PRIVATE NETWORKS PUBLIC OBJECTIVES
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# Interoperability -- Economic and Legal

## Public Access and Closed Network Membership: Electronic Trading Networks in Europe

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## 1. INTRODUCTION[1]

The term, Electronic Trading Networks (ETN) is used in this chapter to define networks which combine the collaborative aspects of electronic trading with the competitive advantages of electronic network based markets. These networks may be designed to ensure openness or closure to various communities of users. The emergence of these and other related advanced network applications has implications for the long term public accessibility of advanced information and communication services.

ETN are being designed to enable the ultimate transfer of all aspects of trade into the electronic sphere.[2] This chapter considers the implications of ETN in the light of the experiences and conflicting priorities of organizations involved in their development. Analysis of several case studies suggests that scenarios for telecommunication infrastructure development which favor greater accessibility for users may be being countered by the proliferation of network applications specifically designed to meet the requirements of closed communities of users.

The chapter draws on the results of research which has focused on factors creating demand for ETN.[3] This work considered whether a shift of traditional physical trading networks into the electronic sphere would encourage greater openness in the trading environment or, alternatively, whether it would encourage new forms of network closure as a result of technical and organizational barriers to control network membership.

As ETN mature and become established, the preferences of network operators and users for highly differentiated network configurations are becoming increasingly apparent. In order to achieve secure and reliable networks, some ETN operators move their services from the public switched telecommunication network to dedicated or internal corporate networks, while others take the opposite route. Still others prefer to develop ETN based on hybrid combinations of the underlying telecommunication infrastructure. However varied the individual network strategies, organizations responsible for managing ETN exhibit a tendency toward the development of closed trading environments. This is often achieved technically through the use of proprietary standards at the service application level, but it also is visible in the design of standards for the operation and development of advanced telecommunication infrastructures.

There has been little public debate about the implications of trends toward closed networks of electronic traders. The result of a migration of trade and commerce onto closed networks could mean that international trade regimes come to favor those able to access and

control these service applications as well as the underlying infrastructure.[4] This chapter suggests that the key issue is not whether the underlying telecommunication infrastructure is subject to single or multiple ownership. Rather, the main issue which should concern policy makers is the terms and conditions of access to networks operating both in support of users who require that access be limited to authorized membership communities and of the wider public.

Table 1 - Design Parameters of Trading Networks

| PARAMETER | DEFINITION | EXAMPLES |
|---|---|---|
| Trade Information | The dissemination of background information, possibilities and options which provide the knowledge base required to become involved in trade | Databases, e.g. Patents, Standards, Catalogues<br>Information Feeds, e.g. Market Intelligence, News Agency reports |
| Trade Facilitation | The information and procedures concerning activities, actions and choices necessary to allow the free movement of goods and services | Legal Procedures, e.g. Customs Clearance, Health and Safety<br>Financial, e.g. Insurance, Letters of Credit,<br>Logistical, e.g. tracking and tracing service<br>Trade Related Tasks, e.g. certification, authentication storage, repackaging<br>Administrative, e.g. electronic movement of information, instructions documents |
| Trade Execution | The process of informing the relative parties that a binding contract has been consummated | Conditions of Trade, e.g. Private Treaty, Closed Market, Open Sale<br>Mode of Trade, e.g. tender, auction, open outcry<br>Type of Trade, e.g. procurement, futures, options |
| Clearing and Settlement | All information-related actions to move goods, funds etc triggered by an executed trade | Information, e.g. title transfer, clearing house, documentation<br>Physical, e.g. delivery, testing<br>Financial, e.g. guarantees, margins, funds transfer |
| Trade Regulation | Information concerning all elements of trade required by voluntary or statutory organizations<br><br>May eventually be released as Trade Information | Telecommunication, e.g. transborder data flows, Access nodes<br>Financial, e.g. capital adequacy, settlement periods<br>Competition, e.g. access, biased markets<br>International Trade, e.g. TRIMS, TRIPS quotas, non-tariff barriers |

