COMPETING IN THE ELECTRONICS INDUSTRY: THE STRATEGIC MANAGEMENT CHALLENGE

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During the 1970s two major events converged to leave the world forever altered: the end of cheap energy and the birth of the microcomputer. The first meant immediate economic uncertainty and a serious challenge to the productive might of the West. The second was the start of a revolution that experts agree will ultimately increase humanity's control of the world it inhabits. It is mainly as a consequence of these events that phrases like 'strategy formulation', 'competitive strategy', and 'strategic management' have become business clichés. Senior executives ponder strategic objectives and targets. Managers down the line develop product/market strategies. Functional managers lay out strategies for everything from R & D, to raw materials sourcing and customer relations. Mere planning has lost its glamour; the planners have all become strategists.

The end of cheap energy signalled the demise of what the Americans call the "smokestack" industries. This decline is presenting a major challenge for management in these industries. Strategies involving diversification, rationalisation, or just plain survival are now common-place in industries like textiles and steel. Meanwhile, the rapid pace of technological development and market growth in the field of electronics is presenting a strategic management challenge of an entirely different nature to industry participants. In the electronics industry the major challenge for managers is to ensure that firms maintain an innovative "thrust" across the total business spectrum. Failure to maintain such a capability results in the erosion of competitive position. This article explores the challenge facing managers of electronics firms as they endeavour to develop the key competences necessary for successful competition in international product-markets. This exploration process considers the following issues:

- the impact of technology on business strategy.
- evolution of electronics industry structure.
- factors for successful competition in electronics industry sectors.
- future industry developments — the challenge for managers.

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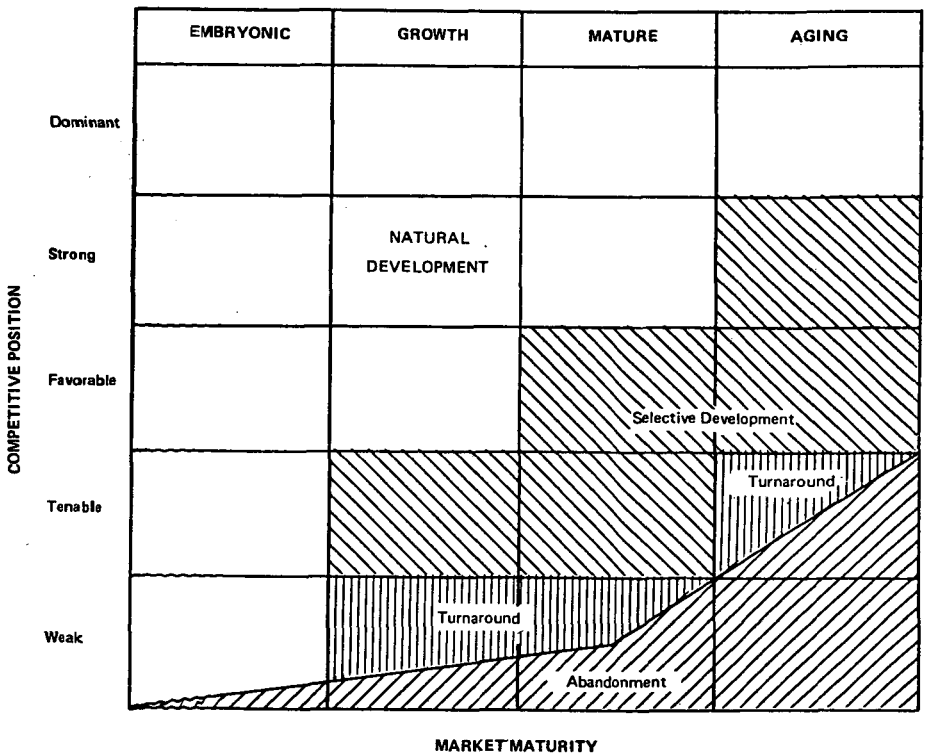
The Impact of Technology on Business Strategy

