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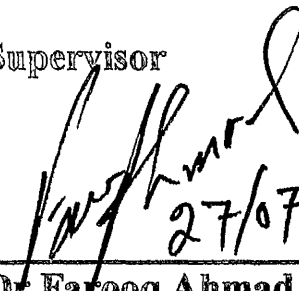
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Title of Project Paper:

**THE CONVERGENCE OF THE TELECOMMUNICATIONS,
MEDIA AND INFORMATION TECHNOLOGY SECTORS, AND
THE IMPLICATIONS FOR REGULATIONS TOWARDS AN
INFORMATION SOCIETY APPROACH**

The undersigned certifies that the above candidate has fulfilled the conditions of the project paper prepared in partial fulfillment for the Master of Business Administration (MBA)

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Abstract

The Information Society is becoming a reality. Its development is fuelled by the rapid technological change, which is transforming the information industries. The nature and speed of this transformation may pose new challenges to policy-makers.

One of the most significant factors is the increasing use by different sectors, notably the telecommunications, media and information technology (IT) sectors, of the same technologies. Evidence of such convergence has been mounting in recent years with the emergence of the Internet and with the increasing capability of existing networks to carry both telecommunications and broadcasting services.

The phenomenon of convergence is relatively new and a range of different views exists on what its implications are for society and for economic activity. There is broad agreement that developments in digital electronics and software are creating the technological potential for a new approach to the delivery and consumption of information services. There is less agreement on how much these developments will change existing practices and over what time-scales. Some consider that convergence will lead to the complete and rapid transformation of existing telecommunications, media and information technology services in such a way that these currently separate groups of services will merge into one another, substantially blurring the previously clear distinctions between them.

Others feel that the specificity of the existing separate sectors will limit the scope for service convergence, and that the media industry has a role as the bearer of social, cultural and ethical values within our society, independent of the technology relied upon to reach the consumer. This would mean that regulation of economic conditions and that of the content of information services should be separated to ensure efficiency and quality. Others believe that, if it does occur, it will evolve over an extended time-scale.

It is nevertheless clear that the implications of these developments are potentially far reaching. The emergence of new services and the developments of existing services are expected to expand the overall information market. This will provide new opportunities for economic growth and employment. At the same time the new communication services environment will also provide opportunities to enhance the quality of Asian citizen's lives, by

increasing consumer choice, facilitating access to the benefits of the Information Society and promoting cultural diversity.

These developments are therefore positive for Asian economic and social development and should be encouraged. Public policy will need to provide a supportive environment for convergence in order to ensure that the potential opportunities are grasped in a timely fashion.

What is needed now is wide ranging and deep debate on the convergence phenomenon and its implications as an input to such policy formulation.

The Paper addresses the nature of the convergence phenomenon, and focuses on the provision of services and the underlying networks over which they are carried. It further deals with the implications for both the shape and substance of regulation, which may arise from convergence.

The Paper does not take definitive positions with respect to new regulatory structures. Indeed, it recognizes that convergence may lead to less regulation in telecommunications and media sectors, and should not lead to more regulation in areas such as IT. Rather it analyses the convergence phenomenon as evident in the market; it identifies issues relating to regulation arising from these developments, and it poses questions in relation to these issues.

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EXECUTIVE SUMMARY

The Background - Convergence

There is widespread agreement that convergence is occurring at the technological level. That is to say that digital technology now allows both traditional and new communication services - whether voice, data, sound or pictures - to be provided over many different networks. Current activity in the market suggests that operators from the sectors affected by convergence are acting on the opportunities provided by technological advances to enhance their traditional services and to branch out into new activities. Telecommunications, Media and Information Technology sectors are seeking cross product and cross-platform development as well as cross-sector share holding. Examples of new products and services being delivered include: (1)

- Home-banking and home-shopping over the Internet,
- Voice over the Internet;
- E-mail, data and World Wide Web access over mobile phone networks, and the use of wireless links to homes and businesses to connect them to the fixed telecommunications networks;
- Data services over digital broadcasting platforms;
- On-line services combined with television via systems such as Web-TV, as well as delivery via digital satellites and cable modems;
- Webcasting of news, sports, concerts and of other audiovisual services.