Source: F. Mandell and M. Jenkin, 'Electronic Trading Networks and Interactivity, The Route to Competitive Advantage?' Case Study Report, SPRU, Brighton, 1992

## 2. DESIGNING INFRASTRUCTURE AND SERVICES

Trends in the development of the telecommunication infrastructure and service applications which support electronic trading can be considered from the perspective of the types of 'design parameters' which they incorporate. For example, the trade cycle can be disaggregated into five distinct phases - trade information, trade facilitation, trade execution, clearing and settlement and trade regulation (see Table 1). Each phase involves the production and exchange of information. The phases embody logically separate and coherent sets of parameters such as levels of access, data quality, security, speed, network redundancy, application standards, gateway protocols, cross-border regulations and dispute settlement procedures. To achieve the levels of confidence and integrity required by users, networks must enable different levels of access for user communities.

The five key design parameters of an electronic trading network suggest that any subset of relationships can be examined with respect to the implications of network design decisions for the strategic advantage of firms, the accessibility of networks for users, and the restrictions imposed by regulatory arrangements. Each of these design decisions will have an impact on the production and use of electronic information, the technical characteristics required of the underlying telecommunication infrastructure, and the organizational structure of the industry.

Each ETN involves compromises with respect to the design specifications required by the different parameters shown in Table 1. These compromises create constraints for both network operators and users. ETN like other networks embody the technical and institutional compromises that are needed to support the various facets of the trade cycle. Braudel[5] suggested that the pace and ease of movement within a trading network (i.e. network integration versus fragmentation or openness versus closure) is conditioned, not by the maximum potential of the parts of the network, but by the minimum characteristics of the elements present across the network. He also observed that advances in technical systems (e.g. communication, road, rail transport) tended to be subject to uneven development patterns. The unevenness of these patterns also created constraints for the network users.

In the context of the emergence of ETN, Braudel's observation encourages us to look at the minimum conditions required to support open or, alternatively, closed electronic network markets. What are the bottlenecks or minimum characteristics of these interlocking technical and institutional networks? What do these minimum characteristics imply for the long term evolution of the underlying telecommunication infrastructure? What do they imply for the balance between private (restricted membership) networks and those which are widely accessible to the public?

## 3. DESIGNING THE INFRASTRUCTURE

A central issue for European Union policy is the management of a transformation from the traditional telecommunication infrastructure to an advanced telematics infrastructure capable of supporting services as diverse as 'plain old telephone service' and the sophisticated applications which may be involved in ETN.[6]

Projections for the rate of growth and diffusion of the telecommunication infrastructure give little indication of the likelihood of any particular development trajectory. For example, it has been forecast that by the year 2000, broadband telecommunication services could

generate annual Public Telecommunication Operator (PTO) revenues in Europe of about 10 billion ECU. Over 1 million business sites could be equipped with fibre access to networks by the year 2000. A much smaller number will make use of this capacity for broadband services. Certain services such as high speed non-voice communication, including graphics and digital imaging, are expected to create demand for growth in higher capacity networks throughout Europe.[7]

However, if the telecommunication infrastructure is to be responsive to a wide range of economic, political, social and cultural aspirations on the part of users, technological advance and network designs will need to be coupled with policy measures. Open access to advanced services will need to be encouraged because of pressures to achieve closure on the part of service designers such as ETN. Many of these users require an 'intelligent' infrastructure platform which can support closed membership networks for selected communities of users. Networks designed to meet these users' needs will be characterized by 'closure.' If this becomes the predominant 'minimum' condition for advanced telecommunication network design, then policy measures will be needed to alleviate bottlenecks to access for the wider community of public users.