Intelligent electronics technology is stimulating basic changes across a broad range of products and markets. As a result, management is faced with a bewildering array of opportunities and challenges. Business strategies to deal with these opportunities and challenges must be based upon an analysis of new and complex product market and financial interrelationships, in addition to the application of traditional strategic planning doctrine. Nowhere are these opportunities and strategic challenges as great as within the electronics industry itself. During the past ten years the emphasis of business strategic doctrine has shifted significantly from an internal, i.e., profit centre, administrative orientation, to an external, i.e., market, competitive-business focus that stresses the strategic business unit. Nowadays, when formulating strategy the following key factors must be considered by firms:

(a) for the business situation — competitive strength;
(b) for industry characteristics — the industry's maturity; and
(c) for strategic alternatives — options appropriate to the business conditions [A. D. Little, 1979]

There are various matrix representations of the relationships among these variables. Perhaps the most widely used is the one developed by Arthur D. Little Inc. shown in figure 1.

Figure 1: *Market Maturity Versus Competitive Position: Arthur D. Little, Inc., Matrix (1979).*



In general, every business participant in an industry occupies a position in the matrix, for instance, in the mature main frame computer market IBM are in a dominant position, the IBM compatible producers like Fujitsu are in a favourable position, and ICL are in a weak position. Furthermore, each position has certain natural strategies associated with it that are normally most appropriate to that position. Hence, for example, an attempt by ICL to substantially increase market share normally would not be a strategic option. On the other hand, IBM is in a position where it can set new trends and introduce new products despite competitive challenge.

Technology can impact on business strategy in three broad ways:
(i) *Technology Can Change Industry Maturity:* an example of this that readily springs to mind is radio; this was relegated to the aging category by the introduction of television, but was resurrected and moved into a growth mode when solid state devices came on the scene.
(ii) *Technology Can Change the Basis of Competition:* perhaps the most interesting example is the global office calculator market which was dominated by Monroe, Sumlock, Burroughs and Olivetti in the 1960s when the calculator was an electro-mechanical device that required a substantial field service organisation to maintain it. In 1969 when the Japanese introduced their first electronic calculator these companies were slow to respond contending that the Japanese could not succeed in the calculator marketplace without significant investment in service organisations, and these were not being put in place. However, the technology permitted the Japanese to create a product which was so reliable that there was no need for an extensive service organisation. The ensuing product acceptance of the electronic calculator resulted in the above mentioned companies being effectively supplanted by the Japanese.
(iii) *Technology Can Change Industry Structure:* a good example of technology changing industry structure came in the 1970s when electronics firms like Texas Instruments and Casio entered the watch market with their new digital watches and in the process displaced a large number of traditional watch makers.

These examples illustrate how the application of microelectronic technology has changed the strategic complexion of just three industries. However, the widespread application and almost continual enhancement of microelectronic technology has been a feature of the electronics industry for the past ten years. This has forced industry participants to cultivate the management skills so necessary for effective competition in what is without doubt the most dynamic of modern industries. A further illustration of the dynamism which characterises the electronics field is detailed below as part of a general examination of the evolution of the structure of the industry.

Evolution of Electronics Industry[1] Structure

As an industry evolves changes occur both in the industry structure and in the nature of competition. Because of its wide diversity of product applications it is difficult to make generalisations with regard to the total electronics industry. Notwithstanding that, it is possible to make a number of general points [see Porter, (1980); O'Brien (1982)]. During its *embryonic stage* industry competition is based on product performance. Customers tend to be fairly price insensitive and a wide range of technological approaches generally exist. Providing a firm possesses the necessary technological competence, entry is easy. However, access to the technology is usually very restricted. There is little opportunity to achieve scale economies since demand is low. Because of this and because of the uncertainty and associated requirements for flexibility, one usually finds a relatively large proportion of small innovative firms. The presence of small innovative firms has characterised the emergence of various electronics industry sectors, e.g., Intel, Advanced Micro Devices, Signetics, and a host of others in the early days of semiconductors, and Apple, Sinclair, Altos, and Fortune, to mention but a few during the introductory phase of the microcomputer.

