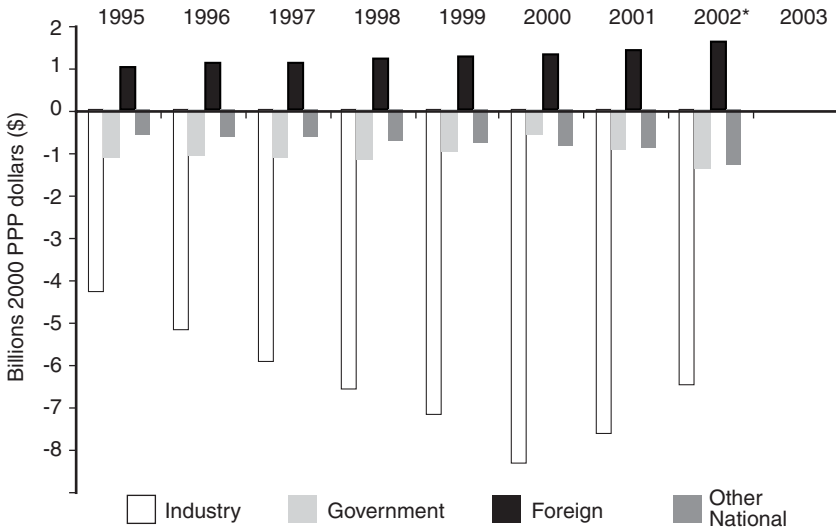
and a couple of large firms outside of this sector are still involved in the funding and carrying out of fundamental research, as reflected e.g. in authorship of scientific publications. And even in those cases, firms rely heavily on outside, mostly public sources of fundamental research. For most firms the increased complexity of science and technology has meant a greater focus on applied and development research and a more explicit reliance on external, university or other, often public, knowledge centres for more fundamental research input. In line with what was discussed above, firms increasingly "shop" on the world market for access to basic and fundamental research and chose the best locations to locate their R&D laboratories. In doing so they will not only hope to make their own, in-house R&D more efficient, but also look to the efficiency, quality, and dynamics of the external, local knowledge institutions, such as universities and public R&D institutions.

Figure 4.2B Gap in EU25—US R&D financing



Source: OECD-MSTI. 2002* MERIT estimate. 2003 not available.

At the other end of the spectrum, over the 1980s and 1990s in most European countries public knowledge investments in universities and other public research institutes became subject to increased national public scrutiny, systematic performance assessment and academic peer

review. As a result academic performance became even more explicitly the dominant incentive in public research institutes: applied, more immediate relevant research became second rated. Effectively it could be said that applied research became "crowded out" of the university environment. Today, the actual national performance of scientific research, measured, for example, in terms of the number of publications per researcher, or per million of euros spent on public R&D is actually not inferior in Europe to that of the United States. Throughout the years, with the increasing dominance of English as the language of scientific communication, the growth in the total "production" of internationally read and reviewed scientific articles in Europe has been much higher than in the United States.

One characteristic of public research is, to some extent, its national embeddedness.[8] From this perspective, the policy towards increasing "competition" between national universities and public research centers, led undoubtedly to important quality impulses to public research in many European countries, but did ultimately *not* lead to specialization of research in Europe[9] but rather, one might argue, to further research duplication. Practically every national university jumped on the same, new, promising research areas (life sciences, nanotechnology, information technology, new materials, etc.), competing nationally, Europe-wide and world-wide to recruit leading researchers. This resulted in a multitude of different, relatively small research groups, each of them seeking additional funding and networks through European funding programs.

The opposing "crowding out" trends in the nature of private research dominated by internationalization and specialization on the one hand and public research dominated by nationalization and duplication on the other hand, warrant a policy of activating public, fundamental research institutions in playing their role in a much more

[8] As a parenthesis, it can be noted that, based on this perspective, the concept of "*national* systems of innovation" developed by (primarily European) authors in the innovation literature such as Christopher Freeman, Charles Edquist, Bengt-Ake Lundvall and Richard Nelson: differences between countries in the set-up and nature of *national* institutions, in particular university education and the public research infrastructure, seems to be able to explain to a large extent differences between countries in innovation strength.

[9] With only a couple of exceptions in areas of so-called "big science" where the use of large instruments and other expensive infrastructures warrants ultimately close cooperation between different countries scientific communities.

dynamic fashion as local attractors of private R&D activities and generators of private firms' research renewal. In short, the activating knowledge policies falling under this heading have to deal with (re-) activating the formal and informal connections between the public and private knowledge investment of the various European "national" systems of innovation. The building of such new formal bridges could take various forms, exploiting to the maximum the institutional variety in Europe. One may think of the technology platforms currently proposed by the EC. Topics should obviously not only include private sector research interests but also public research interests (security, mobility, etc.). Alongside such re-activating linkage policies, one should also focus on activating all other forms of joint knowledge production policies: e.g. policies providing stronger and more effective incentives for scientific entrepreneurs, policies aimed at increasing mobility between public and private research labs, policies opening up private research labs to public (and other private) research interests, etc.

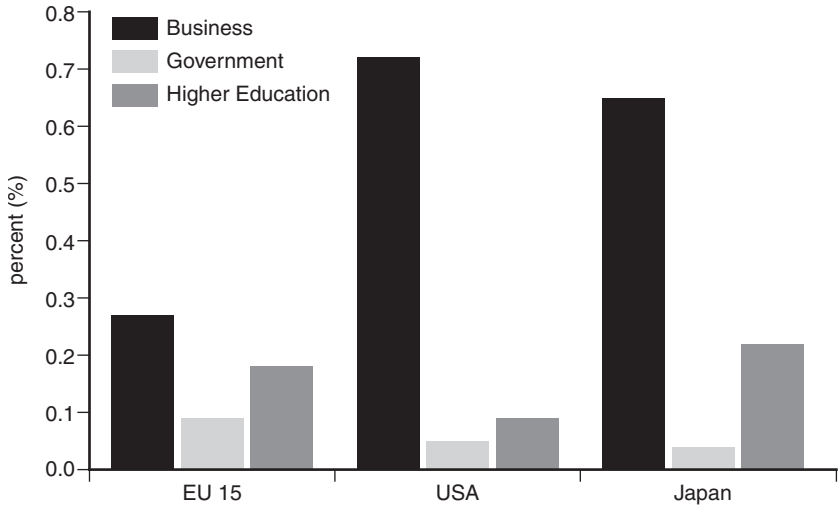
4. Activating Human Knowledge

In the end, private or public research investments depend to a large extent on the availability of highly qualified research personnel. The greatest part of research expenditures, about 70% of total R&D resources on average, goes to the salaries of research personnel. The available data on scientific personnel, formalized under the term "scientists & engineers" (S&E) presented in Figure 4.3, point again to an increasing gap between the U.S. and Europe in privately oriented research. Not only is the percentage of S&E in total employment in the private sector 2 to 3 times higher in the U.S. and Japan than in Europe, but its growth is also significantly lower in Europe than in those countries.

The availability of sufficiently qualified personnel is central in the development of any "sustainable" knowledge economy, also within the context of the Barcelona objective. Without the availability of highly qualified research personnel, the aim to increase substantially knowledge investments in less than a decade, will merely lead to a tighter labor market for S&E and the "poaching" of personnel by the private sector from universities and other public research centres or between European countries. Looking at the current labor costs for R&D per-

sonnel, realization of the Barcelona objective implies a need for an additional supply of researchers between now and 2010 of between 500,000 and 800,000 full-time equivalents[10] (EU Gago Report, 2004). This should be added to the specific European problem of an aging population, which also affects the knowledge sector: from the growing shortage of teachers in a large number of European countries to the rapid increase in the greying of academic staff in practically all European countries.

Figure 4.3 S&E as % of labour force (growth rates 1995-2000)



Two factors appear to be of primordial importance in this discussion. On the one hand, the capacity of a country's own educational system to deliver, year upon year, new cohorts of highly-qualified, scientists and engineers; and on the other hand, the attractiveness and dynamism of the profession of researcher and the attractiveness of the surrounding environment—the quality of the local physical environment, facilities available, presence of other research labs, etc.

[10] Based on the broad estimations made in the so-called Gago High Level Expert Group, *Europe needs more scientists*, DG Research, April 2004.

1. When referring to the supply of S&E within a country, use is sometimes made of the 'pipeline' analogy, which illustrates how, from secondary education onwards, the flow of scientifically trained S&E finally seeps through to the various components of the R&D world. A number of factors will be important in the flow of sufficient S&E supply to, for example, the private R&D sector, despite a decreasing inflow following e.g. demographic factors at the beginning of the pipeline. Thus, there are countless obstacles preventing pupils, students, graduates, and PhD students, throughout each of the different education and training stages from continuing a research career trajectory. The Appendix to the *Benchmark report on Human Resources in RTD*[11] lists these different obstacles, the different possible policy leverages and objectives. At first sight, these seem to be equally applicable to the U.S. or the EU.

So far, mainly the southern European countries have witnessed a large increase in the numbers of students as part of a European catching-up growth process and the relatively high unemployment rate among youngsters, which resulted in, among other things, a considerable expansion of the number of universities and polytechnics. Yet this is a temporary process, which, incidentally, has not led so far to a proportional increase in the demand from the private sector for highly qualified personnel in these countries. The new accession East European countries represent a very different story. Here the higher education systems have a long tradition in delivering highly qualified S&E particularly in the hard sciences. The lack of knowledge relates primarily to commercial and financial access to worldwide market opportunities. Foreign direct investment exploiting the unused technical human capital potential has been quick in picking up this unused human capital knowledge potential. But here too, the long-term demographic trends are negative; raising questions as to the long-term sustainability of the supply of highly qualified human capital.

2. The importance of the dynamics of the local environment is increasingly recognised as being a crucial factor for innovation and the development of knowledge. Many economic geographers emphasized

[11] See *Benchmark report on Human Resources in RTD*, DG Research, European Commission, Brussels, 2002.

the importance of the regional clustering of knowledge activities. Despite the fact that the local supply of S&E remains a crucial determinant for the localisation of private research activities as is clear from the location of many private R&D labs near universities, the demand for knowledge is increasingly also influenced by physical, social and local, cultural factors that will in fact operate as pools of attraction in exerting a pull on highly educated people, in Richard Florida's words: "the creative class." In this sense, the tendency to regionally cluster knowledge centres observed both inside the U.S. and individual European countries is again a logical consequence of the agglomeration and joint production effects of knowledge and its appeal to researchers and entrepreneurs.

Up to now, the various policy proposals aimed at the development of a European Research Area have not really led to a significant rise within Europe of the labour mobility of S&E and European wide knowledge clustering. The barriers to such labor mobility—differences in pension systems, in rules and regulations governing university appointments, in use of foreign languages in higher education teaching—appear all much more significant across European member countries than with respect to the emigration of European S&E towards the U.S. Increased mobility and migration of highly qualified personnel is of course likely to put strongly under question the European ideals of "social cohesion."[12] It is actually surprising that so little thought has been given up to now, to the internal inconsistencies of European ambitions in this area.

To summarize: investments in human capital provide the mirror picture of the knowledge investments described under the previous heading. The crucial distinction here is the one between knowledge, which is codified and can be traded; is embodied in new products or machines. In other words knowledge, which can be "commodified" is ready for use. And on the other hand knowledge, which is tacit, embodied in the brains of individuals, in their competences, in their schooling and training, in their years of life-long experience. Tradable

[12] See for example David, P. "ERA visions and Economic realities: A cautionary approach to the restructuring of Europe's research system," EC STRATA Workshop "New challenges and new responses for S&T policies in Europe," Brussels, 22-23 April 2002, mimeo, for a detailed analysis of the possible, undesirable, regional effects of the ERA as a result of mobility effects.

knowledge looses, depending on the effectiveness of intellectual property protection, rapidly, sometimes the day it is brought on to the market, much of its commercial value. It becomes routine, more or less public knowledge. Tacit knowledge by contrast is difficult to transfer and disappears in the extreme case with the death or the retirement of the scientist or researcher.

Recognition of this distinction is essential for policy making. Indeed, it brings to the forefront the local growth dynamics aspects of joint knowledge production based on so-called "co-location" advantages of the physical agglomeration of human knowledge capital. It illustrates why even in our current Internet world with easy access to codified knowledge, scientists, researchers and highly skilled employees still like to cluster together in similar locations. Activating knowledge will hence imply strengthening the local/regional agglomeration aspects of joint knowledge production. In the case of Europe, it means a more fundamental recognition of regional knowledge strengths, of the particular role of regional authorities in helping their regions to become attractor poles for knowledge workers, in having to make regional choices.

Ultimately it is the success of regional knowledge attractor poles, which will determine whether Europe has any chance of achieving its Lisbon ambitions. A knowledge policy that only focuses on international, tradable knowledge, ignores the essential complementarities between codified and tacit knowledge; by contrast a national knowledge policy aimed at belonging to the technological "lead" reflects often an outdated degree of techno-nationalism. Within the current European context of a union of member states, it could be argued that knowledge policies have been too heavily dominated by national aims and have insufficiently recognized the regional dimension of knowledge production and diffusion. This has been exacerbated in many member countries[13] by the national institutional focus of public research funding organisations.

[13] The exception being member countries such as Belgium or Spain, where the regional decentralization structures has given way to quite explicit regional research and innovation policies.

