The information mall

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The agricultural age was characterized by the exchange of basic commodities through bazaars, while the exchange of goods (and increasingly, services) through shopping malls has defined the ageing industrial age. Though we are now well into the information age, we still lack a comprehensive infrastructure for information exchange. The establishment of an infrastructure for information transportation will naturally lead to the creation of a secondary infrastructure for information exchange. We label this the 'information mall', which could exist in several places in the overall telecommunication system. This article is an examination of the needed characteristics of such malls, and of the public policy choices which have to be made to bring about and shape this vital infrastructural element.

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Rapid advances in information technology are making it possible to dramatically raise productivity levels around the world. Information technology can free resources in two important ways: by replacing many physical assets (such as inventory) with information, and by reducing the time and effort required to conduct everyday functions (such as the use of electronic data interchange rather than paper invoicing). These and numerous other advances, however, are being held back by the lack of a comprehensive, integrated infrastructure for information transport and exchange.

Computing resources have rapidly become extremely powerful and affordable, and the telecommunications industry is in the midst of historic technological and regulatory change. The information industry as a whole, driven by digital electronics, is evolving into a multimedia, multi-trillion-dollar global industry. Society cannot fully benefit from information technology, however, unless its power becomes widely available. Accomplishing that requires an infrastructure – the crucial bridge that enables us to cross the gulf between technology and markets.

Beyond a primary infrastructure to facilitate the production, storage and movement of information, we also need a secondary exchange infrastructure to expedite and enhance information transactions. Without an adequate exchange infrastructure, the information market cannot function efficiently. Transactions will be costly, slow and infrequent, and buyers and sellers will lack ready access to one another. A highly sophisticated and versatile system for managing information exchange and facilitating information-centred transactions will be necessary to handle the exploding volumes of such economic and social activity which will occur in the near future.

Within corporations, marketing managers have been responsible for bringing about the exchange of goods and services. Their activities revolve around bringing about mutually beneficial exchanges through mechanisms such as advertising (to create awareness and interest in their offerings), personal selling (to interactively meet the informational needs of end users and intermediaries), physical distribution (to provide customers with easy access to products and support services), pricing (to ensure cost recovery and maximal matching with customer valuations of product benefits) and a host of other similar activities.

In conducting business in well-developed markets, marketers take the presence of an exchange infrastructure for granted. The elements of such an infrastructure include a sophisticated logistical system for the distribution of goods, a transportation system which enables customers to reach stores easily, ubiquitous telecommunication services, financial

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services to expedite monetary exchange, the availability of well-targeted broadcast and print media, etc. Though such an infrastructure is now widespread throughout much of the industrialized world, its absence in other less developed markets can derail a marketing manager's efforts to facilitate efficient and profitable exchange.

Precisely such a situation exists today with regard to the burgeoning field of information services. The lack of an adequate infrastructure for the efficient exchange of information services is not confined to less developed countries; it is in fact a universal problem. Most developed countries today have advanced telephony systems for voice communications, and many also have fairly extensive (and often separate) systems for the transportation of text, data and video information. However, this does not comprise an information exchange infrastructure; it only provides some elements of what is really needed.

At the level of primary infrastructure, a consensus is now emerging that we need a ubiquitous, publicly switched, inexpensive multimedia broadband network providing, as an initial and approximate target, a gigabit of communication capacity to the end user. It is our contention in this article that at the level of secondary or exchange infrastructure we need to create better ways for information providers and receivers to congregate and efficiently conduct an enormous range of transactions. Such a system would give full expression to the communication and transaction visions being articulated around the world today and into the foreseeable future.

The metaphor used in this article to describe the needed information infrastructure is that of an 'information mall', which shares some characteristics with its natural predecessors – the old bazaars of the ancient trading cities and the modern shopping mall.

The evolution of exchange hubs

The exchange of goods and services has been a central concern of society for countless centuries. Humans realized centuries ago that creating a centrally located 'hub' for such exchange was the most efficient way to organize such commerce. As a result, ancient civilizations always flourished around cities rather than countries – Athens, Rome, Babylonia, Mesopotamia, etc, all city-based civilizations, were the major trading centres of their time. Each had a natural transportation-related advantage around which it organized an elaborate system to facilitate trading. In the agricultural days the natural advantage was usually access to water-based transportation – rivers and sea ports. Around that, an infrastructure was developed which became the local exchange[1] – the bazaar.