Such developments represent concrete examples of an Information Society in the World, particularly in the emergence markets of Asia. They show its potential to touch the lives of every citizen. They also highlight a significant change in the range and diversity of traditional telecommunications and media services.

The Issues at Stakes

The implications of these developments are far reaching. Convergence is not just about technology(2). It is about services and about new ways of doing business and of interacting

with society. The changes described in this Paper have the potential to substantially improve the quality of life for Asian's citizens; to better integrate Asean's regions into the heart of the Asians economy, and to make businesses more effective and competitive on global and national markets.

The emergence of new services and the development of existing services are expected to expand the overall information market, providing new routes to the citizen and building on Asian's rich cultural heritage, its potential for innovation and its creative ambitions.

The global nature of communications platforms today, in particular, the Internet, is providing a key, which will open the door to the further integration of the world economy. This will open opportunities and challenges not only for the Asean Economy, but also for our neighbors in Asia Pacific and more broadly, in the developing world. At the same time, the low cost of establishing a presence on the World Wide Web, is making it possible both for businesses of all sizes to develop a regional and global reach, and for consumers to benefit from the wider choice of goods and services on offer. Globalisation will therefore be key theme in future developments, as changes in Asia are mirrored by developments all over the World.

If Asia can embrace these changes by creating an environment which supports rather than holds back the process of change we will have created a powerful motor for job creation and growth, increasing consumer choice and promoting cultural diversity. If Asia fails to do so, or fails to do so rapidly enough, there are real risks that our businesses and citizens will be left to travel in the slow lane of an information revolution which is being embraced by businesses, users and by Governments around the World.

Governments and policy makers will have a key role in ensuring that such an environment is in place. However, beyond the regulatory framework which is the central focus of this Paper, efforts will continue to be needed, to equip Asia's workforce with the skills which the Information Society requires. Continuing support should be given to research and development activities. Governments, regional and local authorities, as well as the Asian institutions must lead, by example, by fully embracing the technologies and services which the process of convergence is making possible.

Getting the regulatory framework right is of crucial importance

The future regulatory environment will be of crucial importance. The Asean Nations has already developed a comprehensive framework for managing the transition in telecommunications from a monopoly to a fully competitive world. We have also put in place a framework supporting an internal market for broadcasting. Getting the right regulatory framework must be firmly placed within these existing achievements.

This Paper argues that the development of new services could be hindered by the existence of a range of barriers, including regulatory barriers, at different levels of the market. There are, however, differing views on the adequacy of existing regulatory frameworks to deal with the changing environment. One view is that the development of new products and services is being held back by regulatory uncertainty - that existing rules were defined for a national, analogue and mono-media environment, but that services increasingly cut across different traditional sectors and geographical boundaries, and that they may be provided over a variety of platforms. This calls into question the underlying rationale beneath regulatory approaches in the different sectors affected by convergence. Proponents of this view would argue that such regulatory uncertainty holds back investment and damages the prospects for the implementation of the Information Society.

An alternative view would hold that the specific characteristics of the existing separate sectors will limit the scope for service convergence. It further would contend that the role of the media industry as the bearer of social, cultural and ethical values within our society is independent of the technology relied upon to reach the consumer. This would mean that regulation of economic conditions and that of the provision of information services should be separated to ensure efficiency and quality.

These matters need to be debated and resolved. Finding solutions will need to take account of the full range of interests in the various sectors affected by convergence. At the same time, the potential for change will be felt in different ways and at different levels (e.g. technology, industry, services and markets). Whilst digitalisation means that convergence is well advanced at the level of technology, this Paper does not automatically assume that convergence at one level inevitably leads to the same degree of convergence at other levels.

Equally, there is no assumption that convergence in technologies, industries, services and/or markets will necessarily imply a need for a uniform regulatory environment.

Overview of the Chapters

In Chapters I and II, this Paper analyses the convergence phenomenon - its technological underpinnings, current developments in the market, and their possible impact on the telecommunications, media and information technology sectors.

