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# Building Sustainable Knowledge Societies: Towards a Conceptual Framework

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## 1 Introduction

The claim today is that we live in knowledge societies that represent a major departure from the kinds of societies we have lived in the past. In what sense and for whom is this a valid claim? This paper examines some of the arguments that underpin this claim. It also offers a conceptual framework that is intended to encourage critical reflection on the causes and consequences of societies in which digital information plays an increasingly significant role in the formation of our identities. The paper offers an assessment of some of the assertions about the benefits and risks that are associated with societies in which human relationships are intensely mediated by information and communication technologies (ICTs).

At the core of our 21st century 'knowledge societies' is a set of patterns of social and technical interaction that has been made feasible by the spread of electronic communication networks and by the software and digital content that flows through these networks. For those who have access to these networks, there are new possibilities for building relationships in both local and distant places. There are many different beliefs about whether the new possibilities for communicating and for processing information represent a fundamental break with the past. Although various technological innovations are altering our perceptions of time and space, their application may leave many of our cultural, social, economic and political conventions more or less in tact. Whether changes in the way digital information is produced and consumed will provide a fundamentally new basis for accumulating knowledge that can be applied in ways that improve human welfare remains an open question.

Is it right to argue that rapid growth in the availability of global electronic networks and in the quantity and diversity of information is advantageous for all of the world's people? Even if we accept that there is a link between technological achievements in the production and distribution of information and in the capacity of men and women to accumulate and act upon knowledge, what are the implications for people's livelihoods? These are fundamental questions. They need to be answered if we are to understand developments that are at the core of today's 'knowledge societies'.

The conceptual framework that is set out in this paper is based upon several strands of social scientific inquiry. The main focus is on the nature of changes in human relationships when they are intensely mediated by digital technologies and their applications. The Internet is not the only development of ICTs that is perceived to be contributing to changes in the way our relationships are constructed. However, the Internet clearly is playing a very central role in the way many people are acquiring access to digital information resources. Both as a means of communication and as a means of producing and consuming digital information, the Internet's use becoming central to the way many of us come to know about and act upon the world. The perspective on 'knowledge societies' that is developed in this paper starts from the proposition, however, that there is no *a priori* reason to privilege the technological mediation of human experience over other forms of experience.

An assessment of the features of emerging 'knowledge societies' requires critical reflection and an examination of the evidence base for many of the claims about the

impact of innovations in ICTs. Innovations in digital technologies and services clearly are implicated in some of the social and economic transformations of our time. However, the achievement of universal access to electronic networks is unlikely to be positively associated with a strengthening of the knowledge base or with improvement in people's capacities to learn unless such access is accompanied by a variety of other changes. Evidence that ICTs are being applied in ways that assist in enabling people to experience improvements in their lives must be welcomed. However, insofar as there is evidence that ICTs are being applied in ways that lead to disablement, we should be ambivalent about the prospect of the growing intensity of technological mediation in our lives.

The next section examines some of the discourses about the nature of knowledge societies at the start of this century. Section 3 suggests the key concepts for a framework for assessing the benefits and risks of today's technologically mediated societies. In section 4, several issues with respect to the 'digital divide' are considered followed, in section 5, by a consideration of new opportunities and constraints to more effective knowledge sharing. In section 6 the feasibility of using ICTs to promote the building of capabilities for knowledge societies through learning is examined. The key elements of a conceptual framework for examining the characteristics of 21st century knowledge societies are summarised in the conclusion in section 7.

## 2 Discourses on Knowledge Societies

An ambivalent stance towards the digital technologies that underpin today's emerging knowledge societies is crucial. This is because the future pathway of both social and technological innovation is very uncertain. The social and economic consequences simply are not clear. There is nothing conceptually unusual about the uncertainty that surrounds the causes and consequences of technological innovation in the ICT field. Studies of techno-economic and socio-political change (Boden and Miles, 2000; Bijker, 1993; Freeman, 1994, 1988; MacKenzie, 1996) highlight the fact that some technical innovations fall by the wayside. Those that do take off and become integrated within people's lives may do so in ways that differ substantially from those that were initially conceived.

Many observers are claiming that the spread of digital technologies entails fundamental and far-reaching changes in society with respect to individual experience and collective action of all kinds. Castells (1996) argues that a major restructuring of capitalism is underway. Our 'knowledge societies' today operate according to the rhythm of a new form of 'informational capitalism'. The discourses of others who are interested in the economic potential ICTs and the services they support refer to the 'information economy' (Shapiro and Leone, 1999), the 'digital economy' (Margherio et al., 1998), the 'weightless economy' (Quah, 1997) or the 'new economy' (Kelly, 1998). Others emphasise both the social and the economic potential of ICTs using terminology such as the 'information society' (Mansell and Steinmueller, 2000) or the knowledge-based society (Stiglitz, 1999). Much of the discourse – whatever the terminology – suggests that a growing emphasis on the immaterial and on information stocks and flows is a fundamentally new phenomenon.

Although Castells (1996) and many others are reasonably careful to emphasize that information exchange and the communication of knowledge always have been crucial for every society, the argument is that today the deployment of global networks involves specific forms of social and economic organisation. Castells (1996) argues, for example, that informational activities are associated with 'a specific form of social organization in which information generation, processing and transmission become the fundamental sources of productivity and power, because of the new technological conditions emerging in this historical period'. If the Internet and other digital technologies do foster new forms of information processing with major implications for social and economic development and for the exercise of individual or collective power, then it is essential to assess whether these developments are in fact empowering and for whom.

Unfortunately, many social scientific attempts to examine the implications of innovations in ICTs are confined to single disciplines. This makes it difficult to evaluate theoretically informed arguments about the symbolic or economic features of emerging knowledge societies. Empirical studies of both the production and consumption of ICTs also are predominately conducted within disciplinary boundaries such as economics or sociology. This results in a rather fragmentary picture of how a growing intensity of technological mediation is affecting our working and leisure time. Additionally, most of the evidence base that is provided by recent research offers snapshots of the nature of the interactions between our social and technological systems. This means that we have little insight into the dynamics of these interactions or into how they differ in various contexts and geographical places.

Some interdisciplinary examinations of the social and technical features of knowledge societies have been undertaken in recent years. These studies are beginning to shed light on the great variety that exists within our 'knowledge societies'. Much of this work encourages us to challenge those who suggest that there is a simple relationship between investment in ICTs and enabling people to experience social or economic benefit (for example, Boisot, 1995, 1998; Castells, 2001; Ciborra, 1996, 2000; Dutton, 1996, 1999; Gauntlett, 2000; Jonscher, 2000; Mansell and Silverstone, 1996; Mansell and Steinmueller, 2000; and Woolgar, 2002). For the most part, this evidence base is developed from case studies that are conducted in ways that make it very difficult to compare the perceptions and experiences of those who become more intensive users of ICTs with those who do not. Nevertheless, all of this work points to the vital importance of organisational change and learning processes as the keys to whether the application of ICTs is perceived to bring about benefits of any kind.