A similar process in the industrial age resulted in the development of shopping malls. The key transportation infrastructural element in this process was the highway system. The 'anchor' of many of the earliest shopping malls was Sears. In the 1920s General Robert Wood, the CEO of Sears, decided to expand the company beyond the farmers' market by locating all new Sears stores near major highways. This decision had little to do with market segmentation, merchandizing mix or ease of procurement, factors which Sears' competitors concentrated on. Wood essentially bet on the future of the automobile, and as a result Sears never established downtown locations. Their enormous success in the suburbs nearly destroyed downtown-based retailers such as F.W. Wool-

[1]Note that the same terminology is used in telecommunications.

worth, S.S. Kresge (which eventually followed Sears' example by launching K-Mart) and W.T. Grant. Montgomery Ward emulated Sears' strategy, and the two together became the dominant retailers of the age.

In this article we apply analogous criteria to the development of information malls: the presence of a 'natural' transportation advantage (in this case related to information transport) leading to the creation of a hub where enormous numbers of buyers and sellers can easily congregate and where information exchange can be centred. Such hubs have some defining characteristics, as discussed in the next section, which must apply to information malls as well.

The elements of an exchange infrastructure

According to Kahn, an infrastructure must be:

- sharable – it must allow for simultaneous access by many users;
- ubiquitous – it needs to be where you want it, when you want it;
- easy to use – it must be intuitive and require little or no training to use effectively;
- cost effective – it must be egalitarian and affordable to all.[2]

In addition, an information infrastructure must be expandable and flexible, allowing for multimode access. Any infrastructure which does not meet all of these criteria will fail to serve its basic purpose: to facilitate and expand its own usage. These yardsticks can be used to evaluate competing infrastructure initiatives.

Kahn also suggests that infrastructures can be thought of as a pyramid, with a foundation, standards, substructures and definition at succeeding levels. For an information infrastructure, the foundation refers to the hardware supporting the infrastructure: networks, computers and so on. Standards refers to the protocols for interconnecting networks, the operating systems. Substructure refers to the organization of the infrastructure into sections or modules, and to generic distributed systems for manipulating objects. Definition is analogous to end-user applications – what people use the system to do.

An exchange infrastructure has five primary aspects: physical, economic, technical, social and support services. Table 1 summarizes these characteristics, with illustrations from each of the three types of exchange hubs.

'Physical' refers primarily to 'atmospherics'; for a bazaar or a mall it includes the sensory aspects as well as the definition of safety. Most malls are designed so that they look different than other places of business; each one has a distinctive décor and 'feel'. Some are modern and airy; others are old-fashioned and charming. Different kinds of music play in the background. Bazaars had similar elements associated with them; some were raucous and bawdy, while others were serious and businesslike. Designers of future information malls will similarly have to have a defining theme in mind in creating the malls. Given the power of information technology, they will have enormous freedom in developing these 'virtual' environments.[3]

'Economic' has to do with the financial stability and viability of the system and its participants. It allows for the matching of buyers and sellers, ensures liquidity and serves the purpose of time intermediation between needs and the ability to pay. In ancient bazaars it included

[2]This point was made by Robert Kahn in a presentation entitled 'Building information highways', at the *Business Week*-sponsored conference, Information Highways: Linking America for Interactive Communications, New York, 11–12 September 1991 (transcript available from Journal Graphics). This conference (and a succeeding one in 1992) brought together a large number of visionaries and policy makers to discuss the information infrastructure of the future.

[3]A key design philosophy central to this process is 'product integrity', a holistic notion that encompasses form, function and the fit between users and products, rather than treating product components and attributes on a stand-alone basis. See Kim Clark and Takahira Fujimoto, 'The power of product integrity', *Harvard Business Review*, Vol 68, No 6, November–December 1990, pp 107–118.

Table 1. Characteristics of bazaars, shopping malls and information malls.

Attributes	General characteristics	Bazaar	Shopping mall	Information mall
Physical	Atmospherics; safety (personal as well as environmental)	Distinctive sights, smells and sounds; theft prevention	Unique décor, feel and personality; mall security	Look and feel; system 'charisma'; information security and privacy
Economic	Capability to do transactions	Barter; common and sound currency; moneylenders; pawn shops	Multiple payment options; billing services; credit cards	Automatic and instantaneous billing and payments; electronic funds transfer; electronic negotiations; automatic matching of buyers and sellers
Technical	Standards; consistency in interfaces	Docks had to be able to accommodate all boats; certified weights and measures; common trading practices	Consistency in how to enter and leave; multimode means of transport to mall	Modes of navigating; ensuring interoperability; multimode access (audio, video, wireless, wireline, narrowband, broadband, text-based, graphical, etc); multi-system compatability
Social	Enjoyability; human dimensions	Lodging and boarding; festivals for one or two nights	Restaurants; event-related promotions; senior citizens' activities; education; movies	Chat lines; common interest groups; electronic dating; interactive games; hobbyist services
Support	Shared facilities and conveniences; shared marketing efforts	Common grounds; protection from weather; dispute resolution	Shared utilities; restrooms; baby changing rooms; mall concierges; lost and found; parking; daycare; mall advertising and special promotions	Shared information-handling and communication resources; training and help for new users; dispute resolution; electronic housekeeping services; advertising

