VIKINGS, NETWORKS, COMPETITIVENESS AND dot.com:-

Network Concepts Applied to Competitiveness in IT Industries

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DEDICATION - To the modern Vikings:-

Jan Johanson, Häkan Häkansson, Lars-Gunnar Mattson and their Swedish research colleagues.

"Let us now praise famous men - - - Leaders in their deliberations and in understanding of learning. Peoples will declare their wisdom and the congregations proclaim their praise"
Ecclesiasticus (Ch. 44, v. 1-15)

A thousand years ago pagan Vikings from Scandinavia spread fear and terror all over Europe. They were fearless and adventuresome; their ideas and beliefs were novel and met strong resistance. But they took root and prospered. Some Vikings came from Sigtuna and Birka in Sweden. Their clan leaders were called Sven, Erik and Bjorn. Their gods were Odin, Thor and Froya.

The modern Vikings are academic researchers. They are to be found in the Universities of Uppsala, Stockholm, Linkoping, Gothenberg, etc. Their names are Jan Johanson, Häkan Häkansson, Lars-Gunnar Mattson et. al. Their gods are Relationships, Interaction and Networks. Their ideas, concepts and research frameworks have their origins in the same spirit of adventure as their forebears. Crucially, they have extended the boundaries and massively enriched our knowledge of business-to-business markets. This paper is a tribute to the Swedish IMP researchers from an Anglo-Saxon convert.

1. INTRODUCTION

No study of markets as networks, inter-organisational relationships in industrial systems or the internationalisation processes and behaviour of firms could fail to be influenced by the work of Jan Johanson, Häkan Häkansson, Lars-Gunnar Mattson and their Swedish colleagues. This paper reviews and draws upon a selection of their conceptual contributions, especially:-

- Organisational learning in business relationships
- Technical developments in networks
- Network dynamics
- Micro and macro investments in network positions.

However, the study originated in a research programme carried out in the UK by the author and colleagues into new-technology markets. The primary concern is with the competitive processes of firms engaged in five distinct but increasingly linked, information and communication industries. Subsequently, the issues which arise are then interwoven with the above four

conceptual insights which owe their origin to the numerous publications of the Swedish IMP researchers.

This process gives rise to the proposition that the means to achieve and sustain competitiveness, at the level of the firm, can be attributable to those managerial processes involving organisational learning, innovative technical developments, adaptations to the dynamics of the network and making investments in strategic network positions.

2. RESEARCH AGENDA

The primary focus of this paper is on the competitive processes in knowledge-based industries. Specifically, the study is set within the context of evolutionary and rapidly changing new technologies, as are represented by several information technology and communication markets. These are:-

On-line information systems
Electronic data interchange
Telecommunication infrastructure equipment
Computerised business systems
Mobile telephones

One major question to be addressed is `What are the issues facing individual firms in attempting to create and sustain competitive advantage?' Competitiveness with, and differentiation from, other firms pose complex challenges. Yet, throughout the new technology markets listed above, extensive collaboration and joint developments to bring new products and services to end-user customers are endemic. These IT technologies, whose very purpose is to facilitate the exchange of information, across organisational boundaries, draw into collaboration and competition many firms from disparate technical and historical backgrounds. Voice, data and image communications rely on linkages between computers, software, data collection, telecommunications and digital image technologies to offer an integrated system to users.

Such systems are characterised by initial technological diversity (and ultimate convergence), prolonged uncertainty, high capital investment, the lack of a dominant design and very complex patterns of competition. The successive waves of technical developments and innovations compete with each other and also compete with recently established design configurations already on the market.

The multi-media technologies which have been studied have evolved to allow users to interact with and interrogate data, voices and images through specialist software systems. The rapid development of the Internet and the new generation of mobile telephone systems are testimony to these converging technologies.

The technologies investigated in this research have some or all of the following categories of collaborating and competing suppliers:-

Data and Information Providers
Data Access and `Hosting' Specialists
Telecommunications Network Infrastructure Suppliers
Data Distribution Service Companies

Main Frame Computer and Systems Suppliers
Software Specialists
PC Suppliers
User Hardware Manufacturers
Voice and Image Decoders

These technologies appear at different stages of the value-added distribution chain from supplier to user of IT systems.

