications. It was said that there could not be a need for more than two or three computers in the world. As the technology vector progressed costs fell and performance increased, manufacturers such as Univac (Unisys), IBM and Remington Rand entered to supply a growing niche

market in large government departments and large corporations. As the vector moved the computer got smaller and more versatile, attracting more entrants such as Data General, Wang, and Computer Sciences creating a sophisticated mass market among the ranks of world businesses, a “first mover.” As the computer shrank, its cost decreased and its performance increased moving the vector into a larger mass market, which may be termed the affluent medium mass market addressing standard office needs, attracting new entrants such as HP, AT&T, Olivetti, NEC, Toshiba, and Machines and Machines Bull. IBM accessed the “window of opportunity” evident in this market and established the “dominant” model/standard in the IBM 360 line, which was designed to address all standard business needs. This worked well for IBM as the industry focused on IBM’s evolution of both hardware and software; many of its competitors were left with obsolete technology and protocols and in indefensible strategic positions. This market leadership continued until the invention of the micro chip, a disruptive technology (Bower, Christensen 1995), which abruptly accelerated the progress of the technology vector allowing in many new entrants such as Apple, Commodore, and Osborne, IBM choose to repeat its successful strategy of being a late mover and after the needs of the larger mass market was established enter an industry standard/dominant model. IBM was successful in establishing an industry standard with the PC. The technology vector reached the larger mass market, heading towards a commodity. However, unlike its experience with the 360, IBM lost control of the industry standard. It relied on a proprietary “bios” while making the product’s architecture “open,” but would be competitors soon found its way around the “secret” bios, allowing new competitors such as Compaq, Acer, Dell and Lenovo to enter the market and others including IBM to leave the market. The vector has matured from a very few applications with high profit margins to almost ubiquitous applications with razor thin profit margins. The computer technology vector is littered with the bodies of corporations that failed to ride the vector to the next stage, some like IBM were more successful for awhile but it too has largely left the field to concentrate on concentrate on consulting.

Schumpeter described the process as “creative destruction,” (1934) where the march of technology destroys the foundations of incumbent firms. What may be more of a causality of firm destruction may be a firm’s strategy, following miscues from the market. A firm’s misperceptions of the market and resultant strategy may be more at fault. A firm may choose not to follow the technology vector through its evolution and choose what amounts to ultimately as a technological dead end.

Questions arise as to why a company may not or may not choose to ride the vector through its evolution. At a number of junctures through its evolution the computer vector experienced discontinuous or disruptive technology. At each of these junctures many incumbent companies fell away to be replaced by new entrants. Hill and Rothaermel (2003) postulated several causes, which they classified under economic, organizational and strategic. Economic, incumbent firms believing they are protected by barriers to entry invest in incremental improvements to increase their market share in a market defined by the current stage of the vector. Their focus is not on the next stage of technological evolution but on stretching value from the current configuration. Conversely there are major incentives to new entrants to circumvent barriers to entry and implement a radical technological innovation. For example Xerox (PARC) developed what may be considered the first micro computer in its lab as part of its research into document processing, but it choose not to fund its commercial application but instead to make incremental investments in its photocopy and typewriter based technology. Organizational, organizations seek to reduce uncertainty, thereby focusing on their current customers and their core competencies, radical new innovations would be viewed as increasing uncertainty rather than reducing it. Their emphasis on core competencies may also lead to an over reliance on a particular function. For example during the 1970s an over reliance on accounting caused problems for Chrysler, which resulted in a lagging product line. Once an organization has focused and stabilized around a particular market segment the power configurations tend to structure themselves around controlling scarce resources to maintain the status quo. (Cyert & March, 1963). What may be called “macrocultural homogeneity,” whereby the industry is waiting for the other fellow to make the first move or innovation. (Abrahamson & Fombrun,