Many of the reports that are produced by intergovernmental or technical assistance agencies on the status of 'knowledge society' developments offer descriptive accounts of positive change that is said to accompany investment in ICTs (see for instance, Department of Commerce 1999, 2000; OECD 2002; UNCTAD 2002; World Bank 1998). These efforts to depict the contours of emerging knowledge societies rely on aggregate statistics or on micro-level case studies. They generally seek to portray ICT success stories and give little insight into instances of failure or of difficulties in adjusting the organisation of people's 'off-line' lives to take advantage of ICT applications. In general, the wider context in which people's lives become mediated by technology is not considered. However, it is this wider context that is crucial in determining whether or not individuals or groups are obtaining sustainable benefits as

a result of their access to the Internet or other types of ICT applications. The evidence base that supports the different discourses on the benefits and risks of knowledge societies is very weak indeed. It has so far offered very little basis for critical reflection on the causes and consequences of interactions between social and technological change in this area.

The predominant discourses on knowledge societies capture only some of the features of the changes that are associated with innovations in digital technologies. For example, they direct attention to the increasing salience of services and immaterial transactions in the global economy (Helpman, 1998; Lipsey, 1991, 1994; Quah, 1998; Romer, 1990, 1994; Shapiro and Varian, 1998; Stiglitz, 1999). They imply that information in its codified form, circulating through global networks at remarkable speed, can be converted into useful knowledge that is applicable to the needs of the firms, governments, and consumers or citizens.

According to many recent accounts of the development of knowledge economies, for instance, human capital, human organization and management, and human interaction, whatever the purposes of the agents, are increasingly mediated by some combination of hardware and 'wetware' (Romer, 1995). Managing knowledge and learning are seen as processes that require the 'harnessing' of advanced ICTs (Norris and West, 2001; Ruggles, 1997). This is expected to produce positive results including improved decision making and problem-solving capabilities (OECD, 1997). Most of these discussions focus on the economic characteristics of emerging knowledge societies and on stocks and flows of digitally encoded information (Cowan and Foray, 1997; David, 1995). They are primarily interested in codification with little regard for the individual's perceptions, experiences or resources that they have available to them.

Perez (1983) and Freeman and Perez (1988) suggest that as the application of microelectronics-based technologies becomes an increasingly central factor in economic and social development, the efficacy of existing ways of organizing economic and social life is called into question. As innovations in ICTs and social and economic organization occur, there are likely to be substantial costs of social, organizational, and political adjustment.

The analysis of effective policies and strategies for knowledge societies, for the management of knowledge and for the deployment of digital technologies and services is often informed by assumptions about what the new technologies can 'do' rather than by questions about what they may be used to achieve (Anderson, 1997; Garcia, 1995; Information Infrastructure Task Force, 1997; Kalakota, et al., 2000; Kalakota and Whinston, 1997). Some proponents of the idea that the ICT paradigm will bring benefits to all argue that a global knowledge society is on the verge of enveloping everyone (Dizard Jr., 1997). Today's gaps or divides in terms of access are simply a reflection of being at an early stage on the diffusion curve for the new technologies and services. They argue that when everyone achieves equitable access to the knowledge societies that are emerging to day, virtual associations and networks will ensure that no one is excluded from the social and economic benefits of the new form of social order (Rheingold, 2000; Romm, et al., 1997; Sarkar, et al., 1998). In this positive view of an inclusive global knowledge society, immaterial life will favour long-term sustainable growth and social development.

The discourse and the evidence base underpinning our progress towards 21st century knowledge societies focus overwhelmingly on the diffusion and application of technology and its assumed positive impact. In many countries investment in the new technologies is very uneven. There are large numbers of people who are not accumulating any experience of living their lives in an intensely technologically mediated knowledge society. Nevertheless, increasing numbers of individuals and organisations have access to growing amounts of digital information. Many are experiencing reductions in the costs of communicating as a result of the spread of the Internet and the use of electronic mail. But it does not follow that the overall result will be sustainable growth and social development.

We have evidence about the numbers of users of ICTs at various levels of aggregation and of the rates of growth in the production of different types of digital information. However, this evidence base tells us nothing about how these digitally mediated environments are experienced by their users. Nor does it provide insight into how those experiences are associated with learning, knowledge accumulation or action in the world. While we can benchmark relative progress towards new forms of knowledge societies, we have remarkably little basis for critical reflection on how and to what extent people actually value their technologically mediated environments. Insofar as there are transformations in the relationships that people value then much greater attention needs to be given to whether these are consistent with sustainable livelihoods.

## 3 Assessing Emerging Knowledge Societies

Many of the more favourable accounts of knowledge societies developments have been met with dissent. Some of the dissenters argue that there is an embedded bias towards exclusion and disadvantage for some people as a result of a growing requirement to be 'connected' (Angell, 2000; Garnham, 1994, 1996, 2000; Mansell and Silverstone, 1996; Robins and Webster, 1999; Webster, 1995). Most of these accounts acknowledge that even if the technological foundation of our societies is changing and there are many benefits, there are also substantial risks (Mansell and Wehn, 1998). The extent of the benefits and the risks and their distribution throughout the social and economic order is a matter for systematic empirical investigation. The perception of benefit and risk must be expected to differ depending on the standpoint from which it is assessed. It is essential to understand what preferences and values are becoming embedded in the new technology systems. It is also important to question whether there is a consensus about whether the changes should be welcomed and encouraged or whether there is scope for embedding alternative preferences and values in emerging knowledge societies.

One means of making an assessment of the features of emerging knowledge societies is to investigate the 'guiding principles' that becoming embedded in what Freeman (1988) and others have designated as a new ICT paradigm.

### 3.1 Guiding Principles

Freeman basis his analysis of the new ICT paradigm and its 'guiding principles' partly upon Schumpeter's (1947, 1961) understanding of the causes and consequences of technological change. Schumpeter suggested that periodically certain enabling technologies emerge. These technologies challenge the hegemony of former modes of social and economic organization. The gradual replacement of one paradigm by another involves shifts in social and economic organization that affect every aspect of society.

Freeman and Soete (1997) argue that the ICT paradigm is at the heart of today's knowledge societies and that this paradigm is characterized by a growing emphasis on the production and distribution of knowledge. '"Intangible" investment in new knowledge and its dissemination are the critical elements, rather than 'tangible' investment in bricks and machines' (Freeman and Soete, 1997). However, this argument is not simply focused on technology and the economy. It is not concerned only with codified digital information and its flows through networks. It is fundamentally concerned with the extent to which the emergent paradigm involves 'a new set of guiding principles' or common sense practices (Freeman, 1992a). It is an examination of these principles and practices that needs to be at the core of any assessment of today's knowledge societies. Understanding these principles and practices requires a focus on tacit understandings and the contexts in which learning and knowledge accumulation take place.

Even if emerging knowledge societies rest upon a new material factor of production, that is, relatively inexpensive microelectronics technologies and their associated digital embedding of codified knowledge (Primo Braga, 2000; KPMG, 2000), this does not mean that investment in these technologies will support the application of knowledge in ways that generate sustained social and economic development or poverty reduction. The ascendancy of the ICT paradigm and its 'guiding principles' suggests to some that investing in the new technologies and services provides a means of achieving the long awaited 'catch-up' of many of the developing countries (Goldstein and O'Connor, 2000). However, very little is understood about how this might be realised in practice.