In the study of competitiveness, the author first examines the driving forces and the motivations behind the competitive behaviour of firms. The special characteristics of the new technologies are then identified, prior to a discussion of market dynamics and network evolution. After an analysis of the nature of competition, the paper highlights the co-existence of cooperative and competitive behaviour. Finally, the research points to the problems and failures when firms seek to enter new markets with innovations in these information and communication industries.

Thereafter, the four concepts attributable to the Swedish researchers are examined in turn and their relevance to competitive behaviour discussed.

2.1 THE DRIVING FORCES OF COMPETITIVE BEHAVIOUR

Survival and growth are the main spurs to the competitive behaviour of organisations.

This truism was recognised in the early years of the evolution of concepts of marketing and business strategy by Alderson (1957) who argued that these complimentary objectives depended upon three basic principles: first, that the niche that the firm occupies endures; second, that the firm should have some special competences at the core of its position; and third, that the firm has sufficient flexibility to adapt to severe environmental changes, so that new competences develop to supplant those under threat. Thus, a firm is assumed to enjoy a position that is, in some respects, unique. It strives to make the most of its competences and gain some competitive advantage over its rivals.

It is not surprising to find that, likewise, the internationalisation process of firms is driven by survival and growth objectives and also by the necessity to use and develop their special resources in new foreign markets. Establishing a sustainable balance between the resources required for the foreign and domestic markets is never easy nor permanent.

2.2 NEW TECHNOLOGIES

The above simplistic generalisations relating to survival and growth obviously apply to many firms in business-to-business markets. But how likely is it that they apply to new-technology markets where great turbulence prevails and the `rules of the competitive game' are unpredictable? Certainly, adaptability and flexibility of the firm's core competences will be of paramount importance, as also will be the firm's flexibility in marketing and organisational development, where cooperation and competition are by no means mutually exclusive.

In those new-technology markets listed earlier, there occur daunting challenges as the turbulent markets evolve, viz:-

- initial diversity of design and systems configurations
- a growing convergence of disparate and unfolding streams of technological innovations

- disjointed attempts to harmonise and regulate technical standards

2.3 MARKET DYNAMISM AND NETWORK EVOLUTION

The evolutionary phase of new-technology markets and networks offers special insights into the complex nature of competitive activity. Within the various IT industries studied, several common factors of the markets and networks occur.

FEATURE	MANIFESTATION
Turbulence in Networks	High rate of growth of demand High rate of entry of new suppliers Many spin-off companies created High rate of technological innovation Absence of industry product standards Limited regulatory control over market monopolies
Supplier Uncertainty	No established `rules of the competitive game' High technological uncertainty High R&D costs High risks of wrong product and market choices
Customer Uncertainty	Limited experience as first-time buyers High capital outlay High technological uncertainty High risks of product obsolescence Risks of suppliers exiting the market

Though initially turbulent and sometimes chaotic, distinct patterns of competitive activity and network positions can be detected. Some suppliers seek to establish themselves in several levels in the value-added chain. Joint ventures and acquisitions become commonplace. The exercise of bargaining power between cooperating suppliers becomes a source of conflict.

In these unfolding markets, customer demands are heterogeneous and diversified into widely varying application sectors. Market positioning approaches by suppliers are embryonic and insecure. The commercial viability of any user segment defies reliable prediction. Suppliers behave in an idiosyncratic manner when entering the market from different origins and are only able to survive with any certainty in the short term. The very dynamism and potential for huge rewards attracts many waves of new entrants from distinct technological and market backgrounds. These entrants seek to exploit their special skills by developing new user groups as a basis for entering other user segments at a later stage.

In many respects, these IT markets are not so distinctly new but are traditional ones being rejuvenated and reformed. The shock waves of a new technology hit an industry and the internationalisation of a previously stable domestic market draws in foreign competition and creates massive uncertainty. Wrong choices of technology by suppliers, and poor choices of user sector occur, with damaging consequences for longer-term success.

Recent and projected innovations within the mobile telephone, on-line information and financial services and the growth of Internet services herald image projection and access to the Internet

through mobile phones using computerised handsets. Customer uncertainty and confusion occurs during these rapid technological changes. This is confirmed in a contemporary study of the mobile telephone market (Turnbull, Leek and Wing (2000)).

Especially problematic are the international dimensions, where rapid changes and new competition in the original (domestic) market are compounded by turbulence and opaqueness in each target foreign market in the unfolding internationalisation agenda of the focal firm. Survival and growth are dependent upon feed-back and learning through interacting in the market with customers, suppliers and cooperative partners.

