

**The Knowledgeable City:
A Networked, Knowledge-Based Strategy
for Local Governance and Urban Development**

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(ABSTRACT)

This paper describes a new urban management and planning strategy for cities in the Information Age, which face unprecedented levels of complexity and uncertainty driven by globalization and the free flow of information and capital. The strategy is based on two synergistic themes. The first is the development of an open, networked form of local *governance* that involves public, private, and civic sectors in maintaining and fostering the economic, social, and cultural resources of the city.

The second theme is the purposeful management of the “local knowledge infrastructure:” the combination of networked economic, social and cultural knowledge resources that makes each city unique, and is therefore a chief asset of the city. The quality, depth and diversity of local knowledge infrastructure becomes a primary focus of local governance, resulting in the articulation of a balanced, knowledge-based development strategy. The paper concludes with an assessment of the World Wide Web as a technical platform to support the networked urban governance and local knowledge infrastructure processes required for the ‘knowledgeable city.’

Dedication

To Valery –

For all your support and patience, your belief in me, and most of all, your love. We are told that with age comes wisdom – I'm *already* smart enough to know I'm a very lucky man.

Thanks, honey! This one's for you.

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1 Introduction.

Cities across the world are the sites of rapid social, cultural and economic change. Continuing urbanization, the ascendance of the Information Age and the globalization of the economy and culture are driving widespread social change at a rapid pace. For the first time in history, a majority of the world's population resides in cities¹. At the same time, global forces are undermining the social, cultural, and economic substance that binds cities to their regions, citizens to their cities and citizens to each other. Inequities in income and in access to opportunities are increasing on all scales, from the global to the local. Yet with increasing constraints placed on the latitude of national policy-making, cities are obliged to take leading roles in defining their place in the new global network of cities. The question is: will cities accept responsibility in shaping their futures, or will they be mired in parochial issues, incapacitated by stifling institutions and, above all, saddled with obsolescent views of the meaning of the city and the purpose of local governance?

This paper presents the case for a new strategy for managing current urban capacities and planning future urban development, based on two synergistic themes. The first is the development of networked local *governance* which encompasses public, private, and civic sector agencies that are involved in maintaining and fostering the economic, social, and cultural resources of the city. Traditional public sector institutions of city management are inadequate to meet today's challenges. An adaptive and responsive framework of local governance, based on

¹ No distinction is made between "city" and "urban region" in this paper. In general, "city" is used where either or both terms would be appropriate. While mindful of the importance of particular political landscapes, the focus of the paper is on the general socioeconomic dynamics which drive the definition of a holistic, adaptable urban development agenda and a complementary institutional structure of local governance.

collaboration, openness and transparency, is required to shape, encourage, and support the co-evolutionary sociological and technological dynamics that simultaneously are the heart of the threat facing cities as well as the hope for a better future.

The second theme is the purposeful fostering of the “local knowledge infrastructure”: the unique combination of networked economic, social and cultural knowledge resources of the city. Though non-material, the local knowledge infrastructure is not immaterial; it is as integral to the collective well being of all stakeholders as other types of infrastructure that are traditional concerns of local government. The quality and diversity of local knowledge resources becomes a primary focus of urban development, resulting in the articulation of a knowledge-based development strategy. By fostering innovative and balanced development of the local knowledge infrastructure, all city stakeholders can be engaged in developing and benefiting in the city’s unique knowledge-based strengths in all spheres of human agency: economic, social, and cultural.

These two themes comprise a new urban management and development strategy that accommodates all agencies and all citizens of a city in a collaborative, networked form of governance, empowered to assess the unique assemblage of local knowledge resources to define and execute balanced development agendas tailored to the city’s specific needs and aspirations. Cultivating a strong and diversified local knowledge infrastructure, and developing the management capacities to direct development in this new direction are critical tasks for local governance that will enable cities to resume their traditional position as shapers of mankind's future in the “Information Age.”

The argument for this new urban management and development strategy proceeds through four stages:

- 1) Problem definition. Chapters 2 and 3 provide an overview of the challenges facing cities today, originating both from without and from within and the need for a new framework for local governance.
- 2) General requirements for a knowledge-based urban development strategy. The importance of a locality-specific knowledge infrastructure to a city's wellbeing is examined in chapter 4, while chapter 5 covers the composition, content, and the dynamics of the local knowledge infrastructure, emphasizing the importance of creating the conditions for innovation to the vibrant, sustainable city. The notion of the local knowledge infrastructure is also compared and contrasted to the concept of social capital.
- 3) Detailed requirements. The focus transitions from conceptual to practical. Chapter 6 presents the concept of an open information base that consolidates information about the local knowledge infrastructure and the value of such an information base in supporting a range of local knowledge management activities. Chapter 7 presents a sample set of urban management activities that tap the potential of the local knowledge infrastructure and facilitate balanced development of the city.
- 4) Design considerations. Chapter 8 presents an analysis of the World Wide Web (WWW) as a technology platform for supporting local knowledge infrastructure management. The innate characteristics of the WWW are contrasted and compared to the local knowledge infrastructure management requirements developed in the previous chapters to illuminate both the positive and negative implications on the requirements/objectives, and suggest what might be done to attenuate the negative implications.

2 The challenges facing cities in the 21st century.

We are at the dawn of a new era in history, a time when the majority of the world's population resides in cities. It is projected that in the next year or so, a majority of the world's population will be located in cities. By 2025, the urban population is projected to double to 5 billion, and the urban proportion of the total population will rise to over 61 per cent (Hall and Pfeiffer 2000). It is no exaggeration to say that urban problems are world problems, but also urban solutions to achieve sustainable development are world solutions.

The later half of the twentieth century also marked the beginning of the "Information Age" based on the technological revolution centered on the information and communications technologies (ICT). Though the scientific and industrial bases for ICTs extend back to the first half of the 20th century, during the last three decades ICTs have rapidly developed and converged to emerge as one of the fundamental forces powering historic societal change. From beginnings of a technological system located in the techno-industrial centers of California and New England in the 1970s, application of ICTs spread to military technology and international finance through the 1970s, to industrial production systems and offices in the 1980s, and on to homes connected to the Internet in the late 1990s (Borja and Castells 1996). More people have access to more types and quantities of information than ever before. Information is being commoditized and universal information infrastructure access is a major goal of many nations (under the rubric of closing of the 'digital divide'). ICTs are empowering dramatic and rapid change in all societies, with consequential impacts, both good and ill, on the welfare of the members of those societies.