ensuring the integrity of precious coins or other forms of currency, providing for a system of barter, and housing moneylenders and pawn shops for those who needed them. In information malls this dimension has some interesting possibilities. Since information transactions occur with great rapidity, and since inventory holdings are minimal, billing and payment can be instantaneous. Automatic electronic funds transfer will eliminate the need for costly intermediation by banks or credit card companies.[4]

'Technical' refers primarily to standards and interoperability: uniform practices and operating norms which permit easy access and manoeuvrability for different kinds of users. Once they gain familiarity with these standards, users should also be able to function efficiently in all parts of the system. For a bazaar this meant something as basic as ensuring that it had docking facilities capable of accommodating all the various kinds of boats that would arrive there. It also meant ensuring consistency and accuracy in weights and measures. For information malls the analogue is that users should be able to navigate the system at will after learning its basics. It means that the mall should support access via different system platforms, as well as in different media. Just as customers can arrive at a shopping mall using several different transportation means, customers at an information mall should be able to gain access via audio, video or text; they should be able to connect via wireless or wireline, narrowband or broadband. The preferred mode of connecting may be via some inexpensive future multimedia device, of which AT&T's Videophone and Apple's forthcoming 'personal digital assistant' Newton are the crude predecessors. Consumers will most likely use at least two kinds of devices to connect with information malls: a portable device with limited functionality (analogous to a portable radio) and a desktop unit with full functionality (analogous to a hi-fi set). Such multi-accessibility is crucial to widespread acceptance and usage, without which no infrastructure of any kind can be viable.

'Social' is an important aspect of hubs. The social dimensions of commerce have existed since the bazaar. Most bazaars were held on a periodic rather than ongoing basis, and always included one- or two-night festivals. They had inns as well as pubs and eating establish-

[4]Beyond enabling monetary exchange, information malls can expedite exchange via computer-assisted negotiation (which can result in win-win agreements which are more desirable for both parties than non-optimal compromises) and the electronic matching of buyers and sellers. When made more intelligent through fuzzy logic and other approaches, this can be a powerful way to speed up as well as improve transactions (ie achieve a better fit between buyer and seller needs).

ments. Shopping malls have come to replace city squares as the primary meeting place for large segments of society, particularly the young and the elderly. Malls are also now positioning themselves as major entertainment centres, offering not only movies but also plays, concerts and special events; the 'Mall of the Americas' in Minnesota is a combination shopping mall and theme park. They are also likely to add evening educational and hobby-related classes. For information malls, the social dimension may well prove to be a crucial one. Limited experience thus far with systems such as France's Minitel (a pioneering videotext service) suggests that an important characteristic of such systems is allowing people to connect with other people, rather than just with companies or professionals. Numerous levels of such interaction evolve naturally, many completely uncontrolled and unstructured, while others are organized around topics of common interest (see Appendix).

'Support' is needed primarily to handle shared concerns and needs. For a shopping mall these have to do with mall marketing activities, tenant services and customer and employee conveniences. In an information mall service providers would share many computing and communications resources. They would all be interested in recruiting and familiarizing new customers with the mall. Mall management may also be periodically called upon to mediate disputes between 'tenants', and may enforce rules of conduct for dealing with customers.

A virtual shopping mall

Every shopping mall has anchor stores which are full-line generalists, and numerous specialty stores. The latter are of two types: product specialists (such as Crown Books and Egghead Software) and market specialists (such as the Limited and Benetton). Product specialists emphasize deep selection within a narrow range of products, and a well-trained sales staff with a high degree of product expertise. Market specialists provide a range of products specifically geared to a well-defined target market. The Limited, for example, defines its target market as young women from affluent families who are fashion-oriented as well as modern.

Similarly, in an information mall full-line generalists will offer broad-based information services, eg successors to services available today, such as CompuServe, Prodigy, Dow-Jones, etc. In the future, AT&T and local telephone companies will probably enter this category. These would probably be complemented by product specialists (such as providers of financial services or exchange forums for recipes) and market specialists (such as versions of Sabre for travel agents, corporate travel offices and individual consumers, and the Lexis legal information service for lawyers).

The versatility of information malls

Information malls will be extremely powerful and versatile. They can exhibit the typically oxymoronic characteristics of the information age, being simultaneously virtual (you can 'see' things that are not really there) and transparent (you do not see some things which are there).[5] In other words, an information mall can readily make tangible the intangible, while shielding the user from much that is unfamiliar or irrelevant. The structure is enormously plastic, allowing different users to interact with it in completely different ways.