New-technology markets, both domestically and internationally, are ripe for firms to achieve a working accommodation with rivals, either through pre-competitive collaboration or through co-existence. Incremental organisational learning in developing a coherent strategy is self-evident, although harnessing the learning to meet the firm's competitive strategy is a formidable challenge. Organisational learning is a complex construct. (Carley (1999) argues for a more systematic understanding of the relationship between organisation structure and information use in terms of learning at the level both of the firm and of the industry. She argues that organisations that begin quite similar can end up very different, due to learning differences. Firms do not necessarily fail because they are not learning, but because they are learning the wrong things or learning the right things at the wrong time.

2.4 COMPETITION AND COMPETITIVE BEHAVIOUR

Competition is inherently dynamic; a war of movement, where opportunities proliferate for firms to capture a slice of the market through innovation, emulation, differentiation and collaboration.

The more traditional view of competition is frequently argued to be directly related to market structure, as determined by the economic strength and numbers of suppliers and customers, polarised by supply and demand influences. Yet market structure is continuously shaped and reformed by technological forces and the unpredictable behaviour of market players.

Further, it is now valid to view `markets as networks', a concept brought into prominence in the business-to-business literature by the Swedish academic researchers. A network view of markets conceives of descriptive models for explaining market behaviour according to the complex interlinking of several firms through organisational relationships, as distinct from purely economic transactions. A firm's unique position in such a network, its power and competitive advantage, and even its identity, is created through its interactions with suppliers, customers, competitors and a host of third party organisations. Competitive power is accumulated and exercised through these relationships. The structure of the network and its interdependencies contribute to a firm's competitiveness through its bargaining power. Firms learn the extent, the limitations and the legitimacy to their ability to exert network power to secure longer-term competitive success.

Competition is a dynamic process in which there is active rivalry between firms within a network or market or from another network, or even where there is a perceived threat or prospect of rivalry. The rivalry is pursued with varying degrees of intensity on a spectrum from destructive to constructive competition. The firm's learning process in the market aims to assess the benefit and adverse consequences of choosing between these competitive modes. Yet emphasis on rivalry does not preclude dialogue nor exclude collaboration. However, it should exclude collusion, which contaminates the process. Strategic alliances and technological

cooperation are manifestations of dialogue. Further, pre-competitive alliances are commonplace.

2.5 COOPERATION AND COMPETITION IN THE DATA SERVICES INDUSTRY

In pursuit of the internationalisation of the firm in IT technologies and communication systems, it is crucial to the rationale underlying competitiveness to accept the notion of pluralism; there being many sources of rivalry, both known and as yet, unknown. Such rivalry may also occur at many points along the chain of distribution of IT services between the originator and the user. Within the chain, each firm may be engaged in rivalry within its own domain, but is challenged from outside that domain by alternative technologies, innovative processes and new entrants. Thus the boundaries and composition of the network system undergo constant incremental change and reshaping. This is apparent from a closer scrutiny of the various products, systems and services competing and collaborating in the information and communication technologies outlined earlier. One such IT system is on-line data services.

On-line Data Services (OIS) are complementary to, and a technological forerunner of the Internet. They allow a customer to gain access to an information data base held on computers remote from the user site. The user requires a computer terminal or PC and is electronically connected to the remote computer over public or private telecommunication networks. These services provide specialist information to organisational and domestic user groups. At least four distinct technological competences are required at the different levels in the value-added distribution chain. The levels of competence are:-

1. **DATABASE SUPPLY:** Organisations generating information and data (e.g. financial, market research, retailing, leisure). Competi-tion occurs between various information and data providers.

2. **DATA PROCESSING:** For electronic dissemination, the database must be `hosted' on computer facilities. Some facilities involve clusters of main frame computers, whilst others comprise networked PCs. Competition occurs between computer manufacturers, PC suppliers and networking specialists.

3. **SOFTWARE SUPPLY:** The hosted database must be capable of interrogation and searching by users, through appropriate software systems. Competition occurs between software designers and also with many computer suppliers who promote their own proprietary or compatible software packages.

4. **TELECOMMUNICATIONS:** The host computer and users are linked via a telecommunication system - terrestrial or satellite facility. Various accessory products and services are available to gain access to and register the amount of usage of the competing telecomms systems.