1994) may be another organizational factor. An organization may also be too thinly stretched to expend scarce resources on a new venture, that is an organization needs a certain amount of slack and or "absorptive capacity, "to adequately pursue a new opportunity, (Cohen & Levinthal 1990). Strategic, a firm may be restrained by a dependency upon external resource sources and may simply have to follow the directions of a customer or suppliers may simply be geared to a certain product configuration.(Christensen 1997) A firm may also view as irreversible the commitment of resources beyond a certain point and it may feel it cannot change course, at least not easily. The course it is pursuing may be dictated by its current revenue stream. Its R&D, as in the Xerox (PARC) example may not be coupled sufficiently to the corporate strategy, or vice versa. It may not fit the strategic "intent," of the firm.(Hamel&Prahalad). The emphasis on pursuing a current strategy may lead to a kind of tunnel vision or strategy myopia (Levitt, 1975) or what Ohmae referred to as companyism, where no dares the question the standard ethic. In relation companies may fall out of the technology vector because they incorrectly define the business they are in. Levitt gives two salient examples the railroads went into decline because they mistakenly believed they were in the railroad business and not the transportation business and Hollywood experienced turmoil because it believed it was in the movie business rather than the entertainment business, when television was introduced. Xerox failed to climb the computer technology vector when it failed to recognize it was in the document processing business, (not the copy business) which they later (too late) realized.

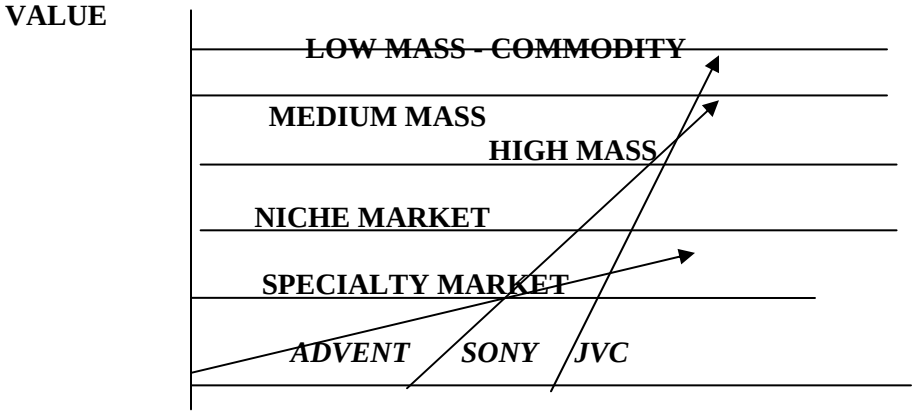


Fig 2.

TIME

FIRM VECTORS

The value of assessing technology vectors lies not in only in assessing the trajectory of the industry vector and related variables, but also in tracking the firm specific vectors of the firm and its competitors and potential new entrants. This comparative or benchmark tracking can provide important insights into the relative competitive positions, particularly in terms of innovation velocity. For example, Advent (Fig 2.) developed the first viable VCR for specialty applications mostly in television stations. An examination of the firm specific technology vectors would have revealed that those of its competitors were much steeper, their innovation velocity faster, and that they would soon not only replace Advent in current markets but also create new niche and mass markets. Further, analysis of potential radical innovation in entertainment recording and play could have revealed the disruptive technology vector of the DVD,VCD and the DVR.