The prime example of the breadth and magnitude of change made possible by the ICT revolution is the globalization of the economy: a radical restructuring and dispersal of economic

activities across the planet, coordinated via digital information exchanges. The resolution of the Cold War cleared the field of serious competition to the twin doctrines of neoclassical free-market economics and democracy. The nearly worldwide acceptance of a common political-economic model, empowered by new technologies, has accelerated the formation of a global economy, "an economy whose core activities work as a unit in real time on a planetary scale" (Castells 1998, p. 3).

Globalization is hailed as the antidote to hard-core poverty by free market advocates and lambasted by its critics as entrenching poverty, undercutting the position of labor, and accelerating environmental ruin. Both positions are correct. The global economy is at its core a new form of capitalism, providing expanded opportunities for entrepreneurs but at the same time introducing new forms and patterns of inequity and exclusion. The unprecedented flexibility granted to corporate management by the new technological revolution has resulted in a global economy that is highly selective. While the global economy encircles the planet, most people and areas are not directly included in it. Everything of value to the global system is linked into the system while everything else is disconnected; disconnection and devaluation are synonymous (Borja and Castells 1996, Castells 1998). The new freedom of flows of information and capital in the global economy also means that the valuations placed on individuals regions are not static. "The global urban system is a network [...], and the changing relationship with respect to that network determines, to a large extent, the fate of cities and citizens" (Borja and Castells 1996, p.23). Given the selective and fluid nature of globalization, action to attenuate and redress the localized negative impacts of globalization will require local government to take a leading role in strategic planning and management (Borja and Castells 1996).

Continuing population growth, along the globalization of the economy and global information exchange have given rise to a fourth major factor driving the development of a new agenda for cities: social movements. Social movements are found at all scales from global spanning to grassroots. Many focus on environmental concerns, ranging from the health of the (global) biosphere and the deterioration of the atmospheric ozone layer to localized issues of clean air and water, risks posed by industrial processes (e.g. the Bhopal disaster), and improper management of toxic wastes. Though there is some concern about the decline of general citizen involvement in social and political life (e.g. Putnam 1995), there is also a complementary trend of increasingly vocal civic demands for greater efficiency and accountability of government and myriad forms of citizen involvement in agenda-setting and problem-solving.

Accompanying these ‘issue-based’ factors driving change in local governance there is a more fundamental aspect. It is a gradual, even subliminal, shift from the “modern” rational worldview that has been the foundation of western social, political and economic development for the last 400 years to a post-modern worldview based on recognition of intricately connected, adaptive, co-evolutionary systems. In this worldview, intricacy and constant change are integral characteristics of all systems, whether natural or man-made, and problems are seldom amenable to reductionist solutions (Goerner, 2000).

3 The need for a new form of local governance.

Cities increasingly are recognized as necessary lead agents in the articulation of a sustainable development agenda to integrate economic, environmental, social and cultural concerns for present and future generations. Cities must develop the capacities to participate in the global economy, even as the majority of economic and cultural activity remains tied to the local area (Borja and Castells 1996). Balancing the needs and demands of the various city stakeholders: the global firm and the local entrepreneur, the globe-trotting “portfolio worker” and the life-long career retiree, requires better coordination of the resources and development of all sectors; private, public and civic.

3.1 Retasking of Local Government.

Local governments are increasingly being pressured from several directions to take active roles in balancing the issues of equitable and sustainable development with the need to encourage restructuring of economic activity to participate in the global economy.

3.1.1 Pressure on local government from within government.

National governments face increasing constraints in the range of tools and actions they can employ to guide the direction of development within their own borders. The last 30 years has seen a trend in the transfer of macroeconomic power from the national political sphere to the global economic sphere (Sassen 2000). International standards for 'fair trade,' business and finance practices are pushed by agents of the global economy, including transnational corporations (TNCs), banks and their political advocates within nations, and (international) regional and international bodies, such as the WTO, NAFTA, EU, ASEAN, and MERCOSUR. International manufacturing, technical, and design standards remove other layers of non-tariff

barriers to trade. Adherence to international trade and economic standards is enforced by the brutally swift judgement of the digitally-enabled global financial community, as witnessed by the collapse of the Latin American economies in the 1980s and the currency crisis of the East Asian 'Tiger' economies in 1997-1998 (Mishra 1999, Waters 1996, Borja and Castells 1996).

While national governments are proscribed from employing traditional macroeconomic policies to steer development on a national scale, advocates within and for local governance are also proactively pressing for a realignment of 'national' and 'international' development policy. Cities are the true players in a multi-level networked global economy (e.g. Borja and Castells 1996, Knight 1995, Hall and Pfeiffer 2000). Cities wishing to participate in the global economy must commit to developing a commensurate level of infrastructure and amenities, including, e.g., ground transportation networks (road, rail, mass transit), airport, sufficient quantities and quality of office space, hotel rooms, and housing. In addition, it is now widely recognized that 'one-size-fits-all' urban (re-) development programs do not yield satisfactory results (Christensen 1999, Landry 2000, Borja and Castells 1996). Urban development agendas are highly contextualized by the unique combination of internal and external factors impacting each city, resulting in unique and complex sets of issues, opportunities and resources. In response to these pressures and tighter budgetary constraints, national governments are devolving responsibility for setting urban development agendas to regional and local governments² (Pfeiffer and Hall 2000, Knight 1995). Regional and local governments are being given more latitude to develop innovative agendas targeting the (re-)development of specific localities (Borja and Castells 1996, Sassen 2000, Knight 1995).

² In the US this trend is labeled "devolution", while in the European Union, the term "subsidiarity" is used.