The availability of access to digital technologies and services is not an elixir for 'catching-up'. Many kinds of action are needed to promote efforts to refashion knowledge societies so that their 'guiding principles' are consistent with generating economic prosperity and social benefit for all (Freeman, 1992b). Freeman and Soete (1994) suggest that a key 'guiding principle' is that digitally mediated interactions should not always be privileged over other forms of interactions. They advocate an emphasis on social interaction in the physically present moments of life in order to ensure that the goal of equity in social and economic development is achieved. When we focus primarily on the potential of digital technologies, it is very difficult to understand whether the 'guiding principles' of emerging knowledge societies are consistent with equity and with experiences that people value in their lives.

There may be positive changes in individuals' experiences of their lives when digital technologies are available to enable learning and the accumulation of new knowledge. However, there may be no change or only change that is regressive or harmful. Some

people may choose not to use digital technologies even when they are available to them. There may also be a wide variety of interpretations of the consequences of using the new technological systems (Silverstone, 1994; 1999; Silverstone and Haddon, 1996).

The scope for choice and variety in the 'guiding principles' within the context of knowledge societies is considerable. This is because technological innovations are humanly constituted. A given set of practices with respect to the organisation of any technologically mediated environment may come to predominate (Dosi, 1982; Dosi and Malerba, 1996; Freeman and Perez, 1988; Freeman and Soete, 1997). However, the stakeholders in society are likely to be able to imagine alternatives and to act upon them if they understand what values and preferences are being favoured and how these are influencing their lives.

The latitude for most people to make informed choices about the constitution of their knowledge societies is greater than is often assumed. Castells (2000) argues that: 'networks …. process the goals they are programmed to perform. … To assign different goals to the programme of the network …, actors will have to challenge the network from the outside'. Challenges may come from those who believe that it is possible to embed different goals or values within the technological networks of the 21st century. There is no generic 'one size fits all' model of a 21st century knowledge society, but diversity cannot be taken for granted. It must be constructed out of local values and preferences for the guiding principles and practices of knowledge societies. Garnham's (2000) observations specifically about the production and distribution of cultural commodities have broader applicability to digital information commodities and to the networks that support their production and distribution. He argues that:

> … the production and distribution of cultural commodities, what is made available for consumption and to whom, is structured - and intentionally structured - in specific, determinate ways. If the connection to individual and group identity formation is granted, then how that power of structuring works and with what effects becomes a matter of legitimate interest.

What is of 'legitimate interest' in any assessment of emerging knowledge societies is the way in which the structuring of global networks and digital information flows is informed by key guiding principles and values and how these, in turn, affect people's lives.

McLuhan (1962) claimed that 'electronic interdependence recreates the world in the image of a global village' or what we designate today as 'knowledge societies'. The development of printing and reading and the shift from orality to text was accompanied by changes in society. However, there were many distinctive aspects of how that transformation occurred. The older technologies of information exchange and communication did not produce a homogeneous global village in terms of values and preferences. A conceptual framework for understanding these structuring processes within today's emerging knowledge societies requires a way of thinking much more clearly about the technologically mediated experiences of people within their particular contexts.

## 3.2 Technologically Mediated Experience

The non-technical features of the social, cultural, economic and political milieu in which the ICT paradigm unfolds are crucial determinants of the features of emerging knowledge societies (Castells, 2000; Dutton, 1999; Kling, et al., 1999; Silverstone, 1999; Woolgar, 2002). Those who have been seeking to understand these non-technical features generally place the analysis of technological mediation at the core of their work. By examining various kinds of mediation processes, they provide numerous insights into the nature of the 'guiding principles' that we are building into our knowledge societies.

The 'guiding principles' of any society are influenced by changes in beliefs and perceptions about what is to be valued. When information exchanges and communication between people are mediated by digital technologies, in effect, digital tools and information content are inserted into our social interactions. Mediation is not simply a structural linking between people and the technical interfaces that enable them to connect to virtual spaces. Mediation involves the formation of relationships that encompass varying distributions of individual and collective power. For some observers, changes in the balance of power give rise to dystopian visions while, for others, utopian visions about future knowledge societies are favoured.

For example, scepticism about today's knowledge societies fuels dystopian visions of the ICT paradigm for writers such as Angell (2000), Metcalfe (2000), Rochlin (1997), and Wyatt, et al. (2000). The threat of surveillance and intrusions into people's private lives are accompanied by claims that the new paradigm is more likely to disempower, than to empower (Perri 6, et al., 1998; Raab and Bennett, 1998). The predominant 'guiding principles' of our technologically mediated lives are concerned with tracking and monitoring and a compelling consumer culture focused on commodified digital information.

In the utopian visions of knowledge societies it is usually suggested that the ICT paradigm will enable globally dispersed production, creating many new employment opportunities in both the industrialized and the developing countries (KPMG, 2000; Mitter and Bastos, 1999). Efficiencies derived from the use of digital technologies are expected to deliver major reductions in the costs of producing services and manufactured goods, thereby advantaging producers in developing countries (UNCTAD, 2000). Proponents of this view also envisage new opportunities for the inclusion of the poor as participants in knowledge societies through their access to distance learning (OECD, 1997, 1999, 2000). In this case, a greater intensity of technological mediation is seen as being consistent with 'guiding principles' that value all people as citizens who can participate in society.

The utopian visions are predicated on a progressive view of technological innovation. In the particular case of ICTs, as Bolter and Grusin (1999) suggest, when one technological medium is re-presented in another there is a tendency for one medium to be regarded 'as reforming or improving upon another'. They refer to this process as 'remediation' (from the Latin *remederi* - to heal or restore to health. Increasingly, they argue, there is an expectation that the availability of digital technologies will unquestionably offer an improvement over earlier media for information exchange or communication. This reasoning suggests, for example, that Internet-based e-

commerce or e-education applications are always an improvement over earlier types of commerce or education delivery. However, when it is acknowledged that the behavioural and cognitive outcomes associated with the use of new technologies can diverge substantially from those that were initially intended (Bijker, Hughes and Pinch, 1987; Hughes, 1987; Mansell and Silverstone, 1996), it is clear that this progressive view of developments in ICTs should be questioned. Similarly, dystopian views must be challenged since it is feasible for the initial intentions of technology designers to fail and for users to subvert or resist them. In order to clarify which developments of the ICT paradigm are likely to be favoured and those that are likely to be resisted it is essential to consider the changes in the 'guiding principles' and practices that are valued by potential users.

There is, in fact, considerable latitude for social actors to make choices about the design of their knowledge societies and about the extent to which these societies rely on technological mediation. In assessing the 'guiding principles' of emerging knowledge societies through the lens of the values and practices associated with technological mediation, we can acknowledge that technology is humanly constituted within diverse social and cultural systems. The Internet and other new digital services and applications are not autonomous forces that act on people. The technological system and the guiding principles associated with it are socially constructed. They can be altered, abandoned, or subordinated to diverse cultural, social and economic values. If the causes and consequences of emergent knowledge societies are to be assessed realistically in terms of their implications for human welfare, we need to examine the various mediation processes that are embedded in them.