In Chapter III, actual and potential barriers are identified which may hold back these technological and market developments. Some of these reflect current market or industrial issues of the sectors affected by convergence, whilst others arise from current regulatory approaches. Some of these issues are already being dealt with in Community initiatives, (for example, in areas of intellectual property, media ownership, electronic commerce and digital signatures) and where this is the case those initiatives are identified. In other cases, these barriers serve as a basis for considering the need, if any, to adapt current regulatory frameworks in the light of the convergence phenomenon.

Chapter IV provides a detailed discussion of issues associated with existing and possible future regulatory frameworks or approaches. These issues fall into eight broad areas:

- Definitions
- Market entry and licensing
- Access to networks, to conditional access systems and to content
- Access to frequency spectrum
- Standards
- Pricing
- Individual consumer interests.

The chapter concludes with a discussion of public interest objectives, options for possible future regulatory models and issues raised at an international level.

Finally, in Chapter V, a set of principles for the future regulatory policy in the sectors affected by convergence are set out, and possible options for future regulatory approaches are identified as a basis for discussion.

Conclusions - The Way Forward

This Paper represents a step on the way to securing the benefits of convergence for Asian's social and economic development. This Paper initiates a new phase in the approach to the communications environment. As such it represents a key element of the overall framework put in place to support the development of an Information Society. It builds on the current strengths of the frameworks for telecommunications and for media. This first step is intended to pave the way for the development of an appropriate regulatory environment which will facilitate the full achievement of the opportunities offered by the Information Society.

Chapter I

Convergence - Definitions and Developments

This Paper represents a further step in the realization of an Information Society. It examines a key set of policy issues relating to the broad infrastructure of telecommunications, media and information technology sectors, for convenience referred to as the 'relevant' sectors in much of this document.

The Paper does not examine policy issues related to the wider set of services which will make the Information Society a reality - services such as Electronic Commerce, which encompasses a range of activities having the potential to revolutionize sectors as diverse as retailing, travel and financial services. The policy issues relating to this wider set of services include those where Community action is already well advanced, for example, in intellectual property rights, copyright and related rights; media pluralism; privacy and data protection; encryption and digital signatures. These are part of the broader framework, which is emerging for new services and activities within the Information Society. They are therefore regarded as outside the scope of the Paper and are given only passing reference where relevant to the issues at hand.

Instead, the Paper concentrates on the underlying infrastructure which will help create and deliver the services of the Information Society to customers. It is made up of the systems of components, networks and services associated with the relevant sectors. In all three sectors, those systems are undergoing fundamental change, primarily through the application of digital technology. This is likely to have consequences for policy and regulation.

The Paper focuses on the on-line delivery of services, dealing with off-line publishing, for example, only insofar as it represents a potential market for the on-line business.

The Paper deals with broad future trends and does not attempt to define markets for the purposes of the application of Community competition law. The positions discussed in this Paper cannot prejudge the positions the Commission may take in the assessment of pending or future cases under the competition rules.

From this perspective, Chapter I describes the convergence phenomenon and the technological developments which underpin it. It also identifies current developments in the market - and how suppliers, service providers and consumers are reacting to them - as indicative of the possible direction of future change. As in any consideration of new markets, the activities of suppliers and service providers give the first indication of how things might develop. Their reactions are tempered by those of consumers, who must accept and embrace the new services before the markets can become a reality.

I.1 Convergence - defining its scope

The term convergence eludes precise definition, but it is most commonly expressed as: (3)

- The ability of different network platforms to carry essentially similar kinds of services, or
- The coming together of consumer devices such as the telephone, television and personal computer.

This latter expression of convergence is one most often cited in the popular press - it is easily understood by consumers and has the added interest of reflecting a wider struggle between computer, telecommunications and broadcasting industries for the control of future markets.

Despite this popular image however, any convergence of consumer devices is today much less real than network convergence. Telecommunications operators are already offering audiovisual programming over their networks (albeit on an experimental basis) and have become major players in the provision of Internet access, as well as backbone infrastructure. Broadcasters have provided data services over their networks for some years and these services will be enhanced over the next 12-18 months by the prospect of digital transmission of both radio and television, and by the addition of interactivity.

Cable operators are providing a range of telecommunications services, including voice telephony in some countries and are starting to deploy cable modems to offer high speed Internet access, in addition to their traditional business of television programming distribution. Beyond the provision of services to the public, both audio and video technologies are also starting to be deployed within corporate 'intranets' as an additional

medium for distributing real-time information. Such applications are also starting to appear on web sites targeted at prospective customers.