5. Activating Innovation

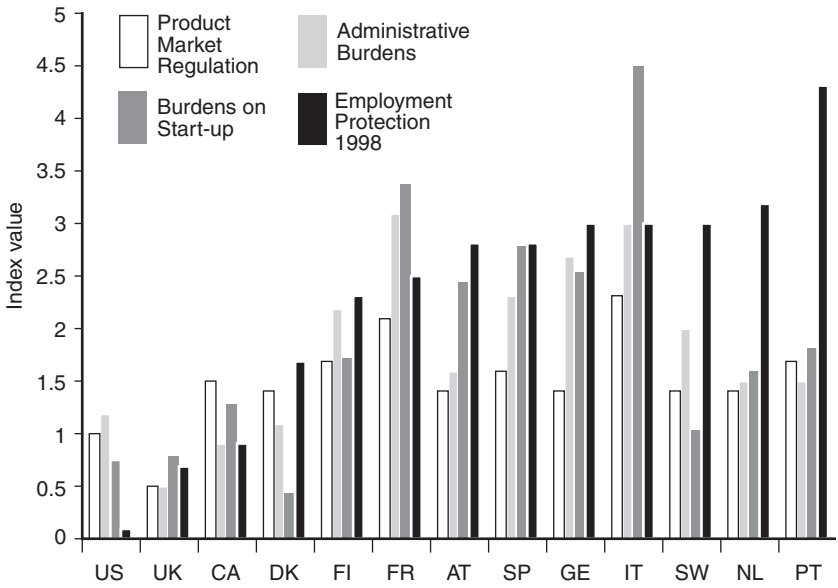
So far, the analysis presented has focused mainly on the technological aspects of knowledge creation and development, specifically the link between private and public research expenditure and the demand for highly educated researchers. Outside of this sphere, however, there are other factors that also play an essential role in the innovation process: the introduction of new products onto the market, the implementation of new production techniques, the right organisational set up, the setting up new, innovative companies, the local innovative and entrepreneurial culture, etc.

This raises the question of the possible existence of intrinsic, institutional, social and cultural barriers in Europe that may have a negative impact on knowledge development and innovation. Besides the well-known institutional barriers to innovation in Europe (the lack of harmonization in the area of the European patent, the difficulties in creating an effective European venture capital market, etc.), the question can be raised to what extent certain aspects of the European continental social welfare model might contain intrinsic obstacles to "entrepreneurship and innovation culture," especially in light of Europe's increasing structural disadvantages in the areas of innovation and high-tech entrepreneurship. The Lisbon declaration was not only an expression of the political desire to strive for a Europe belonging by 2010 to the world's most knowledge-intensive regions, but also that this was to happen within the context of a strengthened, 'activated' social Europe that would have an eye for past social achievements. The question that has in fact *not* been addressed in Lisbon is how activating labour markets and what we have termed here "activating knowledge" can go together and when one is confronted with economic trade-offs.

Based on the so-called regulatory barriers index estimated by the OECD, Figure 4.4, represents e.g. for the U.S. and a number of European countries the various, most common barriers to innovation associated with product market regulations, specific burdens on start ups, administrative burdens and last but not least employment protection costs associated with hiring and firing. This last one appears significantly higher in all European countries than in the U.S., with the UK not surprisingly with the lowest index level.

Economists such as Giles Saint-Paul[14] have analyzed the relationship between labor market institutions, and in particular the costs of dismissing employees, and the development of innovations from a purely theoretical perspective. Hiring and firing costs are in many ways the most explicit manifestation of the social welfare state in most continental European countries. They have led to stability in labor relations and represent an incentive for employers and employees alike to invest in human capital. However, in terms of innovation, and in particular the Schumpeterian process of creative destruction, the cost of developing new activities—whether concerned with new product, process or organizational innovations—will crucially depend on the ease with which "destruction" can be realized. Thus, as shown in Saint-Paul's model, the U.S., with lower firing costs, will eventually gain a competitive advantage in the introduction of new, innovative products and process developments onto the market, while Europe will become specialized in technology-following activities, based on secondary, less radical improvement innovations.

Figure 4.4 Regulatory barriers index (OECD)



[14] Saint-Paul, G., 2002, "Employment protection, international specialisation and innovation," *European Economic Review*, vol. 46, pp. 375-95.

In other words, the dynamics of innovation, of entrepreneurship, of creative destruction thrives better, practically by definition, in an environment providing higher rewards for creativity and curiosity than in an environment putting a higher premium on the security and protection of employment. Viewed from this perspective, the gap between Europe, and in particular continental Europe, and the United States in terms of innovative capacity, efficiency, and wealth creation may also, at first sight look like the price Europe has to pay for not wanting to give up its social model and in particular social securities and achievements.

To summarize: it might be argued that the Lisbon declaration was not really clearly formulated. A better way would have been: how much of the social achievements of the European model is Europe prepared to give up to keep up with the United States, let alone develop Europe into one of the most prosperous and dynamic regions in the world? Or alternatively: which elements of the European social model are sacred and which elements are worth paying a dynamic growth price for?[15]

Many of the proposals on "activating the labor market" with by now popular concepts like "empowerment" and "employability" appear to go hand in hand with innovation and growth dynamics, others though do not. Some European countries such as the UK and Denmark appear to have been much more successful in reducing dismissing costs than others, and appear to have benefited from it much more in terms of growth dynamics. The central question which must be raised within this context is whether the social security model developed at the time of the industrial society is not increasingly inappropriate for the large majority of what could be best described as "knowledge workers" who are likely to be less physically (and by contrast possibly more mentally) worn out by work than the old type of blue collar, industrial workers. The short working hours, or early retirement schemes might well appear to knowledge workers less of a social achievement, work not really representing a "disutility" but more an essential motivating activity, providing even a meaning to life.

[15] As Wim Duisenberg, the previous chairman of the European Central Bank, once stated: maybe we should accept that Europe will always face a growth and productivity gap with the U.S. simply because of existing differences in Europe in language, culture, and customs. As long as we value maintaining those, we will get joy out of our lagging behind the U.S.

There is in other words an urgent need for a complete rethought of the universality of the social security systems in Europe, recognizing explicitly that depending on the kind of work citizens get involved in, social achievements including employment security, a relatively short working life and short weekly working hours are important social achievements and elements of the quality of life, which should not be given up, and the case, probably exemplified by the highly qualified researcher, where exactly the opposite holds. It is in other words urgent time to broaden the discussions in science, technology and innovation policy circles to include social innovation.

Part III
Organizational Reform and Technological Modernization in the Public Sector

Chapter 5

Central Issues in the Political Development of the Virtual State

Jane E. Fountain

Introduction

The term "virtual state" is a metaphor meant to draw attention to the structures and processes of the state that are becoming more and more deeply designed with digital information and communication systems. Digitalization of information and communication allows the institutions of the state to rethink the location of data, decision making, services and processes to include not only government organizations but also nonprofits and private firms. I have called states that make extensive use of information technologies *virtual states* to highlight what may be fundamental changes in the nature and structure of the state in the information age.

This chapter discusses the technology enactment framework, an analytical framework to guide exploration and examination of information-based change in governments.[1] The original technology enactment framework is extended in this chapter to delineate the distinctive roles played by key actors in technology enactment. I then examine institutional change in government by drawing from current initiatives in the U.S. federal government to build cross-agency relationships and systems. The U.S. government is one of the first central states to undertake not only back office integration within the government but also integration of systems and processes across agencies. For this reason its experience during the past ten years may be of

[1] The technology enactment model and detailed case studies illustrating the challenges of institutional change may be found in J.E. Fountain, *Building the Virtual State: Information Technology and Institutional Change* (Brookings Institution Press, 2001). The present paper draws from the explanation of the technology enactment model in *Building the Virtual State* and presents new empirical research on current, major e-government initiatives in the U.S. central government.

interest to e-government researchers and decision makers in other countries, particularly those in countries whose governments are likely to pursue similar experiments in networked governance. The summary of cross-agency projects presented here introduces an extensive empirical study, currently in progress, of these projects and their implications for governance.

A structural and institutional approach that begins with processes of organizational and cultural change, as decisionmakers experience them, offers a fruitful avenue to understanding and influencing the beneficial use of technology for governance. Focusing on technological capacity and information systems alone neglects the interdependencies between organizations and technological systems. Information and communication technologies are embedded and work within and across organizations. For this reason, it is imperative to understand organizational structures, processes, cultures and organizational change in order to understand, and possibly influence, the path of technology use in governance. Accounts of bureaucratic resistance, user resistance and the reluctance of civil servants to engage in innovation oversimplify the complexities of institutional change.

One of the most important observers of the rise of the modern state, Max Weber, developed the concept of bureaucracy that guided the growth of enterprise and governance during the past approximately one hundred years. The Weberian democracy is characterized by hierarchy, clear jurisdiction, meritocracy and administrative neutrality, and decisionmaking guided by rules which are documented and elaborated through legal and administrative precedent. His concept of bureaucracy remains the foundation for the bureaucratic state, the form that every major state—democratic or authoritarian—has adopted and used throughout the Twentieth Century. New forms of organization that will be used in the state require a similar working out of the principals of governance that should inhere in structure, design and process. This challenge is fundamental to understanding e-government in depth.

Throughout the past century, well-known principles of public administration have stated that administrative behavior in the state must satisfy the dual requirements of capacity and control. Capacity indicates the ability of an administrative unit to achieve its objectives efficiently. Control refers to the accountability that civil servants and

the bureaucracy more generally owe to higher authorities in the legislature, notably to elected representatives of the people. Democratic accountability, at least since the Progressives, has relied upon hierarchical control—control by superiors of subordinates along a chain of command that stretches from the apex of the organization, the politically appointed agency head (and beyond to the members of Congress) down to operational level employees.

The significance and depth of effects of the Internet in governance stem from the fact that information and communication technologies have the potential to affect *production* (or *capacity*) as well as *coordination*, *communication*, and *control*. Their effects interact fundamentally with the circulatory, nervous, and skeletal system of institutions. Information technologies affect not simply production processes in and across organizations and supply chains. They also deeply affect coordination, communication and control—in short, the fundamental nature of organizations. I have argued that the information revolution is a revolution in terms of the significance of its effects rather than its speed. This is because the effects of IT on governance are playing out slowly, perhaps on the order of a generation (or approximately 25 years). Rather than changes occurring at "Internet speed," to use a popular phrase of the 1990s, governments change much more slowly. This is not only due to lack of market mechanisms that would weed out less competitive forms. It is significantly attributable to the complexities of government bureaucracies and their tasks as well as to the importance of related governance questions—such as accountability, jurisdiction, distributions of power, and equity—that must be debated, contested and resolved.

In states that have developed a professional, reasonably able civil service, public servants (working with appointed and elected government officials and experts from private firms and the academy) craft the details and carry out most of the work of organizational and institutional transformation. What is the transformation process by which new information and communication technologies become embedded in complex institutions? Who carries out these processes? What roles do they play? Answers to such questions are of critical importance if we are to understand, and to influence, technology-based transformations in governance. Government decisionmakers acting in various decisionmaking processes produce decisions and actions that result in the building of the virtual state.

Career civil servants redesign structures, processes, practices, norms, communication patterns and the other elements of knowledge management in government. Career civil servants are not impediments to change, as some critics have argued. They are key players in government reform. An extended example may be drawn from the experiences of civil servants in the U.S. federal government beginning in approximately 1993. Working with political appointees and outside experts, career civil servants worked out the details critical to the success of several innovations that otherwise would not have been translated from their private sector beginnings to the organizations of the state.[2] Over time, as their mentality and culture has begun to change, a cadre of superior civil servants have become the chief innovators in the government combining deep knowledge of policy and administrative processes with deep understanding of public service and the constraints it imposes on potential design choices. Their involvement is critical not simply as the "users" of technology but as the architects of implementation, operationally feasible processes and politically sustainable designs.

Technology Enactment

Many social and information scientists have examined the effects of the Internet and related ICTs on organizations and on government. Yet the results of such research often have been mixed, contradictory and inconclusive. Researchers have observed that the same information system in different organizational contexts leads to different results. Indeed, the same system might produce beneficial effects in one setting and negative effects in a different setting. This stream of research, focused on effects and outcomes, neglects the processes of transformation by which such systems come to be embedded in organizations. Because these processes may develop over several years, they cannot be considered transitional or temporary. Transformation becomes the more or less constant state of administrative and governmental life.

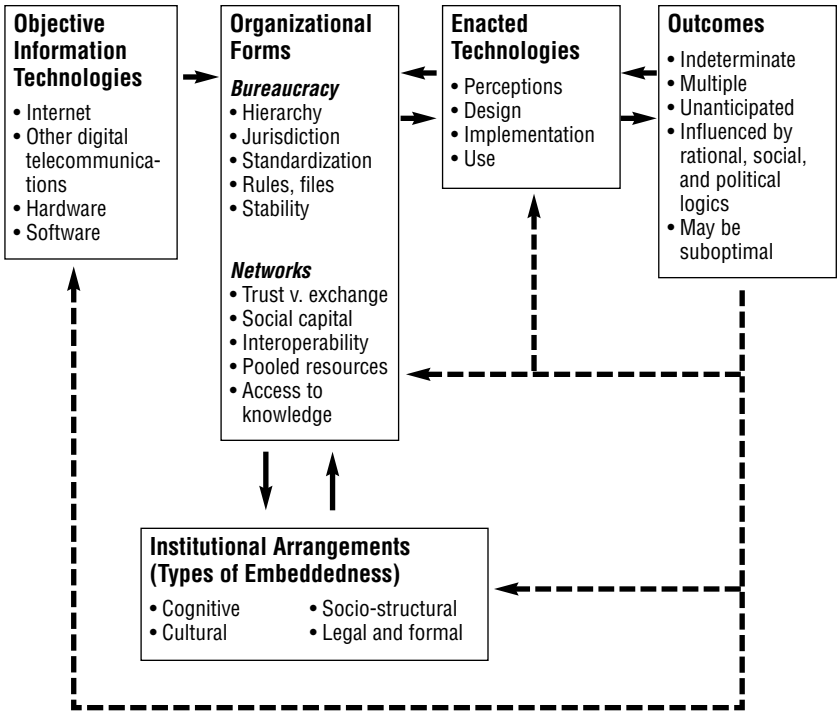
[2] Many of these innovative developments are presented in the cases included in *Building the Virtual State*. See, for example, the cases concerning the development of the International Trade Data System, the U.S. Business Advisor, and battlefield management systems in the U.S. Army.