In the *growth stage* sales take a sharp upturn; this makes entry an attractive commercial proposition. The technological directions are no longer uncertain, and the technologies diffuse, both making entry easier. As sales grow, opportunities for scale economies arise in production, R & D, marketing, distribution and servicing where industry demand is not fragmented. Large firms enter the market because it is large enough to attract them, because uncertainty is reduced and therefore risk is lower, and because their resource advantages can be brought into play. Because of their substantial resources many large firms enter by acquiring a smaller technologically competent firm, for example, witness the recent purchase of the small American semiconductor firm Signetics by Philips. During the growth phase a number of new barristers to entry emerge, e.g., economies of scale, capital resources and access to distribution channels being three of the most obvious. At present in the U.S. personal computer market access to large scale retail distribution has become a major entry barrier.[2]

Transition to maturity: with a slow down in sales growth over capacity often develops. This leads to sharp competition usually with severe price cutting. Many small firms with limited financial resources are driven out. Some others retire to specialised niches while the remainder are taken over or liquidated. The intensity of merger and takeover activity leads to a reduction in the number of competitors and sometimes a more stable industry may emerge with reasonable profitability prospects for the remaining firms. At the moment the semiconductor industry would seem

to be in transition to industry maturity — if the recent acquisitions of Fairchild and Signetics by Schlumberger and Philips is any indication.
Maturity: an industry in the mature phase usually consists of a small number of dominant firms. Considerable economies of scale exist. Price competition is often the norm, with perhaps some minor product differentation accentuated by advertising. Entry to the electronics industry has been rare at this point especially in industrialised economies — where entry has occured it has been by large corporations like Exxon with considerable financial resources.

More frequently, entry occurs from firms in the newly industrialising countries (NIC's) e.g. Taiwan, South Korea and Hong Kong, or other less developed economies, using their competitive advantage of low labour costs coupled with access to well diffused technology. The most notable example of this situation is in the traditional consumer electronics products area, e.g., T.V., radio and audio equipment, where countries like Taiwan and South Korea have managed to carve large market niches for themselves.

An important conclusion from the foregoing analysis, particularly from the point of view of Irish firms entering the industry, is that the possibility of new technology-based firms entering electronic product markets and growing to large size is greatest during the emergent (especially) and early growth stages. The historical experience of the electronics industry undoubtedly bears this out; for example, the following electronic products were pioneered by new small firms which subsequently grew large: Minicomputers (DEC), Microcomputers (Apple), "fail-safe" computers (Tandem), and Microprocessors (Intel).

Key Competitive Success Factors for the Major Electronics Industry Sectors[3]

Most analysts divide the electronics industry (sic) into five major sectors:— 1. components; 2. computers and office equipment; 3. consumer; 4. industrial control and instrumentation; and 5. telecommunications. Across the five sectors various key competitive success factors have been identified [Landy, 1982]. These success factors can vary depending on a particular industry sector's position in the industry cycle (see previous discussion on industry evolution). The building of those competences which are crucially important for successful competition in electronics product-markets is the critical task for managers in the industry. The following is a breakdown of the factors for successful competition by industry sector. It is important to note that as each industry sector includes a vast number of different electronic product-markets it is very difficult to generalise as to success factors. However, a number of generalisations are nevertheless possible.

Components: the major identifiable success factors in the international electronic component sector tend to vary depending on the product-markets served, i.e., standardised or customised component markets. Briefly, the key success factors are:

(i) large scale investment in R & D. This typically involves many professional specialists and runs into many millions of pounds. R & D into new products and processes is a key feature of the competitive behaviour of international electronic component companies.

(ii) access to huge capital amounts in order to develop the plant capacity so necessary to achieve the economies of scale required for effective price competition.

(iii) economies of learning brought about by improved production techniques. This raises the production "yield" of components which in turn makes for lower more competitive prices.

(iv) incremental product innovation, provided the requisite plant capacity and process capability is available, e.g. Japanese semiconductor firms.