[5]Kahn, *op cit*, Ref 2.

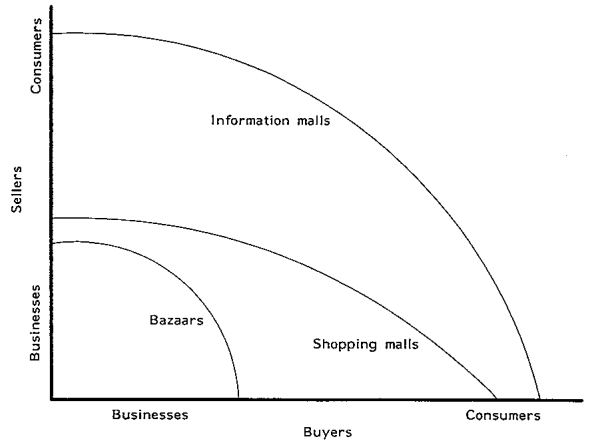

Figure 1. The versatility of information malls.

Another aspect of versatility is the broad range of customers who can be served by an information mall. Agricultural bazaars were primarily organized to facilitate business-to-business exchange. Shopping malls primarily have households dealing with businesses. The information mall will be able to accommodate all types of vendor–customer linkages, including customer-to-customer information exchange and transactions (see Figure 1). In shopping malls these used to be known as flea markets. Most malls actively discouraged on-site flea markets, since they saw them as competing with their primary service. Flea markets were thus relegated to individual and neighbourhood garage sales. Had they been allowed to exist within malls, flea markets would probably have increased mall traffic considerably. Today the primary means of customer-to-customer information exchange is radio talk shows; information is shared by individuals calling in, and others responding to previous callers. The enormous and growing popularity of this radio format suggests that chat lines in information malls which serve a similar function will be major elements in their success.

While shopping malls are in no imminent danger of becoming obsolete, they will be forced to change a great deal. Many malls have already been forced to emphasize services at the expense of goods. They have also greatly increased the range of social and entertainments activities, making shopping malls much more than just places to shop. The arrival of information malls will cause a further transformation; many activities now performed at shopping malls will be more efficiently undertaken at the information mall. An important part of an information mall's identity will, in fact, be that of a virtual shopping mall; to the extent that such virtuality can effectively substitute for 'the real thing', information malls will supplant shopping malls.

Activities in an information mall

Information in the mall will be in multiple forms: data, text, voice, images and video, and various combinations. The economic potential is

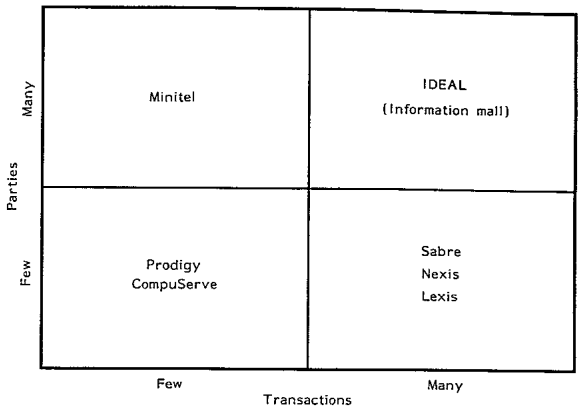

Figure 2. Existing information services compared to the information mall.

enormous. Without an adequate exchange infrastructure, information services are already a $50 billion a year industry. Figure 2 compares the information mall with some existing information services on two dimensions: the number of participants and the volume of transactions which take place. Most existing customer-oriented services allow relatively few transactions, and have a small number of participants (relative to the general population). The largest commercial players, such as Sabre, are characterized by a small number of participants (airlines and travel agents for Sabre) engaging in a very heavy volume of transactions. On the other hand, France's successful Minitel has a relatively large number of participants, but a comparatively small volume of monetary transactions. The information mall would clearly dominate and subsume all of these information services.

When the industry is reconstrued in the broad terms envisaged here, the potential revenues are huge. Information malls will truly become 'one-stop non-stop' service providers.[6] They will be able to handle voice mail, storing and forwarding voice messages worldwide. They will allow for customized newspapers culled from information sources around the world and updated on a real-time basis. They will fuel the growing trend towards work-at-home. They will permit home consultations with a variety of professional service providers, from physicians to lawyers to educators. They will permit on-demand node-to-node or one-to-many videoconferencing (in the USA there are at least 60 separate videoconferencing networks in place now for education alone, requiring an enormous, wasteful and incompatible private infrastructure).