The network platform and the consumer/user environment constitute two elements of the supply or value chain extending from content creation through content packaging, service provision and final delivery to customers (see Fig.1). The value chain is a useful concept for analyzing the behavior of firms and markets in the light of convergence.

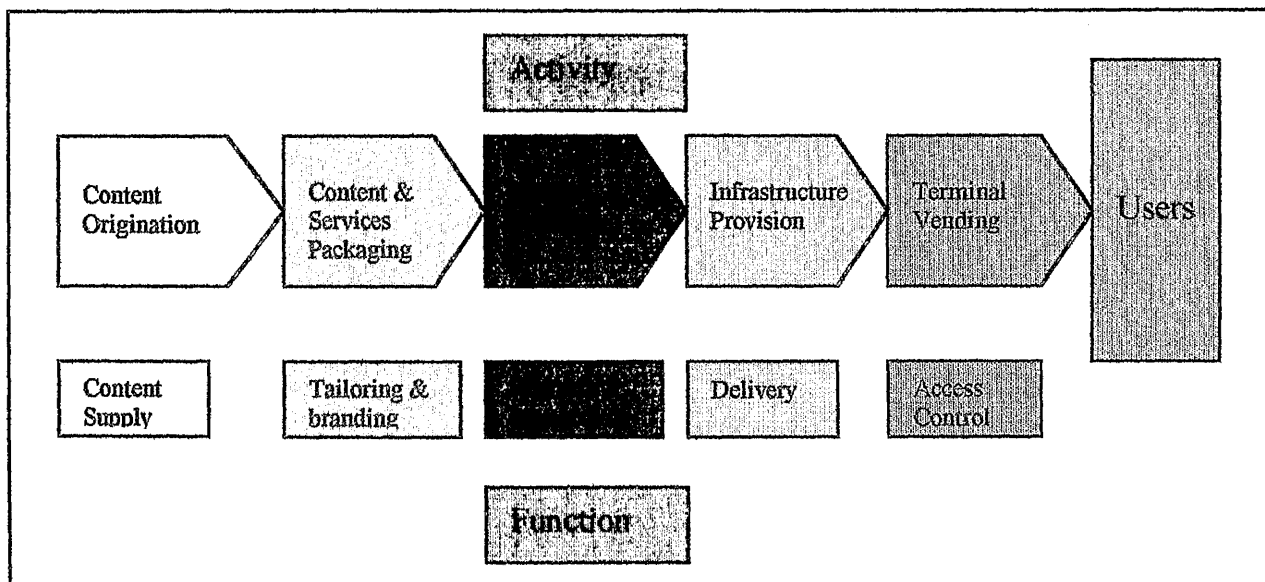


Fig.1: The emerging value chain

Source: Squires Sanders Dempsey LLP and Analysys Ltd.

Today, firms tend to be present in one or more elements of the value chain. Some argue that a shift towards convergence will lead many of today's current players to consider extending their activities beyond their core businesses, and argue that this trend is already visible in some recent mergers and acquisitions.

The potential for change as a result of the phenomenon of convergence can be seen at three different levels (technology, industry, services and markets) (see Fig 2) though there can be no automatic assumption that convergence at one level inevitably leads to the same degree of convergence at other levels, nor that convergence in technologies, industries, services or markets will necessarily lead to a need for a uniform regulatory environment.

Technology convergence, of which the examples cited above are illustrative, is based on the common application of digital technologies to systems and networks associated with the

delivery of services. As section I.2 demonstrates, technological convergence is already happening, and continuing advances in technology will further consolidate the process along the different elements of the value chain.

Many commentators identify a trend towards industry convergence, seen in alliances, mergers and joint ventures, which build upon the technical and commercial know-how of the partners in order to exploit existing and new markets. Such alliances, mergers and joint ventures will continue to be subject to scrutiny under the Community competition rules. Many such alliances are 'horizontal', that is, between firms operating in the same part of the value chain. Those aimed at addressing the potential opportunities offered by market convergence generally involve companies operating in different parts of the value chain, resulting in increased vertical integration. Some of these alliances have met with early difficulties, illustrating the uncertainty of the markets and the risks involved.

