IMPACT OF THE DIGITAL REVOLUTION ON THE MEDIA AND COMMUNICATIONS INDUSTRIES

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Abstract

The world's media, telecommunications and information technology industries are undergoing a period of unprecedented and profound change. Dramatic technological advances combined with market liberalisation and globalisation have together engendered the "digital revolution." A dramatic consequence of this is "convergence," a ubiquitous but loosely defined term commonly understood to denote the blurring of boundaries between the media, telecoms and information technology sectors. There is broad consensus between academics and practitioners that technological advances are bringing these sectors closer together and have the potential to transform them entirely. Tools for analysing these developments include Porter's (1985) value chain and the technologically-based "layer" models developed to ensure interconnection between networks (OSI 1977-84; Grove 1996; Bradley and Nolan 1998).

This paper explores the relevance of these concepts as tools to analyse convergence by applying them to a range of affected sectors. It finds that the utility of the value chain concept resides in its ability to highlight in detail the dramatic changes that have already taken place as a result of convergence. However it does not comfortably accommodate the non-linear, dynamic, cross-sectoral processes that are emerging as convergence gathers pace. Conversely, the chief benefit of layer models is to offer a vision of the future, of the potential endpoint of convergence. However they are arguably too sweeping and technologically determinist to provide a basis for analysis of developments at sectoral or organisation level. The paper proposes a new model for analysing the impact of convergence, which draws on the strengths of the value chain and layer models.

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Introduction

The world's media, telecommunications and information technology industries are undergoing a period of profound change. A cocktail of closely interrelated developments including the exponential growth of the internet and World Wide Web, digitisation, dramatic reductions in the cost of computing power, deregulation and market de-regulation has triggered the so-called "digital revolution" (Henzler 1998; Barwise and Hammond 1998). As a result the boundaries between what were separate universes — content, communications and computing — are eroding. The media, IT and telecoms industries are increasingly being viewed as merging into a mammoth new "media and communication" sector (Chakravarthy 1997; Bradley and Nolan 1988; Collis et al. 1997; Green et al. 1997).

Various analytical tools have been used to explore convergence and its implications.[1] Two of the most popular are Porter's (1985) value chain concept and the so-called layer models. The value chain is widely-favoured by academics and consultants seeking to understand the implications of convergence from a managerial, organisational or competitive perspectives (Tapscott 1996; Henzler 1998; Yoffie 1997; Downes and Mui 1998), while layer models, which were developed as a means of ensuring the interconnection between networks, tend to be preferred by those with primarily technological perspective (Grove 1996; Bradley and Nolan 1998).

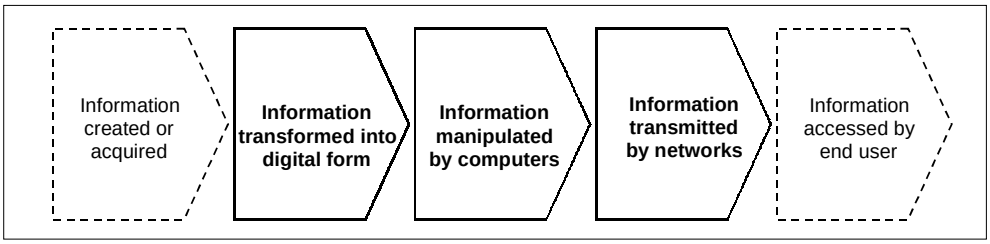
Convergence's Technological Catalysts

Before analysing the implications of convergence on a sectoral basis, it is important to clarify the pan-sectoral changes that have enabled convergence to take place. Two particular technological developments stand out as catalysts for the restructuring of value systems in the industries affected. The first is the trend towards transferring all types of information — voice, text, video, pictures, and music — into digital formats, which can be manipulated by computers. The second is the development of high-speed multi-media communications networks over which digitised data can be transmitted. All types of information can now be transformed into digital form, manipulated by computers and transmitted by common networks. This trend is precipitating the gradual merging of the media, telecoms and IT fields into a new media and communication sector.

In crude terms, the digital revolution means that content-specific distribution, provided by unique technologies, hardware, and methods, is being replaced by content-independent distribution provided by a common infrastructure. The effect of these developments on the value systems of converging industries is dramatic: they are moving out of the physical world, dominated by physical infrastructure and assets into an electronic one where "value" is "virtual." This has far-reaching implications for:

- Accessing content and for the content creator's relationship with their audience;
- Exploiting economies of scale and scope;
- Assessing how value is generated and where the value-creating potential of a business resides;
- The significance of intellectual property rights;
- Organisation structures and forms;
- Competency and skill profiles.

Figure 1: Digitalisation and Convergence: Fundamental Transformation of the Media and Communication Industries



Source: Downes & Mui 1998.

The "Value Chain" Concept as a Tool for Analysing Convergence

The "value chain" (Porter 1985) is an analytical construct which views a firm as a bundle of sequential activities that collectively create value for the end user. Each of these activities adds marginal value to the product. The more competitive the value chain of an organisation, the more the overall value of its product exceeds the sum of its parts, and the more margin the company can realise as profits. An industry's "value system" links the individual value chains of different players within a sector into a system or "chain" of activities stretching from the content originator to the consumer. In this paper, the terms "value chain" and "value system" are used interchangeably to describe the changes within the industry sector. This echoes practitioners and academics, both of whom appear to use the term value chain not only for the activities of a single company but also for the whole industry.

Although the value chain concept has fallen out of scholarly favour in recent years (see for example Stabell and Fjeldstad 1998), it is surprisingly ubiquitous, widely used as a means for analysing convergence on a sector and organisational level. Our research showed it was the preferred tool for practitioners (e.g., Turner Broadcasting Systems, BBC, Bertelsmann), consultants (e.g., McKinsey, Monitor, KPMG) and even academics (Tapscott 1996; Yoffie 1997; Downes and Mui 1998).