### 3.3 Mediation Processes in Perspective

The concept of mediation is central to any conceptual framework that is to guide an assessment of the 'guiding principles' or values that are becoming embodied in 21st century knowledge societies. Mediation refers to a dynamic relational process that binds (or unbinds) networks of individuals or institutions (Coleman, 1994; Cooley and Nam, 1998; Cosimano, 1996; Meyrowitz, 1994). It involves interactions within and between the social, political, economic and technical realms. The way these interactions produce, reproduce and transform the power relations within the social and economic order when they occur in the physical presence of others is reasonably well understood. We also know a considerable amount about technological mediation processes that are experienced through older ICTs such as television, radio and pre-Internet networks (Goffman, 1963; LeFebvre, 1991; Meyrowitz, 1985). We know much less about how mediation processes operate when our relationships are mediated by digital technologies and the online spaces created by the Internet (Bolter, 1999; Mitchell, 1996; Shapiro and Varian, 1998, Thompson 1995).

When mediation occurs through software, computing, or telecommunication systems, it involves more than changes in the linkages between people and the technical interfaces supported by digital technologies (Kim, 2000; Kollock, 1994, 1999; Mitchell, 1996, 1999; Rheingold, 2000). Mediation in electronic space creates the possibility for many new patterns of communication and information exchange. Some analysts argue that these new patterns contain the seeds for the transformation of all aspects of the processes of knowledge creation and application (Brown and Duguid,

1998; Shapiro and Leone, 1999; Gibbons, 1994). Indeed, there is considerable evidence of change in business and other organisational processes, in governance systems, and in the social and cultural systems in the early part of the 21st century. The new technologies offer the potential for forging network relationships that span the globe and that are not tied to physical places or time-bound in the same way as in the past (Cairncross, 1998; Leadbeater, 1999; Negroponte, 1995; Tapscott, 1995; Tapscott, et al., 2000). Because of the limitations of the existing evidence base, what we do not know is how the 'guiding principles' that are embedded in the newer technological systems are affecting people's everyday lives.

Some people find it difficult to imagine how the use of a digital interface with the World Wide Web, for example, can influence people's experience of their economic and social interactions or how people live and act upon the world. However, digital information may be held in many forms including Web pages, CD-ROMs and on-line databases. Technological mediation 'involves literally putting a message into media, or encoding a message into electronic, magnetic, or optical patterns of storage and transmittal' (December, 1995). This can be done in many different ways (Lessig, 1999). Some of these will favour certain linguistic groups and syntaxes over others and some will favour the production of certain types of content over others. The selection of alternatives can lead to different outcomes in terms of the technologically mediated experience of individuals and in terms of social and economic outcomes for society as a whole.

The research literature on the characteristics of computer-mediated communication provides insights into the implications of the way that digital information is structured. Different technically mediated environments are experienced in very specific ways (Steuer 1992; Sheridan, 1992; Lombard and Ditton, 1997). Technological mediation involves a process of enabling people to make sense of their world through a variety of means of expression and interaction. Technologically mediated communication and information exchange have the potential to shape and transform social and economic activity. The specific ways in which this occurs and the outcomes depend on more than the characteristics of the technological mediation process itself. They depend crucially on the cultural, social, political and economic characteristics of non-technologically mediated contexts.

Whether new and valued knowledge emerges as a result of people's technologically mediated interactions depends on a host of non-technical factors. As Brown and Duguid (1998) argue, the technological mediation process that underpins digital information production and consumption must not be confused with the process of knowledge accumulation itself. As they put it,

> It is a mistake to equate knowledge and information and to assume that difficulties can be overcome with information technologies. New knowledge is continuously being produced and developed in the different communities of practice throughout an organization. The challenge occurs in evaluating it and moving it. New knowledge is not capable of the sorts of friction-free movement usually attributed to information. Moreover, because moving knowledge between communities and synthesizing it take a great deal of work, deciding what to invest time and effort in as well as determining what to act upon is a critical task for management.

The knowledge production and consumption process is influenced by the way tacit knowledge and learning occur. If digital information is to be successfully transformed into useful knowledge – and especially knowledge that can be shared across different contexts – then the nature of the tacit, uncodified, processes of learning must be given as much attention as the technologically mediated processes (Cohendet and Steinmueller, 2000; Mansell, 2002).

The kinds of knowledge production and consumption that lead to socially or economically valued action involve learning processes that can only partly be explained by observations about the 'guiding principles' that are embedded in the new technologies. Following Boisot (1998), 'information is something that is extracted from data in order to modify knowledge structures'. But this process does not occur automatically. The expansion of information processing activities based on the ICT paradigm is mainly concerned with achieving data-processing economies and transactional efficiencies. The bias is towards the codification of information. This bias tends to neglect the tacit features of the learning process. Boisot suggests that this bias needs to be 'counterbalanced by a greater organizational investment in uncodified forms of knowledge, in exploratory as well as exploitative learning, and in the cultural values and beliefs that make these possible'.

This indicates that the evidence base for assessing the characteristics of knowledge societies must contain observations not only with respect to the digital technologies that enable the codification of knowledge but also with respect to the tacit environments that play a substantial role in enabling information to be transformed into socially or economically valued knowledge.

Knowledge is generated and absorbed as a result of the negotiation of relationships through dialogue with others. Buber (1970) argued that 'in the beginning is the relation' and his interest was in how human experiences are informed by dialogue. When participation in a dialogue is mediated by electronic mail or the interfaces of the Web we establish new kinds of relationships and our on- and off-line dialogues are becoming tightly interwoven. As Silverstone (2003) argues, drawing on the work of Thompson (1995) and Martin-Barbero (1993), 'mediation is a fundamentally dialectical notion which requires us to address the processes of communication as both institutionally and technologically driven and embedded'. In some cases, these processes may be empowering, but, in other instances, they may be disempowering.

The processes of knowledge production and consumption occur at the individual, intra- and inter-organisational levels. They involve learning processes that may be highly situated and local as shown in Table 1. Learning may also occur on a collective or institutional basis. The third column of Table 1 suggests that the nature of technological mediation within this learning process will be influenced by the specific 'guiding principles' and norms and practices associated with the particular designs and uses of ICT systems. In addition, learning and knowledge accumulation will involve the negotiation of relationships. Only some of these relationships will occur through technological mediation and the codification of digital information. Relationships within the off-line world will influence the social and economic outcomes arising from access to digital information and networks because of the power relationships that are constituted within the learning process.