The technology enactment framework emphasizes the influences of organizational structures (including "soft" structures such as behavioral patterns and norms) on the design, development, implementation and use of technology. In many cases, organizations enact technologies to reinforce the political status quo. Technology enactment often (but not always) refers to the tendency of actors to implement new ICTs in ways that reproduce, indeed strengthen, institutionalized socio-structural mechanisms even when such enactments lead to seemingly irrational and sub-optimal use of technology. One example include websites for which navigation is a mystery because the organization of the website mirrors the (dis)organization of the actual agency. Another example are online transactions that are designed to be nearly as complex as their paper-based analogues. A third example is the cacophony of websites that proliferate when every program, every project and every amateur HTML enthusiast in an organization develops a web presence. These early stage design choices tend to pave paths whose effects may influence the development of a central government over long periods of time because of the economic and political costs of redesign.

The underlying assumptions of designers play a key role in the type of systems developed and the way in which systems are enacted in government. The Japanese government, known for planning and coherence of response, is currently engaged in development of a national strategy for e-government. This response is distinctly different from a bottom-up approach in which innovation from the grassroots of the bureaucracy is encouraged. The U.S. Army's design of the maneuver control system, a relatively early form of automated battlefield management, developed in the 1980s and 1990s, was developed with the assumption on the part of system designers that soldiers are "dumb" operators, button pushers with little understanding of their operations. When much of the detailed information soldiers used by soldiers for decisionmaking was embedded in code and made inaccessible to them, there were substantial negative effects on the operational capacity of the division.[3]

[3] This case is reported in detail in *Building the Virtual State*, chapter 10.

Figure 5.1 The Technology Enactment Framework



Source: J. E. Fountain, *Building the Virtual State: Information Technology and Institutional Change* (Washington, D.C.: Brookings Institution Press, 2001), p. 91.

I developed the technology enactment framework (presented in the figure above) as a result of extensive empirical research on the behavior of career civil servants and political appointees as they made decisions regarding the design and use of ICTs in government. If information technology is better theorized and incorporated into the central social science theories that guide thinking about how government works, researchers will possess more powerful tools for explanation and prediction. In other words, theory should guide understanding of the deep effects of ICTs on organizational, institutional and social rule systems in government which is not ordered by the invisible hand of the market.

The most important conceptual distinction regarding ICTs is the distinction between "objective" and "enacted" technology depicted in

the figure using two separate boxes separated by a group of mediating variables.[4] By objective technology, I mean hardware, software, telecommunication and other material systems as they exist apart from the ways in which people use them. For example, one can discuss the memory of a computer, the number of lines of code in a software program, or the functionality of an application. By "enacted technology," I refer to the way that a system is actually used by actors in an organization. For example, in some organizations email systems are designed to break down barriers between functions and hierarchical levels. Other organizations may use the same system of email to reinforce command and control channels. In some cases firms use information systems to substitute expert labor for much cheaper labor by embedding as much knowledge as possible in systems and by routinizing tasks to drive out variance. In other cases firms use information systems to extend their human capital and to add to the creativity and problem solving ability of their employees. Many organizations have taken a plethora of complex and contradictory forms, put them into pdf format and uploaded them to the web, where they can be downloaded, filled out by hand and FAXed or mailed for further processing. Yet other organizations have redesigned their business processes to streamline such forms, to develop greater web-based interactivity, particularly for straightforward, simple transactions and processes. These organizations have use ICTs as a catalyst to transform the organization. Thus, there is a great distinction between the objective properties of ICTs and their embeddedness in ongoing, complex organizations.

Two of the most important influences on technology enactment are organizations and networks. These appear as mediating variables in the framework depicted in the figure above. These two organizational forms are located together in the framework because public servants currently are moving between these two types of organization. On the one hand, they work primarily in bureaucracies (ministries or agencies) in order to carry out policymaking and service delivery activities.

[4] In this conceptualization I draw from and extend a long line of theory and research in the sociology of technology, history of science, and social constructivist accounts of technological development. What is new in my approach is the synthesis of organizational and institutional influences, a focus on power and its distribution, and a focus on the dialectical tensions of operating between two dominant forms: bureaucracy and network.

On the other hand, public managers are increasingly invited to work across agencies and across public, private and nonprofit sectors—in networks—to carry out the work of government. Thus, these two major organizational forms, and their respective logics, heavily influence the ways in which technologies in the state will be designed, implemented and used.

As shown in the figure, four types of institutional influences undergird the process of enactment and strongly influence thinking and action.[5] *Cognitive institutions* refer to mental habits and cognitive models that influence behavior and decisionmaking. *Cultural institutions* refer to the shared symbols, narratives, meanings and other signs that constitute culture. *Socio-structural institutions* refer to the social and professional networked relationships among professionals that constrain behavior through obligations, history, commitments, and shared tasks. *Governmental institutions*, in this framework, denote laws and governmental rules that constrain problem solving and decisionmaking. These institutions play a significant role in technology enactment even as they themselves are influenced, over the long run, by technological choices.

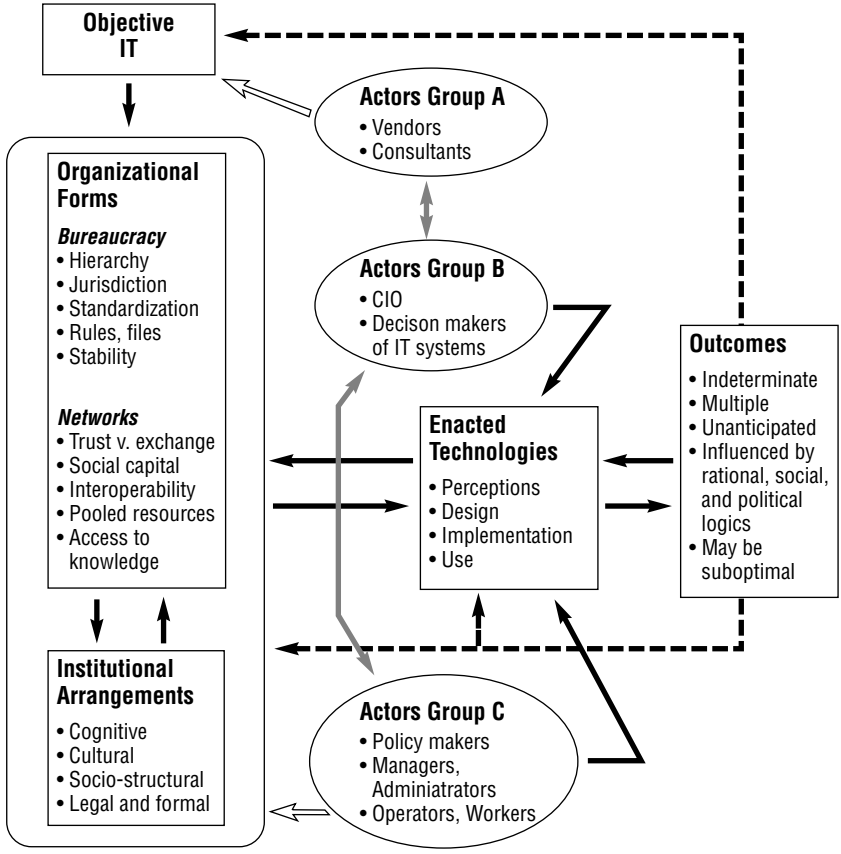
Note that causal arrows in the technology enactment framework flow in both directions to indicate that recursive relationships dominate among technology, organizational forms, institutions, and enactment outcomes. The term "recursive" as it is used by organization theorists means that influence or causal connections flow in all directions among the variables. This term is meant to differentiate recursive relationships from uni-directional relationships in which, for example, variable A leads to variable B. For example, smoking leads to cancer. But cancer does not lead to smoking. In a recursive relationship, variable A and variable B influence one another. For example, use of ICTs influences governance. And governance structures, processes, politics and history influence the use of ICTs. Recursive relationships specified in the technology enactment framework do not predict outcomes. Rather, they "predict" uncertainty, unanticipated results and iteration back through design, implementation and use as organizations and networks learn from experience how to use new

[5] I am indebted to Professors Paul DiMaggio and Sharon Zukin for this typology of institutional arrangements.

technologies even as they incur sunk costs and develop paths that may be difficult to change. The analytical framework presents a dynamic process rather than a predictive theory.

An extension of the model, presented in the figure below, highlights the distinctive roles played by three groups: IT specialists in the career civil service, program and policy specialists and other government officials at all levels from executive to operational, and vendors and consultants.

Figure 5.2 Key Actors in Technology Enactment



The three groups of actors play distinctive but inter-related roles in technology enactment. Actors in group A, comprised of vendors and consultants, are largely responsible for objective technology. Their expertise often lies in identification of the appropriate functionality and system architecture for a given organizational mission and set of business processes. What is critical for government is that vendors and consultants fully understand the political and governance obligations as well as the mission and tasks of a government agency before making procurement and design decisions. It is essential to understand the context and "industry" of government, just as one would have to learn the intricacies of any complex industry sector. Just as the information technology sector differs from the retail, manufacturing, and the service sectors, so the government sector exists in a unique environment. Within government as well are varying policy domains and branches whose history, political constraints, and environments are important to understand.

Actors in group B, according to this model, include chief information officers of agencies and key IT decisionmakers. These government actors bear primary responsible for detailed decisions of system design. Actors in group C—policymakers, managers, administrators, operators, and workers—have a strong, often unappreciated and overlooked, influence on adjustments to organizational and network structures and processes. It is imperative that some members of this group develop expertise in the strategic uses of ICTs in order to bridge technological, political and programmatic logics. These depictions simplify the complexities of actual governments and the policymaking process. They are meant to draw attention to the multiple roles involved in enactment and the primary points of influence exerted through each role. In particular, the relationships between groups B and C are often neglected when, in fact, they are crucial for success of projects.

Propositions

Six propositions may be derived logically from the technology enactment framework and the political environment that exists in most industrialized democracies.

Proposition 1: Perverse incentives

Public servants face a set of perverse incentives as they make decisions regarding the possible uses of technology in their programs and agencies. Public executives in most states try to accumulate larger budgets and more staff in order to increase the power and autonomy of their department. They learn to negotiate successfully for appropriations for their program and agency. In the theory of adversarial democracy, such conflicts among programs and agencies are assumed to force public servants to sharpen their arguments and rationales for programs. This competition of ideas and programs is meant to simulate a market from which elected officials can choose thereby producing the best results for citizens. The adversarial model of democracy makes the development of networked approaches to government difficult. The impasse can be broken only by significant restructuring of incentives to dampen unwieldy tendencies toward agency autonomy and growth.

For this reason, public executives face perverse incentives. If they implement new information systems that are more efficient, they will not gain greater resources; they will probably enact a situation in which their budget is decreased. If they implement information systems that reduce redundancies across agencies and programs, once again, they are likely to lose resources rather than to gain them. If they develop inter-agency and enterprise-wide systems with their colleagues in the bureaucracy, they will lose autonomy rather than gaining it. So the traditional incentives by which public executives have worked are "perverse" incentives for networked governance.

Proposition 2: Vertical Structures

The bureaucratic state, following from the Weberian bureaucracy, is organized vertically. By that I mean that the government is organized in terms of superior-subordinate relations, a chain of command that extends from the chief executive to the lowest level employees of the government. Similarly, oversight bodies for budgeting, accountability and even for legislation exercise oversight through the chain of command structure. These vertical structures are the chief structural elements of government institutions. Incentives for performance are derived from this structure. This verticality, central to accountability and transparency, also makes it difficult and to use technology to build

networked government. The more complex difficulties are not technical. In fact, it is rather easy to imagine how a federal enterprise architecture should be designed. What is difficult is reconceptualizing accountability, oversight, and other basic elements of governance in networked relationships.

Proposition 3: Misuse of capital/labor substitution

In the U.S. federal government, agencies were not allocated significant new resources to develop IT. Congress has assumed that the use of ICTs to substitute for labor would generate resources for technological innovation. Although labor costs can be reduced by using IT, there are a few complexities that should be enumerated here.

First, organizations must learn to use IT. This requires human labor and experienced human labor is critical. It is difficult to downsize and to learn at the same time regardless of popular management imperatives to force employees to innovate through large-scale cutbacks.

Second, although some jobs can be eliminated through the use of ICTs, e-government necessitates many new and expensive jobs. Specifically, IT positions must be created for intelligent operation of systems, for monitoring and protecting data and processes, and for redesigning processes as legislation and programs change. Outsourcing is an option, but is nonetheless expensive and cannot completely replace an internal IT staff. Large organizations have found that IT staffs are expensive. In particular, website content requires labor-intensive attention; protection of privacy and data security in government exceeds industry standards and practices; and some degree of institutional memory and knowledge for networked governance must reside within the permanent civil service rather than in a plethora of contracts. By placing critical strategic knowledge in the hands of contractors, governments put themselves in the position of having to pay for this knowledge multiple times and lose the possibility to leverage this knowledge internally for innovation. Asset specific technological knowledge should reside within governments and must be viewed as a necessary cost of e-government.

Third, the U.S. government has made a commitment to provide public services through multiple channels: face-to-face, telephone, mail, and Internet. Thus, they are faced with the strategic and opera-

tional complexities of designing, developing, implementing and managing across multiple channels. For these reasons, and others, the simple idea of substituting technology for labor is misleading and erroneous. In Portugal, it seems necessary to continue to employ multiple channels for services given the demographic differences in Internet use. Here the social decision to respect the elderly population should dominate over technological possibilities for e-government. Other Iberian states have simply eliminated paper-based channels in order to move the population to e-government.