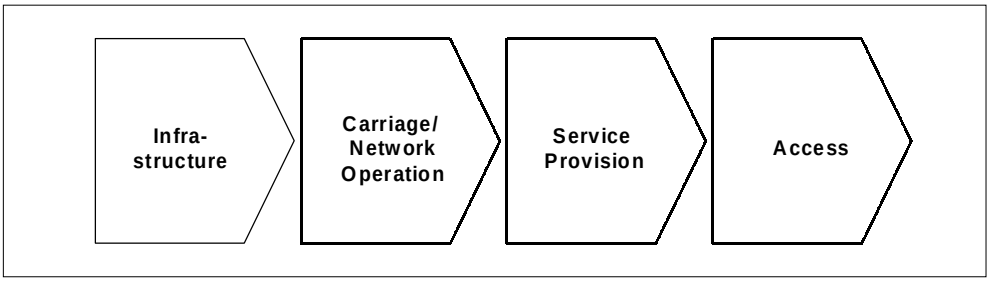
In the following pages the value chain and value system concept are applied to the various industries affected by convergence with the aim of highlighting the critical changes taking place.

Telecoms Industry

The telecommunications sector has been defined as comprising every public and private enterprise, that provides the products or services necessary to transmit data (voice/sound, text, pictures, video etc.), between a transmitter (either a person or a technical device) and a receiver (a person or a technical device), by using telematic connecting modes independent of the physical distance of the communication partners (Gerpott 1996). The traditional value chain had four stages: (1) network infrastructure provision (2) carriage or network operation (the physical transmission facilities); (3) services provision (the transport facilities that create a communication service); and (4) access — telecommunications equipment. For decades the industry was highly concentrated — dominated by a handful of national monopoly players (France Telecom, Deutsche Telecom and British Telecom in Europe, AT&T and the so-called

Baby Bells in the US). These players effectively controlled all stages in the value chain, typically controlling the last three steps outright and outsourcing the first step to companies such as Alcatel , Motorola or Siemens.

Figure 2: Telecom's Traditional Value System



Drivers of Change

Three developments in particular disrupted this state of affairs. The first was a continuing trend towards the liberalisation of telecoms markets. For example, in 1984 British Telecom was privatised and AT&T was broken up; Deutsche Telecom was privatised in 1998. Second, a combination of technological developments allowed different data to be processed in the same way (Bane, Bradley, and Collis 1996). This dramatically reduced bandwidth requirements, made more "intelligent" networks feasible (Badwin, McVoy, and Steinfield 1996). This, in turn, made an array of new transmission modes, new telecoms-based services and new access equipment (terminal devices) possible. Third was a change in customer demand, arising out of the international trend for globalisation and consolidation, whereby a growing number of global organisations began to demand global services from a single telecommunications supplier (British Telecom 1998/99).

The Emergent Telecoms Value Chain

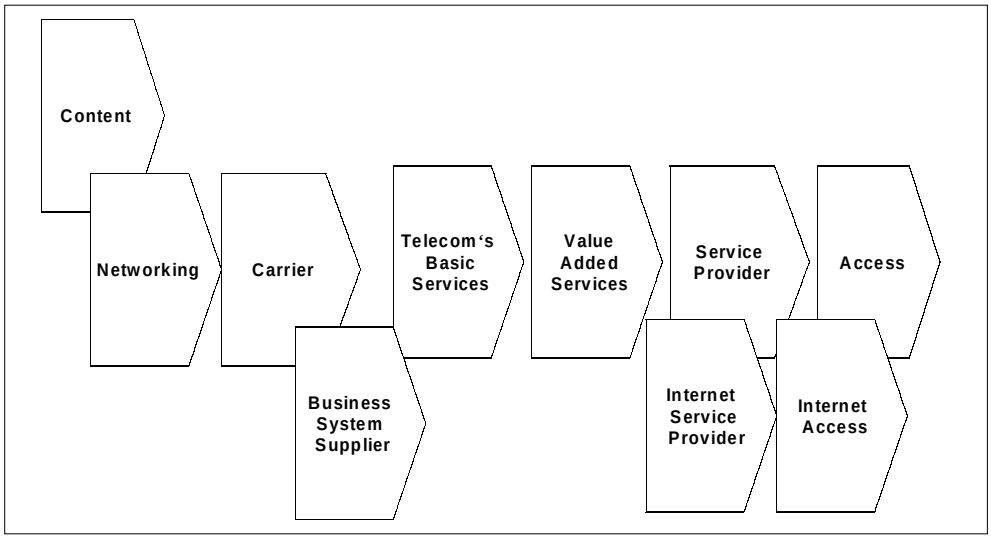
As a result of these developments the structure of the telecoms sector's value chain has changed fundamentally. A remarkable extension has taken place into new activities that were not traditionally part of the sector's span of activities. Two developments are particularly noteworthy. First, entirely new stages, for example the value added telecom services (VAS or VANs), have emerged. Second, stages which were formerly included in the traditional value chains of other sectors, for example business systems or Internet related activities, have been integrated into the telecoms value chain. This means that the telecoms and IT industries are becoming ever more closely enmeshed. For example where telecoms companies provide intelligent networks and IT players the "smart servers" which act on behalf of the network.

VAS and VANS. The huge array of recently launched added-value telecoms services broadly fall into two categories (Gerpott 1996). Value added network services (VANS) can be provided without investments in further infrastructure apart from very basic additions. Examples include customer-calling services such as call waiting or call forwarding. Value added services (VAS), for example teleworking systems, require additional infrastructure.

Business system provision. The provision of business systems was traditionally the province of the IT-sector. However the telecoms industry realised that its core competence in running networks could be leveraged by entering this business segment and accordingly started to supply business systems via the provision of company wide intranet services. Examples include Global Intranet, a service jointly developed and supported by France Telecom, Deutsche Telekom, Sprint and GlobalOne, or extranet services (British Telecom 1998/99).

Internet service provision. These activities fall into two categories: pure internet access provision, such as that supplied by Arcor, Viag Interkom or UUNET, and internet service providers (ISP), supplied by companies such as T- online, AOL or Compuserve, which offer additional services such as news, archives or interest groups. Telecoms operators are moving into these areas for two main reasons. Firstly, most Internet backbones belong to telecom organisations, and entry into the ISP- market is therefore a logical step. Secondly, the emerging field of internet telephony is widely viewed as an important threat to traditional telecoms services because it is far cheaper, especially in the USA where ISPs have to pay flat rates for peering[2].