In order to provide data-based services, firms possessing any of these few basic competences must link up in a network structure of mutual dependency and cooperation. Each linked-up group competes with other groups in inter-network rivalry. Some firms operate and compete at only one level in the value-added chain but others operate or seek to operate at several levels. Predator competition occurs to gain network power and this occurs simultaneously with cooperation in the short term. The structure of the mobile telephone industry has a similar multi-layer, value-added chain, comprising network operators, service providers, retail outlets, etc. (See Turnbull, Leek and Ying (2000).

2.6 SUSTAINING COMPETITIVENESS

The sustainability of competitiveness is crucial. Managing change, flexibility, uncertainty and risk is the essence of maintaining and enhancing a competitive position in the market or network. Advantage occurs to firms which have:-

1. the ability to influence or determine the bases on which competition occurs and, thus, to shape `the rules of the game'.

2. the ability to create and secure customer, supplier and cooperative partner loyalty.

3. the will to maintain the competence to innovate and imitate.

Competition is multi-faceted and is concerned with relative performance rather than some absolute standard. Clusters of firms emerge in the form of competitive or strategic groups within networks. Competitiveness can only realistically be evaluated in comparison with other firms in that cluster. Therefore, flexibility, growth, position in the network and effectiveness of response to the actions of other firms may be a better measure of competitiveness than simplistic measures of profit and market share. Such simplistic measures fail to address the question `What market?' or `How should overhead costs be allocated to different technologies or markets?' Further, short-term measures, devoid of future orientation, are inadequate. Explanations for successful competitiveness abound in the literature and cover such single factors as productivity gains, new product innovations, market specialisation and R&D investment. Some researchers argue that a realistic perspective on the nature of market-based competition requires a model which distinguishes between the nature of supply and the nature of demand through space and time (Hunt and Morgan 1996). A firm's acquisition and development of resources has an important bearing on competitiveness.

The development of a resource based view of the firm permits an analysis of competition between firms with heterogeneous resource assets rather than homogeneous ones (Wernefeld 1984, 1995). The competitive process is viewed as a constant struggle among firms for a comparative advantage in resources that will yield advantageous market positions and, thereby, superior financial performance (Hunt and Morgan, 1997).

Pettigrew's (1985) view of competitiveness as managing organisational change, as a multi-dimensional cluster of attributes, sheds quite a realistic and pragmatic light on the subject.

In the IT and communication industries studied, the correct choice of technological trajectory and its ability to match embryonic customer needs was much in evidence as a managerial view of achieving and, more importantly, sustaining competitiveness. Technological rivalry manifested itself in product and service innovation with a long-term time horizon. This also showed itself in imitation, emulation or substitution of competitor product designs as short-term holding actions.

2.7 FAILURES AND PROBLEMS IN ENTRY STRATEGIES

In spite of the excitement generated by the technological innovations occurring, there arise formidable problems that give rise to false predictions and failed entry strategies in the IT industries studied. These are:-

- the `new is good' fallacy
- the inability to `successfully manage new technology' based upon past experience of earlier innovations
- the mistaken conviction that the dynamics of `diffusion of innovation, knowledge and product adoption' concepts will automatically be stimulated by enthusiastic opinion leaders
- the `customers can afford it' phenomenon, founded on strong underlying economic growth in user industries.

In these IT industries it has been argued (Litter and Wilson (1989)) that firms attempting to sustain a competitive position must recognise that the market moves inexorably to greater stability. This will inevitably pose new threats to the differential position which a firm has secured in the early stages. These threats are:-

- a trend towards technological uniformity
- the increase of customer expertise and buying power
- a reduction in costs and a downward price spiral
- the broadening of product applications from the original user groups
- intensified competition through imitation and high volume producers entering the later stages in the market

New-technology markets cause firms to exit from a sector or country when their distinctive competences no longer match the prevailing conditions. Late entrants may achieve a competitive advantage over early encumbents and the least efficient players are driven out or acquired. This process accelerates collaboration and strategic alliances between firms.

3. CONCEPTUAL INSIGHTS AND PERSPECTIVES FROM THE SWEDISH RESEARCHERS

The early research publications of the Swedish IMP scholars in the 1970s focused on industrial marketing and purchasing behaviour, their interplay and the organisational problems which arose. In the 1980s they highlighted the crucial role of inter-organisational relationships and interaction concepts in business markets. They argued that social, cultural, technological and organisational interactions and exchanges underpinned such economic relationships.