The European Union's policy framework for the telecommunication infrastructure has been taking shape since the mid 1980s. By 1988 the Commission of the European Communities had observed that 'to flourish, telecommunication has to have the optimum environmental conditions.' One aspect of Commission activity has been a drive to promote the development of telematics services in support of the competitiveness and cohesion of the Single European Market. Programs have been aimed at promoting the competitiveness of manufacturing industry and at changing the structure and operation of the European telecommunication infrastructure.[8] This has been accomplished through policies directed at areas such as harmonization of standards for services and equipment and improved network access.[9] The Union's Framework Programs have supported pre-competitive research projects on technologies and applications with the aim of encouraging investment in an open accessible network.[10]

Much attention has been focused on corporate requirements for advanced services. By the early 1990s, it was clear that these would need to include pan-European access to wide area networks; data functionality matching the performance of local area networks; a mix of technologies and services creating the conditions for experimentation with new applications.[11]

The consumers' interest in the telematics infrastructure have not been neglected. The lead time and riskiness of investment in consumer oriented services, the demand for interactive and other types of services, and the need for a redefinition of concepts of public (universal) service have all been taken into consideration.

Public policy aims to influence the balance between publicly accessible and closed membership networks. The main emphasis has been directed to strengthening the coherence and integrity of the underlying European telecommunication infrastructure. However, the predominant vision for the development of services such as ETN is one which favors increasing heterogeneity, complexity, and in many cases, restricted access to new services.

In Europe, as in other regions, the key infrastructure institution in the early phases of telecommunications was the universal monopoly PTO. The PTO had little competence in fields such as computing or software development and relied upon closely linked equipment manufacturers to develop innovative services. Applications beyond telephone, telex, and simple data transmission were left to other firms within the information technology field.

Today's vision of a telematics infrastructure in Europe makes several assumptions about the level of complexity, standardization, and scope for new entry that will emerge in the future. A 'stage-oriented' scenario is influential. An essentially linear metmorphasis of the infrastructure is expected in which national PTOs remain dominant at first and the terminal equipment market is liberalized bringing entry opportunities for peripheral equipment manufacturers. Competitive tendering is required of the PTOs and two, or perhaps three, public switch manufacturers become the preferred suppliers of the PTOs. Mobile service providers are licensed and their equipment manufacturers see their markets expand. In some cases, satellite operators are licensed to engage in service provision.

In subsequent stages, the market position of the PTOs becomes less dominant and interconnection of facilities and services begins to be a priority issue. Service providers increase their use of infrastructure facilities to support new applications. Ultimately, the PTOs must contend with one or more network operators who are given the right to provide service to the public. The final stage foresees many different PTOs providing intelligent platforms to support numerous applications. Whether each PTO has the same service obligations with respect to the availability and accessibility of its network services has remained an open question in most of the member states of the European Union.

In addition, the fact that there are many possible departures from the technical configuration suggested by this stage oriented scenario and that these have implications for the balance that emerges among open network applications and those tailored to meet the needs of closed membership groups has not been an issue at the center of telecommunication infrastructure policy debates. For users, the main issues concern the access and usage conditions that will enable them to make use of the functionality embedded in the infrastructure.

One class of users which places heterogeneous demands on the infrastructure is comprised of those engaged in electronic trading. The following section focuses on electronic trading as a special case of infrastructure use and on the trends in network design that are associated with ETN applications.

## 4. DESIGNING ELECTRONIC TRADING NETWORKS

Six Electronic Trading Networks (ETN) in the Netherlands, Sweden, the United Kingdom, and the United States are considered here. These networks involve some of the largest firms in the telematics sector as well as organizations with little prior experience in managing or operating telematics services. They include examples in the financial services, transport and distribution and agricultural sectors (See Table 2). This section considers the ETN design parameters in terms of the requirements imposed on the underlying infrastructure and the specifications for computing power and software.

### 4.1. Telecommunication infrastructure use

NORDEX ETN membership was open to professional brokers rather than to institutional investors. Users were provided with a dedicated telephone line connecting a workstation to a central computer in London. Connections were established using private leased circuits in Europe supplied by PTOs and competing third party suppliers. Operators