Proposition 4: Outsourcing may appear to be easier than integration

It may appear to political decisionmakers that it is easier to outsource operations than it is for government managers to negotiate the politics of integration, that is, information sharing and working across agencies. In other words, there is a danger that some services and systems will be outsourced in order to avoid the political difficulties of internal governmental integration of back office functions or cross agency functions. But in some cases, outsourcing would be a mistake because the negotiations within the government necessary for integration to move forward form a necessary process of learning and cultural change, through enacting technology. The arduous process of making new systems fit the political, policy and operational needs of the government is, itself, the transformation of the state toward a new form coherent with the information society. Outsourcing may appear to be the easier course of action. But ultimately states must make difficult decisions regarding asset specificity, that is, the knowledge and skills that should reside within the government.

Proposition 5: Customer service strategies in government

Governments have an obligation to provide services to the public. But this is one element of the relationship between state and society. First, customers are in a different relationship with firms than citizens are with government.[6] Customers have several options in the market;

[6] See J. E. Fountain, "The Paradoxes of Customer Service in the Public Sector," *Governance*, 2001, for an extended analysis of differences between customer service strategies in economic firms and their use in government. In this working paper I simply mention a few of the more important arguments published previously.

citizens have but one option for government services and obligations. Customers pay for services; but citizens have a deeper relationship and great responsibility toward their government than a fee for service relationship. They do not pay taxes in exchange for services. Tax systems in most states are a form of redistribution, a material system that reflects a social and political contract. In a democratic system of government "of the people, by the people, and for the people," citizens have deep obligations to government and governments have deep obligations to the polity. So the customer service metaphor, particularly in its most marketized forms, is a degradation, minimization, and perversion of the state-citizen relationship in democracies.

Second, in the private sector, larger and wealthier customers are typically given better treatment than those customers who have little purchasing power or who have not done business with a firm in the past. Market segmentation is critical to service strategies in firms but is not morally or ethically appropriate for governments. Moreover, customer service strategies in U.S. firms tend to reward those customers who complain with better service in order to "satisfy" the customer. Those customers who do not complain do not receive better service. This, again, is not morally or ethically appropriate for government. Some citizens cannot exercise voice, or articulate their needs, as well as others. Public servants have an obligation to provide services equitably regardless of the education, wealth, or language skills of the citizen.

As the U.S. government tried to adopt some of the customer service ideas that were popular in economic firms, they did increase responsiveness to citizens. Moreover, public servants experienced a deep change in their attitudes and behavior. In many cases, the culture of agencies and programs changed to become oriented toward citizens rather than toward the internal bureaucratic needs of agencies. These were positive benefits from the customer service metaphor.

But some corporate citizens exploited the notion of customer service to extract benefits from the state. Powerful corporate citizens used "customer service" as a way to pressure agencies to provide benefits and to develop policies and rules that were inequitable and that would advantage some firms or industries over others. Ford Motors, Motorola, and Cisco are indeed large "customers" of the U.S. government. But the regulatory regimes developed for industries cannot serve some "customers" better than others. At the corporate level, the

customer service metaphor breaks down as a normative force. For these reasons, the Bush Administration discontinued the use of "customer service" as a government strategy. They use the term "citizen-centric" instead.

Proposition 6: Embeddedness and cultures

One of the chief learnings from the experiences of the U.S. government in the development of e-government has been the strong role of embeddedness and culture. Embeddedness refers to the fact that information systems are situated in the context of complex histories, social and political relationships, regulations and rules, and operational procedures. It is not a simple matter to change an information system, therefore, when it is embedded in a complex organizational and institutional system.

Integration across Agencies: An Example

A marked rise in the use of the Internet, at the beginning of the 1990s, coincided with the beginning of the Clinton administration and the initiation of a major federal government reform effort, the Reinventing Government movement, led by Vice President Al Gore. In addition to the development of regulatory and legal regimes to promote e-commerce, the administration sought to build internal capacity for e-government. A key strategy of the Clinton administration included the development of virtual agencies. The virtual agency, in imitation of web portals used in the private sector, is organized by client—say, senior citizens, students, or small business owners—and is designed to encompass within one web interface access to all relevant information and services in the government as well as from relevant organizations outside the government. If developed sufficiently, virtual agencies have the potential to influence the relationship between state and citizen as well as relationships within government among agencies and between agencies and overseers.

During the Clinton administration, development of cross-agency websites floundered due to intransigent institutional barriers. Oversight processes for cross-agency initiatives did not exist. Budget processes focus on single agencies and the programs within them. There were no legislative committees or sub-committees nor were

there budget processes that were designed to support cross-agency, or networked, initiatives. The government lacked a chief information officer, or any strong locus of executive authority or expertise, to direct and manage initiatives lying across agencies and across jurisdictions. These institutional barriers, as well as others, posed deeper challenges to networked government than the usual and oft-cited complaints about resistance to change on the part of bureaucrats. Bureaucrats were simply responding to incentives, norms, and the dominant culture.

In August 2001, in a continuation of the path toward building interagency capacity (or networked approaches within the state) the Bush administration released the Presidential Management Agenda. The complete agenda includes five strategic, government-wide initiatives; this paper summarizes one of the five initiatives: e-government.[7] The e-government plan, initially called "Quicksilver" after a set of cross-agency projects developed during the Clinton administration, evolved to focus on the infrastructure and management of 25, cross-agency e-government initiatives. The projects are listed in the table below. (I describe each project briefly in Appendix One.) The overall project objectives are to simplify individuals' access to government information; to reduce costs to businesses of providing government with redundant information; to better share information with state, local and tribal governments; and to improve internal efficiency in the federal government.[8]

The 25 projects are grouped into four categories: Government to Business, Government to Government, Government to Citizen and Internal Efficiency and Effectiveness and a project which affects all others, E-Authentication. Government-to-business projects include: electronic rulemaking, tax products for businesses, streamlining international trade processes, a business gateway, and consolidated health informatics. Government-to-government projects include: interoperability and standardization of geospatial information, interoperability for disaster management, wireless communication standards between emergency managers, standardized and shared vital records informa-

[8] For further details see "The President's Management Agenda," p.24 http://www.whitehouse.gov/omb/budget/fy2002/mgmt.pdf.

[9] Jane E. Fountain, "Prospects for the Virtual State," working paper, COE Program on Invention of Policy Systems in Advanced Countries, Graduate School of Law and Politics, University of Tokyo, September 2004. English language version available at http://www.ksg.harvard.edu/janefountain/publications.htm

tion, and consolidated access to federal grants. Government-to-citizen projects include: standardized access to information concerning government benefits, standardized and shared recreation information, electronic tax filing, standardized access and processes for administration of federal loans, and citizen customer service. Projects focused on internal efficiency and effectiveness within the central government encompass: training, recruitment, human resources integration, security clearance, payroll, travel, acquisitions and records management. Also included is a project on consolidated authentication. (For further information concerning each project see www.e-gov.gov). For a detailed description of the implementation and management of one of the initiatives, Grants.gov, an effort to standardize the grants management process across several agencies, see Fountain (2004).[9]

Table 5.1 Cross-Agency, E-Government Initiatives

Government to Citizen	**Government to Government**
Recreation One Stop	Geospatial One Stop
GovBenefits.gov	Grants.gov
E-Loans	Disaster Management
IRS Free File (IRS only)	SAFECOM
USA Services	E-Vital
Government to Business	**Internal Efficiency and Effectiveness**
E-Rulemaking	E-Training
Expanding Electronic Tax Products for Business	Recruitment One-Stop
Federal Asset Sales	Enterprise HR Integration
International Trade Process Streamlining	E-Records Management
Business Gateway	E-Clearance
Consolidated Health Informatics	E-Payroll
	E-Travel
	Integrated Acquisition Environment
	E-Authentication

Source: http://www.egov.gov

The 25 projects were selected by the U.S. Office of Management and Budget from more than three hundred initial possibilities. The plethora of possibilities were in nearly all cases developed during the Clinton administration and continue outside the rubric of the Presidential Management Initiative. In al cases, such projects focus attention on the development of horizontal relationships across government agencies. In this sense, the projects move beyond the first stage of e-government which typically entails providing information

online to citizens. They also progress further in the use of ICTs than Stage Two E-government, which has tended to focus on putting transactions such as payments to government online.

Their specific objective of a focus on cross-agency consolidation is to reduce redundancies and complexity through standardization of generic business operations in government. A cross-agency approach also limits operational and information processing autonomy—the "stovepipes"—of government agencies and departments (http://www.whitehouse.gov/omb/egov/about_backgrnd.htm).

The projects are overseen and supported by the Office of E-government and Information Technology, a statutory office within the U.S. Office of Management and Budget established by law in 2002. An organization chart detailing the new structures within OMB is presented below. The Administrator for E-government and IT, shown at the apex of the organization chart, is the Chief Information Officer of the federal government and an associate director of OMB reporting to the Director. The position initially was held by Mark Forman, a political appointee, and is currently held by Karen Evans, a career civil servant. The Associate Administrator for E-Government and Information Technology, reporting to the Administrator, is responsible for the 25 cross-agency projects. The five portfolio managers represented in the organization chart—some of whom are career civil servants and others of whom are political appointees—have specific responsibility to oversee the 25 cross-agency initiatives. A management consulting group (not shown), whose members are not government employees but private contractors detailed to OMB have been responsible for most of the day-to-day communications and reporting with the programs. In effect, they serve as staff and liaisons between OMB and the cross-agency projects which are based in and across government agencies.

The new organization within OMB signals a major institutional development in the U.S. federal government. Before passage of the E-Government Act of 2002 (Public Law 107-347), which established the federal CIO and OMB structure, there was no formal structural capacity within OMB to oversee and guide cross-agency initiatives. The structural gap formed a major impediment to the development of networked governance during the Clinton administration. In terms of political development and fundamental changes in the nature of the bureaucratic state, we see in these organizational changes the emer-

gent institutionalization of a governance structure for the direction and oversight of cross-agency, or networked, governance.

The organization chart depicts the 25 cross-agency initiatives reporting directly to portfolio managers within OMB. This representation is meant only to indicate that oversight and guidance of the projects is exercised by portfolio managers. The managing agency for each project is a federal agency rather than OMB. The projects are not part of the OMB hierarchy. The formal authority for each project belongs to the federal agency designated by OMB as the "managing partner," or lead agency.

The matrix presented below arrays federal agencies along the top of the grid and projects along the left side. Agency partners for each project are marked with an x. The managing partner is denoted by an X in bold-face type. For example, the column and row colored blue indicate that the U.S. Department of Health and Human Services is a partner agency in eight initiatives and the managing partner of two projects, health informatics and federal grants.

Each managing partner agency appointed a program manager to lead its project. The program managers are typically senior, experienced career federal civil servants. They have been responsible for developing a consultative process among agencies involved in each project and, in consultation with OMB, they are responsible for developing project goals and objectives. In most cases, program managers were also required to devise a funding plan to support the project in addition to a staffing plan. Neither funds nor staff were allocated as part of the president's plan.

The E-Government Act, the legislation that codified the new organizational structure within OMB, provided for federal funding for the projects of approximately $345 million over four years. But an average of only $4 to 5 million per annum has actually been appropriated by Congress. Strategies developed by each project for funding, staffing and internal governance vary widely and have been largely contingent on the skills and experience of the program manager. So far, the legislature has not adapted organizationally to networked government. This lag in institutional development makes it difficult to build networked systems because appropriations of funds continue to flow to individual agencies and programs within them.

Table 5.2 Presidential Management Initiative E-Government Projects: Partner Agencies and Managing Partners

Projects/Departments	DoC	DoD	DoE	DoEd	DoI	DoJ	DoL	DoT	EP	FDIC	FEMA	GSA	HHS	HUD	NARA	NASA	NRC	NSF	OP	SBA	Smithsonian	SSA	Statte	Treasury	USAID	USDA	VA
Consolidated Health Informatics		X											X									X					X
Disaster Management	X	X			X	X		X			X	X	X	X			X			X		X				X	
E-Authentication	X	X		X		X		X	X			X	X			X				X		X		X		X	X
Grants.gov	X	X	X	X	X	X	X	X	X		X		X	X		X		X		X					X	X	X
E-Payroll		X	X																X			X		X			
E-Training		X					X	X				X							X			X					
E-Travel		X						X				X						X						X			X
E-Vital		X		X		X	X						X						X			X		X		X	X
E-Records Management		X	X		X			X	X						X									X		X	
GovBenefits.gov			X	X			X				X		X	X								X	X			X	X
Expanding Electr. Tax Products																						X		X			
IRS Free File																								X			
Federal Asset Sales		X		X						X		X		X						X				X			X
Geospatial One-Stop	X	X	X		X			X	X		X		X	X		X	X		X							X	
Integrated Acquisition Env.	X	X			X			X				X				X				X						X	X
Enterprise HR Integration		X																	X				X	X		X	
E-Clearance	X	X	X			X											X		X				X	X			

Table 5.2 Presidential Management Initiative E-Government Projects: Partner Agencies and Managing Partners (continued)