**Table 1: Building Capabilities for Knowledge Societies**

| Level of Analysis | Learning | Technological Mediation |
|---|---|---|
| Individual | Situated and local learning | Guiding principles; norms and practices of ICT development and use. |
| Intra-organisational | Situated and local/collective and institutional | Guiding principles, norms and practices governing ICT use within organizational boundaries |
| Inter-organisational | Local/Collective and institutional | Guiding principles, norms and practices governing ICT use between organisations. |

Whether ICT-based learning opportunities lead to the accumulation of knowledge that has the potential for improving human welfare depends upon the way technological mediation interacts with the non-technologically mediated world (Mansell, 2002; Millar, 2002). There is a growing recognition in the literature on 'knowledge management' that the tacit nature of knowledge is a very important factor in determining how people learn and act upon the world (Cohendet and Steinmueller, 2000; Eliasson, 1990; Neef, 1998; Nonaka and Takeuchi, 1995; Steinmueller, 2000). For an assessment of the characteristics of emerging knowledge societies, it is crucial to examine the influence of the values and norms embedded in the new ICT paradigm and how these are combined with the values and norms embedded in earlier ways of organising society.

The conceptual framework presented in this section emphasises technological mediation, its structures, processes, and patterns alongside non-technologically mediated relationships. Examining the features of technological mediation in emerging knowledge societies and the conventional ways of building relationships through dialogue offers a means of revealing the dynamics that are at the core of today's knowledge societies. The application of this framework gives rise to questions that can be considered in the light of the accumulating evidence base on the most predominant features of emerging knowledge societies. For example:

- What values and perceptions about technologically mediated interactions are embedded in a given ICT system or application?
- How are these likely to be valued by the intended users?
- What alternatives exist to the predominant ICT system or application?
- What characteristics of the non-technologically mediated learning environment are present?
- How do these interact with the technologically mediated environment?
- How is the process of knowledge production and consumption structured and by whom?
- What alternatives exist and who values those alternatives?

The next section provides some evidence of the extent of the 'digital divide'. It suggests that there is an urgent need to move beyond a simple focus on the technological features of this divide.

## 4 'Digital Divides' in Perspective

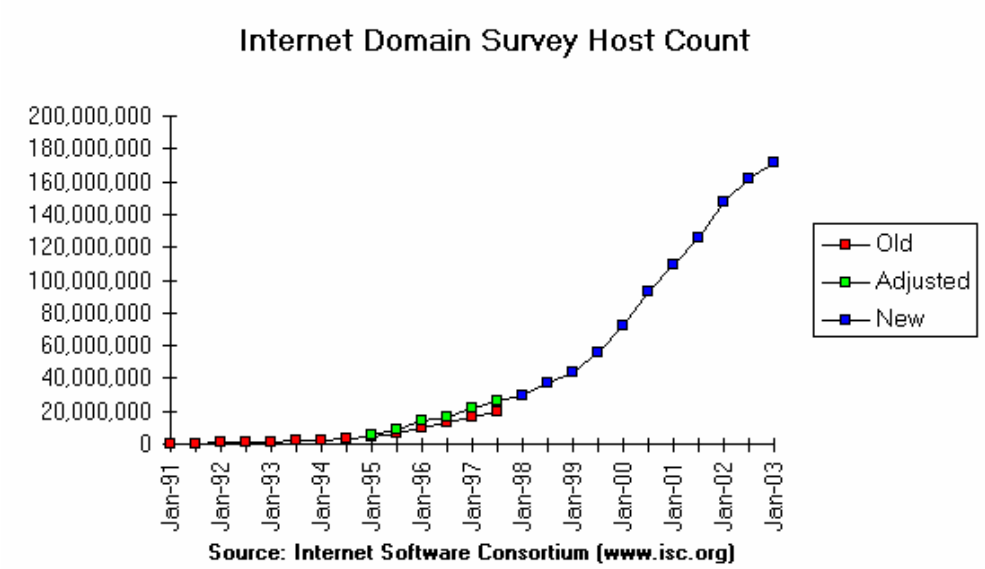
The promotion of 21st century knowledge societies (or information societies) has reached a prominent position on the policy agendas of most countries and it is very high on the international policy agenda. A substantial amount of attention is being given to the need to invest in ICTs in order to give more people access to the digital tools that enable access to digital information resources.

The United Nations High Level Panel on Information and Communication Technologies, for example, has concluded that many benefits would follow from increasing investment in ICTs as a means of connecting to and participating in the today's societies (United Nations, 2000). This view was echoed in the United Kingdom's Government White Paper on 'Making Globalisation Work for the Poor'(Department for International Development, 2000) and it is present in the policy statements of many other industrialised and developing countries. The focus of the G-8 Digital Opportunities Task Force (2002) is on 'e-development' including ICT access and connectivity for health, education and skills-building initiatives. Viewing ICTs as a great potential 'equaliser', policy often focuses on resolving the obstacles to the spread of digital technologies and on taking advantage of 'digital opportunities'. There are many different applications of digital technologies, but much of the policy discussion focuses on whether the Internet can provide people with improved access to information resources that will enable them to become effective participants in their knowledge societies.

Figure 1 shows the rate of increase in the numbers of top level Internet Domain Name hosts from 1991 to 2003. By January 2003 there were estimated to be a total of 171, 638, 297 top level hosts. The growth since 1996 in the numbers of registered hosts that enable people to access the Internet has been enormous.

Figure 2 shows the distribution of these hosts. The results of the January 2003 survey of Domain Name Hosts show that hosts assigned country names in the industrialised world account for 26.2% of the total of 171, 638, 297 top level hosts. Hosts assigned developing country names account for only 2.4% of these names and the Central and Eastern European Countries (CEEC) account for only 1.4% of these names. Figure 2 also shows that the number of hosts in the Business/Commercial (aero, biz, com) and Organisation (net, pro, org, name, int, coop, aq) categories account for a substantial share of the total hosts. Hosts opting to register under the domain names of .info, .edu, or .museum, that is, the Educational or Informational categories account for only 4.4% of the total.

**Figure 1: Internet Domain Survey Host Count, 1991-2003**



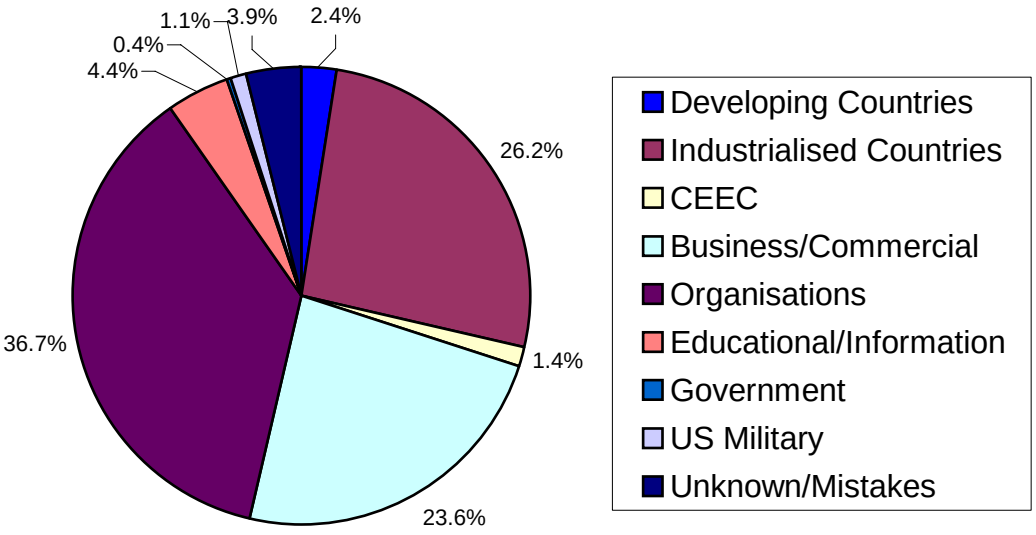

Source: Internet Software Consortium, http://www.isc.org/ds/ accessed 15 February 2003.