Network concepts then became a dominant theme and were linked to technological developments (Häkansson (1987)), supplier management (Axelsson (1987)), business strategy (Häkansson and Snehota (1990)), and international business activities (Häkansson and Johanson, 1988)).

The general proposition was that markets and business networks can be regarded as sets of connected firms and as sets of connected relationships. In the 1980s this perspective was extensively researched and developed by Johanson and Mattson (1990) and by Häkansson and Johanson (1992) as an adaptation of the social exchange network (Cook and Emerson (1978)). The primary function of these relationships is argued to be efficiency (through interlinking of activities) creating resource leverage and mutuality (based on the self interest of actors). The secondary function is related to creating chains of activities, constellations of resources and shared network perceptions (Anderson, Häkansson and Johanson (1994)).

The markets as networks' concept has spawned novel perspectives to the study of business interactions. Membership of various networks defines the most important sets of relationships for firms at any given time. A basic function of the net is to supplement resources and competences internal to the firm. Access to such resources will be conditioned by the structures of power and dependency overlaid upon the net (Mattson (1985)). These structures identify the net as a `political' concept. Networking is undertaken in pursuit of various competitive goals.

It is apparent that the ideas and concepts from the research publications of Johanson, Häkansson, Mattson and their collaborative authors have resonances with the issues raised in the discussion of competitive processes outlined in the first part of this paper. Here, four such concepts are reviewed and analysed with respect to their possible relevance to competitiveness.

3.1 ORGANISATIONAL LEARNING PROCESSES IN BUSINESS DEVELOPMENT

The new technologies, around which this paper is focused, are clearly knowledge-based industries. Many firms have developed close links with independent research organisations, universities and other sources of scientific and technological know-how. These links supplement the firms' own R and D capabilities, thus creating special technological networks (Häkansson, Havila and Pedersen (1999)). Learning within these networks can give the firms distinctive competitive advantage. The acquisition of knowledge and competences, as an organisational learning activity, is derived from the firm's own experience by experimentation and from the experiences of others. This is a knowledge transfer process. It is argued that the more connections a firm has in such a network, the greater the probabilities of learning (Häkansson, Havila and Pedersen (1999)). Interactions, through social, economic and technical exchange within network relationships facilitates these two-way communications and promotes better organisational learning.

Johanson and Mattson (1990) argue that, for technology to gain market acceptance, the following aspects of the organisational learning process are relevant:-

- suppliers and customers require extensive information about each other
- such knowledge is widely diffused through supplier and customer organisations
- extensive interaction is necessary across many levels and functions within organisations
- efficient knowledge transfer takes time to develop
- learning is interwoven with working experience and interfirm cooperation
- confidence in each other's ability and commitment is vital
- adaptations in technology and working procedures often cement the interorganisational bonds and interdependence

Organisational learning is crucial to understanding how different types of customers' needs may be satisfied and how best to handle a portfolio of inter-organisational relationships. At an international level, the learning process is linked to an appreciation of how different markets and cultures should influence marketing strategy. Additionally, learning is focused on the competitive behaviour of other firms in the network in order to develop an effective entry strategy and the establishment of advantageous network positions. Learning has constantly to be applied to understanding what are the `rules of the competitive game' and how market power may be acquired and legitimately exercised in different market settings.

3.2 TECHNICAL DEVELOPMENTS IN NETWORKS

In the preceding sections covering IT industries, technological innovations and adaptive behaviour were shown to be of paramount importance in sustaining strong competitive positions.

In their model of industrial networks (Häkansson and Johanson (1992)) the authors' aim is to present and facilitate an integrated analysis of stability and development in industrial systems. The model's basic variables are actors, activities and resources, which are all related to each other. Actors perform activities and/or control resources. Transformation activities change resources from one actor to another. Transformation and transfer are mutually dependent upon one another. On the basis of control of resources, so power relationships occur between actors. Technological capability in design and production is a vital resource controlled by a firm and is clearly an ingredient of a firm's competitiveness.

Sources of new technologies are numerous. Innovations and technical developments can be initiated by a supplier actor or by a user actor or by the interaction processes between suppliers and users. They also arise from sources external to these actors. Häkansson identifies three types of technical change activities (Häkansson (1987)):

- investments in capital (equipment and processes)
- improvements in technical efficiency by day-to-day rationalisations
- product or general technological developments

Häkansson goes on to argue that technical development is by no means a linear and simple process amenable to management control. In a similar manner to business strategy, technological strategy may be little better than `muddling through' by trial and error. Some novel ideas are tried, others may never be tried and some become standard solutions over time. Technical development networks are often unstable and imperfect. Optimality cannot be applied to a firm's network position. There is always scope to change and improve. The technical development network can be an idea generator and source of resources. It can also be an information transmitter and a learning system (Häkansson (1987)).