Figure 3: Telecom's Emergent Value System



Impact on Organisation Structures

Reconfigurations of the telecom industry's value system, arising from convergence between the telecoms and IT industries, is leading players in the industry to adopt new structural options. Two contrasting responses can be seen. The first, favoured by established players such as the former national monopolists, is to remain full-telecommunication-service providers, via a range of initiatives designed to maintain their presence at every step of the extended chain. For example, France Telecom's stated goal is: "to become ... a leading European full-service telecommunication company" (France Telecom 1998). This can involve building new in-house competencies and skills, through acquisition, via alliances or through the establishment of spin-offs. Strategic alliances

are common. These can be preferable to mergers because they offer a way of bypassing national and international regulatory restrictions. For example, when TCI merged with AT&T, it was required to divest its 23.5 per cent stock interest in Sprint's PCS wireless business. Two types of alliance are taking place. First, there are alliances between telecoms players and companies in another sector affected by convergence: examples include Cisco Systems' and General Instrument's alliance with AT&T to develop a High Speed Internet Access Network, and British Interactive Broadcasting (BIB), an alliance between BSkyB and British Telecom. Second, there are alliances within the telecoms sector itself. However, telecoms companies seeking to be active over the entire value chain can find themselves disadvantaged by virtue of their size, which can create inflexibility and slow responses. One response is to establish spin-offs that specialise in new steps along the value chain: for example, T-Online and T-Mobil, are subsidiaries of Deutsche Telekom.

The second response for organisations confronted with the new telecoms value chain is to focus on single steps of the chain. Newcomers seeking to capitalise on the entry opportunities arising from the break up of monopolistic value chains favour this approach. They are generally small start-ups or spin-offs of companies from other sectors that try to get hold of the telecommunications value chain. Examples are Mannesmann Arcor or o.tel.o in Germany. As start-ups seldom have enough resources to become active in carriage, most focus on stages such as service provision or value added services. Gains made here can later provide the basic capital for entry into other stages, as evidenced by MobilCom or TelDaFax in Germany.

Some commentators suggest that, in the long run, the full-telecommunication-service providers will dominate the industry. They argue that the needs of an increasingly global customer base will force telecommunications companies to offer full services. This hinges on the issue of interconnection fees. New players concentrating on providing pure service companies have been able to interconnect with the existing telecommunications networks of established players because legislation has forced the former monopolies to allow newcomers affordable access to their network in order to promote the liberalisation of the telecommunication market (Welfens and Graack 1996). Others suggest that alliance activities will lead to a gradual consolidation of the industry into a network of global players (British Telecom 1998/99). Examples are GlobalOne (France Telecom, Deutsche Telecom and Sprint) and Concert (comprising British Telecom and AT&T). It is anticipated that this trend will lead to the development of supercarriers — global telecom suppliers catering to global customers (Price Waterhouse 1997). What is clear is that the telecoms industry will experience strong competition from the IT industry, which in contrast to the telecoms industry contains many small, nimble entrepreneurial firms.

Media Industries

The media industries are hard to define precisely.[3] They clearly include "traditional" media activities such as newspaper and book publishing and radio and television broadcasting, but a diverse range of other industries are also variously included in the sector. The analysis here concentrates on two sectors that are being dramatically affected by the digital revolution: television broadcasting and consumer book publishing.

Broadcast Media

Significant players in the broadcast media sector, particularly in Europe, tend to have monopolistic or oligopolistic roots. As with telecoms, a strong regulatory framework combined with dominant national players and a relatively stable technological base gave rise to a straightforward value chain that had existed for decades. In broadcasting this comprised three stages: (1) acquiring or producing content (programs); (2) packaging (scheduling programs into channels), and (3) distributing the packaged content to the end users (transmission). As a rule, traditional broadcasting organisations controlled all of these stages. Thus, public service broadcasters in Europe, and the US networks, originated or commissioned much of their content, packaged it and transmitted it over a national broadcast network which they either owned or to which they had guaranteed access.

Figure 4: Broadcast Media's Traditional Value Chain

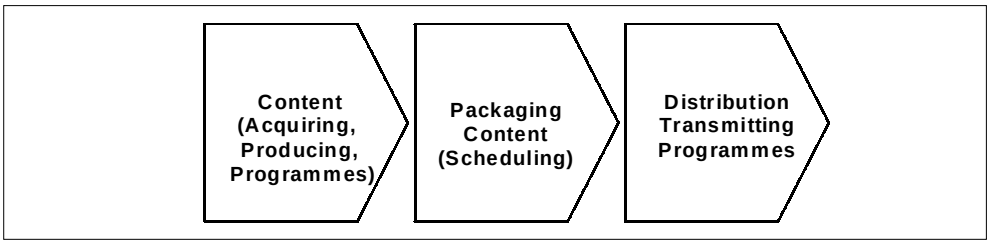
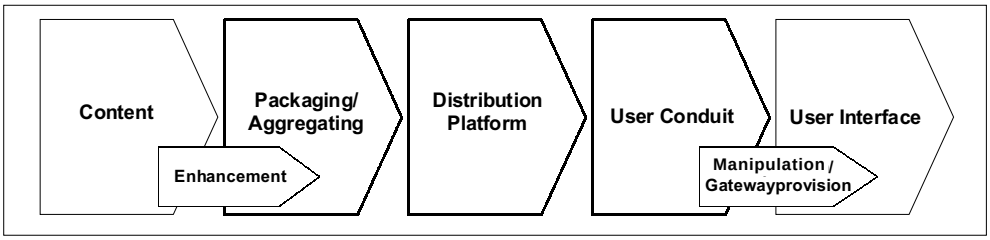


Figure 5: Broadcast Media's Emergent Value Chain



The most marked change to the broadcasting value chain is a fragmentation or disintermediation of stages, the net result of which has been, as with telecoms, to expand the overall value chain. The broadcasting industries have become accustomed over the past few years to fragmentation in terms of channels, audiences and funding options. This process can now be discerned in respect of the industry's basic processes as well. The various "links" in the chain which once represented bundles of fully-integrated processes have been "unbundled" creating more distinct stages. For example the content stage is fragmenting into originating, sourcing, aggregating and enhancing, although some would argue that a number of these activities have regrouped to form a new stage, "content aggregation." Similarly, at the end user stage, new activities are developing, such as providing gateways or new means by which consumers can interact with and select from digital media products via, for example, electronic programme guides. As a result the basic broadcasting value chain has expanded from three to five, and arguably seven, stages:

Content. The first step involves originating content. In this context, it is the output of production companies, movies and television studios, news organisations etc.. The growing influence of information technology on the media sector means that the term "software" is increasingly being used interchangeably for that of "content." The content segment has seen a tremendous increase in its economic leverage, reflecting its disproportionate importance in attracting consumers. However as a sector it is expected to remain fragmented, specialised according to content type (Greenstein and Khanna 1997). Newsgathering, documentary filmmaking and developing talk show formats are fundamentally different tasks and present limited opportunities for consolidation.