Policy and Regulation

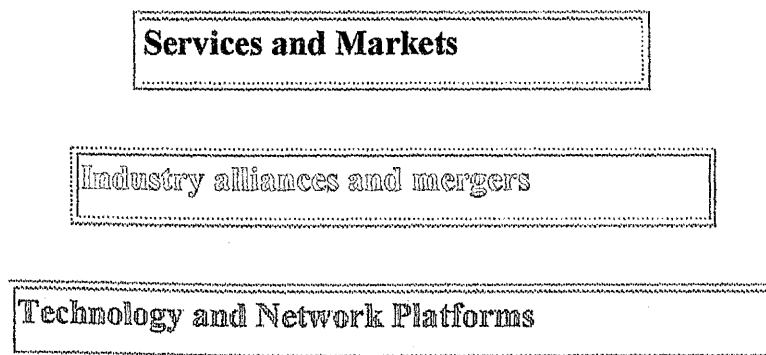


Fig.2: The stages of convergence

It is also difficult to be precise about the services arising from convergence. Many new services will result from technological progress within given sectors, and may not result from cross-sectoral activity at all. Others will be a direct result of cross-fertilization between sectors, telecommunications and broadcasting for example. Where there is a suggestion of the latter, the term "convergent services" will be used in this document. Where a more general reference is appropriate, it will simply refer to the term "new services", without signifying any precise legal definition.

I.2 The enabling role of technology

This Paper is not primarily concerned with technology(4); rather it addresses the new business and market phenomena which are being enabled by technological developments, and which are altering traditional provider-consumer relationships. An understanding of the nature of these developments can lead to a better appreciation of the potential for change.

Digital technologies underpin convergence

As already stated, the underlying trend is the common adoption of digital technologies by the relevant sectors. Digital technologies cover a range of disciplines generally associated with the computer and telecommunications industries - digital micro-electronics, software and digital transmission. Applied piecemeal within each of the relevant sectors, these technologies have already demonstrated their greater efficiency, flexibility and cost-effectiveness, and have shown how they can enhance creative potential and promote innovation.

Computer technology now plays a key role in content creation and production in both cinema and broadcasting worlds. The ways in which audio-visual material is produced, delivered and consumed are evolving. Content is becoming "scaleable" so that it can be used in different environments and delivered on different network infrastructures. The basic building block is the MPEG family of standards for the digital encoding of moving images. Once encoded in this format, images may be modified, manipulated, or transmitted in the same way as any other digital information. The systems and networks handling such information are of course indifferent to the nature of the source material, be it image, sound or text. Digital source encoding thus forms the basis of technological convergence.

Digital transmission(5) may be carried over broadcast networks or over terrestrial wired or wireless infrastructure. When applied to broadcasting networks, the most significant impact of digitalization is the immediate expansion of capacity, effectively removing a scarcity, which has limited growth of the sector since its inception. But processing power and software are also helping generalize consumer devices like the set-top box. Implementing functionality in software helps overcome the product life-cycle problems associated with hardware, reducing market inertia and facilitating innovation. It also gives such devices a level of

intelligence, which allows broadcasting networks to emulate the switching capabilities normally associated with telecommunications. For example, satellite pay-television operators can today address individual customers through conditional access systems, often combined with the terrestrial telecommunications network to provide a 'hybrid' return path for interactive services.

Network technologies for convergence.

As alternative telecommunications infrastructures become more widespread, high-speed networks based on optical fibers will soon be capable, in combination with modern server technology, of operating cost-effectively in a virtual broadcast mode.[Endnote1]

The high data rates and spectral efficiency achievable through digital transmission open up the possibility of delivering high-quality audio and video signals over a variety of different network infrastructures(6). Transmission technologies such as narrow-band ISDN, xDSL and ATM will ensure that both existing and new infrastructures can play a role in carrying the new services. The capabilities of existing networks are also enhanced by the compression techniques implicit in the MPEG standards, allowing networks of limited transmission capacity to carry services previously considered possible only on sophisticated and more costly wide-band infrastructures.