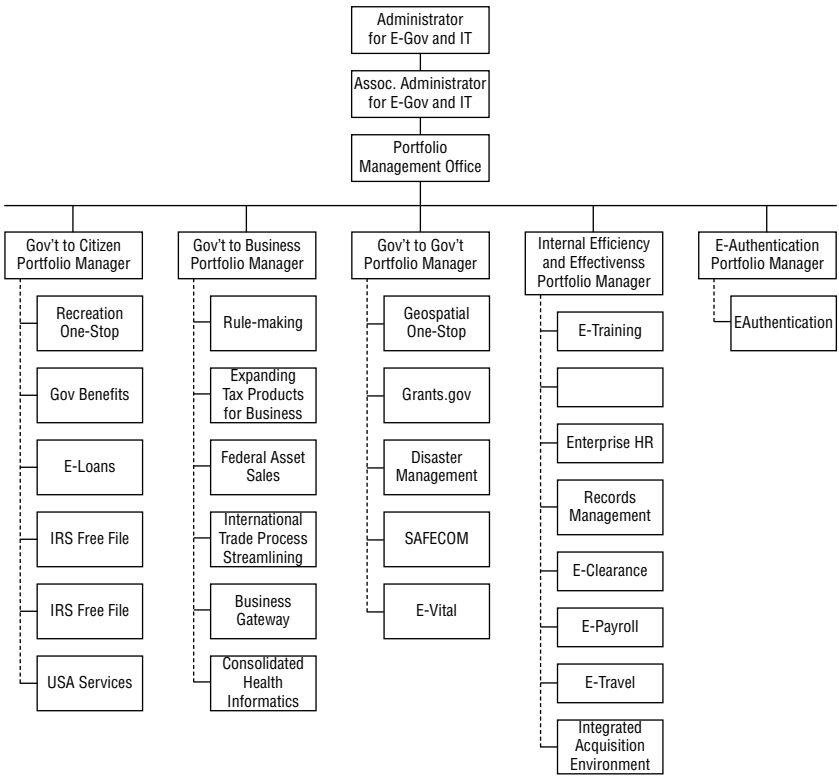
Projects/Departments	DoC	DoD	DoE	DoEd	DoI	DoJ	DoL	DoT	EP	FDIC	FEMA	GSA	HHS	HUD	NARA	NASA	NRC	NSF	OP	SBA	Smithsonian	SSA	Statte	Treasury	USAID	USDA	VA
Int'l Trade Proc. Streamlining	X					X														X			X	X	X	X	
Business Gateway	X						X	X	X											X				X			
E-Loans				X							X		X	X						X						X	X
E-Rulemaking						X	X	X														X	X		X	X	
Recreation One-Stop	X	X			X			X													X	X		X	X	X	
Recruitment One-Stop	X	X			X		X	X	X					X		X			X							X	
USA Services							X				X	X	X							X		X				X	X
SAFECOM	X	X			X	X		X			X		X											X		X	

Source: OMB Project Management Office: E-Gov Partner Agencies Public.xls, unpublished document, no date, Revised, July 1, 2004.

U.S. Federal IT Budget

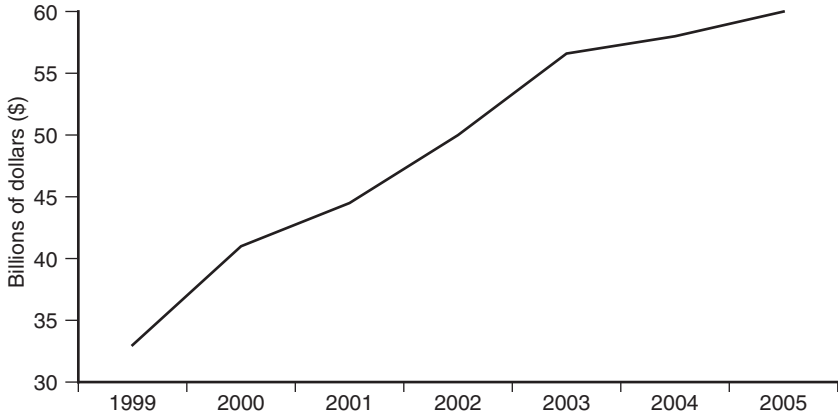
U.S. federal investments in government IT spending increased steadily from approximately $36.4 billion dollars in 2001 to 59.3 billion in 2004. According to OMB estimates, eighty percent of this spending is for external consultants indicating a high level of contracting out of ICT services. Technical expertise and human capital in the federal government is being greatly weakened as a result under the "competitive outsourcing" policy and lack of human capital with IT expertise in the federal government. But this increase in investment also suggests a commitment to building a virtual state.

Figure 5.3 OMB Office of E-Government and Information Technology Organization Chart



Source: Office of Management and Budget "Implementation of the President's Management Agenda for E-Government: E-Government Strategy" p 19, 2/27/2002, http://www.whitehouse.gov/omb/inforeg/egovstrategy.pdf, and www.egov.gov, accessed 7/1/2004.

Figure 5.4 U.S. Federal Government IT Spending



Source: OMB: "Report on Information Technology (IT) Spending for the Federal Government, Fiscal Years 2000, 2001, 2002" , OMB: "Report on Information Technology (IT) Spending for the Federal Government, Fiscal Years 2002, 2003, 2004" Excel spreadsheet: http://www.whitehouse.gov/omb/budget/fy2004/, accessed 7/2/04, OMB:"Report on Information Technology (IT) Spending for the Federal Government for Fiscal Years 2003, 2004, and 2005": http://www.whitehouse.gov/omb/budget/fy2005/, accessed 7-2-04

The E-Government Act tied appropriations to strategic, business and IT plans of agencies and created a fund of $345 million to support cross-agency initiatives and monitoring of their development for fiscal years 2002 to 2004. In contrast to the bottom-up approach of the Clinton administration, the Bush administration approach is top-down, engineering in its approach to systems development, and emphasizes strict and rigorous project management. Yet there have been enormous disparities between the funds actually allocated to the e-government projects and and the congressional appropriation. As John Spotila, former director of Information and Regulatory Affairs in OMB, remarked: "… Even without homeland security absorbing most of the IT dollars, cross-agency projects have never been a favorite of Congress, where appropriations are awarded through a 'stovepipe system' of committees that makes a multi-agency approach difficult."[10] Appropriations for the cross-agency initiatives were $5 million in FY 2002 and 2003 and only $3 million in FY2004. A congressional source

[10] Quotation from *Federal Computer Week*, February 18, 2002: http://www.fcw.com/fcw/articles/2002/0218/cov-budget1-02-18-02.asp

recently noted: "We have never been convinced that the fund [requested to support cross-agency initiatives] doesn't duplicate what already exists in other agencies or performs unique functions … It has never been well-justified, and we don't have a lot of spare cash lying around."[11]

Conclusions

The bureaucratic state is not outmoded, but the nature and structure of the state is changing fundamentally as information and communication technologies are being absorbed into governments. It is not vanishing but remains critical to standard setting, rule by fiat softened by consultation, integrity of processes, and accountability. It is the locus of the "national interest" in an increasingly globalized network of nations. The virtual state is intersectoral, interagency, and intergovernmental yet achieves connection through standardization, rationalization, and systems interdependence.

Although communications researchers have used the concept "co-evolution" to refer to reciprocal relationships between technology and organizations and their co-development, the reference to co-evolution connotes that enactment simply happens. By contrast, I have developed the technology enactment framework to examine how the actions of public officials and other government decisionmakers interact to enact technology. So the technology enactment framework builds specificity and explanatory power into models of co-evolution of technology and government organizations

This chapter has focused on structural and institutional changes to the state in the elaboration of the technology enactment framework and the illustration of recent efforts by the U.S. government to create inter-agency structures and processes. Technology plays a key role in changing the capacity of public servants to engage in knowledge creation and exchange. These informal exchanges among professionals within and outside government through the Internet comprise a powerful change in the public policymaking process. Information

[11] John Scofield, spokesman for the House Appropriations Committee, quoted in *Government Computer News*, February 9, 2004. See http://gcn.com/23_3/news/24892-1.html, accessed July 2, 2004.

technology has afforded the capacity for different and greater communication, for different and great information and knowledge sharing, and for greater transparency and display of complex information. All of these change the types of conversations and dialogue for government officials. The daily, informal exchanges are among the most important and potentially far-reaching changes in policymaking and governance.

The virtual state is intersectoral, interagency, and intergovernmental. But it achieves this fluidity and cross-boundary character through standardization, rationalization, and the management of interdependence.

Is the virtual state a non-place?

The idea of a "non-place," drawn from contemporary theory in anthropology, refers to the increasing use of generic systems, applications, interfaces, terminologies, and more to replace unique, particular place-based images, systems, terms and other markers.[12] Generic, corporate systems tend to ignore the particularities of countries, regions, cities, and other local geographic and historic "places." In fact, the desire of corporations to communicate their "brand," intensifies the diminishing of place. For example, the external face of the McDonalds Corporation looks the same in every country regardless of "place." Airports tend to look the same so that a person in an airport may have few markers that provide information about the particular culture of a place.

I have not yet drawn out the implications for government and governance of this increasing homogenization of approaches. But I would say that there might be a loss of attention to the particular problems and political issues that belong to particular places given their unique history and geographic features. This is the general idea of a "non-place."

I do not think that the virtual state in any country will become a "non-place" for many years. But I want to issue a warning about the increasing use of pre-packaged, generic applications, interfaces, and

[12] See Marc Augé, *non-places: introduction to an anthropology of supermodernity* (London: Verso, 1995). Translated by John Howe.

systems in governments around the world. These homogenized, standardized products are those of major multi-national firms. They provide organizations and inter-organizational networks with the ability to inter-operate, which is a great benefit to governments and societies. But they diminish local particularities that provide a sense of place and serve to maintain distinctive cultures.

The challenges that lie ahead are not simply technical. Indeed, the technical challenges are relatively simple. The more complex and difficult challenges related to the virtual state are intellectual, governmental and practical. As the use of ICTs in government moves forward there is much more at stake than simply increasing efficiency and service levels. Bureaucracies and the bureaucratic model have been the source of government accountability, fairness, and integrity of processes. If the bureaucratic form is changing, what forms, structures, and processes will replace it? Given these governance challenges, business models and business language can be limiting and misleading as a source of wisdom and advice for building the virtual state. Business experience can inform operations and systems development. But public servants and the polity will have to engage in deliberation to bring clarity to governance questions.

The role of the public servant is changing but remains critical in democracies. Civil servants play a vital role in domestic—and increasingly in transnational and global—policy regimes. Professional, experienced public servants are essential to the virtual state. I suppose that it is obvious to say that professional, experienced public servants are critical. But in the United States, many conservatives would like to eliminate the public service and to use contract workers instead. So, my comment is made in the context of a debate about the privatization of the public service. The argument is that e-government and networked government make professionalism and experience even more important within the entire public service. IT is not a substitute for experience and professionalism. It is not a strategy for deskilling the public service although it may be possible to eliminate some jobs made redundant by IT. It is critical also for IT professionals to have better interaction with other professionals.

All public servants need to be knowledgeable about IT, if not in a technical sense then in terms of understanding its strategic and political importance. Governments must be careful customers of private

consultants and vendors. I do not think that most private firms really understand the differences between government and private sector organizations. And most do not care about these differences or view them as their responsibility to understand. Hence, public servants must understand the differences between systems built for the private sector and the requirements necessary for government systems. Vendors generally do not understand the higher standards of accountability that are the obligation of the state, fair and equal treatment of citizens, access, transparency and, in particular, security and privacy necessary for government systems.

These are not obvious statements in the present business environment. In the U.S. some public servants have been intimidated by Congress and private consultants to believe that they are inferior decision makers, that they are out of date in their thinking and that, in nearly all cases, that the private sector "can do it better than government." Public servants, in many cases, insufficiently value their knowledge and experience to negotiate in a strong way with private firms. It is necessary for contractors to build the large systems for government. But it is also necessary for public servants to play a strong role in the design, development and implementation of those systems. They are the decision makers with the experience and depth of knowledge of government operations and politics. Thus public servants are the decision makers who know when to import a system from the private sector and when a system needs to be modified for public use.

Researchers and practitioners are just beginning to explore the potential for cross-agency capacity and policymaking. Extending the ideas presented in this paper beyond inter-agency relationships within the federal state, one can readily imagine that we may have to redefine and modify ideas about federalism due to networked governance. Moreover, the increasing use of inter-sectoral relationships—that is, relationships among the public, private and nonprofit sectors—marks the virtual state. There is strong evidence to support the claim that virtual integration, that is, the location of information and services from different agencies and programs on one website, does in some cases lead to pressure or the desire of decision makers for actual organizational level integration.