The key activities in an information mall will include the following:

Information. In the USA yellow pages alone is a more than $8 billion industry today; add to that the value of instant access to multimedia encyclopaedias, the major libraries of the world, photograph banks, the art collections of all the major museums of the world, and so on. The immediacy and uncompromising quality of high-speed digital transmission will truly revolutionize information availability and utilization.[7] The Library of Congress, with its collection of 100 million items, gets a scant 2000 requests for information each day, most of them internal.

[6]This phrase was coined by the Singapore government to describe its philosophy of providing a large number of government services over electronic networks.
[7]Microsoft has articulated a vision of 'information at your fingertips', and has started to build a large digital library in anticipation of a future broadband delivery network.

Access through an information mall would increase this by several orders of magnitude.

Transactions. A major purpose of the information mall will be to facilitate electronic shopping for goods and services. Virtual shopping malls will permit consumers to choose the mode of shopping they are most comfortable with. Impulsive and visually oriented shoppers are likely to want to 'stroll' down the various aisles of a virtual supermarket (which may look exactly like their preferred store or could be custom designed by them) and click on their desired items. Others may place standing orders and review them periodically. Over time, the application of more virtual reality technology will permit consumers to electronically 'try out' numerous products from their home.

Entertainment. Numerous entertainment options will be available on demand to consumers. These will include movies in any language, audio programmes and television shows from around the world. Other forms of entertainment will include interactive games (including the possibility of playing physical raquetball with a remote opponent), fantasy games, virtual travel to exotic locations and anything else that can be dreamed up by creative service providers.

Education. As discussed earlier, shopping malls are selling less merchandize and more services; some are planning to offer evening classes. In an information mall the perfect infrastructure will exist to radically alter modes of teaching and learning. Students will be able to interact with remote human instructors through videoconferencing; they will, for instance, be able to take French lessons from an instructor in Paris. This will probably lead to the emergence of a new class of superstars – outstanding professors from universities around the world whose knowledge and communication skills could easily be tapped through the information mall. Students will also be able to learn by interacting with computerized 'agents' who would guide them through various techniques and procedures. A great deal of distance learning already takes place without the benefit of such an infrastructure. When one does become available, the potential is enormous.

Social interaction. Shopping malls have so far not done a very good job of facilitating social interaction. Information services have an important inherent social dimension which users find irresistible. Myriad possibilities exist as to the ways in which they will be used to increase social interchange.

Robert Kahn has suggested that there is more money to be made through infrastructure than from most high-technology investments combined.[8] It is impossible to predict *a priori* what share of transactions each of the above activities will account for when information malls are in place. As we have said earlier, much of what will happen will be serendipitous; more often than not, predictions are confounded by the peculiar dynamics and economics of information-centred exchange. It is safe to say, however, that information malls will become a major economic force in the future, both through information exchange and through facilitating the exchange of all kinds of goods and services.

[8]Kahn, *op cit*, Ref 2.

The impact of information malls

Recent Federal Communications Commission (FCC) decisions allowing telephone companies greater freedom to enter the information and video delivery businesses should accelerate the introduction of electronic malls. However, it still appears that the USA is likely to lag behind other countries, since most do not have the political debates and regulatory tangle that exist here. Many countries around the world also see the creation of an advanced information infrastructure as a means of leapfrogging over developed countries.

The most likely candidates in the industrialized world for the early introduction of an infrastructure to enable information malls are at two extremes of planning: Japan and the UK. The best-orchestrated effort will probably be mounted by NTT, with their clearly articulated vision of a 'visual, intelligent and personal' (VIP) network. At the other extreme is the UK, where there will be no single company, but a free-for-all market.

Though the investment required to establish them is large, the payoff from information malls will be immense.[9] An information infrastructure will improve economic performance across all industries, leading to increased international competitiveness. While business will certainly become more productive, we will also see significant improvements in the quality and productivity of education and health care – two enormous sectors of the economy whose costs have been rising rapidly. The implications of widespread working at home, shopping at home, videoconferencing and reduced demand on transportation systems will be felt throughout society. It will virtually open the nation and eventually the world. The advent of information malls, and the resulting broadening of the industry's markets, will stimulate the further development of the information industry, leading to an industrial bonanza over the next quarter century.[10]

Government clearly must play a significant role. Previous infrastructure milestones (such as the railroads, electrification and civil aviation) were all aided by the government. The USA now has three very large and successful network providers: broadcast, cable and telephone.[11] Rather than merely seeking compromises between positions advocated by rival industry groups, the government must fashion a clear vision of what is needed (NTT's 'VIP' vision presents an admirable model), and then create incentives and regulatory policy to ensure than it is realized within the desired time frame.