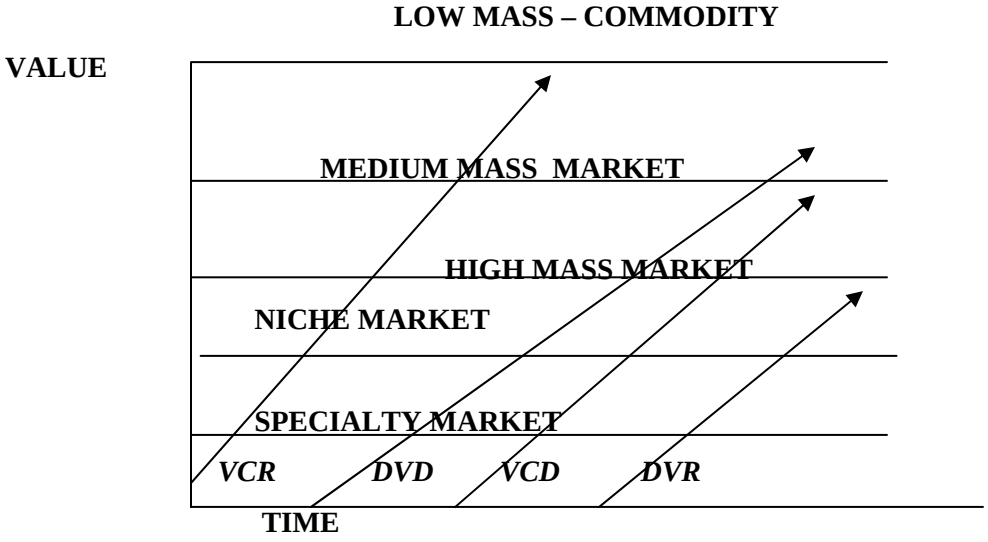
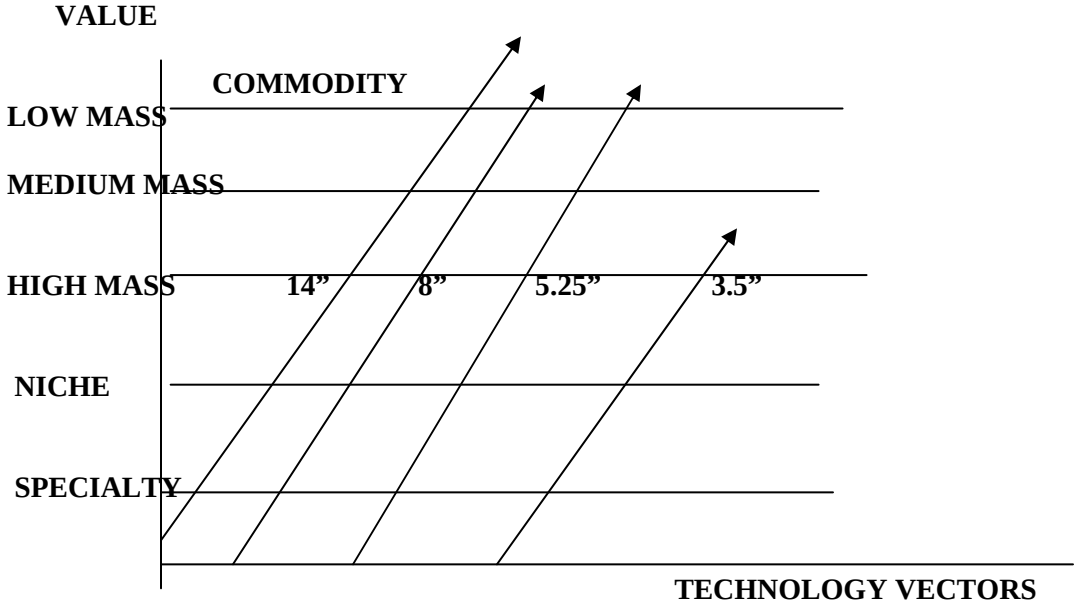


Fig 3.

TECHNOLOGY VECTORS

The analysis could have shown VCR incumbents when it would be effective to focus resources on the DVD, or currently whether to invest in the VCD or DVR. Similarly Christensen (97) showed that the mass markets opened up by the 14” Winchester drive were supplanted by the faster rising technology vector (disruptive technology) of the 8” drive, and then by the 5.25” drive, currently challenged by the 3.5” drive. As Christensen showed the markets for each of the incumbent drives were challenged and the absorbed by the new disruptive technology, new drives.

Fig. 4.