ATM is of considerable interest as a multimedia transport technology. It is a high-speed cell-relay technology, capable of transporting telecommunications traffic of different characteristics (voice, data, video) over the same network, and has been designated by the ITU as the basis for broadband ISDN, the successor generation of its narrow-band counterpart. This continuing competition between different technologies can change the fortunes of one approach or another, making it difficult to be prescriptive about tomorrow's network architectures. This may be a relatively minor problem given that today's applications and services are becoming increasingly independent of the underlying infrastructure that carries them.

Internet technology is leading to platform independence

The most relevant example of such platform independence is that of the Internet Protocol (IP). IP has developed into the *de facto* network protocol for the Internet, able to route and transport all the elements of a multimedia service (text, image, motion video and sound). IP is also used in Intranet products, providing an infrastructure for multimedia applications within a company or other closed user group. The Internet can best be described as a network of networks interconnected on an open basis using IP, usually running over transmission links leased from telecommunications operators (TOs). It has evolved very rapidly over the past decade from a largely academic- and government-sponsored network with a backbone capacity of 56kbit/s in 1986, increased to 45 Mbit/s in 1993, and to 155Mbit/s in 1996. This huge change in the capacity of the Internet's infrastructure has been in response to the remarkable growth in the number of people using the Internet and the range of applications and software tools developed for it.

The open, non-proprietary approach to standards for the Internet has made it easy for companies to take advantage of, and build on, the advances made by others in the industry. For example, many would argue that the rapid development of the capabilities of the World-Wide Web (WWW) has been enhanced by the open approach to browser development taken by vendors such as *Netscape*, *Microsoft* and *Sun*. The Internet will be further enhanced as a vehicle for multimedia transport by the development of several improved or new protocols, which Internet service providers expect to implement within the next three years.

This brief review of the salient technological developments is not meant to be exhaustive, but to illustrate the role of technology as the motor of change. Technology is developing constantly; its application to innovative services and the bringing of those services to market promise even further dramatic change in the future.

I.3 Current market developments

Significant changes are now being realized through the application of new technology to the individual sectors, and these are examined in turn. Such changes are not in themselves evidence of convergence, but as suggested earlier, the commonality of technology applied could provide a basis for that convergence to develop.

Digital television and digital audio broadcasting services are changing today's audiovisual landscape

In the early 1990s it became apparent that digital technology could be efficiently and cost effectively used for the delivery of television and audio signals. Of particular interest was the possibility of delivering many more channels over the same infrastructure (cable TV, satellite transponders, terrestrial spectrum) by using digital compression rather than existing analogue transmission.

In the television area, building on the work of the Digital Video Broadcasting (DVB) project,^[Endnote2] and against the background of a regulatory framework provided by the Television without Frontiers Directive, the Television Standards Directive and other measures digital TV services have recently been launched in Europe. Other countries around the world are also making use of DVB technology and European standards. The first commercial services started in France in April 1996.

Although it is early days in the development of this market a number of interesting phenomena - which are either new to TV or significant developments of past practice - are appearing as digital compression is cost-effectively reducing capacity constraints:

- *Programme bouquets and thematic channels* - Broadcasting companies are marketing their digital services in the form of 'bouquets' of programme channels. The "bouquet" complements 'generalist' TV channels with thematic channels concentrating on news, sports, movies etc. offering viewers greater choice and coverage of areas of specific interest to them. Already evident in the analogue era, thematic channels are set to increase in number and to achieve ever finer levels of segmentation with digital technology. Such channels will need to seek wider

audiences for economic viability, and pan-European operation could be a way of securing them.

- *Near Video-on-demand* - The availability of substantial transmission capacity at reasonable prices will soon make "near video-on-demand" (NVOD) services possible. *Example: With 60 satellite channels, ten 90-minute films could be broadcast simultaneously, each one starting at 15-minute intervals.*
- *Pay-per-view* - Similarly, it is possible to market specific events or movie-showings on an individual subscription basis. Such pay-per-view services have been provided in the UK on analogue channels (for boxing championships) and Spain in digital format (for football league matches). The greater capacity of digital television allows the simultaneous broadcast of several such events (the most obvious case being matches played in a football league), giving viewers the choice of access to a particular event on a 'pay-per-view' basis.