Hosts involved in activities relating to learning and knowledge generating activities can register under other domain names at the top level, but these data indicate the overwhelming predominance of industrialised countries and the importance of business as compared to other activities on the Internet. There is a 'digital divide' between the wealthy and poor countries and, although not indicated by these data, within countries and regions.

The majority of the content of the World Wide Web is produced in the English language and this creates a major barrier for many potential users. Figure 3 shows changes in the propensity of Web users to choose to surf the Web using one of the languages supported by the Google search engine. Between March 2001 and January 2003, although English continued to be the predominant search language, there was a slight increase in the use of non-English search languages. This may suggest that a key barrier to accessing the technologically mediated environments of knowledge societies is declining to some extent.

Obtaining access to the Internet may lead to substantial cost-savings for users as a result of their use of electronic mail or information that is mounted on the Web. However, as the *1999 UN Human Development Report* noted, it should not be assumed that the presence of a network and computers means that ICTs are accessible for all users. Cultural, gender, and institutional norms and practices can create barriers to access even when it is technically available. In addition, the prices paid by businesses and many citizens for Internet access are prohibitively high in poor countries (see Table 2). The cost of personal computers also can represent more than a year's salary for people in many developing countries.

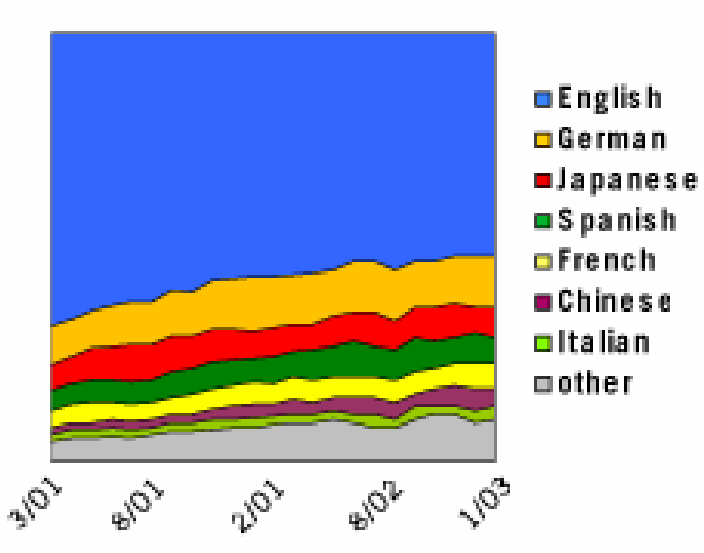
**Figure 2: Top Level Internet Domain Name Hosts by Category, January 2003**




Note: For the Internet Domain Name Survey methodology which counts the number of IP addresses that have been assigned a name, see sources. Total Top Level Hosts = 171, 638, 297. Business = aero, biz, com; Organisations = net, pro, org, name, int, coop, aq; Educational = info, edu, museum; Government = gov; Unknown= unknown, arpa.

Source: http://ixos.turkuamk.fi/users/S058S01/PikkiS/factsoftheintern.htm accessed 15 February 2003; http://www.isc.org/ds/WWW-200301/dist-byname.html data for January 2003.

**Figure 3: Languages Used to Access Google - March 2001 - January 2003**




Source: Google, http://www.google.com/press/zeitgeist.html ,accessed 15 February 2003.

**Table 2 Monthly Internet Access Prices in Selected OECD and African Countries**

| OECD | USD | % of GDP per Capita | Africa | USD | % of GDP per Capita |
|---|---|---|---|---|---|
| Mexico | 94 | 14.8 | Uganda | 92 | 107.0 |
| Turkey | 65 | 12.8 | Guinea | 65 | 45.3 |
| Japan | 50 | 2.6 | Sierra Leone | 50 | 118.0 |
| Finland | 33 | 2.2 | Ethiopia | 32 | 76.8 |
| US | 29 | 1.2 | Mozambique | 29 | 69.6 |
| Australia | 24 | 1.5 | Senegal | 24 | 17.6 |

Note: Comparisons need to be interpreted with caution due to data reliability problems and variations over time.
Source: Commonwealth Working Group on Electronic Commerce (2000), p. 41.

In addition, greater connectivity is often associated with an increase in the supply of digital information and expectations for improved economic performance. However, the empirical relationship between ICT investment by a country and its economic performance is difficult to demonstrate empirically. Most attempts to do so employ aggregate statistical indicators to assess productivity gains or they examine case study evidence. These studies highlight the ambiguity of the relationship between investment in the new technologies and the consequences for the economy or society as a whole (Affuso and Waverman 2002, Brynjolfsson, and Kahin 2002, Mansell 2002). Given the uncertain relationship between investment and outcomes, it is difficult to promote policies in cases where ICT investment is given a higher priority than, for example, investment in clean water, secure food supplies, or electrical power and the transport infrastructure.

Policy to promote the development of the ICT infrastructure traditionally has focused on universal access for individuals to telecommunication or Internet services. Collective models of access provision have been developed in recent years especially through the use of cybercafés operated by entrepreneurs and through public-private partnerships to equip schools and other public institutions with the basic tools for participating in technologically mediated knowledge societies. However, there is a continuing need to strengthen the capabilities of those who have to consider the investment options and to choose ICT solutions that are responsive to people's needs and values (MacLean et al. 2002). Policy should be guided by whether ICT applications are responsive to social or economic problems, not to a technological imperative to invest (Mansell 2001). The emphasis needs to be placed on the specific ways in which ICTs can be used to mediate human relationships and on the consequences of these forms of mediation in people's lives.

Despite their high level of aggregation, these data indicate the persistence of barriers to participation in the technologically mediated world of the 21st century. The policy implication, especially in the context of knowledge societies discussions, is that much greater effort should be made to create new opportunities for ICT mediated learning. The goal is to strengthen the knowledge base of those who are disadvantaged or marginalized in their societies and to build an appropriate knowledge base to sustain economic growth and social development overall.

The 'digital divide' means there is a substantial risk that those without access to the Internet or other forms of technologies are being marginalized and excluded from society. Access to networks and digital information does need to be extended to reduce these 'digital divides'. However, the discussion in the preceding sections of this paper highlights the fact that ICTs have 'guiding principles' embedded within them and these need to be taken into account. These technologies can serve only as potential enablers of learning and knowledge accumulation. The Internet may allow users to participate in a global space, but this space is not value neutral. The values and power relationships embedded in the technological system that supports 21st century knowledge societies have implications for the kinds of social and economic development that occurs, for the extent of information sharing that is possible, and for the kinds of education and learning that are feasible.