Accompanying the call for devolution of urban development policy is a complementary call for more cooperation between local jurisdictions in urban areas. The California Speaker of the House recently appointed a new Commission on Regionalism to study ways California's local governments can start working with rather than against each other. The motive for appointing the commission is not to improve efficiency through reorganization or merging jurisdictions, but to improve global competitiveness of urban areas. "The winners in the New Economy will be the regions that learn to work together to relieve traffic congestion, build affordable housing, preserve open space and promote economic development," (in Peirce 2001)

3.1.2 Pressure on local government from without.

Increased pressure on local government from the civic sector arises from several interrelated factors:

- From a political perspective, a resurgence of direct democracy is evident in citizen rights movements and community activist group's demands for more responsiveness and accountability from their governments.
- Community-based organizations and issue-centric non-governmental organizations (NGOs) are demonstrating new methods for the provision of social services, in some cases augmenting, but often substituting for, public services. In either case, these grassroots, activist organizations demonstrate that there is room for improvement of (local) governments' delivery of services that respond to real community needs.
- Improved accessibility of public sector information (made possible by ICT advances) has advanced citizen awareness of the functions and effectiveness of the public sector, pressuring government to operate and regulate in a more open and transparent manner.

Some of this public pressure is manifested as purely local citizen activism, while in other cases, it may be allied or spearheaded by a national or international organization. The ICTs that have enabled the globalization of corporate operations have also enabled more broadly based

social movements. The targeting of illegal permitting of toxic chemical production by the Pittsburgh Paint and Glass (PPG) chemical plant located in Lake Charles, LA by Greenpeace is an example of a global organization acting locally (Greenpeace, 2000).

3.2 From local government to local governance.

Though local government is being recognized as the appropriate level of politics, planning and management to articulate a new balanced development agenda, the breadth of this task extends far beyond the traditional mission and resources of the local public sector. The real world of local community needs is found in the complex interactions between a) a viable business environment; b) citizens' needs for decent housing, economic security, good health, psychological stability, equitable access, mobility, cultural fulfillment, and c) a healthy environment. All this in addition to the basic services that have traditionally been construed as being 'public sector' responsibilities. The private sector and civic sectors therefore are also key contributors to the vitality of cities and the viability of their futures.

3.2.1 Sectorization in local government.

Acknowledging that the complex of local circumstances must inform development agenda also tacitly condemns the current delivery of public goods through sectoralized government agencies and programs. Traditional hierarchical city management reinforces separate specialist functions of departments, providing independent sectoral interventions (Knight 1995).

In “Cities and Complexity,” Karen Christensen (1999) demonstrates that sectorization at the local level of government is only part of a larger system of governmental sectorization that has developed indirectly in response to issue complexity (see Figure 3.1). Over time, the empirical, reductionist method of problem analysis has produced a plethora of new specialist areas, new legislation and regulations, new agencies, and new programs. The responsibility of

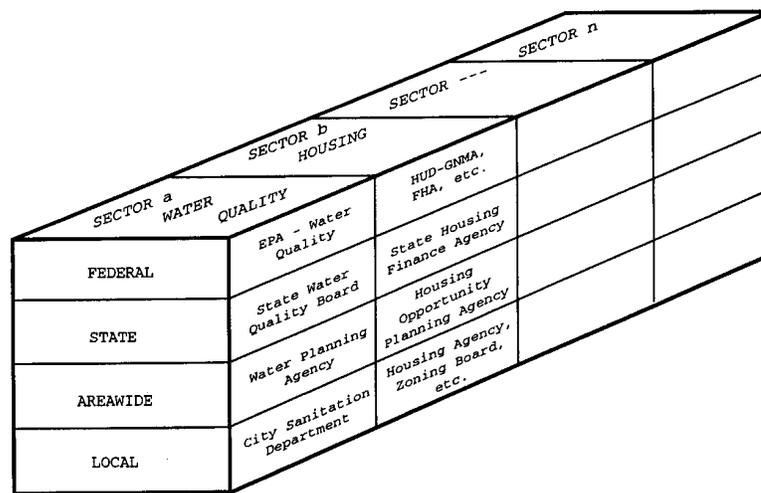


Figure 3.1 Vertical chains of sectoral agencies
(From Christensen 1999, p51)

local government has shifted to conforming local policy and administrative procedures to the requirements imposed by higher government agencies.

Strong sectoral linkages between national, sub-national and local government agencies undercut the potential for area-based development. "Organizational feudalism³" of vertical chains of sectoral agencies is built on administrative and procedural requirements that accompany financial and technical aid provided by higher levels of government. Legislative committees,

³ (Benson, in Christensen, 2000, p.73).

private interest groups, shared specialist education and professional affiliations buttress the vertical alignment of government.

Top-down programming and projects still are the norm in the US and elsewhere, despite moves to devolve responsibility downward and foster coordination between local agencies (Christensen 1999, Knight 1995, NAPA 1997). The result is sector-dominated government providing programs of insufficient breadth to produce real change, as well as programs at cross-purposes, managed by different agencies. "Sectoral effects on an area are determined by sector, rather than by area initiative. Collectively, sectors affect an area in a disjoint fashion" (Christensen 1999, p.83), as illustrated in Figure 3.2.

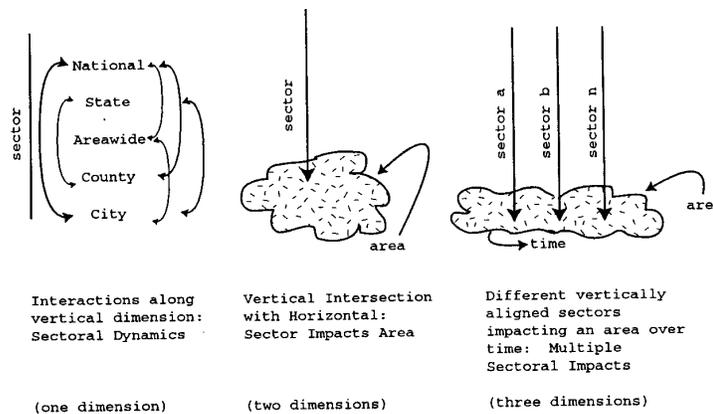


Figure 3.2 Interactions Among Government Agencies Along Three Dimensions (Source: Christensen 1999, p. 66)

In addition, the factionalized operation of local government facilitates the agendas multi-national corporations, allowing them to circumvent or overwhelm the concerns of other, more local stakeholders. This furthers the unevenness of economic development within cities and the inequity of access to opportunities and resources (Borja and Castells 1996, Sassen 2000).