The above factors so essential for success in all international component markets are, to put it bluntly, way outside the range and scope of existing Irish-owned electronics firms. In fact, they are way outside the scope of the total existing Irish resource base in electronics. Indeed the transition of the overall electronic components sector to industry maturity which is now starting to occur makes native Irish involvement in the international component industry virtually impossible.

(2) Computers and Office Equipment: The extremely wide scope of the computer and office equipment sector makes it very difficult to generalise with regard to success factors. However, there are a number of general requirements to which any firm, either in the industry or considering entry to it, must give prime consideration. These are:

(i) the need for technological/product innovation in growth segments to create a further growth dynamic, or in selected niches to achieve the product differentiation which gives a competitive advantage.

(ii) successful growth in computers and office equipment is dependent on other management skills in addition to R & D. Notable among these is sophisticated marketing strategy — especially in the area of product planning [Churchill, 1982]. Computer markets are changing very rapidly with rapid changes in technology, frequent entry by new firms, and cross-entry by existing firms from other electronics segments. Choice of the right product to make and the timing of introduction is a highly skilled activity in this environment, and is crucial to the successful growth of computer firms.

(iii) in addition to the above, distribution has become a vital element in the small business systems and personal computer end of the market (see

earlier references to retail distribution in the section on industry evolution).
(iv) in the mainframe and super mini computer areas, and in office products like typewriters and copiers, economies of scale, especially in servicing, are key ingredients for success (e.g. IBM and Xerox).
(v) in personal and other microcomputers markets, economies of scale in manufacturing are extremely important especially as this is a price-competitive market. This, together with software production economies, makes access to large capital amounts a crucial part of penetrating the market. It is, of course, still possible to penetrate the small computer market by buying standard parts in large quantities and coupling the assembled hardware with standard software to still provide a competitively priced system. However, as the market matures the high volume production capacity of industry giants like IBM and Fujitsu will make it very hard for a small firm to match them on price.

(3) Consumer: there are two distinct divisions of the consumer electronics industry each deserving of separate analysis. In the traditional electronics products sector i.e., Radio, T.V. etc., the following are the major prerequisites for competitive success:

(i) large plant capacity in order to ensure that the scale economies so necessary for competitive pricing is achieved.
(ii) large capital resources in order to provide the plant capacity and production equipment necessary for efficient production.
(iii) need for a sophisticated marketing strategy particularly in consumer advertising to achieve product differentation (i.e., brand awareness) — there are marketing economies of scale at work here and small firms may not be able to advertise in sufficient depth to penetrate the mass market.
(iv) if a firm does not want to compete in the mass market, technology, design, style and reliability are important factors for competitive success in niche markets.

In the new products area e.g. video games, security systems etc., the success factors tend to vary from those in the traditional sector: Marketing, particularly a market development strategy is vital for success. New consumer products need consumers, and consumers must be *made aware* of the new product's attributes if it is to have any chance of appealing to them. Advertising on a large scale is necessary to achieve this awareness, witness the video games manufacturers T.V. advertising bombardment prior to last Christmas. Distribution is also vital for new consumer products as the choice of distribution channel will determine whether the product will diffuse quickly. The Japanese quartz watch manufacturers in the main ignored the traditional jewellery store outlets when they introduced their new digital products in the early 1970s and pushed them

through a number of different retail outlets. This ensured that the product diffused rapidly. Economies of scale in production are very important in watches, calculators and, increasingly, in video games; they are not as important in security systems. Research and development is important for all new consumer product companies in order to avoid product obsolesence. Remember, the life cycles of consumer electronic product tend to be short particularly as semiconductor technology, the driving force of the industry, is so dynamic. It is noteable that the Japanese companies who dominate the overall consumer products market are integrated backwards into semiconductors, e.g., Hitachi, Toshiba and Sony.