Appendix One

25 E-Government Initiatives: Brief Descriptions

Program	Description
Government to Citizen	
Recreation One-Stop www.recreation.gov	"Provides a single point of access, user-friendly, web-based resource to citizens, offering information and access to government recreational sites" http://www.whitehouse.gov/omb/egov/gtoc/recreation.htm
GovBenefits.gov www.govbenefits.gov	"Provides a single point of access for citizens to locate and determine potential eligibility for government benefits and services" http://www.whitehouse.gov/omb/egov/gtoc/govbenefits.htm
E-Loans www.govloans.com	"Creates a single point of access for citizens to locate information on federal loan programs, and improves back-office loan functions" http://www.whitehouse.gov/omb/egov/gtoc/online_loan.htm
USA Services	"Develop and deploy government-wide citizen customer service using industry best practices [to] provide citizens with timely, consistent responses about government information and services via e-mail, telephone, Internet, and publications" http://www.whitehouse.gov/omb/egov/gtoc/usa_services.htm
IRS Free File http://www.irs.gov/app/freeFile/welcome.jsp	"Creates a single point of access to free on-line preparation and electronic tax filing services provided by Industry Partners to reduce burden and costs to taxpayers" http://www.whitehouse.gov/omb/egov/gtoc/irs_free.htm

Government to Business	
E-Rulemaking http://www.regulations.gov/	"Allows citizens to easily access and participate in the rulemaking process. Improves the access to, and quality of, the rulemaking process for individuals, businesses, and other government entities while streamlining and increasing the efficiency of internal agency processes" http://www.whitehouse.gov/omb/egov/gtob/rulemaking.htm
Expanding Electronic Tax Products for Business	"Reduces the number of tax-related forms that businesses must file, provides timely and accurate tax information to businesses, increases the availability of electronic tax filing, and models simplified federal and state tax employment laws" http://www.whitehouse.gov/omb/egov/gtob/tax_filing.htm
International Trade Process Streaming http://www.export.gov/	"Makes it easy for Small and Medium Enterprises (SMEs) to obtain the information and documents needed to conduct business abroad" http://www.whitehouse.gov/omb/egov/gtob/trade.htm
Federal Asset Sales http://www.firstgov.gov/shopping/shopping.shtml	"Identify, recommend, and implement improvements for asset recovery and disposition, making it easier for agencies, businesses, and citizens to find and acquire/buy federal assets." http://www.whitehouse.gov/omb/egov/gtob/asset.htm
Business Gateway http://www.business.gov/	"Reduces the burden on businesses by making it easy to find, understand, and comply (including submitting forms) with relevant laws and regulations at all levels of government" http://www.whitehouse.gov/omb/egov/gtob/compliance.htm

Consolidated Health Informatics	"Adopts a portfolio of existing health information interoperability standards (health vocabulary and messaging) enabling all agencies in the federal health enterprise to "speak the same language" based on common enterprise-wide business and information technology architectures" http://www.whitehouse.gov/omb/egov/gtob/health_informatics.htm
Government to Government	
Geospatial One-Stop http://www.geo-one-stop.gov/; http://www.geodata.gov/	"Provides federal and state agencies with single point of access to map-related data enabling the sharing of existing data, and to identify potential partners for sharing the cost for future data purchases" http://www.whitehouse.gov/omb/egov/gtog/geospatial.htm
Disaster Management http://www.disasterhelp.gov/	"Provide citizens and members of the emergency management community with a unified point of access to disaster preparedness, mitigation, response, and recovery information from across federal, state, and local government … Improve preparation, mitigation, response and recovery for all hazards through the development of interoperability standards that enable information sharing across the nation's emergency management community …." http://www.whitehouse.gov/omb/egov/gtog/disaster.htm
SAFECOM` www.safecomprogram.gov	"Serves as the umbrella program within the Federal government to help local, tribal, State and Federal public safety agencies improve public safety response through more effective and efficient interoperable wireless communications." http://www.whitehouse.gov/omb/egov/gtog/safecom.htm

E-Vital	"Establishes common electronic processes for Federal and State agencies to collect, process, analyze, verify and share vital statistics record information. Also promotes automating how deaths are registered with the states (Electronic Death Registration (EDR))." http://www.whitehouse.gov/omb/egov/gtog/evital.htm
Grants.gov http://www.grants.gov	"Creates a single portal for all federal grant customers to find, apply and ultimately manage grants on-line." http://www.whitehouse.gov/omb/egov/gtog/egrants.htm
Internal Efficiency and Effectiveness	
E-Training	"Create a premier e-training environment that supports development of the Federal workforce through simplified and one-stop access to high quality e-training products and services …" http://www.whitehouse.gov/omb/egov/internal/training.htm
Recruitment One-Stop	"Outsources delivery of USAJOBS Federal Employment Information System to provide state-of-the-art on-line recruitment services to job seekers including intuitive job searching, on-line resume submission, applicant data mining, and on-line feedback on status and eligibility." http://www.whitehouse.gov/omb/egov/internal/recruit.htm
Enterprise HR Integration	"Streamlines and automates the electronic exchange of standardized HR data needed for creation of an official employee record across the Executive Branch. Provides comprehensive knowledge management workforce analysis, forecasting, and reporting across the Executive Branch for the strategic management of human capital." http://www.whitehouse.gov/omb/egov/internal/enterprise.htm

E-Clearance	"Streamlines and improves the quality of the current security clearance process" http://www.whitehouse.gov/omb/egov/internal/eclearance.htm
E-Payroll	"Consolidates 22 federal payroll systems to simplify and standardize federal human resources/payroll policies and procedures to better integrate payroll, human resources, and finance functions." http://www.whitehouse.gov/omb/egov/internal/epayroll.htm
E-Travel	"Provides a government-wide web-based service that applies world-class travel management practices to consolidate federal travel, minimize cost and produce superior customer satisfaction. The E-Travel Service will be commercially hosted ..." http://www.whitehouse.gov/omb/egov/internal/etravel.htm
Integrated Acquisition Environment www.BPN.gov www.ContractDirectory.gov www.EPLS.gov www.FedBizOpps.gov www.FedTeDS.gov www.FPDS-NG.com www.PPIRS.gov www.WDOL.gov	"Creates a secure business environment that will facilitate and support cost-effective acquisition of goods and services by agencies, while eliminating inefficiencies in the current acquisition environment." http://www.whitehouse.gov/omb/egov/internal/acquisition.htm

E-Records Management	"Provides policy guidance to help agencies better manage their electronic records ... Four major issue areas: Correspondence management, Enterprise-wide electronic records management, Electronic Information Management Standards, Transferring permanent records to NARA." http://www.whitehouse.gov/omb/egov/internal/records.htm
E-Authentication	
E-Authentication	"Minimizes the burden on businesses, public and government when obtaining services on-line by providing a secure infrastructure for on-line transactions, eliminating the need for separate processes for the verification of identity and electronic signatures" http://www.whitehouse.gov/omb/egov/ea/eauthentication.htm

Chapter 6

Uses of Internet and Mobile Technology in Health Systems: Organizational and Social Issues in a Comparative Context

James Katz, Ronald E. Rice and Sophia Acord

Introduction

The Internet provides an opportunity to the public and healthcare professionals to access medical and health information, improve the efficiency and effective, timely healthcare. The rise of mobile systems and the widespread adoption of the cell phone mean that mobile applications are an exciting and rapidly expanding domain for such applications. Many new offerings are being developed through digital appliances, computer terminals and mobile devices. Yet important empirical questions remain to be answered at every level about how effective these systems are, how people in various socio-demographic sectors actually use these systems, what their different effects are on those sectors, and whether their expense justifies the efforts involved. Important too are issues of how quickly and in what format they should be created, who should bear the costs of development and dissemination, how to ensure their dependability and sustainability, and what their immediate and longer term social implications might be.

In earlier work, we have highlighted structural problems with Internet healthcare applications (Katz & Rice, 2001). More recently, we have observed that (1) there has been substantial resource commitment, resulting in the creation of many useful centralized services (some commercial, some governmental); (2) however, despite their utility, perceived and actual inadequacies of these services have stimulated disparate groups to organize their own compensatory, decentralized and local networks of health information resources. These include Internet listservs, "blogs" (that is, online interactive diaries or

"Weblogs") and local telephone circles. Often these para-institutional sources are designed to respond to patient needs as perceived by patients and care-givers, and response to the way they formulate and articulate their health concerns. But just as questions must be raised about the bias, flexibility and ease-of-use of the centralized systems, questions must also be raised about the bias, accuracy and accountability of the new flexible ones. (4) As new communication technologies are developed, they are also explored for novel e-health uses. Here a recent example is radio-frequency identification (RFID) tags that allow medical paraphernalia, prescription drugs to be traced, monitored and controlled. Indeed, RFID tags are already being used to track and treat patients in hospital settings. These technologies can not only deliver services cost-effectively but will inevitably save lives. They may even prevent the outbreak of epidemics. However, some of these new technologies raise not only serious questions for students of privacy and ethics, but fear of them may lead to avoidance behavior on the part of sick people. This in turn could lead to potentially catastrophic consequences for both the individual and the general population.

Clearly for both centralized and decentralized Internet health resources, there are still many issues to be resolved at the cultural, user interface, institutional and system levels. Of particular concern for those seeking to develop practices at the community level, attention needs to be given to issues of (4) how new systems reconfigure physician/patient relationships and how they re-distribute the respective benefits and drawbacks to both sides of the relationship (Rice & Katz, 2006), (5) to what degree they open channels of communication to help patients and physicians come to terms with new technologies in mutually-beneficial ways and help them communicate about how to best use new technologies for medical ends, and (6) how to create socially sensitive e-health services that are also socially equitable in terms of accessibility (Katz, Rice & Acord, 2004). And of course we are concerned about (7) what role cultural and social aspects impede the deployment of new, cost-effective healthcare and medical services.

In our analysis, we perceived a dialectical process: each of the above analytical themes stems from an original problem perceived by one or more stakeholders, which in turn gives rise to specific forms of Internet use. From these there arise new contradictions, which sug-

gest potential, often novel, solutions. So advancement in effective Internet and mobile healthcare systems require not only empirical data on the specific reception of each system by its users, but also a larger framework that understands the logic of self-interest and cultural moorings that affect each system in a larger setting. For instance, analysts need to consider ways in which people try to use the Internet and mobile to serve their own needs, and how, when doing so, they become enmeshed in, or seek to subvert, the inherent logic and vested interests of health institutions and information systems.

Assessment of these problems involves issues that go beyond good intentions and laudable aims (or other motives) of providers. They should include consideration of the inherent bureaucratic logic of one-way information flow. This logic governs traditional relations of healthcare organizations with their clients, even as these operations are extended into digital domains and widespread access. Further, as this process unfolds, it often includes within it a market logic of packaging information for return on investment, and at the very least some concern about program efficiency. These inherent logics sometimes lead to confusion on the user's part since the user may not understand the deeper motivations and rationales. Yet organizations, if they are to have a continued existence and reap the rewards of sunk costs and prior efforts, must also attend to their vested interests.

Moreover, the specific area of health is further complicated by considerations of (and conflicts among stakeholders over) value orientations toward the rules governing individual and group privacy, commercial free speech, access to markets, legal and medical regulations, and effectively informing, protecting, and enabling patients as well as physicians and other healthcare workers. Increasingly, too, there are concerns of legal accountability and human rights. Thus, responses to identified problems that do not address these limitations are unlikely to be viable over a longer term. This is in contrast to the ways some new technologies are deployed, which might be described as "create a new technology, deploy it in a few sites, and then ask people how much they like it." Ultimately, then, it seems reasonable that further research on e-health applications needs to take into account (and be predicated upon) the *needs* of all stakeholders involved in the medical sphere (e.g., patients, physicians, hospitals, policy makers, regulators, and payers).

Before delving into the themes, we should mention our perspective, which we dub "Syntopian" (Katz & Rice, 2002). The Syntopian perspective rejects both dystopian and utopian perspectives on the social uses and consequences of information and communication technology. Rather, it emphasizes how people, groups, organizations and societies adopt, use and reinvent (Johnson & Rice, 1987; Rice & Gattiker, 2000) technologies to make meaning for themselves relative to others. Hence, while possibilities are limited by the nature of the given technological tools, systems and their uses are (potentially) surprisingly flexible. Thus technology becomes shaped by individual needs and social contexts. The perspective also highlights that the internal logic of both formal organizational systems and personal social systems are fully applicable to the Internet (Castells, 2000).

In this chapter, we focus on delineating some recent developments in the use of the Internet and related technologies for healthcare. The emphasis is on the situation in the US, though we draw on other countries as well for comparative and descriptive purposes. We try to highlight the macro social issues that could be of interest to policymakers and suggest possibilities that could merit consideration by system designers or healthcare service professionals.

Internet Technology and E-health Resources

E-health resources have wide appeal in the US; quality, utility sometimes problematic

Clearly e-health is something that has great appeal to Internet users throughout the world, especially in North America. Numerous surveys have shown that in the US in particular there is heavy use among consumers and especially physicians (Katz, Rice & Acord, 2004). Many institutions have devoted vast resources to putting medical information online (Boston Consulting Group, 2003). In the US, this includes PubMed and Medline via the National Library of Medicine, which are generally accessible online from Internet-connected computers, regardless, generally speaking, of where around the globe they might be located. These resources are often free, which, though partly understandable, is also in many ways astonishing. (Portugal, incidentally, has committed to putting large amounts of information in

Portuguese on line and making it readily accessible to its citizens. As a case in point, to provide better access to governmental data, Portugal reportedly offers free public access in some parish churches—"eGovernment in Europe," 2004).

However, websites such as the NHS library or MDConsult.com, which aim to provide accurate and secure information to health-seekers, suffer from readability problems (Ebenezer, 2003) and are rarely designed for patients (Tench et al., 1998). Moreover, at least in the US and Canadian contexts, patients are generally unaware of these high-quality data sources (Sigouin & Jadad, 2002), so they are often not places to which consumers are likely to turn, at least in the first part of their attempts to seek information. Hence, health seekers tend to use general search engines, such as Google (Boston Consulting Group, 2001, 2003). However, the more centralized and commercial websites found in this manner generally lack customer interaction features. Instead they provide only unidirectional information (Cudmore & Bobrowski, 2003). For example, fewer than one out of three pharmaceutical company websites offer a way to respond online to consumer requests. Fewer than half of health-supply websites respond to online requests or questions (Pharmaceutical, 2003). Yet government health sites are even less interactive (Rice, Peterson & Christine, 2002). Further, these more general health sites may not provide the specific, contextual information appropriate to the user's needs, and may have both identifiable and hidden commercial and other biases.

Personal websites have role

Personal, rather than commercial, educational or government, health websites play a significant role in the construction of medical knowledge online, and represent the growth of interest in 'local' knowledge. In a search for rheumatoid arthritis, 34% of relevant sites were posted by an individual, more than those posted by a non-profit organization, and over 6 times more than those posted by an educational institution (Suarez-Almazor et al., 2001). Yet, very little research has been done on the ways in which health-seekers use this information source, as its existence is often overshadowed by online support groups. It is likely that "blogs," or web logs (which are essentially on-line diaries with an interactive component that encourages others to leave comments), will be playing a growing and complementary role in these processes.