Though much more can be said about the dynamics and dominance of sectorization in government, the implications on local governance can be simply (if not simplistically) summarized:

- In the long term, cities wanting more control of their destinies must lobby higher levels of policy (national *and* international) for more autonomy for themselves and reduced structural sectorization in policy and implementation.
- In the meantime (which could be forever), cities must: 1) recognize the subversive effect of sectorization on local policy-making 2) develop the management capacity to counteract the deleterious impact of sectoral dominance on local development agenda and implementation options, and the subsumation of local interests by global economic agents that this governmental factionalism allows.

3.2.2 Acknowledging complexity.

Rather than fighting against the complexity found in the real world, or ignoring it through adherence to sectoral government policy and practice, post-modernist researchers from many disciplines (Goerner 2000, Nieuwenhuijze 1998, Hwang 1996,) are asserting that complexity is an integral part of most systems, whether natural or man-made. Complexity provides systems – including urban systems – the capacities of flexibility, responsiveness and adaptability to thrive in a dynamic world (Bugliarello 1999).

Acknowledging the interconnectedness of our urban systems has ramifications for how we manage our cities. The current structurally sectoralized form of local government cannot address the tasks already allocated to it, in large part because the allocation is formulated in a piecemeal fashion. A new framework is needed which encourages flexible cooperation between local government agencies as well as partnering with private and civic sector agents (Dyck 1998, Fisher 1995, Borja and Castells 1996).

3.3 Transitioning from hierarchical organization to open collaborative networks.

The preceding sections of this chapter demonstrate that traditional forms of local government alone have neither the resources nor organizational structure to direct or carry out an urban development strategy sufficient to meet the present challenges. The complex interaction of urban development issues makes them unresponsive to sectoral interventions, while the resources for addressing the issues are not wholly within government. Collaborative arrangements with other stakeholders, in both the business and civil society, are essential.

The collapse of Communism and the restructuring of the private sector in the post-industrial age provide useful insights into a new model for restructuring local government and transitioning to an open collaborative network of local governance. The fall of the Berlin Wall on November 9, 1989 signaled the decisive failure of a grand experiment in centralized control of the economic and social welfare agenda. Communism's demise can be traced to the stifling of innovation and adaptability as well as the lack of effective feedback mechanisms (responsiveness and accountability) to ensure that quality of life was maintained. While equity was a supposed hallmark of the system, in practice quality of life was not monitored as the basis for adjustments of policy or resource allocation. (Unvalidated) equity became an excuse for mediocrity and inertia, and led to general socioeconomic decline (Silvan 1992, van Vliet 1992).

Command-and-control management also dominated the private sector of the democratic societies of "first world" states through the industrial age. Top-down organization structures were the norm of the Fordist enterprises that typified the industrial economy. These enterprises were successful at marshalling vast supply chains to support concentrated production centers that

turned out large volumes of well-priced products to meet strong post-war consumer demand⁴. In the current post-industrial age however, corporate operations have been dispersed globally. Corporate dispersion has been complemented by increased market demand for product differentiation in terms of design, quality, and product sophistication. Demand for increasingly sophisticated goods and specialized services has spurred the application of a greater range of specialized knowledge in operations. Management has been forced to make the transition from a top-down decision-making model to one of highly interconnected open networks that facilitate inputs of multiple types of knowledge into many facets of production. Businesses are interconnected through ever-changing multi-layered networks, providing information, feedback, and choice between multiple providers and multiple clients, allowing each enterprise to innovate and respond quickly to new market demands and opportunities (Borja and Castells 1996).

From a global perspective, the organizational structure of the global network economy is a network of 'urban nodes', though it is not a network of equals, with each node occupying a unique niche within an hierarchical economic network. (Luithlen 1998). "It may have an hierarchy, but it has no center. Relationships between nodes are asymmetrical, but they are all necessary for the functioning of the network -- for the circulation of money, information, technology, images, goods, services, or people throughout the network" (Castells 1998, p.4). It is an organizational model that is *scalable*, as each urban node is home to one or more economic clusters: tightly interconnected network of firms, including multiple competitors and client businesses, served by ancillary business service firms. The network model is also *robust*;

⁴ In the US, the tools, techniques, and especially the skilled personnel needed for hierarchical management of large-scale production operations were developed by the colossal wartime production operations of World War II. Yet this common organizational culture fostered a static definition of competitiveness based on economies of scale, leaving US business, beginning in the late 1960s, vulnerable to new production models, e.g. as employed in Japan, emphasizing quality. Quality is a knowledge-based value-added attribute created through the acquisition of new

individual urban nodes may fall out of the network, and individual firms may fail while the economic cluster continues to thrive. Finally, the network economy relies on the cooperative sharing of information. This is a key distinction between the industrial economy and the network economy. The industrial economy placed value in scarcity. In the network economy, value lies in abundance and relationship.

Value explodes with [network] membership, in turn drawing in more members. The concept of economies of scale is over-ridden by the 'law of increasing returns. Competition in the industrial era meant producing more for less; today, in the networked economy 'increasing returns are created and shared by the entire network. [... T]he gains reside in the greater web of relationships' (Kelly in Landry 2000, p.34)

3.4 Summary.

The global economy provides a useful organizational model for a new form of local government that is adaptive to specific conditions, responsive to new needs and allows interdisciplinary operations to become the norm rather than the exception. Reorganizing local government based on the network model is also an effective antidote to sectoral independence. Internal reconstitution of local government also facilitates networking with non-governmental stakeholders involved in the balanced development of the city. Local government must engage in collaborative arrangements with other stakeholders through participation in multiple, non-hierarchical networks. Local government will have to take on new leadership roles in order to balance demands for economic development, equity, social justice and an enriching urban environment, but just as important, local network-organized government will need to participate in a larger network of local *governance*.

information (e.g. reliability, customer preferences and differentiation) and the evaluation of this information to improve planning, design, and production.