Table 2: Electronic Trading Network Organizations

| Organisation | Functional Description | Ownership and Control |
|---|---|---|
| NORDEX<br>Case Study No. 1 | Nordex is a London based, cross-border electronic marketplace for global professional investors who trade in shares of companies based in the four Nordic Countries. Nordex operates via a central counterpart mechanism offered by Citibank and linked to the bank's Clearing and Settlement Services. Planned to extend the service to Holland and Budapest | Subsidiary of Kinnevik (privately controlled Swedish Holding Company) which has national and international interests in the Information Distribution Industry e.g. Telecom ( fixed and mobile), Credit Card Phones, Cable and Satellite TV, Home Shopping Services |
| Chicago Mercantile Exchange (CME)<br>Chicago Board of Trade (CBOT) and Reuters<br>GLOBEX<br>Case Study No 2 | 'After Hours' 24 Global Trading Network linking Members of National Exchanges to buy and sell Futures and Options Financial Instruments e.g. Stocks, Currencies (using CME/CBOT structures); Global Networking/Facilities Management to be provided by Reuters | Will operate as an accumulated structure<br>-the three principals (CME, CBOT, Reuters)<br>-the National Futures Association (USA)<br>-the national exchanges (e.g. Paris MATIF)<br>-the members. NB. The fees paid by the users will be split between the above parties |
| UK EDI Association Oil Industry Interest Section<br>PRODEX<br>Case Study No. 3 | Inter-firm Product Exchange Reconciliation Scheme. Based on EDI messages developed by UK group for submission to UN/EDIFACT | Part of pan-European EDI user Group - The European Oil and Gas EDI Group - involves both EC and EFTA countries |
| Maritime Cargo Processing Plc<br>MCP<br>Case Study No 4 | A trade facilitation organisation which allows users direct access to UK Customs data and inventory control system (DEPS) | Service Company jointly owned by the founder members of the Port Community<br>Port of Felixstowe majority owned by Hutchison (Hong Kong) who also own Hutchison Communications |
| Dutch Tele-auctions<br>VABA<br>Case Study No. 5 | VABA is a computer bureau and consultancy to provide network based services over leased lines to fruit and vegetable auctions | Wholly owned subsidiary company of CBT (Central Bureau of Fruit and Vegetable Auctions). CBT owned by the provincial auctions |
| Dutch Video auctions<br>Westland<br>Case Study No 6 | Westland is a trading center for buyers and an auction complex for flowers and pot plants. Provides grading, certification, packaging and other trade related services to its members. The video auction is a local initiative which may be offered to other auctions | Grower owned co-operative with 3000 members |

Source: R. Mansell and M. Jenkins, 'Electronic Trading Networks and Interactivity: The Route to Competitive Advantage?' Case Study Report, SPRU, Brighton, 1992

of the underlying telecommunication infrastructure established connections using conventional facilities. GEIS Co., for example, configured its network to handle traffic generated by the ETN and another operator incorporated a transLAN bridge to connect the ETN. Innovations were required to meet the technical requirements of the ETN operator using interoperable cross-border proprietary standards and protocols.

In the case of GLOBEX, innovations were required to make the system operational. The network connects Reuters' subscribers and hubs traffic in Hong Kong, London, Paris and New York. To meet stringent requirements for security, speed and reliability, the network needed to have a three second response time and 99.5 percent availability.

Those developing the PRODEX ETN failed to find a way of using the telecommunication network in a way that met their members' needs. To do so would have required equipment suppliers to upgrade the existing infrastructure and to agree standards to support X.500 directories and databases. At the time there was little commercial incentive to do so.

The MCP ETN was originally designed to support direct data input using dumb terminals connected to a mainframe computer via the public network and leased lines. To retain users, the network operator added features and services, but was forced to rely on external suppliers. This led to increased operational costs and the operator was required to establish gateways into its mainframe computer for users already established on other networks.

In the case of the tele-auction (VABA), network operators and telecommunication suppliers provided a centrally configured network based on leased digital circuits and the Dutch PTO's Packet Switched Data Network. In the case of the video-auction (Westland), an on-site fibre-based Local Area Network was required.

### 4.2. Information processing and software

At the heart of the NORDEX ETN was a central electronic order book into which dealers placed offers to buy and sell on the market. The software was written in-house and workstations were configured to support open systems. The system involved a moderately complex configuration of computer processing capability. From the users' perspective the software was user-friendly and required a relatively high degree of co-ordination between the network operator and the computer workstation and mainframe suppliers.