The US government has long supported high-bandwidth networks connecting scientific facilities. But those serve relatively few users (perhaps hundreds of thousands), with well-established requirements. While there are logical reasons for proceeding in this fashion, this 'trickle-down' approach is simply wrong when it comes to information technology deployment into the infrastructure. There are already over 60 million other PC users, representing one in four homes. The information infrastructure must be built for this larger market; it must not be unduly constricted through myopic assumptions about the amount of bandwidth 'ordinary' consumers need.

It is possible, and even desirable, that more than one industry may respond to government initiatives and build an information exchange infrastructure. More likely, there will be strategic alliances between hitherto divergent players. Clearly, satellite and mobile media offer physical and economic advantages for many voice, video and data

[9]Estimates of the cost of creating a digital broadband communication system (central to the concept of the information mall) for the USA range from $100 to $250 billion. While this represents a large outlay, consider that the cost of standardizing electrical outlets and plugs across Europe is being estimated at $125 billion! Surely the societal and competitive benefits of an information infrastructure are worth more. See 'Socket to them', *Economist*, 7 November 1992, p 74.

[10]Louis J. Rutigliano of Ameritech has proposed a strong role for the government in bringing about a broadband communication infrastructure. See 'Rethinking public policy for the global information economy', paper delivered to *Business Week* conference, Information Highways: Linking America for Interactive Communications, 11–12 September 1991.

[11]Al Sikes, Chairman of the FCC, has commented that 'the user ... or the prospective users ... up until now have really been bit players in this drama, and that's too bad': see 'America's stake: our next frontier', keynote address, *Business Week* conference, Information Highways: Linking America for Interactive Communications, 11–12 September 1991.

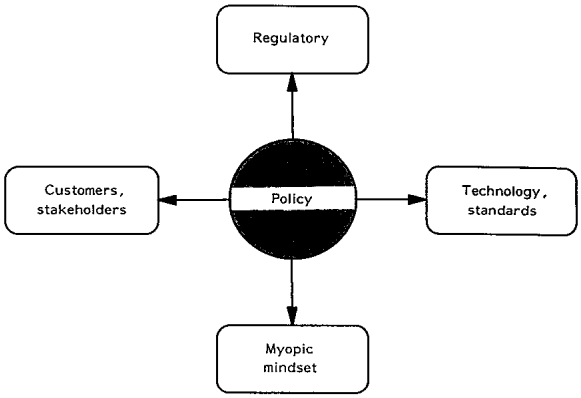

Figure 3. Policy impacts of the information mall.

services. There may eventually be more than one universal public switched video network, and such a competitive market will spur rapid advances in the quality and scope of services available to users.

The public policy imperative

Though the information mall is needed (and for reasons of global competitiveness, it is needed sooner rather than later), we have to recognize that market processes are not the only solution. The side effects of unfettered market processes are not always desirable. Information is central to the functioning of developed societies; the information mall will be such a powerful mechanism for information exchange that it can lead to undesirable consequences, as detailed in the next section. The government clearly has an important role to play in safeguarding individual rights and mitigating potentially negative impacts on society. Primarily, it must address four key issues: individual and organizational privacy, information security, controlling the intrusiveness of information technologies (crucial with an 'anytime, anyplace' technology) and assuring universal access (to prevent the creation of information 'haves' and 'have-nots').

There is much to be gained by the government playing a more activist role in this area. By using public policy to intervene in the market, the government can help remove four bottlenecks that result from an exclusive reliance on market processes (see Figure 3). Most directly, it can use its regulatory authority to move the industry in desired directions. It can also play a lead role in getting industry to establish technological standards, and can spur the development of key component technologies through targeted incentives.[12] Thirdly, the government can play a role in public education, of individuals as well as industry players. This is what Singapore, for example, does very well, using the media to build a consensus of public opinion around new initiatives.[13] The government can also accelerate adoption by mandating technology utilization as a part of all public education. Finally, government can also play a role in changing the myopic mindset that seems to pervade various sectors of the information industry. Rather than continually

[12]An interesting example of this is the FCC-mandated requirement of 800-number portability; to comply with this edict, the industry had to come up with several technological breakthroughs in switching and speed deployment of Signaling System 7.

[13]This is also known as the concept of 'megamarketing'.

fighting turf battles among themselves, industry participants need to recognize that their greater good will come from cooperating in bringing to reality a shared vision of a sophisticated information society. The key concept in this framework is thus convergence – if the government can help converge the suppliers, customers, technology, regulatory boundaries, etc, onto a common vision, it will greatly speed up the transition.