(4) *Industrial Control and Instrumentation:* industrial electronics is distinguishable from other electronics sectors in that end uses are extremely diverse. Thus, individual product quantities tend to be comparatively small, and engneering design and software development costs have a substantial impact on equipment pricing. Moreover, industrial users tend to place a high value on application engineering support, equipment reliability, supplier reputation and after-sales service. The industrial control and instrumentation sector can be divided into five major segments, as follows: process controls, automated manufacturing, laboratory analytical instruments, automated test equipment and building automation systems. The key requirements for successful participation in these segments of the industrial control and instrumentation industry are:

(i) *Process Controls*

- a highly competent engineering sales and service organisation.
- a complete product line suitable for the process industry sectors served.
- a reputation for manufacturing reliable equipment and providing good technical support, ranging from initial applications engineering to maintenance assistance.

It is also possible for a company to exploit a number of product opportunities in process control without becoming a full-line supplier in which case the key success requirement would be:

- sound product and marketing strategy implemented by a highly skilled and motivated operations and management team.

(ii) *Automated Manufacturing:*

- in the components area of automated manufacturing scale economies associated with competitive pricing is becoming increasingly important.
- in the still largely embryonic equipment area, feasibility, reliability and performance must be demonstrated to users who are largely unfamiliar with the product and its potential use.
- in the specialised products area i.e. robotics, the key success factors are the development of competitive products, and large promotional and

educational investment, in order to help develop a still relatively new market.

(iii) *Analytical Instruments:*

- Here, the key success factors are reputation and technical expertise. Most analytical instruments require special technical expertise which combine art and science to develop successful products. People with these qualifications are understandably scarce.

(iv) *Automated Test Equipment (ATE):*

- The key success factors for participateion in ATE are expertise in the design and manufacturing of electronic products, and experience with computer based data acquisition systems, and software development and maintenance. In addition, as with all industrial control products, a good sales, distribution and service organisation is a must.

(v) *Building Automation Systems (BAS):*

- Need for a reliable source of dependable hardware.
- Ability to meet large market development costs.
- Need for a highly skilled service organisation.

(5) *Telecommunications*

Not unlike the other major electronics industry sectors telecommunications encompasses a vast range of products and services. This makes generalisations with regard to success factors a difficult task. However, a number of general prerequisites for successful competition in this sector do exist. In virtually all segments of the telecommunications market the key issue is how to gain access to a predominately "tied" market. "Political pull" is more often than not a key factor for success in many international markets. Also, the nature of public switching and transmissions equipment products, i.e., high production costs and very large size, means that access to substantial capital amounts is vitally important for the manufacturer. Finally, the need for large scale investment in research and development while extremely important in all sectors of the telecommunications industry is especially important in the highly competitive terminal equipment market. Funding of R & D over a period of time must be stable to allow basic technological advances to be achieved. To be productive a research program can't stop at every twist and turn of a company's earnings. Stable R & D funding is an important prerequisite for success in a high technology industry such as telecommunications.

The key success factors by industry sector are synthesised in Figure 2.

N.B. *(See figure 2).* It is important to note that the above factors are generally the most important from the point of view of competitive success in each industry sector, however, they are by no means a comprehensive list of all the prerequisites for success in electronics.

Figure 2: *Major Competitive Success Factors by Electronics Industry Sector.*

Success Factors / Industry Sectors	Technology (R&D)	Scale Economies	Learning Economies	Product Innovation	Product Planning	Distribution	Mkt Development	Mkt Penetration	Consumer Advt	Capital Resources	Product Design	Servicing	Reliability	Reputation	Software
COMPONENTS	•	•	•	•						•					
COMPUTERS AND OFFICE EQUIPMENT	•	•		•	•	•						•			•
CONSUMER	•	•							•	•	•		•	•	
INDUSTRIAL CONTROL AND INSTRUMENTATION	•	•			•		•			•		•	•	•	•
TELECOMMUNICATIONS	•	•						•		•					

Future Industry Developments — The Challenge for Managers

The electronics industries will look different twenty years form now, at the start of the twenty first century. That is an easy prediction in the light of the last momentous twenty years. But, just how different will the electronics industries look? Will the structure be close to today's with recognisable companies making recognisable products, or will there be an evolution towards just a few large and all encompassing supercompanies dominating every market from consumer to communications, components to industrial? Certainly, as the electronics industries move into the mature phase this could happen [Porter, (1982)]. It can in fact be argued that such a movement is already under way, with semiconductor manufacturers spreading into the computer business and computer manufacturers extending into the communications industry and so on.