GLOBEX was designed to support order entries using terminals consisting of a keyboard, monitor and printer located in the offices of clearing and individual members. Administrative terminals in the offices of clearing members receive confirmation of trades. Since the system was introduced, the intention has been to provide more real-time screen based information than is available to traders on the NORDEX system. Reuters, the network operator, absorbed the development costs of the software.

PRODEX's reliance on the application of computer processing power and software was relatively low. However, the software involved a set of rolling files for each company containing internal transactions and no plans were made to exchange information electronically among members of the trading community.

The MCP application of computing and software to support the data entry system ensured that software development would be as user friendly as possible. The MCP system software resided on the company's computers and the network was star shaped offering dumb terminal type tele-emulation. Since no sophisticated front end features were available to end

users the system encouraged proprietary software and systems development on the part of specialist software houses.

The two ETNs in the Netherlands (VABA, Westland) required greater use of computer processing capacity. In the case of VABA, the computers occupy a central position in a number of star shaped networks and a central computer runs each tele-auction. Nevertheless, despite a relatively lengthy computer and software development process, the tele-auction runs more slowly than the physical auction. At Westland, computers link terminals and printers via a Local Area Network. Two video-walls require sufficient network capacity to allow the screens to be refreshed in under a second.

In each of these cases a network operator selected technical configurations and took responsibility for combining telecommunication and computing functions. The telecommunication infrastructure, service attributes, computing facilities and software capabilities were designed to meet the trading parameters of each organisation with varying degrees of success. Different parameters of each network were associated with specifications for peak volumes of traffic, access, speed, reliability, security, cost, etc. The selection process reflected the variable skills present in the user communities, the availability of computer processing power, and the availability of underlying infrastructure capacity which met their specifications.

## 5. DESIGN CONSTRAINTS AND MINIMUM CONDITIONS

The technical constraints encountered during the development of these ETN were demanding because they required negotiation with disparate equipment manufacturers, ETN operators and authorized members of trading communities.

These technical designs did not require major innovations in technology. Nevertheless, the main design constraints were: the uneven availability, cost, and access conditions of telecommunications infrastructure and services in different geographical areas; the need for co-ordination across spheres of competence (e.g. PTOs, cable operators, third party network operators); and, most importantly, the need to agree to minimum standards without which these ETN could not be extended to the members desired by the network operators.

For example, at the time the NORDEX ETN was designed in the early 1980s, the ways in which software should be written to emulate electronic trading were little understood. The network operator responded by attracting developers from a local rival company who had undertaken the early pioneering work. By importing competencies some of the risks associated with software development were reduced, but this decision created other problems. The inherited software development hardware platform became the basis for the trading communication network for which it was not ideally suited. Additional time and effort had to be spent tuning the technical system to match the communication and processing requirements of this particular market.

The design parameters for GLOBEX as a global market were demanding. Ensuring there would be no degradation of the market service caused by technical problems was difficult. There were numerous delays as network designers struggled to ensure that the software algorithm could cope with surges in network traffic as members were trading.

The preferred technical strategy for PRODEX was to use an X.400 system based on the public switched telecommunication network. This approach needed the provision of an X.500 central directory containing the addresses of all potential users of the system. This service was not available.

The design for the original MCP ETN was constrained by the need to interconnect to the UK Customs Computer system. This was a videotex system with ports on the computer reserved for MCP's user base. This technical constraint set the tone for the entire MCP development. Being a small technically inexperienced company they contracted out the software development to programmers linked to a hardware company who used their own proprietary operating systems. Responsibility for network management was taken by a sister company. They too had preferred technical strategies. The main technical constraint for MCP was to optimize the technical preferences of unrelated competing suppliers. This shaped the development of message standards, user interfaces, etc., in ways that have made further progress difficult.

Initially the VABA ETN was started by a group of users who attempted to work with an independent software company. Once VABA became involved, software development was brought in house and most of the problems were resolved. As originally designed the system had a major shortcoming - it was slower than the existing system and the average number of traded lots completed per minute decreased by 25 percent.