4 The search for an effective urban development agenda.

Cities are the engines of economic growth. Their share of national output in nearly every country is much higher than their share of the labor force. Cities are concentrations of physical and human capital, production and consumption (Hall and Pfeiffer 2000). Yet faced with the task of creating a balanced development agenda to benefit the well-being of their citizens, cities would appear to have little control over their own futures in the face of the forces of globalization. Urban economies are buffeted by decisions made by a global network of corporate management. The past few decades have amply demonstrated the foot-loose nature of financial capital. Even the 'permanence' of capital committed to constructed production facilities has proven to be shallow roots of corporate commitment to a locality, as attested by abandoned "brownfields" which dot the post-industrial landscape. So while local economic development projects targeting brownfields and other derelict parts of the urban space do have appeal, an exclusive focus on 'bricks and mortar' is no more a guarantee of local prosperity than the previous businesses which occupied the sites (Landry 2000, Knight 1995).

Though globalization has dismantled the industrial city, closer examination of the network economy reveals *knowledge* as an important factor in the network economy. The importance of knowledge to the networked global economy provides the basis for the articulation of a new, post-modern, urban development agenda that focuses on retaining and building the knowledge capacity of the city. The key to this planning model is found by considering what knowledge is.

4.1 The role of knowledge in the networked economy.

For all the currency of the notions of the "Information Age," the "Information Economy,"

and the (new) “Knowledge Age⁵,” there is considerable confusion between the terms “information” and “knowledge.” There is reasonable agreement on the notion of *information: data* put into context. The notion of knowledge, however, is a bit more confused. Brooking differentiates knowledge as: “information in context + understanding” (Brooking 1999, p4), while Rossel defines knowledge as “information that we have internalized (integrated with our own internal framework)” (Rossel 1999, p5). The problem with both of these definitions is that knowledge is treated as an object. Both views are consistent with ‘typical’ knowledge management initiatives surveyed by Von Krogh, Ichijo, and Nonaka (2000), that fail to make any fundamental distinction between information and knowledge, thereby treating knowledge within the conceptual framework of information management. Knowledge in this paradigm is amenable to the same handling, storage, and transmission technologies used for managing information. This (implicit) understanding of knowledge as simply a special set of information is encouraged by the availability of powerful new information technologies to make “knowledge” available throughout a global company. This view has abetted by the cognitivist research tradition (e.g. Simon 1996) that has developed formal models of human cognition that resemble the current technology of information processing machines. It is a Positivist conception of knowledge and knowledge management that emphasizes “quantifying ever smaller pieces of information, an obsession with measurement tools, the use of terminology that may limit the free flow of ideas, the rigid procedures established – and the overarching assumption that knowledge can be controlled,” (Von Krogh, Ichijo, and Nonaka 2000, p26). In this view, the concept of knowledge is constrained to that which is *explicit*; knowledge can be documented, stored, and retrieved by others. This concept of knowledge, however appealing to corporate managers seeking to capture

⁵ The concluding chapter (9) considers a “Knowledge Age” heralded nearly a half century ago.

and control the firm's knowledge "assets," as well as to vendors of 'knowledge management systems,' is a view constrained to only what is easily identifiable.

To return to the definition of information with a different emphasis: information is data *put* in context. Putting data into context requires action to sift, analyze, sort and re-present according to some purpose. "Information is a difference, which makes difference," (Bateson in Von Krogh, Ichijo, and Nonaka 2000, p27), but the differentiation is the artifact of the application of knowledge. Knowledge provides both the purpose and the criteria for transforming raw data into information, yet it extends beyond information manipulation.

Information is about meaning, and it forms the basis for knowledge. Yet knowledge goes one step farther. It encompasses the beliefs of groups or individuals, and it is *intimately tied to action* [emphasis added]. Beliefs, commitments, and actions cannot be captured and represented in the same manner as information. Nor is knowledge always detectable; it is created spontaneously, often unpredictably. Therefore, storing knowledge and transferring it electronically from one part of the company to another is difficult. (Von Krogh, Ichijo, and Nonaka 2000, p27).

McDermott (1999) expands on the concept of knowledge as active process, providing a number of characteristics that distinguish knowledge from information:

- Knowing is a human act. Knowledge is about knowing; to know a topic or a discipline is not just to possess information about it, but the ability to use it.
- Knowledge is the residue of thinking. "From the point of view of the person who knows, knowledge is a kind of sticky residue of insight about using information and experience to think," (McDermott 1999, p106).
- Knowledge is created in the present moment. "It is largely invisible and often comes to mind only when we need it to answer a question or solve a problem. [...] Learning from past experience, sharing insights, or even sharing "best practices" is always rooted in the present situation.... Insights from the past are always mediated by the present, living act of knowing," (ibid.).

- Knowledge belongs to communities.

The idea that knowledge is the stuff “between the ears of the individual” is a myth. We don’t learn on our own. We are born into a world already full of knowledge, a world that already makes sense to other people-our parents, neighbors, church members, community, country. We learn by participating in these communities and come to embody the ideas, perspectives, prejudices, language, and practices of that community. (Ibid., 107).

- Knowledge circulates through communities in many ways. A community’s knowledge is not limited to that which can be expressed and transmitted symbolically: e.g. writing or other means of recording, presentations, display, public demonstration. Knowledge is also infused in unwritten work routines, tools, work products, machinery, the layout of a workspace, stories, and specialized language.
- New knowledge is created at the boundaries of old. “New knowledge typically does not come from thinking within the ordinary bounds of a discipline or craft. [...] New ideas emerge in the conflict of perspective, the clash of disciplines, the murky waters at the edge of a science, the technology that doesn’t quite work, on the boundaries of old knowledge” (ibid. p109.)

The overall point to made here is that knowledge is not static but intimately tied to activity, and not confined to an individual (as we may have been conditioned to think of it), but involves communal activity.