A two-edged sword

Every new technology (or economic activity in general) has some side effects. The negative social consequences of the old bazaars were significant: trading posts, while they were great for the world as places of exchange and commerce, usually destroyed the local native culture surrounding them. The same was true with shopping malls; they destroyed local businesses and caused significant economic and social displacement in the surrounding area.[14] The information mall may be even more damaging, because it is far more versatile ('anytime, anyplace') than any commercial or social institution before it. It will bring about the truly global village, and in the process native identities may be sacrificed, at least to a degree. Information malls will also directly and tangibly affect the well-being of shopping malls, to the extent that transactions are taken over, and to the extent that some social needs can be met by the information mall. Retailing accounts for $3 trillion out of the $6 trillion US economy, and the information mall will definitely shrink and reshape it. Developed countries, where retailing is a greater component of GNP than upstream activities, will be more affected. Significant economic and social displacement will take place, even more than that induced by the advent of shopping malls.

As detailed in the Appendix, a virtual community experiment such as Habitat, even with its crude technology (slow speed and poor graphics), proved to be a powerful and immersive medium. In the future, with HDTV and photorealistic virtual reality, such fantasy communities could become all too real. While society at large must wrestle with the broader freedom-of-expression and freedom-of-congregation aspects of the information mall, its sheer power (and the increasingly indistiguishable line between the virtual and the real) call for, at the very minimum, a degree of self-regulation. Services such as Prodigy and others already have such guidelines. The information mall could borrow guidelines from the publishing industry, and the communications industry (some rules regarding the public airwaves are strictly enforced by the FCC). In the end, public policy and market processes must come together; both are equally important in this case.

Accelerating the inevitable

Arthur C. Clarke, the well-known author and futurist, has observed that were it not for the telegraph and the railroads (which provided the communication and distribution infrastructure for the industrial age), there probably would not be a United States of America.[15] It is widely recognized today that a nation's competitive advantage derives in large measure from the quality of its infrastructure;[16] increasingly, the 'electronic infrastructure' is becoming even more important than the physical infrastructure.

This reality has been recognized by several countries. For instance,

[14]Currently there is much concern about the changes wrought on small communities when Wal-Mart moves in. There are now several consulting firms whose business is based upon advising small local merchants how to react to Wal-Mart's arrival.

[15]Quoted by John Eger at the *Business Week* conference cited earlier.

[16]As Robert Reich has suggested, the global economy is characterized by extremely fluid movements of raw materials, capital and technological know-how; the only elements which cannot flow freely across borders are people and infrastructure. The latter elements are thus crucial in attracting the former, and are the primary drivers of a nation's competitive advantage.

Japan has committed itself to spending $250 billion over the next 20 years to rewire the nation, and projects that 30% of its GNP will come from services made possible by that broadband network by 2015. Singapore has embarked on an ambitious initiative to create an 'intelligent island' through extensive networking and the development of a ubiquitous broadband communications system. The country has clearly articulated a vision of a fully networked society in which information technology will be deployed to the fullest extent in a highly planned, orchestrated effort to maximize its societal and competitive impact.[17]

Clearly, while infrastructure may appear to be a somewhat mundane matter, it is anything but that in today's world. Even as countries move to repair their crumbling physical infrastructures they must focus on the urgent need to formulate a public policy that will result in the creation of an advanced electronic infrastructure. This is too crucial an issue to be left purely to market processes; governmental leadership is essential in setting priorities and providing incentives to ensure that development proceeds in the right direction and at the needed pace.

In the USA economists and other researchers have noted for years that the enormous investments that companies have made in information technology (now accounting for over 50% of capital spending) have failed to yield any significant improvements in white-collar productivity. Robert Solow, an economics Nobel laureate from MIT, has dubbed this the 'Productivity Paradox'. On closer analysis, one finds that the aggregate numbers are somewhat misleading; the reality is that some companies have achieved dramatic results, while others have seen no improvements at all. The former have achieved their success by doing two things: first, they have 'reengineered' many of their business processes to take advantage of available information technologies, rather than simply using the technology to automate existing ways of doing business.[18] A second and related way in which companies have leveraged their information technology investments is to invest even more in infrastructure-like facilities. Any new technology can be hamstrung by the unavailability of an adequate and suitable infrastructure. For instance, some companies have established high-capacity private communication networks. Others have installed VSAT satellites on rooftops to facilitate communication.

The costs of creating infrastructure are enormous, and usually cannot be borne by any single company on the basis of its own internal requirements. Nor can a single company afford to maintain and upgrade an infrastructure once it is built. Infrastructure costs cannot be loaded onto transaction costs without significantly depressing the demand. Some companies create a limited infrastructure for their own use because none exists, and the market is willing to pay for the higher margin because of a lack of choice (ie they are a monopoly provider); this is a very expensive solution that very few companies can even afford to contemplate.