The next section considers several key areas that are being targeted to encourage the use of ICTs – including the Internet – to support information sharing that has the potential to strengthen the knowledge base.

## 5 Strengthening the Knowledge Base of 21st Century Societies

One of the advantages of the spread of the Internet – even if this is very unevenly distributed – is that it appears to provide a technological infrastructure for substantially improved knowledge sharing. In the light of the conceptual framework set out in section 3 of this paper with its emphasis on the codified and tacit aspects of knowledge, it is clear that investment in ICTs can be expected to address only one aspect of the prospects for improved knowledge sharing. The new technologies provide access to potentially vast amounts of digital information and this information can be circulated at very low cost by taking advantage of the features of the Internet. However, improved information access requires that information be structured and managed in a meaningful way and that it be offered in ways that do not make it prohibitively expensive for users.

Some initiatives are being developed to promote improved sharing of digital information resources by using digital technologies to support access to the information that is stored in libraries. One goal is to constitute a large distributed virtual collection of digital information (Web-Based Education Commission, 2000). Distributed libraries within a global electronic network could be interconnected with local electronic libraries. Although it is technically feasible to distribute the world's stocks of library information around the world, there are substantial barriers. One of these is the increasing effort to enforce copyright on digital intellectual works. The ascendancy of the 'guiding principle' that insists that intellectual property rights in digital information should be extended and enforced to a greater degree than ever before is a prominent feature of 21st century knowledge societies. Substantial barriers to knowledge sharing are also attributable to a continuing failure to invest adequately in information access centres in areas that are most affected by the 'digital divide' and in the information content that would support citizen's needs for information that is applicable in their local contexts.

## 5.1 Digital information resources and information sharing

The major producers of digital information products (including software) are very actively seeking to strengthen intellectual property protection. They are calling upon governments to ensure that international conventions and national legislation are updated and enforced. At the same time, they are distributing content (and software) 'free' in a bid to sell a growing number of ancillary services (Mansell and Steinmueller, 1995, 2000). The perspectives of the creators of digital information differ as to the benefits and costs of the enforcement of intellectual property rights depending on several factors.

For instance, many individuals benefit from ensuring that the information they create is distributed in the public domain. When people use public domain information they make little or no use of available copyright protection or they develop new approaches such as in the case of 'copyleft' for software and the Open Source Movement and 'Free' Software Movement developments (Weber, 2000). Contributors to public domain information benefit from the dissemination of their work in ways that are indirectly related, or completely unrelated, to their receipt of revenue or income. Examples include the researcher who disseminates scientific data, individuals exchanging political viewpoints, or teachers sharing insights on education. Generally, these kinds of information creators support the inexpensive distribution of information and they have little interest in copyright protection.

The Internet makes it possible to copy information essentially for free and this is posing new challenges for digital information owners, creators, sellers, and users of intellectual property. Although the production costs of digital information are falling, the costs of searching for relevant information, and of defining problems and questions are growing (Dyson, 1998). Although much information is being provided 'free', this is increasingly serving as advertising for related services such as support, aggregation, filtering, assembly and integration of information.

Citizens and researchers in developing countries may benefit from the growing amounts of digital information in the public domain. However, they also face high charges because of the relatively high costs of software, personal computers and telecommunication services in relation to their incomes. Having to pay royalties to copyright holders can put useful information out of their reach regardless of its potential value. For citizens and firms in developing countries the cost of infringement of copyright increases as intellectual property protection is strengthened. These costs may take the form of trade sanctions that are threatened or applied or the costs of defences against claims of infringement (Commission on Intellectual Property Rights, 2002).

In the United States and most other countries provisions exist for 'fair use' of protected materials as long as copying or downloading of legally protected information is not done for commercial reasons (Lessig, 2001). The so-called doctrine of 'fair use' (with various limitations and conditions) permits reproduction for research, teaching and scholarship, comment and criticism, and news reporting. The increasing use of technical means of rights protection and of tracking transactions and licensing is reducing the application and scope of the 'fair use' doctrine. The Campaign for Communication Rights in the Information Society (CRIS, 2002;

Hamelink, 2002) has these and related issues at the centre of its agenda of advocacy of a wider sphere for the production and consumption of public domain information.

In general, the tensions between the major digital information producers who offer their products in the commercial marketplace and those who favour an open, peer-to-peer model of information exchange are likely to grow. The greater the effort to extend and enforce intellectual property rights in digital information, the more restricted is the potential for using the digital 'tools' to promote widespread information sharing.

## 5.2 Information access centres for citizens

There are efforts to create opportunities for improved access by citizens to digital information resources that can be shared within communities and which can play a role in building a stronger knowledge base. The promotion of telecentres represents one type of effort to build information sharing capabilities (Benjamin, 2002). Improving the capabilities of citizens to access, manage and communicate digital information is important for enabling citizens to participate in their emerging knowledge societies. Community information centres can support information sharing and exchange. Such centres can also support public access to a mix of government and related information services.

Telecentre initiatives in some developing countries are providing new models for private and public investment as well as for public and private partnerships (Murray, 2002; Murray, et al., 2002). When they are successful, they can contribute to the development knowledge societies by supporting community information sharing, citizen access to local and global communities and various kinds of education and training. However, the sustainability of information access centres depends upon the type of organisation (commercial, school, municipal, community centre, etc.) that is involved and on the role of the market. A major issue is whether commercial viability can be established. When it cannot be, there are issues of how to justify public funding and subsidies for access to digital information (Mansell, et al., 2003).

Efforts to justify public investment in e-government require a demonstration that these services can help to improve citizen access to information that they value. In most cases, the 'guiding principles' for these services do not give a high priority to transparency or to local needs (Mansell and Nikolychuk, 2002; National Audit Office, 2002). Even if the potential exists for ICT applications to be enabling and empowering, this expectation is not always being fulfilled in practice. Some new e-government and e-democracy services are enabling increased decentralisation and empowerment of the poor, but many do not develop in this way (Tambini, 1999). Technologically mediated services in this area are likely to enable greater citizen participation in knowledge societies only if enabling conditions are put in place. These conditions include principles for freedom of association and laws and regulations that create possibilities for citizen participation (Norris, 2001).

Strategic initiatives to foster knowledge societies also require high levels of commitment and leadership. Creating conditions for the empowerment of communities and citizens through the application of the digital technologies requires

fostering citizenship and cultural identity as well as some kind of authoritative leadership (Steinmueller, 2002). As in other areas of ICT investment, information access centres and services that are intended to facilitate citizen access to digital information and to facilitate information sharing do not automatically lead to effective knowledge creation or application. To achieve this goal, capability building initiatives are needed in many areas.

## 6 Building Capabilities for Knowledge Societies

Access to digital information resources alone does not provide a basis for transforming digital information into useful knowledge. In the knowledge societies of the 21st century human capabilities are as important, if not more important, than the technologies. Capabilities are needed to establish policy, to mobilise resources locally and globally, to define information needs and the kinds of knowledge societies that people will value and accept, and to develop technologically mediated solutions that are responsive to those needs and values.