Packaging and aggregating. This stage involves packaging, scheduling or otherwise integrating media content. Although discrete stages, the packaging and content stages have traditionally been closely linked. Recent years have seen a trend towards "unbundling" packaging into a discrete stand-alone stage. A forerunner was MTV, which acquired promotional videos from music publishers and packaged these into a channel, which it then sold on to broadcasters. The trend towards unbundling the packaging stage has given rise to a new media competence, media aggregation. This involves securing, and bundling content into a format appropriate for a designated audience. This can involve what is known as "enhancing," i.e. reworking acquired content to match specific niche audience requirements.

Packagers are essentially intermediaries, their world is one of alliances. A packager's success depends on an ability to build relationships in three directions. First with content providers — it must secure access to quality content. Second with the conduit — with the organisations providing the distribution for the content they package. Third, and most challenging, with the ultimate consumer. This means developing the uniqueness of their product to such a point that its reputation overrides that of the content provider and the transmission companies. This in turn hinges on the ability to create strong brands (Collis et al. 1997).

Distribution platform and conduit. Although distinct stages, distribution platform and conduit are considered together here, since both are experiencing similar changes. Convergence is having two particularly marked effects on these stages of the value chain. First the rapid developments in distribution technologies have led to a profusion of delivery options. For example there are now up to five different delivery methods for a digital TV signal: terrestrial, satellite, cable, multi-point microwave and ASDL. As part of this process the distribution stage has split into two stages, distribution platform and connection to end-user.

Second and by extension, distinctions between transmissions systems are becoming less relevant and distribution is becoming commoditised, eliminating any competitive advantages that might arise as a result of exclusive distribution arrangements. As a result, there is a trend towards substituting one delivery option for another: for example, where video and audio data is carried over the Internet or where Internet traffic to be carried over high-speed broadband media.

Interface. Also termed the "user conduit," this is essentially domestic distribution, the means by which the ultimate consumer receives content in a domestic or business environment (PC, TV; set-top box etc.). This area is subject to great uncertainty because developments are governed by consumer reactions to the various "new to the world" products and services that are currently being developed.

The interface stage is being revolutionised by technological developments and is subject to the same forces of fragmentation that are evident elsewhere in the value chain. New types of interface that slot in between the stages of user conduit and the end user are constantly developing. An example is the conditional access system which was initially developed as a means to enforce payment of subscription fees, and which will play a major role in enabling the delivery of interactive services to TV's and PCs, and also provide a bridge to electronic commerce.[4]

More radical examples are intelligent schedule assistants or electronic programme guides (EPG's), which are enhanced remote control devices. The greatest area of uncertainty is of course the convergence of the TV and PC. In 1998 thirty-three different companies had hardware products which enabled the Internet to be received on the TV, although under 40,000 units were deployed worldwide (*Screen Digest*, March 1998).

Impact on organisation structures. Disintermediation of the broadcasting value chain has created entry opportunities, which are often seized by new players. Start-ups enjoy the speed and flexibility needed to capture first mover advantages, and have a lower investment – psychological or financial– in existing business practices. An example is the UK company Flextech, which packages bought-in content into channels it then sells on to television broadcasters.

In parallel, there is a trend towards the creation of joint ventures and alliances. As distribution options multiply and fragment, media companies have to establish joint ventures and alliances to ensure distribution and access to their viewers. An example is the BBC's satellite digital distribution agreement with BSkyB. Thus, whereas broadcasters once were active at all stages of a relatively compact value chain, they are now effectively retreating "back" along an extended value chain towards content related activities.

Vertical integration via mergers and acquisitions, although less popular than before, is still in vogue for the big media conglomerates. For example Time Warner's merger with Turner Broadcasting System. The strategic logic is twofold. First, having accepted the view that "content will be king" in a converged media world, companies are seeking exclusive access to new sources of content with which to expand their range of products or markets. Second, if they lack a guaranteed distribution architecture they can seek to integrate content and conduit vertically, in order to ensure that they can deliver content to mass audiences or prevent downstream players from extracting excess profits. Indeed, merger and acquisition activity during 1997 was focused on the acquisition of cinema chains, broadcasters and television channels, all considered to be of increasing importance in a multi-channel era (*Screen Digest*, April 1998).

In the long term, vertical integration may be unfeasible in a digital context. The reasons are pragmatic. First, mastering an entire digital value chain is neither practical nor affordable. In the words of then-CEO of TCI, John Malone, "No organisation has the skill level or the balance sheet, except maybe Bill Gates." Second, horizontal integration seems to be a more effective structure, as demonstrated by the Wintel partnership of Microsoft and Intel (Yoffie 1997). A final point to make in relation to vertical integration is that even when this is taking place, a disintermediation can be occurring at the same time. Therefore although companies may be seeking to control more links in the chain (or maintain their traditional portion of the chain), the number of links in that chain is nonetheless increasing (McEachern and O'Keefe 1998).

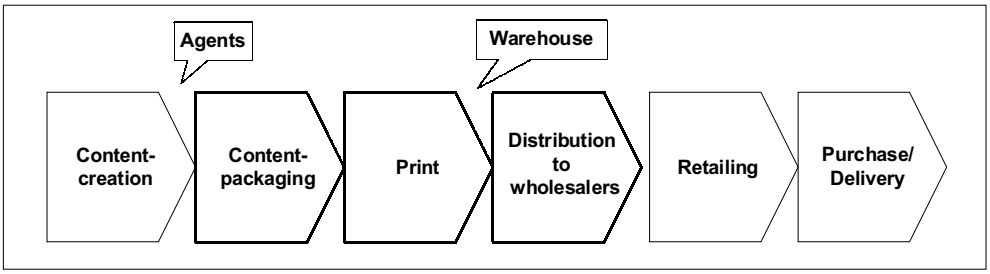
Consumer Book Publishing

When considering changes to the book publishing value chain, some of the unique characteristics of the industry need to be borne in mind. First, the culture is traditionalist and somewhat technophobic. Second, it is characterised by a huge and diverse number of unique products, and enormous uncertainty about market tastes. This arises in part from the number of discrete stages between the person who commissions the book and the customer who buys it, and the paucity of the information flow between these stages. Third, low margins and low profitability, due in part to its use of unit costs as a key metric, characterise the industry (Saunders 1998; Shatzkin 1998). When combined with lack of market information this results in high print runs which translate into high stock levels and high warehousing costs.