Companies that create such an infrastructure eventually begin to sell its use to others. In the industrial age, industries such as minerals and mining created the basic infrastructure of the railroads, which soon became the transportation mode of choice for freight as well as passengers. American Airlines' Sabre reservation system started out as a means for travel agents to make bookings on American Airlines flights, but has grown to include all airlines, hotels, car rental companies and so on.

[17]Rajendra S. Sisodia, 'Singapore invests in the nation-corporation', *Harvard Business Review*, Vol 7, No 3, May–June 1992, pp 40–50.

[18]Some have described this as 'paving the cowpaths'. For a good overview of work process re-engineering, see Michael Hammer, 'Reengineering work: don't automate, obliterate', *Harvard Business Review*, Vol 68, No 4, July–August 1990, pp 104–112.

In the physical world this is analogous to a manufacturer not only setting up retail stores to display and sell its products, but also roads to transport people and products to that store, a bank to handle financing arrangements, a communication system, and so on. Most companies, of course, lack the resources (as well as the vision) to be able to create their own infrastructure. As a result they are only able to extract a fraction of the value that is inherent in their information resources.

Any economic system is constrained by its weakest links; consequently the linking of multitudes of islands of information technology through a comprehensive information infrastructure will have a dramatic impact on raising productivity levels throughout the system. While any competitive advantages accruing to early-mover, 'private infrastructure' companies will vanish as a result, the aggregate impact will be a much higher plateau of performance throughout the economy.

Bringing such a system to fruition, however, is impossible without coordinated and visionary public policy actions. The telecommunications industry does not have the incentive to provide such bandwidth unless the computer industry is able to generate or receive information at such rates; by the same token, the computer industry is wary of developing such capabilities unless facilities exist to share them over large distances.[19]

This dilemma can only be resolved through the catalytic effects of public policy. Rather than merely adjudicating between the various rival industries seeking to define and dominate the future infrastructure, government must play a more visionary role: that of determining national interests and facilitating a coordinated movement in that direction. In all of this they must represent the interests of their ultimate constituency – the millions of end users whose lives and livelihoods will be affected by the presence or absence of an advanced information exchange system.

[19]This dilemma is described in detail by Kahn, *op cit*, Ref 2.

Appendix

The Habitat experiment and its lessons[20]

Habitat is a large-scale many-user graphical virtual environment that was created by Lucasfilm in 1985. It was initially designed to be an on-line entertainment medium in which people could meet in a virtual environment to play adventure games. Users, however, extended the system into a full-fledged virtual community with a unique culture; rather than playing prescripted fantasy games, they focused on creating new lifestyles and utopian societies. 'Avatars' (the term used to describe the virtual figures on the screen) could move around, pick up, manipulate and put down objects, gesture and talk (their words appeared in a balloon above the figure). The Habitat world was inhabited by a large number of objects, such as ATMs, vending machines, weapons, drugs, doors, decorative knick-knacks, magic wands, teleport booth for quick long-distance transport, etc. As an entertainment-oriented cyberspace, Habitat provided participants the opportunity to get married or divorced (without real-world repercussions), start businesses (without risking money), found religions (without real-world persecution), murder others' avatars (without moral qualms), and tailor the appearance of one's own avatar to assume a range of personal identities (eg movie star, dragon). Just as SIMNET enables virtual battles, Habitat and its successors empower users to create artificial societies. What people want from such societies that the real world cannot offer is magic, such as the gender-alteration machine (Change-o-matic) that was one of the most popular devices in the Habitat world.

Social scientists are discovering more about utopias by studying Habitat and its successors than they did by researching communes, which were too restricted by real-world considerations to meaningfully mirror people's visions of ideal communities. Giving users magical power opens up learning in ways that developers are just beginning to understand. As with any emerging medium, at first traditional types of content are ported to the new channel; then alternative, unique forms of expression – like Habitat – are created to take advantage of ex-

panded capabilities for communication and education.

In building the world, the engineers' conceit that all things could be planned and then implemented according to specifications proved to be a fallacy. As they discovered, 'Detailed central planning is impossible; don't even try . . . The organism will do whatever it damn well pleases.' The developers thought they were game designers; they ended up being more like cruise directors.

Habitat is now known as Quantumlink's Club Caribe, and has a 'population' of about 15 000. A technically more sophisticated version, called Fujitsu Habitat, is operational in Japan.

[20]See C. Morningstar and F.R. Farmer, 'The lessons of Lucasfilm's Habitat', in M. Benedict, ed, *Cyberspace: First Space*, MIT Press, Cambridge, MA, 1991, pp 273–302.