Physician websites becoming an important resource

In the US, it appears that about one-third of physicians have a Web site, of whose development obstetrics/gynaecology and internal medicine specialists have been the most prevalent (AMA, 2002). Howitt et al. (2002) studied UK websites and found that, apart from e-mail sent to the practice, possibilities for electronic communication were low, as was the general quality of information. Sanchez (2002) notes that the vast majority of physician websites focus on practice enhancement tactics, rather than specific patient service. In contrast to the supply side of the healthcare equation, Norum et al. (2003) report that cancer patients want to see more information on hospital websites that is directly related to the delivery of healthcare. For example, these include waiting time before a physician is available, treatment services, and office location information (Pastore, 2001). Services like WebMD are providing physicians with an array of electronic support, including websites and secure email. Patients have reported that these sites are cumbersome, in part due to the concerns about liability and the assumption of responsibility.

Desire for useful online information from physicians is also typical of Spain, apparently, even though there is overall less Internet health-seeking and more traditional ties to local providers. This desire is reflected in a study of Catalonian patients. Panés et al. (2002) found that 84% of Internet health-seeking patients (which represented 44% of all patients) suffering from irritable bowel syndrome wanted a local website from their own clinic; 65% were willing to pay for this service. It seems that patient demand continues to exceed physician supply of useful information both in the US and Spain.

Health kiosks: Crossing a digital divide?

Health kiosks are uncommon in the US and tend to be situated in clinic waiting rooms (indeed the proportion seems to be declining for reasons of inutility and cost). For example, Sciamanna et al. (2004) experimented with a kiosk giving tailored advice on fitness and smoking. Although fewer than one/third of the participants had ever used the Internet to seek health information, over 80% found the kiosk easy to use. However, less than half of the doctors looked at the report provided by the kiosk or discussed it with the patient. Goldschmidt and

Goodrich (2004) placed bilingual kiosks in clinic waiting rooms and noted that 68% of people said they found all the information they were looking for, and that flu shots increased by 24% following the installation. In contrast to the US (which seems to use kiosks to reduce information demand on the physician), other countries are experimenting with health kiosks containing pre-sorted information, to reach communities which may not have Internet access or know-how. Jones et al. (2001) found that among an elderly Spanish population without Internet access, 25% were interested in the kiosk idea. While in terms of professional opinions about their utility, kiosks do not rate high, they may yet be a significant way to disseminate medical information to socially remote communities or in specific delivery locales.

Physician education resources

There is great potential for the Internet to help educate and update physicians. For instance, Casebeer et al. (2003) details the positive impact that a Web-based physician tutorial on preventative care (in these specific case, sexually transmitted diseases) had on the knowledge of the experiment group versus the control group.

Policy Concerns of Centralized Applications

Due to the decentralized, unregulated nature of the web, and even the contested nature of what constitutes valid and quality medical information, the accuracy and usability of online information are extremely pressing policy problems (Berland et al., 2001; Kunst et al., 2002; Rice, 2001; Zeng et al., 2004). As just one example, websites that offer so-called alternative medical treatments have been described as containing dangerously inadequate or misleading information (Ernst & Schmidt, 2002; Hainer et al., 2000; Molassiotis & Xu, 2004). Organizations such as HON (Health on the Net) have devised guidelines to rate the quality of e-health information, and some current websites carry the HON seal of approval (Wilson, 2002). However, it is not clear really to what degree health-seekers use general search engines because they are not familiar with approved medical resources, or because they are specifically looking for alternative treatment ideas. As there is no way to prevent the dissemination of hazardous information, the best use of resources seems to be to develop

sanctioned general web health portals and raise public awareness about ways to look for reliable health information, especially by the patients' physicians. The recent success of WebMD Health (after staggering losses in 2001) demonstrates the fruits of such policies.

In addition, it does seem as if health-seekers realize the dangers of bad health information online and want the development of local-medical sources such as physician websites. In responding to this need, the biggest factors are ensuring readability, privacy, and publicity in accurate medical sources, as well as informing patients of clinical studies for new treatments. As Seidman, Steinwachs and Rubin (2003) point out, there still needs to be developed a robust tool, accessible to health-seekers, to identify quality information on the Internet.

Yet these concerns should not blind us to the enormously important role online health information is already playing. For instance, Wagner et al. (2004) report that patients who suffer chronic diseases (in this case diabetes) find that the information gained through online channels help them manage their situation. Moreover, there is another way in which quality interacts with the Internet, and this is in terms of rating the quality of physicians and healthcare providers (especially hospitals and insurers). Indeed, this is one area in which we could predict a revolution that will benefit the public even at the cost of some individual or institutional reputations.

Apart from the quality or design of Internet health applications, there are still major differences in exposure and access. It is not always clear whether the fault or limitation inheres in the application or in the target population. But in the USA, at least, there are consistent "digital divides" in access to healthcare information. These include socioeconomic status, gender, race (Houston & Allison, 2002), health status, language (Berland et al., 2001, found Spanish-language sites suffered from even worse quality issues), age (Meischke et al., 2005)[1] and physical disabilities such as elderly immobility (Katz & Aspden, 2001) or visual impairment (Davis, 2002). Most importantly, much data support claims that higher education levels corresponds with Internet use (Giménéz-Perez et al., 2002; Licciardone et al., 2001;

[1] In fact, in a recent study in Washington State, only 7% of seniors who suffered heart attacks *and* had Internet access ever looked for information on their conditions online (Meischke et al., 2005).

Pandey et al., 2003). Kakai et al. (2003) found that people of higher education levels prefer to get their health information through seemingly objective, scientific, and updated forms, such as the Internet, while those of lower educational levels prefer to have their information come from mass media and other people because they say they like the human approach. Perhaps one way to increase delivery to the "have-nots" may be to develop health kiosks in ways that appeal to the elderly and non-native language speakers; of course attention to location and usability would be paramount, as well as situated teaching campaigns to train local populations in their use.

Cultural factors are also important in understanding the policy implications of various e-health applications (Yom, 1996). Kakai et al. (2003) found differences in preferred information sources along ethnic lines, as Caucasian patients preferred objective, scientific, and updated information obtained through medical journals, research institutions, and telephone and Internet sources, while Japanese patients preferred media and commercial sources such as TV, magazines, books, and other written sources. Non-Japanese Asians and Pacific Islanders tended to favor information sources marked by person-to-person communication, such as physicians, social groups, and other cancer patients. In the US, black women had a 60% lower likelihood of using computer-based resources than did white women (Nicholson et al., 2003), and non-white people are less likely to use the Internet to look up health information for breast cancer (Fogel et al., 2002). Social and cultural factors of populations and communities hence appear to be important considerations when developing targeted e-health applications (Morahan-Martin, 2004).

Thus, despite the widespread development of Internet e-health applications, these resources do not seem to be accessible to, or at least accessed by, large portions of US society. Nor do they often seem recognized as a source for medical knowledge in communities and cultures that are already much more familiar with face-to-face physician interaction. The challenge remains then to create health information systems accessible in ways that fit lifestyles and choices of underserved groups, motivate healthcare providers to provide personal encouragement for and information about using online resources, and encourage these groups to develop knowledge and routes of accessibility to e-health websites.

Internet Technology—Multidirectional

E-health applications also should not stop at merely providing unidirectional information, although this is important. Keeping in mind the way most non-students learn, it is important to develop on-line possibilities for multi-directional interaction between health-seekers and appropriately tailored information.

Physician webcams

Bamford et al. (2003) implemented a country-wide network of physician webcams in the UK through the implementation of double-headed microscopes in 35 histopathology departments across the UK. A year after installation, they found that 71% of the physicians had not even used the networking software. All of those physicians who had used it found it effective for diagnosis and exchanging opinions. Bamford et al. conclude that the project did not achieve its aims to due excessive workloads preventing physician training, IT staff reluctance to render assistance, but above all, user attitudes.

Email

Many physicians do not use email because they are not compensated for the time involved to check, assess, and respond (Anderson et al., 2003; Harris Interactive, 2001; Rice & Katz, 2006); and there are liability and confidentiality issues that preclude using email. In contrast, American healthcare consumers overwhelmingly say they would often like to be able to contact their physicians by email rather than through office visits (CyberAtlas, 2002; Norum et al., 2003). Patients would like to email for prescription refills, non-urgent consultations, and to receive test results (Couchman, Forjuoh & Rascoe, 2001). However, it is noteworthy that 75% of patient emails to physicians included requests for medication/treatment information or actions, or specific diseases/symptoms (Sittig, 2003). Hassol et al. (2004) found that most patients preferred email communication and face-to-face communication with their physicians (depending on the matter), while US physicians preferred telephone to email communication. Of those 20-30% of physicians who do use email or electronic communication, many see improved patient satisfaction and some note improved efficiency and care (Harris Interactive, 2001).

In this context, it is unsurprising that researchers have attempted to develop software that would identify terms in patients' emails that could be then linked to medical information to be emailed back to the patients without the need for a physician response (Brennan & Aronson, 2003). This system may be efficient, but it is also likely to raise some serious concerns in the minds of the patients; it may be that patients want email because they seek a *human* response, which may be paradoxically more difficult through traditional physician-patient channels.

Sometimes it is suggested that "out-sourcing" of medical information provisioning could help the developed countries as well as developing ones. This idea is already widespread in many technical and consumer support fields, most notably in computer user problem resolution. However, there appears to be scant interest on the part of healthcare consumers for such services at this point. For instance, Hassol et al. (2004) evaluated interest in various ways in which offshore physicians could be contacted by patients. They found mild interest in telephone contact methods among Americans, but no interest whatsoever in an email service.

Health information management systems

Mendelson and Salinsky (1997) note that the early failure of many Community Health Management Information Systems (CHMIS) (similar to CHINS, or community health information networks) was due to the lack of private sector support for integrated, state-wide systems. In addition, the general public distrust of state-sponsored health care systems combined with the proprietary interests of the players involved served to eliminate them in the majority of states (Eder & Wise, 2001; Katz & Aspden, 2001). However, in states where health databases exist, such as Wisconsin Health Information Networks, the direct access to clinical and administrative data saved up to $68,000 a year for private practices and up to $1 million for hospitals (Mendelson & Salinsky, 1997).

Using electronic medical records in hospital databases was demonstrated to help ensure consistent and correct coding by physicians, as well as context-sensitive treatment in Germany, by Muller et al. (2003). Patient-accessible health records have been found to be a valuable step forward, with satisfaction, rates in the 65-85% range (Hassol

et al., 2004; Joustra-Enquist & Eklund, 2004; Wang et al., 2004).[2] Yet there is both resistance to them by staff due to local cultural practices and larger concerns about privacy and security. Radio-frequency identification (RFID) systems are expected to blend database management and mobile tracking together in extremely fruitful ways, although problems of cost and integration remain to be solved before they can see widespread deployment.

Outside of the US, the EU has implemented a general e-health strategy for the years to come,[3] and Tachinardi (1998) describes an ongoing project in Brazil to build a network of e-health applications including a unified health record for the exchange of patient data, and a virtual hospital of health information and medical journals for physicians and lay patients..

Discussion groups

Online discussion groups respond to many of the needs unfulfilled by the centralized information providers. In some cases, these groups extract information from professional journals (Wikgren, 2001) and recreate it in a way to make it more applicable and understandable among the users. Many discussion groups include physicians (Katz & Aspden, 2001). Practically all conditions and situations have groups,

[2] Wang et al. (2004) developed a web-based personal health record for patients to collect and manage their health information (medical history, past surgeries, medications, and allergies), to request self-referrals, and to store a record of their consultations. The PHR also includes a messaging system that can be structured into the workflow of referral management as well as allowing more general communications. A preliminary study was conducted with 61 patients. Thirty-two patients completed a survey in which 85% of respondents were satisfied with the usability and 94% were satisfied with the overall online referral process. Joustra-Enquist and Eklund (2004) report on SUSTAINS, a web-based health care account in which the patient can login (with a login sent to their mobile phone) and review medical results and prescriptions and information, and exchange written information with physicians; participants reported that it is beneficial for both parties. According to Hassol et al. (2004), 65-85% of Americans in an experiment with electronic health records reported them easy to use, and that they understood all the information; a small minority reported confidentiality concerns.

[3] By the end of 2005, each member state should have a national roadmap for e-health, focusing on e-health symptoms and electronic records, and there will be an EU public health portal. By the end of 2006, member states should have a common approach to patient identifiers and identity-management, as well as interoperability standards for health data message and electronic health records. By 2008, health information networks should be commonplace (European Commission, 2004).

including those that deal with chronic conditions or embarrassing conditions (Millard & Fintak, 2002) and rare diseases (Patsos, 2001). Participants also report across-the-board benefits for themselves (Pew, 2000; Pew 2002) and for their loved ones (Till, 2003). They especially seem to like the fact that use offers empathy (Preece & Ghozati, 2001), personal empowerment (Sharf, 1997), and emotional support (Winzelberg et al., 2003). In fact, many report that symptoms seem reduced or alleviated by membership (Lorig et al., 2002; McKay et al., 2001; Winzelberg et al., 2003). This is not surprising in part because if people did not perceive benefits, they would not be using the systems. The social-psychological and emotional benefits are the qualities that are often lacking in treatments provided by physicians and institutions. Beyond the perception of psychological and emotional benefits, however, perceptions of actual health changes and improvements may be highly inaccurate and may even lead users to engage in treatment practices that are harmful.

E-commerce and online bidding

MedicineOnline.com offers an auction service in which patients can elicit physician bids for surgeries (Baur et al., 2001). It is unclear who uses this service, however, and what impact it has. At the same time, online "retail" e-commerce is likely to grow quickly, in part because of the desire to reduce costs and, in many societies including the US, to open channels of competition. This is likely to affect the cost of, and hence demand for, many elective procedures. Cosmetic surgery and whole-body magnetic resonance imaging (MRIs) are likely to be among those that are going to be competitively marketed online. Certainly there is already much promotion among dentists for both routine and cosmetic procedures through traditional distribution channels, and it is likely that the Internet will also become an important method of advertising for many common procedures and for attracting patients to under-utilized hospitals and treatment centers.