In the mid-1990s, the industry saw a rise in the power of distributors and retailers for books and records, resulting in downward pressure on publishers' margins. Publishers responded to this shift in the power balance by accelerating the trend towards consolidation, which was already observable during the 1980s (Saunders 1998; Steinbock 1995). This led to the creation of a number of "mega-publishers," typified by Bertelsmann's purchase of Random House, which it then merged the publishers it had purchased in the 1970's with Bantam Doubleday Dell.

The traditional value chain of the book publishing industry encompasses six stages and a strictly sequential construction: content creation, content packaging, printing, and distribution, retailing and, depending on the means of distribution, delivery to end-user. In some, cases literary agents act as intermediaries between authors and publishers. Some newly printed books are sent directly to the wholesalers, but the majority is housed in publishers' own warehouses awaiting orders from the book trade.

Figure 6: Traditional Value Chain in Consumer Book Publishing



Emergent Value System

The digital revolution promises to have a dramatic impact on the book sector. It has created new distribution channels (online bookstores), a new production process (printing on demand) and even innovations to the fundamental product itself (electronic books). For the book publishing industry, the impact of these developments is likely to be extreme. Entry barriers will fall, allowing new players to enter the market, and anew types of publishing intermediaries to emerge. Online bookstore will have significant implications for market structure, concentrating power further in the hands of retailers who have access to valuable customer information. Traditional industry value chains could be replaced with interactive and interdependent value-nets and new types of publishers could emerge offering different sets of services to authors.

At the current time it is too early to predict with any degree of confidence how the industry's value system will alter. Instead, the following text explores a number of different value scenarios, ranging from a marked contraction of the value system (via printing on demand or digital distribution) to the emergence of interdependent, interactive non-sequential "value networks," which could usurp the existing system entirely.[5]

Figure 7: New Value Chain in Consumer Book Publishing: Online-Book-Retailing

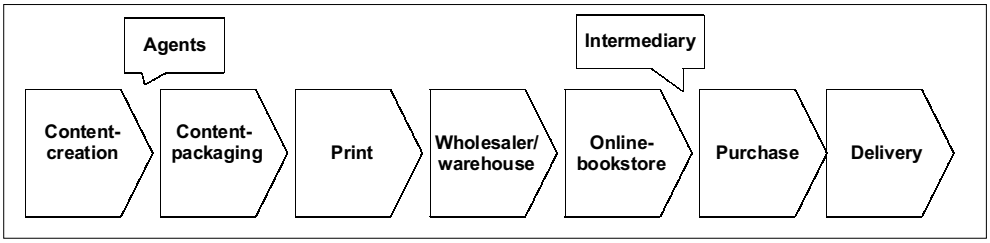
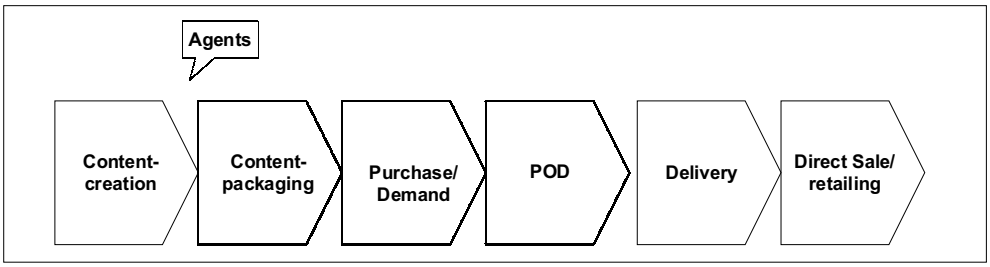


Figure 8: New Value Chain in Consumer Book Publishing: Print-on-Demand (POD)



On-line retailing. The world's oldest media product, the book, is proving to be one of the most popular e-commerce products for a number of reasons. First, it is a "low involvement," low risk purchase. Second, as a text-based product, which can be digitised, product features can be easily communicated in a Web environment via reviews, personal recommendations, or sample chapters.

On-line retailing reverses two stages in the traditional value system: a book is sold before it is delivered. In some respects online book retailing represents an enhancement of the traditional book-retailing model. Customers receive additional services (extra information, search facilities etc.), while retailer can collect rich market data about its customers.

Intermediaries. New to the book publishing value chain are intermediaries or cybermediaries which are understood here in the sense of organisations that mediate between supply and demand in electronic commerce environments (Sakar et al. 1995). Examples include acses.com, which compares book offers on the internet by checking out prices, availability, delivery details and bookbrowse.com, which gives the virtual bookbuyer the possibility to flick through a book and read a few pages.

Printing on demand (POD). Printing on demand (POD) also rearranges stages in the book industry value system by enabling purchase to precede printing. POD has hovered on the industry's horizon for many years but is finally becoming financially at-

tractive as a result of improvements in digital technology (Seybold Report 1998). Low print runs will finally be economically viable, meaning in turn that publishers can experiment with niche products, reprint at low quantities, and that books should no longer go out of print. In the future POD will also enable distributed printing (already commonplace in the newspaper and document printing (http://www.docunetworks.com), whereby content is delivered digitally to the printing presses close to the end-consumers, thereby reducing distribution costs (Seybold Report 1998).

Hybrid interactive and interdependent value systems. POD reduces barriers to market entry, by removing the need for substantial print-runs of new titles. This reduces the capital requirements to enter the industry and opens the market to small-scale publishers and self-publishers (Seybold Report 1998). At the same time it creates a niche for new intermediaries such as ToExel.com, which provide authors with services ranging from editing and printing to marketing and publicity. The author can choose which services are required, and the intermediary is not involved in any financial risk, in the process a totally new "value constellation" becomes possible, in which the intermediary acts as a nucleus connecting different activities.

e-books. Technological developments also enable books to be digitally downloaded and read on hand-held computers (for example NuvoMedia's Rocket e-Books, SoftBook, Everybook and Glassbook), thereby eliminating the printing stage entirely. This reduces entry barriers even further, since authors can simply post manuscripts on the Internet.