Enterprises that actively seek information exchange with their suppliers and clients, adhere to the latest standards and procedures (quality criteria), anticipate new demands (market information), and can ably market their goods or services in a global context have competitive advantages over rivals that do not employ these value-added stratagems. The common factor of these stratagems is the high level of knowledge (processes) embedded into new production: to analyze, judge, make decisions, to create new information, new designs, new products, etc. (Borja and Castells 1996, Landry 2000, Knight 1995).

While the importance of knowledge to an enterprise has become increasingly understood at an operational level by company management, it is still not generally acknowledged in either economic theory or in the economic community at-large. Knowledge is a factor of production not accounted for in neoclassical economics that is predicated on a closed system of production in which labor, capital and (natural) resources are the only and interchangeable factors of production (Hwang 1996). In contrast, Boulding, references a complex, ecological model of economics, identifying three classes of inputs and outputs in economic production: matter, energy and information. The relationship between matter and energy is accounted for by the entropic law⁶, but the inputs and outputs of information "represent an open system related to but not totally dependent on matter and energy" (Boulding 1968 p.171). This premise is most obvious in the so-called 'New Economy' companies whose chief assets are 'intellectual capital' in terms of market assets (brands, relations with customers and collaborative agreements with other companies), intellectual property, and the knowledge of the staff⁷ (Brooking 1999). The network economy is an open system that exploits information through the application of specialized yet coordinated knowledge to improve productivity, in some cases simultaneously reducing inputs of all three classic factors of production. Knowledge is a production factor that can produce non-linear productivity improvements. Just-in-time (JIT) supply chains are one

⁶ Ecological economists (e.g. Daly) also argue that the economic system (no matter how organized) is not closed because it ignores the Second Law of Thermodynamics. Physical production always involves the conversion of low entropic, high-organization matter/energy to high-entropic energy, ... There is a dissolution of 'productive' energy, "lost" to the environment.

⁷ Though Brooking is correct to distinguish the true asset base of knowledge economy firms, she nonetheless retains the traditional capitalist paradigm; knowledge is similar to other forms of capital. Because knowledge has legs (i.e. personnel can work off the job) she goes to great lengths about the importance of retaining staff and keeping them happy so that they do not leave unplanned. From this perspective, therefore, it is important to 'capture' the knowledge that staff 'have inside their heads,' before they leave, either by their own volition or due to management decisions.

example of the use of knowledge to reduce both capital and resource use, resulting in lowered production costs. The networked economy is arguably "the knowledge economy."

There is something new in the Information Age. It can be empirically argued that at the source of productivity and competitiveness [...] there is the capacity to generate new knowledge and process relevant information efficiently. To be sure, information and knowledge have always been essential factors in power and production. Yet it is only when new information and communication technologies empower humankind with the ability incessantly to feed knowledge back into knowledge, experience into experience that there is, at the same time, unprecedented productivity potential, and an especially close link between the activity of the mind, on the one hand, and material production, be it of goods or services, on the other. (Castells 1998, p.8)

For stakeholders in a city's future development prospects, the implications of the importance of knowledge are clear. Assessments of alternative development strategies based on the closed system model of neoclassical economics will likely overlook or underestimate the value of knowledge as a non-linear contributor to development.

The pivotal role of knowledge in the Information Age substantiates the 'human capital' school of development in general and, specifically, the importance of education to improve knowledge skills. For cities to be competitive in the global economy, quality education must be provided that can produce students adept in knowledge skills. This policy mandate extends not only to children's education, but also to providing continuing education opportunities for adults who do not have the general skills for using information technology and working in collaborative, networked arrangements.

4.2 Knowledge Infrastructure: tying knowledge to the city.

Beyond a general development policy imperative to improve the knowledge capacity of its citizens through better education opportunities, a focus on developing knowledge skills does not in itself confer any strategic advantage to a locality planning for its future. In urbanized societies, the primacy of family ties gives way as well-educated young adults seek the best

options to build their careers. The high quality of education provided by many small rural school districts in the US have delivered generations of quality workers to urban centers across the nation. Meanwhile the small rural hometowns are gradually becoming disconnected from the economic vitality of the nation, surviving to a large extent on the inflow of pension and social security payments. The same unsustainable dynamics can work against a city that does not plan how to retain the human capital it develops.

A strategy of improving the knowledge capacity of citizens must be embedded within a larger policy of developing a sufficient "local knowledge infrastructure" of the city. The local knowledge infrastructure can be viewed as a network structure comprised of knowledge nodes and the interconnections between these nodes. The knowledge nodes include the organizations and individuals that exchange information and cooperative engage their respective knowledge resources through interaction (or interconnection) with other organizations or individuals. The local knowledge infrastructure includes economic, social and cultural knowledge networks of the city, particularly place-specific knowledge resources. For example, Bentley (1999) notes that while economic, social and knowledge analyses are loosely connected by vague rhetoric in mainstream development policy in the UK,

... the most inspiring examples of innovation in business, the voluntary sector or government, all seem to have found new ways of sharing and creating knowledge through different kinds of social relationships. Whether this is a new type of school, an employee-owned business, or a pioneering community centre, there is almost always a strong correlation between their use of knowledge and the social relationships between owners, staff, users and so on (Bentley 1999, xviii).

By actively promoting and developing citywide 'self-awareness' of the local knowledge infrastructure, local governance can increase opportunities to strengthen the economic, social and cultural bases that uniquely characterize the city, sustaining a positive feedback loop. At the individual level, citizens become embedded in the vital framework of the city. Ronald Burt has

shown that individual workers maximize their employability when they have a range of weak ties across and beyond their immediate work context (in Bentley 1999).

4.3 The local roots of the city's knowledge infrastructure.

There are a number of locality-specific advantages to focusing on the city's knowledge infrastructure as a basis of an urban development agenda.