These phenomena, which constitute a significant departure from classic schedule-based broadcasting, have the potential to improve consumer choice. In addition, and because the "digital channel" is inherently more flexible than an analogue channel, it can deliver other services in the form of data, graphics, moving pictures or combinations of these. Digital television shares these characteristics with digital audio broadcasting, which also offers listeners near CD quality sound. "Multimedia data broadcasting" already provides for the downloading of computer programmes including video games, data files and direct access to the Internet from the TV set or network computer(7).

Example: Hughes Olivetti Telecom launched the DirecPC satellite Internet access service in 1996. It connects some 2000 sites across Europe to the Internet at speeds up to 20 times greater than conventional modems.

The arrival of digital radio offers exciting possibilities for the combination of radio and images, or links to Internet sites marketing CDs or tickets for band being broadcast. Broadcasters such as CNN and the BBC are starting to make parts of their broadcast content available on the Internet, extending their normal geographical reach, whilst a new breed of webcasters is emerging to broadcast particular live events, such as sports coverage, concerts, major events, etc..

Example: Coverage of the recent Irish elections was available to Irish citizens all over the world via a webcast site (www.itv.com)

Other innovations in the broadcasting field include Widescreen TV using 16:9 format, the technical possibility of higher definition pictures.

Telecommunications liberalization is widening choice and lowering prices

In less than ten years, the Asian telecommunications sector has experienced a radical transformation from one characterized by rigid and inefficient monopoly to a sector facing full and vigorous competition, with the total liberalization of services and infrastructure due to take place in most countries. This transformation owes its beginnings in part to an earlier phase of convergence - that between telecommunications and computing - over a decade ago. Technological convergence rapidly gave rise to market convergence, and to "value-added" services - innovative services which borrowed concepts from both sectors, and which allowed businesses to extend the power of computing beyond the geographical confines of their immediate locations.

The regulatory traditions of the telecommunications sector contrasted sharply with the free-market environment in which the computing industry had developed, and their coming together meant that some rationalisation of these different regulatory philosophies would be needed if the new services were to flourish. The 1987 Green Paper (8) concluded that greater harmonisation and gradual market opening in telecommunications would provide the most fertile environment for such growth. The first measures were initiated in 1988 and culminated in the introduction of full liberalisation of the telecommunications sector by 1 January 1998. This step-by-step process of telecommunications liberalisation and global market opening is already bringing substantial benefits to many businesses and consumers, with lower prices, improved customer service and innovative service offerings. Even so, the overall level and structure of prices continue to have a major impact on the take-up of new services. The mobile communications business is particularly dynamic.

Example: Close to one in three people in Scandinavia have a mobile phone and there are more than 37 million mobile telephony users in Europe.

Increasingly, such mobile systems are adding a multimedia component. One aspect of market convergence occurring within the telecommunications sector is that between fixed and mobile telephony, as in certain countries and amongst certain groups of the population (e.g. students, small businesses), mobile phones are replacing fixed connections.

However, this practical example of how fixed and mobile networks are converging is only part of a wider trend towards the full integration of wired and wireless technologies, which is the key goal of the next generation of digital mobile communications systems. This will offer users a platform on which to receive a seamless set of voice, data, multimedia and audio-visual services wherever they are.

The Internet is bringing new services to business and the public at large

It is, however, in a third sector, the Internet, that changes have been the most radical. The Internet is both the symbolic and prime driver of convergence. It is a vehicle for the delivery to users of both existing services (electronic mail, video, sound, voice telephony, for example) and completely new services (e.g. World-wide Web). It has rapidly evolved from a government/ academic network to a powerful communication and trading platform. Characterised by an unprecedented growth rate (doubling its number of users every year), the Internet has started to influence a number of economic sectors, with the emergence of a fast-growing electronic-commerce economy.

The Internet is displacing traditional computer networks, and showing the first signs of how it may provide a platform, which over time replaces traditional methods of trading. For example, traditional business-to-business trading on closed corporate networks is giving way to multidimensional commerce on global open networks. The Internet is also providing an alternative means of offering the core telecommunications business activity (even if differences in quality still distinguish the two services) through the delivery of Internet telephony, without in some cases either party needing to have a computer. The Internet is also a significant platform for broadcasting services.