Figure 9: New Value System in Consumer Book Publishing: Interdependent and Interactive

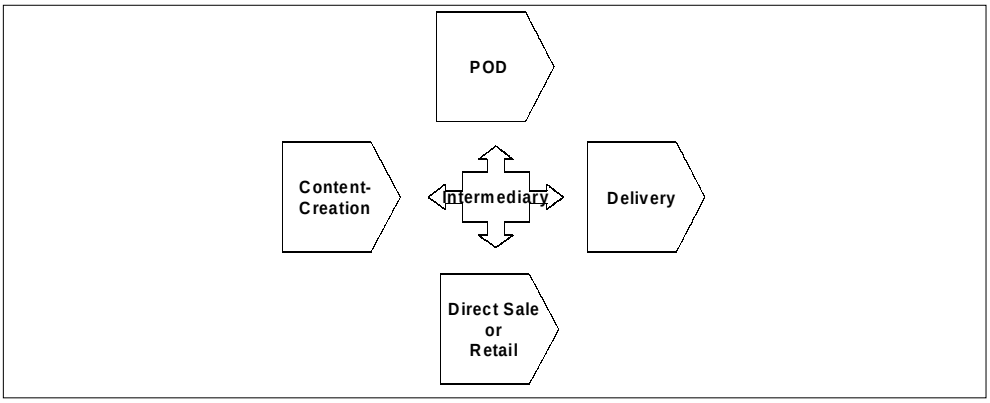
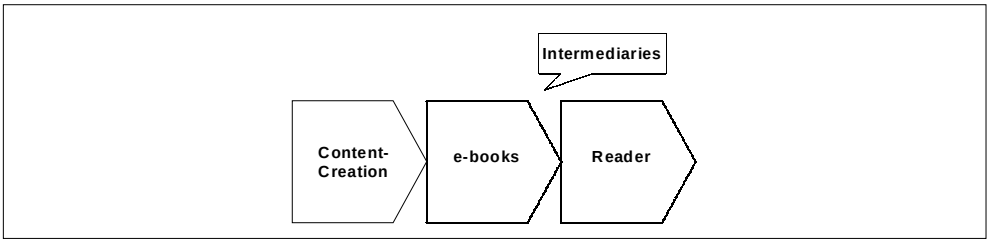


Figure 10: New Value Chain in Consumer Book Publishing: Electronic Books



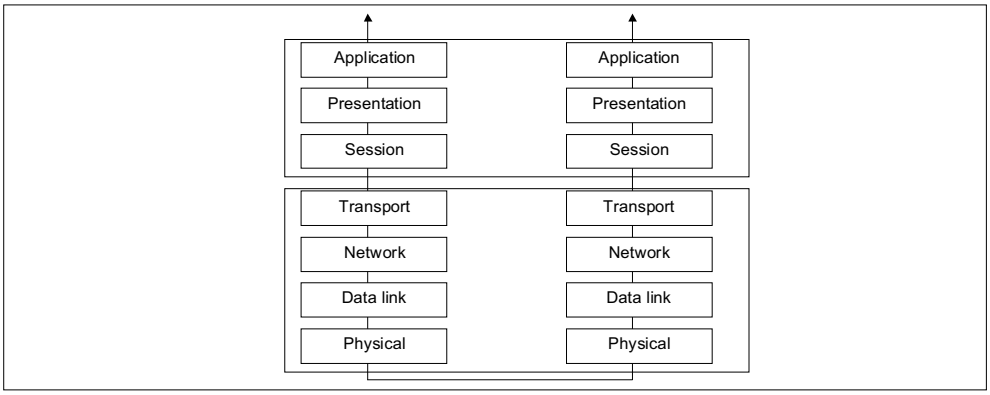
Layer Models as a Tool to Analyse Developments in the IT Sector

Layer models are the IT industry's favoured tool to explore the ramifications of convergence. There are a number of probable reasons for this. First, the origins of the layer models lie with the IT sector so they are to some extent an automatic choice. Second, they have technologies as their prime focus, which are the core focuses of the sector. Third, because of the industry's shift towards open systems, and a concurrent shift away from sequential processes, layer models offer a more accurate representation of industry structure than a sequential value system.

The "father" of layer models is perhaps the OSI (Open System Interconnection) model introduced by the ISO in 1977 and which subsequently became the dominant model for the IT industry. It was developed in response to the launch of open standards and sought to create international standard for networks composed from heterogeneous hardware.

The OSI model is designed to enable communication in open networks with different devices through open standards that form the nucleus of network communication. The OSI model (Figure 11) distinguishes seven layers that are together necessary for communication between partners. The layers interact both horizontally (peer-to-peer) and vertically. The four lower layers fulfil transport functions and are application independent, while the top three are application specific and user-oriented. This is a pure reference model that gives general guidelines and design instructions, but no specific protocol-definitions (Detken 1998; Elsing 1991).

Figure 11: Open System Interconnection Model (OSI)



Source: International Standards Organization (ISO).

Information Technology Industries

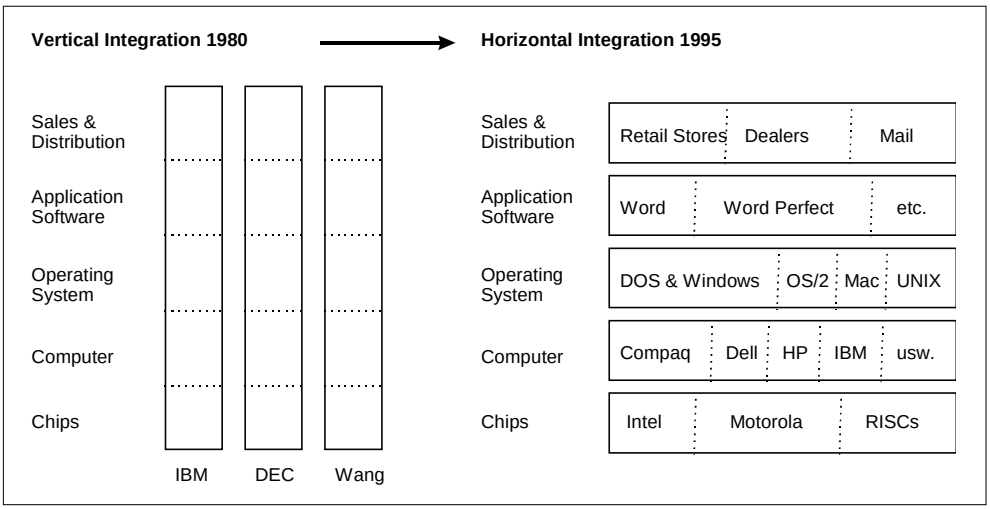
The information technology industries have been defined as industries that "produce, process, or transmit information goods and services as either intermediate demand (inputs to production to other industries) or as final products to consumption, investment, government purchases, or exports [or] provide the necessary infrastructure (communications) for the Internet to operate" (US Department of Commerce 1998). The sector falls broadly into two segments, hardware and software/services. The former includes makers of mainframe, client/server, and personal computers, other compu-

ter-based systems, storage devices, networking equipment, peripherals and business equipment, as well as computer equipment retailers and wholesalers. The latter includes companies involved in the design, development and marketing of all types of software, providers of software and providers of computer services, such as maintenance and systems integration (Hoover's, Industry Snapshot, Computer 1999).