1) Clustering: Spatial agglomeration in the Knowledge Economy. While improvements in ICTs and transportation technologies has enabled the transfiguration and spatial dispersion of previously vertically integrated and hierarchically-managed corporations, the dispersion of productive activities has not been random. The 'static' agglomeration economies of the Fordist model of production were based on a sufficient concentration of local supplier-client business chains to achieve economies of scale in production or distribution. The new 'dynamic' agglomeration economies derive competitive advantage in terms of technological learning and improvement (Harrison, Kelly, and Gant (1996), cited in Porter, 2000). Dynamic agglomerations, or "clusters" are "concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g. universities, standards agencies, trade associations) in a particular field that compete but also cooperate," (Porter 2000, 15).

Confounding predictions of the death of cities and the rise of cottage industries and teleworking, the networked economy has increased the intricacy of transactions and demand for specialized services. The trend in service-intensity effects all firms, whether international in scope or not, and has impacted growth in cities at all levels of the urban hierarchy (Sassen 2000). Spatial agglomeration of goods and services enterprises form local economic networks that

interconnect not just through digitized information exchange. Predictions of the paperless office, now transfigured into the notion of the virtual office, have been with us for over two decades, yet more paper than ever is used in business. Recent advancements in ICTs encouraged many companies to develop common information bases that could be shared by staff worldwide. Yet most companies have discovered that leveraging knowledge requires more than shared access to digitized data. Some of the knowledge that people need to share “is neither obvious or easy to document, knowledge that requires a human relationship to think about, understand, and appropriately apply. Ironically, while information technology has inspired the ‘knowledge revolution,’ it takes building human communities to realize it” (McDermott 1999, p103). For inter-company exchanges, face-to-face meetings, in causal as well as formal settings, are still highly preferable for some types of dialogue and for negotiation (Borja and Castells 1996). "For work processes requiring multiple specialized inputs, considerable innovation and risk-taking, the need for direct interaction with other firms and specialists remains a key locational factor" (Sassen 2000 p. 139). Silicon Valley, the epitome of the Information Age, comprises a dense spatial clustering of firms interacting in a very fluid network. People and ideas flow freely from company to company (Borja and Castells 1995, Sassen 2000, Offner 2000). Meanwhile, the Wall Street Journal (July 17, 2000) reports that Internet-only based businesses (dot.com companies) are not displacing 'place' as an important element of business. 'Closed for further business' signs are cropping up on Internet-only business websites, while the "multi-channel" firms -- those with bricks and mortar operations -- are already bringing in 59% of e-business and gaining.

2) Local economic clusters, while interconnected to the global economy to a greater or lesser extent, cannot be easily uprooted or duplicated. Each specialized economic cluster is a multi-

faceted constellation of related goods and services that is not easily reproducible, even if there is high demand for the ultimate product. Though barriers to entry of a particular enterprise into the local knowledge network may be relatively low, the barrier to other localities wishing to reproduce the entire complex of activities is not. Conversely, it is easier to expand the productive capacity of an existing network than to replicate it, which confers additional competitive advantage to existing local knowledge networks. A new form of economy of scale has arisen. “Because of externalities, public and private investments to improve cluster circumstances benefit many firms,” (Porter 2000, p18). The multi-organizational nature of a local knowledge network confers advantages of adaptability, openness to innovation, and scalability, but also, deep-rootedness within the local economy.

3) The importance of individuals as knowledge nodes. The effective and efficient use of information, that is, ‘knowledge-in-action,’ engaged in productive collaborations, is the raison d’être for the new economic clusters. This has consequential impacts for urban planning and management. For example, by not distinguishing between the ICT-based information infrastructure and the knowledge infrastructure that drives the demand for the information infrastructure, Luithlen argues that it is the “gravity of information” that provides the centripetal force that has sustained urban concentration in the face of global dispersion of productive processes. From this perspective, coordinated development of the (information) infrastructure belongs to a technical engineering tradition rather than a form of social engineering (Luithlen 1998). Yet, if we concentrate on knowledge as a collaborative activity, it is clear that

coordinating development is a social engineering effort (which may be supported by technical engineering efforts)⁸.

The importance of knowledge returns more power back to individuals. Rather than “going to work”, they *bring* the production potential to the workplace. The changed relation between employee and place of work highlights the importance of accentuating the city strategies that increase citizens’ ‘sense of place.’ Knowledge workers are real people, connected to social and cultural community networks. There is a bias in workers’ locational preferences in favor of the status quo; i.e. most people would rather stay in a community that provides a good quality of life than move to an unknown city. Policy to maximize the local social and cultural knowledge infrastructure valorizes the intangible qualities that make a city an attractive place to live. Such policy reaffirms the locational decisions of the many householders who are agents in the local knowledge-based economy, thereby attenuating the destabilizing dynamics of the globalized economy.

The interconnection between knowledge workers and sense of place is both the basis for a positive future for cities, as well as a warning. “When a city becomes unattractive, not only does its own talent not return but it becomes more and more difficult to attract talent from elsewhere. A loss of knowledge resources or a net out-migration of talent, often referred to as ‘brain-drain’, weakens a city’s intellectual infrastructure and diminishes its chance for knowledge-based development in the future” (Knight 1995, p. 233). The ‘non-economic’ qualities of the city may take on even more importance to knowledge workers in the future. Peter Drucker (1999) argues that the institutional arrangements of ‘Knowledge Revolution’ businesses will come under

⁸ Luithlen does advocate some of the positions taken in this paper, but by missing the true source of “gravity,” his prescriptions are framed as a duality. City planners’ social engineering responsibilities are viewed as counterbalances to technology-centric development, rather than synergistic aspects of development.

pressure to change. It will not be possible to continue to “bribe” knowledge workers with salaries and stock options, especially as new industries will take time to become financially successful. Knowledge workers’ values will have to be met, and they will demand more recognition and social power. For the city, this will mean that knowledge workers will be inclined to stay with companies longer as they are given a more substantial stake in their companies, but they will only stay in places where they, their families, and their companies can thrive.

5 Managing the local knowledge infrastructure.

N.B.: this chapter is an abstraction of things in the real world, not a blueprint for a digitized information model of these things, which is the subject of the next chapter.