In the IT industries researched, the nature and choice of technological trajectory and product design by a firm in these emerging markets has distinct similarities with the general process of technological innovation and diffusion. Uncertainty is seen to surround the optimum technological trajectory (Nelson and Winter (1982)). Risk-handling behaviour, availability of skills and experience with comparable problems frequently guides the specific choice of trajectory. In rational and normative models, technical choices, business development processes and marketing planning are idealised as fully integrated and mutually dependent. In practice, it appeared possible to distinguish crudely between those firms which develop products to suit market needs, those that have cultivated markets to capitalise on products developed and those firms which merely attempt to emulate or substitute the products developed by competitors. All are different approaches to competitive behaviour.

3.3 NETWORK DYNAMICS

Network turbulence and the unpredictable behaviour of firms is endemic in rapidly evolving new technology industries. Changes in the network arise by changes in actors (such as suppliers, competitors and new entrants). Firms attempt to improve or protect their network positions by building up internal (technological) or external (relationship) competences. One

purpose is to get a better organisational `fit' to other actor firms (Häkansson and Henders (1995)). A key question is **`who controls the knowledge and competence resources within the network?'**

Network dynamics are brought about by simultaneous and cumulative changes, such as new entrants, new user groups, new strategic alliances, etc. Consequently, changes in relationships and power balances occur which Häkansson and Henders (1995) refer to as heterogenezing (i.e. new designs), restructuring (attempts to do existing activities better) and control (consolidating one's access to resources).

As demonstrated in the research among IT-based industries, network turbulence, with the consequential risks and uncertainties for suppliers and customers, has become a regular occurrence.

The key to the dynamics of a network structure is the power and dependency structures overlaid upon it, and the behaviour of firms to change or capitalise upon it. Whilst the very existence of a relationship implies some degree of cooperation, this does not subvert the competitive goals of the participating firms. The dominant direction of influence and the understood `rules' guiding behaviour in the relationship, will be determined by the balance of power. Such power struggles are affected by factors such as financial strength, expertise, trust, legitimacy, etc., in addition to the technological competence and availability of other options for the firm.

3.4 NETWORK POSITIONS AS INVESTMENTS

The processes of the internationalisation of firms has been conveyed as investments in market (and network) positions by Johanson and Hallen (1985) and Johanson and Mattson (1985). In their analysis of the international marketing of German companies, the former authors distinguish between micro investments in specific market relationships and macro investments in markets, countries and complex networks. These authors emphasise the need for an awareness of the psychic and geographical distances from the focal company to the different markets. Establishing information channels with various parties and specialists is part of the international learning process related to understanding how each market operates.

Internationalisation occurs when some of the relationships in the domestic market network are connected to existing or potential relationships in a new foreign market network. Alternatively, a firm's resources can be made inter-dependent with resources controlled by actors in other networks. Such adjustments involve investments in new resources by the firm and purchase of already existing resources controlled by other actors. Cooperation, coordination and strategic alliances testify to this approach (Johanson and Hallen (1985)).

The Uppsala school of researchers emphasise the contrast between deterministic styles of strategic investment decisions on the one hand, and adaptive, incremental learning styles of `muddling through'. (Johanson and Wootz (1984), Johanson and Hallen (1985) and Hallen (1986).

In the IT industries in our studies, rapid internationalisation of firms and markets occurred. Investment strategies were fraught with problems of implementation. Incremental, flexible and reactive planning was essential. The firms with diverse origins in computing, telecommunication, office systems, data services, etc., have been subjected to periods of regular technological and market changes. Adaptive strategies for macro investments have superseded any grand deterministic strategic planning.

Johanson and Mattson (1990) propose that, because firms in a network of relationships are dependent on one another, their activities need some form of coordination. This coordination is not centrally planned nor by an organisation hierarchy, nor by a price mechanism. Instead, coordination occurs through the interactions between firms in a network. Firms exercise considerable freedom of choice when selecting their counterparts and gain access to each other's resources.