Transformation of the Information Technology Industries

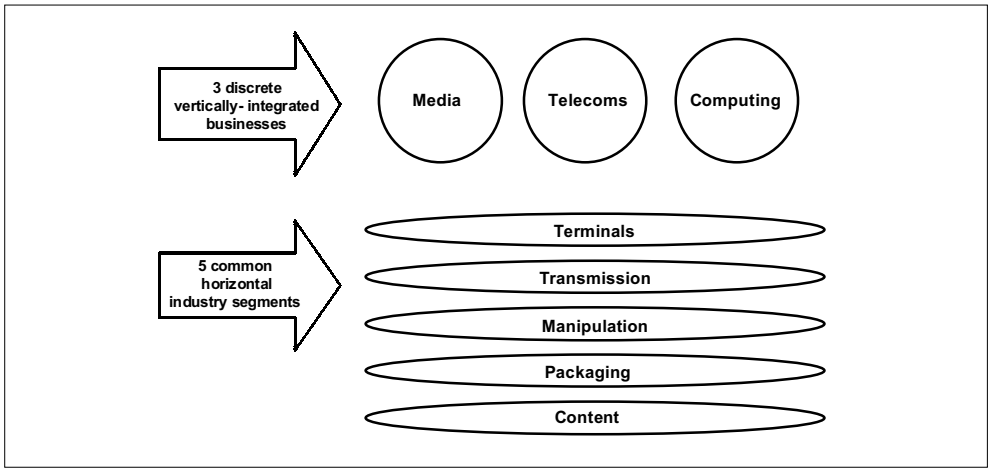
The IT industries have been moving towards open standards and system-based competition since the 1980s. As a result, between the late 1980s and early 1990s the sector reoriented itself from a vertical structure based on proprietary solutions and dominated by organisations operating in all activities into five horizontal industry segments based around open standards. This shift resulted from a number of interrelated industry-specific factors: liberal markets with minimal regulatory intervention which allowed players the freedom to respond to technological breakthroughs and associated market opportunities; a breathtaking speed of technological advance; the strategic importance of standard setting and economies of scale; extreme competition and a tradition of and a culture based on innovation and radical change. These developments were depicted by Grove (1996) using a variant of a layer model (Figure 12).

Figure 12: Transformation of the IT Sector, 1980-1995



Bradley and Nolan's 1998 layer model effectively expands Grove's model for the transformation that had taken place in the IT industry to describe the impact of convergence across all affected sectors. Their model shows three vertically-discrete industry sectors (media, telecoms and computing) transmogrifying into a collection of common horizontal "layers" or activities that together deliver content to consumers: content, packaging, delivery or distribution and user interface three discrete vertical businesses (Figure 13).

Figure 13: Impact on Fundamental Industry Structure



Impact on Organisation Structures

The shift from vertical to horizontal in the IT industry has encouraged the development of certain organisational forms. The dynamic nature of the sector has encouraged the development of start-ups focusing on specific industry processes which can often grow rapidly to establish a dominant position in global markets, as evidenced by some of the most successful organisations in the digital arena, such as Dell Computers or Cisco Systems. Indeed, within the sector a particular pattern in the life cycle of start-ups can be observed. Discontinuous technological development creates new entry possibilities and triggers a flood of start-ups (Yoffie 1997; Christensen 1997). The majority of these will fail, but a number will survive and establish a new industry standard within a specific process layer. This phase will be followed by one of consolidation.

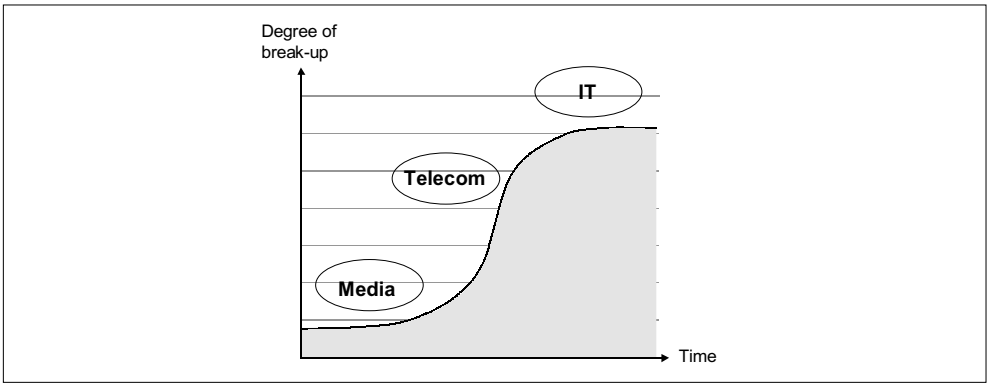
The second trend is for spin-offs from established players, for example Lucent Technologies, a spin-off of AT&Ts equipment business. These frequently occur where convergence is causing industry sectors to overlap, such as in the datacom sector (for example Global Information Solutions, also a spin-off off AT&T, which produces complex computer systems for businesses). Spin-offs are attractive because they can facilitate high speed, creative responses to technological developments. They combine the benefits of minimal hierarchies and fast decision processes with the advantages of an extensive and mature R&D capability and the parent company's financial resources.