In the case of Westland, the development of an analog video system to run on a LAN was not difficult. The main technical problem was to transfer the system to external off-site networks. The PTO could not provide the capacity.

## 6. PUBLIC ACCESS AND PRIVATE MEMBERSHIP

A major network design consideration in each ETN was the impact of organizational and regulatory constraints. Problems arose because of difficulties in gaining agreement among the major network users. For example, NORDEX was launched in 1989. The reaction of brokers to the system was positive but there was reluctance to accept the risk of trading on an anonymous system. The absence of a known counterpart stalled the launch for six months. Citibank agreed to act as the universal central counterpart and each participating broker was required to agree to separate contractual obligations. As a result membership of the network was closed.

The main organizational challenge to GLOBEX was to attract major exchanges to the system. The US Commodity Futures Trade Commission adopted a rule limiting the liability of parties involved in GLOBEX. This rule disclaims the Chicago Mercantile Exchange from liability related to the development of GLOBEX and from losses arising from failures and malfunctions in the system. The total liability in a single day for all claims is limited to US$ 100,000 and the ruling requires members to supply clients with customer information and risk disclosure statements. Members must therefore belong to a closed 'club' of traders. PRODEX members also had to agree standards and procedures. Wide inter-company variations existed in the ways that products or locations were described. Only those using the PRODEX standard can effectively utilize the system and there is no interactive network.

The challenge to the Dutch tele-auction (VABA) was to modify the attitudes of user organizations. The auctions insisted that only Dutch produce be sold on the ETN and that only Dutch buyers would be able to access it. The objective was to use technology to reduce

transaction costs and to raise returns to the growers using the system. The technology was used as a barrier to competition and market access. The Dutch video-auction (Westland) operator understood the benefits of logistical and trading networks and the intention was to open the network to non-Dutch users. Members profit from using the market, not from sharing surpluses that are generated centrally and this has affected the users' willingness to let the ETN operator push toward opening the network to outsiders. In each case, the problems of conflicting economic interests were resolved by solutions at a technical level which were regarded by users as being non-threatening to their longer term competition position in the marketplace.

## 7. CONCLUSION

Where the primary design feature of an ETN in these case studies has been to achieve security, trading integrity, and membership closure, there have been pressures to adopt a closed network solution in support of this goal. Proprietary standards have been used to restrict access to a limited community of traders - and these standards are regarded by users as a positive development. The ETN operators have forged new interfirm relationships, often across the borders of nations. They have tended to locate in the most favorable regulatory environments and the heterogeneity and fragmentation of networks and national regulations have been used as tools to exert 'regulatory arbitrage.' Co-ordination has occurred in the development of ETN when member organizations in a trading community have not been likely to face direct competition in their product or service markets. But, where competition has been likely, both technical and institutional (regulatory) barriers have been put in place, or existing ones have been used effectively to ensure that the design of the ETN enables the control of information flows among restricted groups of traders.

These ETN illustrate the multiple design parameters that can become embedded in networks. Closed ETN networks are achieved using a combination of technical and institutional criteria concerning membership. These criteria guide the network design process even when there is an economic justification for the extension of an ETN to new members in order to build critical mass and generate new revenues for the network operator. ETN that succeed in moving a growing number of the parameters of the trading cycle into the electronic sphere will take time to diffuse widely, but pressures favoring the emergence of closed, proprietary networks will continue to be strong. These come to the fore whenever members' commercial interests need to be protected. The new generation of electronic markets will not, therefore, offer a panacea to the exclusionary biases of traditional trading markets. At the ETN applications level, the tendency toward network heterogeneity is likely to strengthen despite policies which favor greater homogeneity in the terms and conditions of network access via the implementation of open standards and network interfaces. The minimum conditions for ETN development are being driven by priorities in the trading environment and by the needs of ETN members. This is despite the fact that the technical capabilities of computing and software technologies and the 'intelligent' infrastructure which can, in principle, support open networks.