Yet another conundrum with which to wrestle is, were such consolidations to happen where would innovation come from? Traditionally, advances in electronic technology have emerged from the small, often shoestring, company started by an entrepreneur who had an idea and wanted to bring it to the market place. If such operations no longer flourish will there be such pioneering in a supercompany with its carefully structured parts and its zealously guarded table of organisation? Is not the nature of such concerns to busy themselves with making and selling products rather than to nurture innovation? It is significant that recently a Business Week special feature on Hewlett Packard, one of the most innovative and entrepreneurial of the longer established U.S. electronics companies, reported that H-P's entrepreneurial tradition is colliding with the demands of its fast growing computer business [International Business Week, 1982]. Another major facet of electronics is changing, i.e. the world of technology is shrinking. Roughly 50% of electronics industry advances are now coming from the U.S., but that is a sharp reduction from the years when the rest of the world lagged far behind the Americans in introducing new ideas. Japan and Western Europe while still running somewhat off the pace, are no longer imitators. The gap is closing and it may well be closed fully by the turn of the century. With all these forces for change it may seem that evolution is inevitable. Yet there are certain limitations that must be taken into account — limitations to what people can accomplish, to what the industries can do, and, of course to what the technologies can do. The question is whether any of these limitations is insurmountable, or if any will hinder progress.

The highest probabilities for major growth and development would seem to be in computers, communications and semiconductors. Within these fields, however, there are many considerations to ponder when attempting to forecast the shape of things to come. It is certain that further advances will occur, but the question is, what kinds and how significant are they likely to be?

The projected transition of the electronics industries into industry maturation is sure to pose a major challenge for managers within the industry. Their biggest challenge over the next ten to fifteen years will undoubtedly be the development of a capability to think strategically. Strategically managed companies can challenge and stimulate their managers [Gluck, Kauffman and Walleck, 1980]:

(i) by stressing the need for a thorough understanding of their competitors' strategies;

(ii) by focusing on a specific theme, e.g., international business, new manufacturing process technology, or alternative distribution channels for their product(s);

(iii) by negotiating strategically consistent objectives between the company's various business units;
(iv) by demanding strategic insights: remember the manager who can't tell his chief executive something more than what is generally known about his business, is scarcely going to surprise his competitors either.

In addition, it would appear that those electronics companies which place greatest emphasis on the following management principles are most likely to ride out future industry shakeouts: the value of teamwork, leading to task-oriented organisational flexibility, not rigid hierarchies; the development of an entrepreneural mode of thinking and planning within the organisation; the encouragement of open communication across functions, especially technical, operations, marketing and strategic management; the creation of a shared belief that the enterprise can largely create its own future a fundamental feature of organisations making entrepreuneurially inspired innovations.

To conclude, as the economic system becomes increasingly complex and the integration of single business units into multinational diverse organisations continues, ways must be found to restore the entrepreneurial vigor of a simpler more individually oriented company structure. As the electronics industries concentrate and become less fragmented, the maintenance of the "entrepreneurial thrust" which has been a feature of the industry to date is likely to prove extremely difficult for firms. However, strategic management linking the rigor of formal planning to vigorous operational execution may prove to be an answer.

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NOTES

1. *Electronics Industry:* Electronics is not an industry, rather it is a technology which has a wide variety of applications in various industries and products; however, for the purpose of my analysis, I have defined it as an industry.

2. See *International Business Week,* "The Coming Shakeout in Personal Computers." Nov. 22nd, 1982. pp. 48-53.

3. The identification of key success factors was undertaken through a formal analysis of the global electronics industry based on models of strategic analysis and particularly Porter's framework for competition analysis.