Web-Based interventions

The US has experimented with web-based health interventions, while other countries tend to focus on mobile phone text-based interventions (Curioso, 2006). For the US, one web-based diabetes care

management system saw an improvement in testing and check-up regularity among its users (Meigs et al., 2003). Overall, Wantland et al. (2004) found that web-based interventions were much more likely to achieve noticeable results than non web-based interventions in behavioral studies. These included areas of increased exercise time, knowledge of nutritional status and knowledge of treatments. However, in the UK, Eminovic et al. (2004) tested a web-based triage service with a nurse and found on average that it took twice as long to diagnose and treat complaints as with the NHS direct hotline. This study suggests the importance of interpersonal and cultural aspect in developing e-health applications.

Mobile Communication Technology: Bi-directional and Multidirectional

Telephone

The telephone can function as the basis for local support networks, often designed to harmonize with local culture. (Indeed it has been an important component in healthcare for more than a century!) In the US, this may be seen in the case of the Native American Cancer Survivors' Support Network (Burhansstipanov et al., 2001). This example is actually a cultural adaptation, based on dissatisfaction with tribal clinics. There was no use of local tribal authorities, in order to prevent the loss of confidentiality characteristic of small communities. Instead, survivors from other communities provided support via telephone. A similar project, the Aldre Vast Information Centre, took place in western Sweden (Hanson et al., 2002). In response to the requests of older people and their families, the project established telephone, videophone, and Internet support to older citizens and their families. The project had positive results in empowering these people to make better health care choices. As an alternative to face-to-face clinic-based behavioural counselling, Glasgow et al. (2004) describe how interactive voice-response telephone calls can generate comparable results.

The telephone is relied upon in Iberian countries in some ways like the Internet is in the US. A Spanish study of a call centre for oncology patients reports a decline in emergency hospital visits (42% to 24%), and an overall short call length (3-5 minutes) (Ferrer-Roca et al.,

2002). This study demonstrates that telephone networks can be valuable for local patient support networks, as well as acting as effective paths to medical care. And, the short overall call time may indicate that such multidirectional networks will not take the toll on a physician's time that they fear. Likewise, a study of one Spanish telephone-intervention (Marquez Contreras et al., 2004a), found that telephone interventions increase treatment compliance as well as overall health.

Mobile phone

While Americans are relatively heavy seekers of Internet health information, there are relatively few mobile phone health applications in the US. The reverse is the situation in many other developed and developing countries (Curioso, 2006). Studies from Spain provide an illuminating contrast in usage patterns. Giménez-Pérez (2002) found that although only 36.5% of patients were regular Internet users, 76.6% of the patients owned a mobile phone, and 96% of those used it more than once a week. As a result, health applications involving mobile phones in Spain are more effective. Marquez Contreras et al. (2004b) conducted a controlled group study with hypertension patients; members of the intervention group were sent reminder text messages to their mobiles 2 days a week. Hypertension was significantly lower (51.5%) in the control group compared to the intervention group (64.7%). In another Spanish study, Vilella et al. (2004) found that text messages were an effective way to remind patients of immunization schedules prior to travelling abroad. Likewise, Bielli et al. (2004) report on an Italian study which analyzed the use of mobile phones for patients' health reporting. It was successful for 58% of patients; those who did not use it were older, less educated, and less familiar with new communications technology (mobile phone calls, mobile phone SMS, Internet, and email).

Similarly, trials in Asia report significant success with mobile phone health applications. Kubota et al. (2004) discuss a mobile application in which text messaging was used to send information about body weight reduction to study participants. Their study claims successful weight loss in 32% of the cases. Tang et al. (2004) report on a Hong Kong study that created a system for medical digital picture/scan information distribution and archiving using the physician's mobile

phone as the base. A central server handled the pre-sorting and processing of images. A Philippine study by Tolentino et al. (2004) describes a mobile phone based system for event reporting to develop an anaesthesia surveillance system.

Zhang et al. (2004) attribute much credit to mobile phone networks in the widespread success of public education during the SARS epidemic in China. Press reports at the time of the SARS epidemic described how public health workers in Hong Kong who were combating SARS would receive training and operational orders via SMS (short message service). The general public used SMS to alert others about which apartment buildings had infected residents (and hence should be avoided). At the same time, in the People's Republic of China, some people who were alerting others via SMS about SARS risks in their area were arrested by police and charged with spreading socially destructive rumors. The SARS example shows how mobile applications can be important in major health emergencies, but also shows how mobile communication can be a source of concern for officials seeking to control public behavior and movement of information.

Quite tellingly, research in Asia suggests strongly that there are substantial benefits available via mobile health applications for the elderly (once they have undergone the necessary training, of course). Ogawa et al. (2003) report on the success of using mobile phones with a pen-type entry sensor to provide and assess home care needs for elderly patients. Miyauchi et al. (2003) used mobile phones attached to sensors in order to inform medical services if elderly patients fall and are immobile, or are otherwise immobile, for set periods of time. Yoshiyama et al. (2004) also used mobile phones with digital photograph technology to effectively allow elder home care patients to communicate with their physicians.

Certainly there are some US applications employing mobile phone interventions. Several studies have been devoted to health improvement and self-management strategies as opposed to the management of specific chronic illness. For instance a study by Obermayer et al. (2004) used mobile phone text messages to deliver smoking-cessation intervention to college students, with a positive result. A similar study by Lazev et al. (2004) reports on the success in using mobile phone text to reach a low-income HIV-positive population in a smoking cessation program. The participants would not otherwise have land

phones or transportation to a clinic, so the mobile allowed them to get real-time counselling in life situations. Durso et al. (2004) also assessed how mobile phones could be used to communicate with older patients diagnosed with diabetes.

Morrissey (2004) blames concerns of electromagnetic interference with medical equipment for the poor availability of mobile phone networks in hospitals, claiming that alleviation of these concerns can lead the development of helpful physician and staff mobile communication. Klein and Djaiani (2003) note that this interference occurs only in close proximity to hospital equipment, and should not prevent the use of mobile phones in patient care areas and away from sensitive equipment, where access to and use of mobiles would encourage compliance with hospital policies.

Mobiles to fight AIDS and malaria in developing countries

It is worth including in our analysis a brief mention of the way mobile technology is being used to control malaria and AIDS. In the case of AIDS, free text messaging services are available in Kenya, where users can send text questions and receive free answers. As well, the free service sends out daily tips on how to prevent infection and deal with the disease's consequences. This service is provided by NGO One World (BBC, 2004). In Mali, local mobile company Ikatel sends free text messages with PSI-created health slogans twice a month to each of the company's 350,000 clients, and also prints AIDS and malaria prevention slogans on at least one million of the pre-paid phone cards most used by low-income customers. Sample messages include: "Protect your family against malaria—use an insecticide-treated mosquito net" (Plus News, 2004).

Certainly, given the mobile's success in social and business settings, there can be great expectations for the usefulness of the technology in fighting disease, especially in poor countries. These mobile health applications are interesting examples of how health information can be inserted directly into the daily lives of targeted populations, which contrasts with more traditional systems that are physically and psychologically remote from the active health-seeking population.

Mobiles healthcare databases highly useful in developing countries

In Rwanda, mobiles are used for connecting remote hospitals with centralized laboratories and supply houses. This saves enormous amounts of time and greatly increases efficiency. This initiative is based at the Earth Institute of Columbia University in New York City. Another mobile database operation may be seen in India. There, a rural healthcare project utilizing mobile phones won the UN's 2003 World Summit Award for e-Health. It triangulates mobile phones carried by field representatives to interconnect patient data, computers used by doctors in clinics, and a central database. Thus, distance-diagnosis is possible, saving on transportation costs, and other obstacles to health care (Simha, 2003).

Advanced mobile videophone and multi-media messaging

Chu and Ganz (2004) describe an ingenuous mobile medical application which uses commercial 3G wireless cellular data service to transmit a trauma patient's video, images, and electrocardiogram signals to a trauma specialist when the patient is in a remote location. Similarly, Weiner et al. (2003) used videoconferencing in nursing homes for unscheduled, night-time consultations. This study found that mobile multimedia applications were especially effective in dealing with mental health patients.

Mobile telemedicine

Telemedicine often is the use of satellite mobile communications technology to transfer information from patient to physician without the need for face-to-face interaction (Feliciani, 2003). Mobile telemedicine systems are used to convey images and information from location to location, such as from a remote clinic or an ambulance to a trauma centre (Heaton, 2006; Tahoka et al., 2003). Studies of systems include a German remote heart monitoring system, in which cardiac patients have their heart signal monitored and transferred to their mobile phone, and from there transmitted to their physician. Another one was a system in Brazil that allows remote physicians to confer via desktop computers with metropolitan cardiologists, and TelCardio Mobile, which allows important data and test results to be transferred

to physicians via mobile phones and PDAs. As a result, consultation and diagnosis can occur independently of a local infrastructure. There are many other telemedicine developments in India, the UK, and the EU, which allow the remote monitoring of patients by physicians in a hospital, via information transmitted over a mobile phone (Tahoka et al., 2003).

Important rationales for telemedicine are efficiency and effectiveness: physicians can do more with their time, and specialists can be remotely accessed by general clinics in low-income and sparsely-populated locations. Exemplifying the former, Holleran et al. (2003) describe the benefits of providing physicians with a wireless handheld device that is Web-enabled. The device can receive patient information anywhere, thus allowing physicians to respond in both a timely and an informed manner. A comparable approach has been developed by Chen et al. (2003). Although based in New York, their HealthNet system is used to provide better health care to Brazil's low-income northeast population. Examples of applications include fetal care and cardiology using telediagnosis and rendering second opinions about needed medical procedures (Barbosa et al., 2003).

Policy Implications of Internet and Mobile Health Technology

Ultimately, under most conditions it seems that healthcare applications have to resonate with a culture/society's dominant form of technology use. If either the provider or the patient side of the equation is resistant, difficulties will ensue. While the Internet has been characterized as an ideal way to disseminate information both locally and globally, for a variety of reasons discussed above, it has not succeeded in connecting up large portions of the population. Rather, telephone and mobile telephone health applications are relatively more popular in European and Asian countries; this is also reflected in the extraordinarily rapid spread of the mobile phone, which makes the heretofore seemingly rapid spread of the Internet seem slow by comparison.

Fahey (2003) warns that relying on cell phones to send text messages will lead to further inequality in health care along socioeconomic divides. However, other studies, such as Lavez et al. (2004), demonstrate the opposite. In fact, the very portability of mobile

phones and PDAs, enhanced by further device-to-device wireless technologies, actually make them versatile candidates to provide health care to remote areas, elderly individuals, transient workers, and individuals with disabilities (Curioso, 2006). (Sorri et al., 2003 developed a digital induction loop to improve the use of cell phones by the hearing impaired by means of reducing incompatibility with hearing aids.)

Concerning cross-cultural comparisons, it seems that most US telemedical developments are aimed at supporting physicians (such as mobile PDA-devices), while most non-US applications seem to be aimed at supporting patients (e.g., two-way health reporting through mobile phones).

To sum up, it seems that the original predictions about the problems of centralized systems continue to be borne out. Certainly unidirectional health applications continue to be developed, and succeed to some extent. But in trials and experiments, patients continue to ask for two-way communication and localized sensitivity. The abundance of mobile phone health applications in non-US countries, although their development came later than the original US health websites, seems to demonstrate the important role that the cultural-historical use of technology has on the acceptance of e-health devices. Above all, patients in remote areas or lower-income communities, as well as the elderly, generally find *interactional* e-health applications far more desirable than centralized sources. This differential is likely due to the cultural emphasis in these groups on non-mechanistic, face-to-face interaction. On the other hand, the active, independent, and non-confrontational health-seeking culture in the US lends itself well towards Web-based applications. In this regard, it will be interesting to track e-health developments as US mobile phone usage and EU Internet usage continue their respective rise. Yet, no matter the technology (Web or mobile phone), decentralized and interactional e-health applications seem to be taking an ever more prominent role in healthcare. Many programs that use them as their base also seem to be enjoying relative success. Presumably further development of these resources will add value to, and stand alongside of, the still-developing older formats of centralized, unidirectional healthcare information resources.

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Chapter 7

E-Learning and the Transformation of Education for a Knowledge Economy

Betty Collis

Introduction

Major changes are occurring in society in the ways in which we work and interact with each other. Collectively we are experiencing a change to a *knowledge economy*. I will focus on several of the main characteristics of functioning productively in a knowledge economy and give some examples of how these characteristics can relate to transformations in educational processes in the corporate setting, for ongoing professional education, and in higher education. However, for a transformation to take place many changes must occur in the institutions, regulating bodies, and world views of those involved.

Functioning Productively in a Knowledge Economy

The term "knowledge economy" is an evolving phrase without a precise definition. A search of the Internet on 5 February 2005 identified nearly a million hits, many of which are portals with multiple links. The knowledge economy is related to changes in society worldwide, particularly globalization, information/knowledge intensity, and networking and connectivity.[1]

Characteristics of a knowledge economy include: the increased mobility of services, information, and workforce; the need to derive local value from information often in creative ways that go beyond expected performance; the need to work in multidisciplinary and distributed teams; the need to use information technology (IT) for knowledge management, sharing, and creation; the need to update and change ones skills throughout one's lifetime; and the need to "act autonomously and reflectively, joining and functioning in socially heterogeneous groups" (The World Bank Group, 2003, p. 17). "These attributes produce a new type of marketplace and society, one that is rooted in ubiquitous elec-

[1] As an example see http://www.skyrme.com/insights/21gke.htm