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DISK DRIVE MARKETS (adapted from Bower & Christensen, 95)

Disk drive manufacturers could has assessed the rise of each successive technology vector and determined the opportune timing to focus resources on the new technology. There are various strategies firms have used to positive effect. Christensen (1997), focused on what might be called the "spin out"; the creation of an autonomous subsidiary Cisco (2000) has generally used what might be called a focused "spin in," with the acquired unit remaining autonomous. Cisco (2000) will search and monitor its business environment for a potentially fast rising company in its focused area of technology, buy them out and pump large amounts of capital into the firm, functioning somewhat like a corporate venture capitalist. The assessment of pertinent technology vectors can be very useful in development of traditional firm strategy. If a firm decides it wishes to compete on price (Porter 1985) it would be important to estimate when the industry vector is expected to reach commodity level, and when the next "disruptive" technology will take the market. If a company seeks to compete on differentiation (Porter 1985) in a niche market it would be important to estimate how long that niche may last before the technology moves on to mass markets. Other such traditional firm strategies as seeking and Defender, Reactor, Analyzers or Prospector position (Miles, Snow 78) would benefit from knowing what technological aspects to enhance and defend, or conversely what to prospect for.

Raymond Vernon's (79) work on the product life cycle and the evolution of a technology vector showed that US and most developed economies focused their efforts on the earlier stages of a technology vector, where the profit margins were higher. Medium and developing economies were shown to focus upon the latter stages of the evolution of a technology vector, particularly in the commoditization stage. This being true for most Asian economies, however, often with US or European brand names. Large first world retailers such as WalMart or Carrefour have through their purchasing tactics have often accelerated the

commoditization of the technology. While profit margins and ROI may decline as a technology matures aggregate returns over time may dwarf the aggregate returns earned in the early stages of a technology vector. This may be the chosen strategy of many Asian firms to seize rapidly evolving vectors, extend them, create a 'dominant' design (Tushman, Anderson 2004), rapidly bring down the cost of that design, thereby creating a commodity, with thin unit profit margins, but with large aggregate revenues. The control of large cash flows being considered to be more important than high profit margins on fewer units.

Conclusion

The assessment of technology vectors comprising a dynamic environment within the context of strategy development creates a more accurate picture of a firm's four dimensional competitive position. It can help lift the blinkers from what may be termed strategy myopia, a close cousin of marketing myopia, and thereby contribute to the development of more comprehensive and accurate strategies. It can assist in the development of a strategically appropriate structure, resource allocation, and accurate strategy implementation. The objective and clear understanding of technology vectors can help Australian and Asian firms determine appropriate strategy and timing to increase market share and market dominance.

References

Bower, Joseph L. and Christensen, Clayton M. (1995) *Disruptive Technologies: Catching the Wave*. Cambridge: HBR January-February

Christensen, C.M. (1997). *The innovators dilemma: When new technologies cause great firms to fail*. Boston: HBR Press

Cyert, R.M. & March, J.G. (1963) *A behavioral theory of the firm*. Englewood Cliffs. NJ: Prentice-Hall

Hill, Charles W. & Rothaermel, Frank T. (2003) *The performance pf incumbent firms in the face of technological innovation*. New York: AMR Vol. 28. No. 2

Levitt, Theodore (1975), *Marketing Myopia*. Cambridge: HBR September-October

Miles, Raymond E. and Snow, Charles C. (1978*). Organizational strategy, structure, and process*. New York: McGraw-Hill Book Co.

Ohmae, Kenichi (1989) *Companyism and Do More Better*, Cambridge: HBR, January-February

Porter, M.E. 1985. *Competitive advantage: Creating and sustaining superior performance*. New York: Free Press.

Prahalad, Hamel, Gary

Schumpeter, J.A. (1942) *Capitalism, Socialism and Democracy*. New York: Harper & Row

Tushman, Michael L., and Philip Anderson, eds. *Managing Strategic Innovation and Change: A Collection of Readings.* 2nd ed. N.Y.: Oxford University Press, 2004

Raymond Vernon, "The Product Cycle Hypothesis in a New International Environment," *Oxford Bulletin of Economics and Statistics*, 41(4) (November 1979):255-267