These tendencies should not come as a surprise. They are a reflection of the underlying economic incentive structure which affects the commercial decisions of network user organizations who frequently are engaged global competition. Their aim is to use ETN to their own competitive advantage rather than to that of all potential users.

As Braudel observed: 'The division of labor on a world-economy scale cannot be described as a concerted agreement made between equal parties and always open to review. It became established progressively as a chain of subordinations, each conditioning the other. Unequal exchange, the origin of inequality in the world, and by the same token, the invariable generator of trade, are long-standing realities.'[12] The Commission of the European Communities, and especially the Directorates responsible for information technology and telecommunication and competition policy, have yet to address the implications of design closure in applications such as ETN. Policies continue to rely on pressures by user communities to encourage open access to advanced network applications.

The case studies reviewed here suggest that such pressures are unlikely to be strong where they conflict with users' economic interests in achieving a high degree of security, confidentiality, etc. There is a growing need on the part of policy makers to address the way contradictions in design parameters coalesce in various telematics service applications. There are clear tensions in the access and membership conditions expected by competing and co operating user communities and these cannot be expected always to be resolved in favor of open network access. The parallel trend toward heterogeneity in the underlying telecommunication infrastructure is likely to exacerbate these trends toward network closure.

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## ENDNOTES

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[2] See, for example, Benjamin, R. "Electronic Links create new Market Dynamics," *Computerworld*, p. 22, November 1990; Bressand, A. and K. Nicolaidis, "*Strategic Trends in Services: an Inquiry into the Global Service Economy*," New York: Harper and Row, 1989; Butler Cox Foundation, *Electronic Marketplaces*, London: Butler Cox Foundation; Hootman, J., "The Computer Network as a Marketplace," *Datamation*, pp. 43-46, April 1972; Keen, P.,*Competing in Time: Using Telecommunications for Competitive Advantage*, Cambridge, MA: Ballinger, 1986; Malone, T., J. Yates and R. Benjamin, "The Logic of Electronic Markets," *Harvard Business Review*, May-June 1989; Promethee, *Networked Markets*, Project Promethee Perspectives No. 13, May 1990; and Turner, S, J. Epperson, and I. Fletcher, "Producer Attitudes towards Multicommodity Electronic Marketing," *American Journal of Agricultural Economics*, No. 65, pp. 818-822, 1983.

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[5] Braudel, F., *Civilization and Capitalism 15-18 Century: Vol.III - The Perspective of the World*, London: Collins 1984.

[6] The telematics infrastructure refers to the substantial degree of information processing capability that resides within the public network with the advent of software driven 'intelligent' switching capabilities. The telematics infrastructure offers an 'intelligent' platform which may be used to supply services which require information processing far beyond that needed for the simple conveyance of messages.

[7] Commission of the European Communities, "Perspectives for Advanced Communications in Europe: 1990," Volume 1, Summary Report, Commission of the European Communities, Brussels, February 1991.

[8] Mansell, R., P. Holmes, and K. Morgan, "European Integration and Telecommunications: Restructuring Markets and Institutions," *Prometheus*, Vol. 8, No. 1, pp. 50-66,1990; Mansell, R., B. Holbrook and T. Darmaros, "Telematics Services for the Less Favoured Regions of the European Communities: A Political Economy of Development," in B. Mody (ed.), *Planning Communication Technology Development: Alternatives for the Periphery*, New York: Sage Publications, 1994.

[9] Since 1987 legislation in the form of Directives has included: Commission of the European Committees, "Directive, 16 May 1988 on competition in the markets for telecommunication terminal equipment," (88/301/EEC), 1988; Commission of the European Committees, "Directive, 28 June 1990 on competition in the markets for telecommunications services," (90/388/EEC), 1990; and Council of the European Communities, "Directive 28 June 1990 on the establishment of the internal market for telecommunications services through the implementation of open network provision (ONP),"

(90/387/EEC). Also see: Commission of the European Communities, "Towards a Dynamic European Economy: Green Paper on the Development of the Common Market for Telecommunications Services and Equipment," COM(87) 290 final, 1987.

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