The mode of micro investment conduct by firms in some of the IT industries was to form sub groups or sub networks of several firms of service providers, whereby each firm occupied and fulfilled a defined role within that sub group. These roles were based on the type of technological competence of the firm as, for example, a data provider, computer specialist, telecommunications distributor etc. These sub groups were formed voluntarily, and so the firms were exercising their freedom of choice of partners and, thereafter, their resources were coordinated by contractural agreement. When firms internationalised, they would seek identical or similar groupings of partner firms to penetrate a new market and jointly benefit from their coordinated resources and experiences.

Johanson and Mattson's notions of cumulative processes in relationship development, the need for internal coordination of interdependencies in the network and the establishment of network positions by `extension', `penetration' and `integration' are valuable analytical ideas.

4. SUMMARY

In their pursuit of competitive advantage, firms strive to establish, defend and develop unique market and network positions. Such positions, being founded originally on the firm's core competences, have to be sustained when market and technological upheavals occur.

In the IT and communication industries, the markets are found to be inherently volatile, due to successive innovations and regrouping of competitors. There is a pervasive atmosphere of high risks and alarming uncertainty. Therefore, the survival and growth objectives of firms are necessarily overlaid by the dominance of adaptability of technology and organisational flexibility to serve these rapidly evolving markets. It has been argued that the boundaries of the competitive arena for these IT technologies are unclear. This is especially true of international markets because spin-off firms and changing strategic alliances arise amongst competitors. The great technological diversity of supplier firms is manifest in the variety and unpredictability of their strategic behaviour.

Within this complex arena, the various network concepts, attributable to the Swedish researchers, offer novel structural frameworks and insights for the study of competitive behaviour.

The `markets as networks' approach has emerged as a dominant contemporary theme. It provides a valuable concept for understanding the many connected relationships which affect and are affected by the activities of individual firms, as actors. Networks can accelerate technical innovations and changes. They may enhance market competence and open up efficient channels of communication. Their impact upon the international dimensions of a firm's growth and global activities was reinforced in our study of IT and communication markets.

The `organisational learning processes' perspective, advocated by the Swedish researchers is shown to be based upon linking into or building knowledge networks. The acquisition of technological and market knowledge is achieved through interactive relationships between suppliers, customers and third parties. This takes time and involves close inter-organisational and interpersonal contacts between the firms involved. Clearly, this is an incremental and adaptive learning process, based on trial and error, experience and flexible organisational systems.

Häkansson's et al. views on `technical development in networks' was reinforced by the Swedish group's original model of industrial networks, as represented by actors, activities and resources. This concept provided a helpful analytical framework for understanding innovation and the development of technological networks in business markets. Firms in a network, or competitive arena, emerge from disparate backgrounds and possess a variety of scientific and technological resources. Market power and actor activity are often based on such resources. Decisions concerning the appropriate technological strategy are complex, when taken in the face of recurrent waves of innovations from existing and prospective competitors. The inability of one design to gain widespread market acceptance in the early phase of competition, is followed by technological convergence as actors' resources are redirected to conform to increasing standardisation of designs to meet customers' demands.

The Swedish ideas on `network dynamics' gives added emphasis to our own portrayal of network turbulence and the disruption of existing power dependency systems within market and network relationships. The need for firms to identify `who controls the knowledge and competence resources' in a rapidly changing network poses a formidable challenge.

The `network positions as investments' concept finds resonances in the study of IT industries, through the formal cooperative groupings of several firms from backgrounds in computers, software design, telecommunications, etc. These groupings require considerable joint investments in systems integration, shared technological competences, inter-firm trust and commitment. These established network positions, however, are insecure and embryonic, due to firms in such groupings engaging in clandestine competition between each other to secure greater dominance and control of the group. The Swedish researchers' sceptical views on highly centralised planning for foreign market involvement and the competitive behaviour of subsidiaries are relevant to the behaviour of firms in the IT and communication industries. The experiential learning models are shown to necessitate incremental, adaptive planning. These are more readily applicable to these rapidly evolving technologies than the grand deterministic approaches normally associated with centralised strategic planning.

In conclusion, it is apparent that competitiveness in the turbulent, knowledge-based industries studied, benefits considerably from the insights of the four network concepts developed by the Swedish researchers viz:-

- competence in managing organisational learning processes.
- creativity in building and harnessing technical development networks.
- ability to adapt to the dynamics of the market and network.
- resource management skills in making investments in strategic network positions.

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