There are many examples of efforts to use digital technologies to provide improved content for general education and ICT-specific skills training. Many of these initiatives are sponsored by a variety of public and private sector organisations and multi-lateral agencies. Some are aimed at strengthening education for those who are marginalized; others are tailored to building a highly skilled workforce in areas that have been targeted for social or economic development.

The models for developing ICT-supported education and training vary enormously. For instance,

- In the Pacific Islands, virtual education services are being provided by the Extension Unit of the University of the South Pacific in Fiji using satellite connections (Rajasingham, 1999).
- The M.S. Swminathan Research Foundation in South India is supporting the Village Information Project in Pondicherry (Shadrach, 2002).
- World Links for Development (WorLD) provides Internet connectivity and training for teachers, teacher trainers and students, sponsored by the World Bank Institute (2003).
- The WorldSpace Foundation (2003) is developing an Africa Learning Channel using satellite-based village radio receivers and combines content from NGOs and other producers.

Although ICTs are being used to provide opportunities for capability building, there are major constraints on the scale and scope of such initiatives. Copyright on the use of instructional products and materials can restrict information sharing. The costs of implementing distance education and training programmes are high and the initial hardware, operating software, and instructional materials often require funding that exceeds the available resources. In addition, support for learners is often not consistent with the demands of learning in technologically mediated environments. Teachers may be reticent to embrace the use of ICTs, pedagogical approaches may not be consistent with interactive digital media structures or content, and there may be

strong preferences for face-to-face learning when teachers and learners are given a choice (see Farrell, et al., 1999; Commonwealth Secretariat, 2001).

With respect to all aspects of capability building for knowledge societies, as Heeks (1999) argues,

> IT on its own does not do anything useful; in order to do anything, it must become part of an information system; information systems do not necessarily involve computers and telecommunication equipment; even when they do, information systems are much more than just IT because they involve people and their actions.

As in the earlier sections of this paper, Heeks emphasises that learning environments must take account of all facets of the 'information system' – both the technologically mediated and the conventional settings in which knowledge is produced and consumed. While distance learning using the Internet can bring new information to hospitals and schools, education and training requires more than digital information delivery. Effective learning involves building relationships within and beyond the boundaries of organisations and these must be fostered through time. In addition, even universal access to digital information will not be meaningful for people whose education and training does not permit them to use it effectively. In order to transform digital information resources into useful knowledge there are significant costs that must be incurred. These costs include those associated with skills development and support services. They include costs associated with the requirement for a reasonable level of literacy. It may be possible to develop 'texts' and user interfaces based on pictographic and audio-visual information, but the vast majority of the world's illiterate populations are excluded from using text-based digital information services. In addition, digital information access needs to be customised to the needs of users. In most cases, customisation is being left to market forces. Although many institutions are moving into the field of distance education, they often draw on non-specialist resources and do not to tailor their digital products to local needs.

There is a relatively clear collective vision of a 'knowledge society' in the discourse on policy at the highest levels (Digital Opportunities Task Force, 2001a, b). This envisages a society where digital technologies play a significant role in enabling people to improve their social and economic circumstances. But at the level of investment and implementation, there is a considerable risk that technological solutions will be unresponsive to local needs and values. If citizens fail to see positive changes in their standards of living and quality of life as a result of investment, then growing levels of cynicism can be expected. There is also a risk that the absorption capacity of some of the poorest countries will be stretched by the many fragmented initiatives to invest in digital technologies (Okpaku, 2002).

The UNESCO 'World Report on Knowledge Societies' creates an opportunity to assess the extent to which universal access to the technologically mediated networks that support emerging knowledge societies is being achieved as well as the consequences. It offers the opportunity to move beyond a focus on the 'digital divide'. This can be done by examining how people are producing and absorbing digital information from local and distant sources in contexts where there are opportunities to learn and to pursue lifelong education. If provides a good opportunity to assess

whether or not the digital technologies are being used effectively to transform universities and to devise new educational methods and means of promoting the discovery and application of new knowledge.

By sifting through the accumulating evidence base on the role that the Internet and other digital technologies are playing in producing and consuming digital information there will be instances of successful capacity building for implementing sustainable knowledge societies. However, there will also be evidence of failures. This paper provides a framework for examining the determinants of both the successes and failures. This will provide insight into the strategies that can be used to avoid an over-reliance on technological mediation and an insensitivity to the values of those who are involved in building knowledge societies. The production of the UNESCO World Report in 2003 offers a possibility for critically reflecting on how the new 'guiding principles' are becoming embedded in ICT-mediated initiatives for education and lifelong learning. There will be scope for proposing alternatives in cases where these principles are inconsistent with enabling people to benefit from their access to emerging knowledge societies.

## 7 Conclusion

In countries and regions around the world, people have very different goals, visions and priorities for their knowledge societies of the 21st century. Even in the most intensely technologically mediated environments, digital technologies and networks cannot support all aspects of learning that leads to the effective production or application of knowledge. The conceptual framework that is set out in this paper emphasises two issues of fundamental importance for the future of knowledge societies.

The first is the need to assess the 'guiding principles' and practices that are embedded in the knowledge societies of the 21st century. These principles cannot be discerned by examining technology 'impacts'. This is because these principles include social and cultural values, perceptions of ethical behaviour, and commercial norms and standards. These principles become embedded within the technological landscape as a result of numerous dialogues and actions. The principles reflect the views of the prevailing stakeholders about those aspects of our non-technologically mediated world that are to be valued. Where those values restrict access to digital information resources or exclude people because they are inconsistent with what they value, then investment in ICTs will not lead to effective learning.

The second is the need to devise improved means of examining how technological mediation is influencing social and economic relationships of all kinds. A focus on the changes in the perceptions, beliefs and attitudes of those who are living their lives through the lens of technological mediation can shed new light on how knowledge societies are evolving. Comparisons of the experiences of learning through technological mediation and other forms of learning will make it feasible to assess whether ICT solutions are, in fact, the best way to encourage knowledge creation and application.

Castells (1998) argues that ICTs have become 'the indispensable tool for the effective implementation of processes of socio-economic restructuring … The prevailing networking logic transforms all domains of social and economic life'. However, the ICT paradigm will not itself cause our societies to be more equitable and inclusive than they have been in the past. The chance to apply these technologies in ways that are enabling rather than disabling depends on how they are used and what values become embedded in them.

Critical reflection on the accumulating experience of the knowledge societies of the 21st century is essential if we are to ensure that the new 'guiding principles' are those which are valued by the majority of people. The knowledge societies of today represent a departure from the past in terms of the global spread of networks and the very low costs of producing and distributing information. However, as choices are made about the design and use of ICTs, many of the predominant 'guiding principles' of the knowledge societies of the past are being re-embedded in today's digital applications and systems. This gives rise to the risk that existing social and economic problems will be perpetuated even as the use of the new technologies creates very great potential to access digital information resources. Whether the ICT paradigm becomes advantageous for all the world's people will be a reflection of the choices of the values that become embedded in the technologically mediated systems that underpin our 21st century knowledge societies.

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**Notes**

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