Limitations of Layer Models

In some ways, the IT industries are the "motor" of the digital revolution, and it is therefore appropriate that a model showing the impact of convergence should have its theoretical roots in information technology applications. However although these approaches are grounded in the processes that are driving convergence, they are an imperfect means of visualising this process. First, models such as Bradley and Nolan's are visionary. This may well represent the "endpoint" scenario, the ultimate result of convergence, but it does not capture the complex transformations taking place as the process of convergence gathers pace, nor provide a means of highlighting interim developments. Further, layer models do not differentiate between industry sectors,

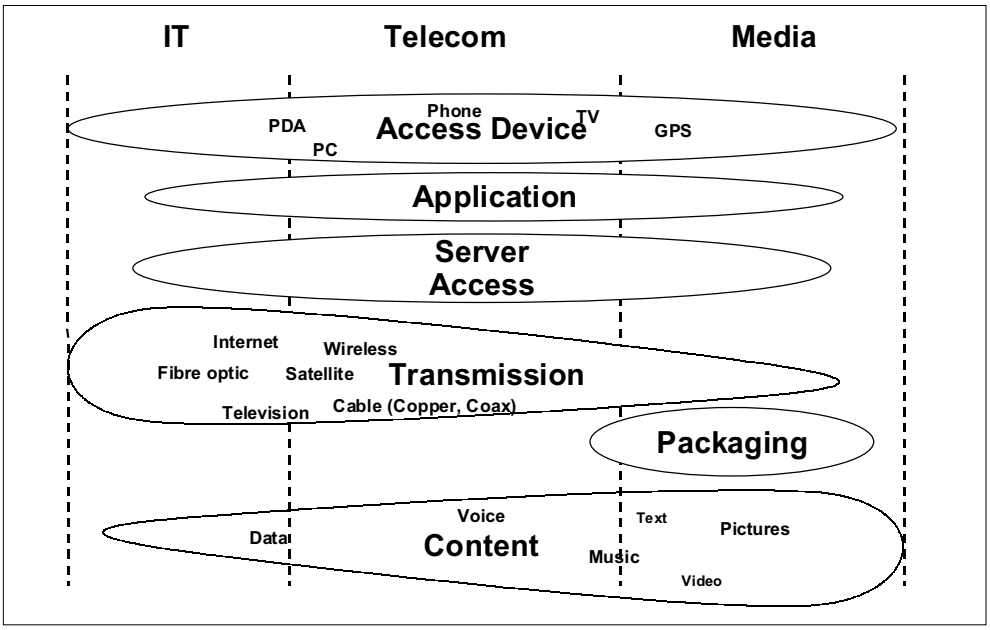
implying however tacitly, that convergence is having the same impact on each. In reality changes are not proceeding in parallel in each sector. Indeed as this paper indicates, analysis at industry level reveals a rich array of different responses: some sectors are further along the convergence path than others.

Figure 14: Converging Industries: Different Stages in Break-Up of Value Chain



Source: McKinsey.

Figure 15: A new model of convergence



A "Converged Layer Model"

As the digital revolution accelerates, a new model is required, one which enables such developments to be modelled and analysed, and which accurately represents developments across all three sectors — IT, telecoms and media.

A preliminary sketch for such a model shown below. This seeks to integrate value chain and layer perspectives by combining the value chains of all three sectors (which are shown as vertical columns) while at the same time identifying seven different layers or stages. All key elements of earlier layer models are incorporated, but two additional ones, content and packaging, are also included. Unlike OSI, this model does not concentrate solely on the functions necessary for networking but also includes activities "outside" the network such as content generation, packaging or access providing. Like OSI however, each layer has a well-defined interface through which communication with adjacent layers takes place.

However, in this new model the size and the proportion of the layers varies according to their relevance the sector concerned. Thus the content layer is heavily weighted towards the media sector, and transmission towards the telecoms and IT sectors. Similarly, the transmission and application functions that were originally the domain of the IT or telecoms industries are shown as extending into the media field, since these activities are increasingly relevant for the media industry as it starts to distribute content over the electronic networks such as the internet. The opposite is true for the content and packaging layers, which have traditionally been the province of the media industry but, due to the increasing importance of data and voice traffic, are now of increasing relevance to the IT or telecom companies.

The layers that are common to all sectors depict the increasing shift towards common functions, standards and components shared by all three industries. Once content is in a digital form it can be transmitted through the traditional TV (copper-)cable or through the (coaxial) telephone line or through the Internet. The same applies to access devices. A TV, a computer, a telephone or a personal digital assistant can receive digital content.

Conclusions

A key finding of this paper is that at this early stage of the convergence process sector-specific value chains are still clearly recognisable, if not entirely intact. Convergence can clearly be observed within sectors, and prophesied blurring of structural barriers between segments, for example between the telecoms and IT sectors, is clearly taking place. However in view of the extensive and long-standing legacy of existing technologies, strong differences in culture between the sectors, and consumers' only gradual adoption of new products and services, convergence is proving a slow process. It would be premature to claim that industries affected by convergence have merged into a new pan-industry sector.

From the theoretical perspective, further findings concern the appropriateness of the two models applied. Porter's value chain concept offers a valuable means for capturing the detailed consequences of convergence, but is most appropriate to static, clearly-bounded situations, which by definition converging industries are not. Non-sequential, dynamic and interactive industry alignments are not easily accommodated. For example, the "pre-convergence" telecommunication sector, which consisted of a single nation-wide company, could be clearly described. However, the liberalisation of the telecoms market and technological changes have transformed the industry's value system into something that can no longer be represented through a sequential and linear value chain. New services and products are popping out of the telecommunication value chain linking it directly to the value chains of the IT and media sectors.

Conversely, the layer models, while providing a valuable endpoint scenario are limited, firstly, in that they do not provide insights into convergence's "interim stages," and, secondly in that they treat all sectors as identical.

In response to the shortcomings of these traditional tools, a new model is introduced which combines the strengths of value chain and layer approaches. This has two particular advantages. First, it combines all sectors in a single model while allowing them to retain their distinct identity. Second it depicts the uneven progress of convergence via the differing proportions of the various layers.

Notes:

1. Although convergence is most frequently described as affecting the media, telecoms and IT industries, other industries, such as consumer electronics and office equipment, are also affected.

2. Peering is the process of exchanging data on the Internet. The process is necessary for networks to connect. It occurs primarily at Network Access Points (NAPs).

3. Veronis Suhler (1998) identifies 13 industry-segments: television broadcasting, radio broadcasting, subscription video services, entertainment (film, music, interactive), newspaper publishing, consumer books, consumer magazines, online, business-to-business communication, professional and educational publishing, business information services, advertising agencies, and speciality media (directory publishing, out-of-home media, direct marketing.

4. Electronic commerce means the electronic transaction of business; http://www.businessmedia.org/netacademy/glossary.nsf/kw_id_all/92.

5. Because the book publishing industry's value system is being affected by technological developments in on-line retailing and printing, both activities are included in the analysis.

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