The concentration and variety of knowledge that characterize a vital city constitutes an inherent, place-based advantage of cities. Recognizing this ‘collection’ of knowledge as a type of infrastructure is the first step in realizing the opportunities to be gained by treating it as a substantial basis for urban development. Given that knowledge itself is not a material asset, but rather is dynamic -- both product and productive process --, and often involving communal activity, it would be futile to try to ascertain an absolute measure of the ‘amount’ of knowledge in a city, or to definitively assess the “qualities” of the local knowledge infrastructure, much less try to ‘create’ more knowledge infrastructure by fiat. On the other hand, the premise of this paper is that it is feasible to encourage the development of an environment that facilitates the deepening of the knowledge base and encourages greater interconnection.

5.1 Composition of the local knowledge infrastructure.

The local knowledge infrastructure has a (multi-)network structure, which, like any network, comprises both nodes and interconnections. The components of the local knowledge infrastructure should be considered to include a) organizations and people as “knowledge nodes,” and b) interconnections between knowledge nodes. Organizations, whether private, non-profit/civic sector or public sector are obvious candidates for consideration as knowledge nodes. An organization is the combination of purpose and a knowledge framework, populated by people with specialized knowledge, within which framework cooperative, mutualistic action takes place; manipulating information, creating new knowledge and innovations.

Individually, people can also be considered as “knowledge nodes” of the local knowledge infrastructure as well, each with his/her own unique package of specialized knowledge and experiences to contribute. Indeed, one of the defining characteristics of the networked economy is the rise of the ‘portfolio worker,’ providing an integrated set of knowledge and skills, versus the demise of the ‘company career man.’ Compared to organizations, people, viewed abstractly, are “knowledge nodes” with higher levels of tacit knowledge that is more deeply integrated, the integration being much less bounded by conscious classification and design, (though much is, e.g. developing a necessary repertoire of job skills, completing a Master’s degree).

As important as the organization and individual knowledge nodes, the *interconnections* between the nodes are also critical parts of the definition of the (networked) local knowledge infrastructure. Interconnections may primarily support economic exchanges (e.g. goods and services plus all of the supporting coordination), but may also support social exchanges and cultural exchanges, in any combination. Each interconnection is conditioned by the participating knowledge nodes that are engaged in the exchanges, i.e. each node engages in an interconnection for some purpose. Both nodes and interconnections are part of a network and the definition of each is incomplete without the other. As previously noted, many firms are busily deconstructing their own boundaries as they interpenetrate with other firms.

Yet it is also possible to have instances of multiple interconnections between extant knowledge nodes, whether organizations or individuals, which bring together their respective knowledges to pursue a common interest. This confluence of interests and knowledge is a knowledge node in its own right, regardless of its temporal persistence, and can be denoted as a “community collaboration.” A community collaboration may range from a single informal get-together to discuss a pressing issue, to periodic meetings of neighbors or ‘communities of

interest,' or, at the other extreme, well-established community organizations with dedicated resources. The complementarity of node and interconnection is especially relevant for less-established community collaborations, which often have more purpose than dedicated resources.

Cities offer a wide choice of (potential) interconnections for organizations and individuals, whether seeking prosaic exchanges or unusual, innovative synergies. A goal of management of the local knowledge infrastructure should therefore be to increase the opportunities, for individuals and organizations, to tap (other) locally available knowledge resources either directly or in multi-party collaborations. The secondary effect will be to increase the density and variety of the interconnections between knowledge nodes, thereby more deeply embedding knowledge nodes (people and organizations) into the city's fabric of life, which should be another goal of local knowledge infrastructure management.

The local knowledge infrastructure therefore should not be thought of as intangible or indefinable, a "quality" too "soft" or ethereal to be identified. Nor is it related to just one segment of urban life -- confined, for example, to just "community," or "economic" development. Purposeful development and management of a local knowledge infrastructure can be an explicit function of local governance, and like other public infrastructure, the local knowledge infrastructure can be viewed as an underlying base facility managed for the benefit of all stakeholders of the city.

Box 5.1 A Note on 'Managing' in a network context.

'Managing', 'planning', and 'developing,' activities take on softer-edged meanings in the context of an open collaborative networked governance structure. "Management," may be likened to an old term with complex connotations, "shepherding." Managing and planning in this context means to convoke and guide stakeholders to articulate an strategic objective, to watch over the vision by continuous evaluation and reaffirmation, and ensuring that responsible stakeholders operate in support the objectives. The focus is on enabling dialogue to achieve consensus and monitoring outcomes, not dictating and supervising the processes. Public sector "management" also means being willing to lead and to assume risks of unproven strategies in order to encourage innovation.

5.2 Content of the local knowledge infrastructure. Beyond economy: the social and culture knowledge infrastructure.

Chapter 4 discussed the emergence of multidisciplinary, multisectoral economic networks or “clusters” as a key characteristic of successful global competition. The local knowledge infrastructure however, is not confined to just economic networks, because staff and management are comprised of whole people. Nor are all people, each a valuable knowledge resource, involved in economic production⁹. People require a variety of social and cultural amenities to thrive. Cities have a potential advantage of harboring a concentration of diverse social knowledge and cultural knowledge, in the best cases enriched by contributions of multiple cultures (Landry, 2000). There are four interlocking reasons for local governance to integrate development of the social and cultural knowledge infrastructure into the development strategy of the city:

1) Fostering increased intricacy of social and cultural knowledge opens new opportunities for entrepreneurs and workers operating in these fields. From a fiscal and economic standpoint, this is sound development strategy. "Scientists, lawyers and doctors are not the only form of knowledge workers; there are writers, artists and programmers, entrepreneurs and impresarios, social workers, teachers and many others who do not necessarily have high degrees or salaries" (Knight, 1995, p. 238). Knowledge resources are being valorized by governments in many socio-cultural areas including health and social services, environment, restoration, sports and entertainment, fashion and design, music, graphic arts, culinary arts, agriculture, or culture and

⁹ This will become increasingly true in developed countries as greater proportions of the population enter retirement (e.g. the US “Baby Boomer” generation).

wine- making, education and training, publishing, religion, travel, and tourism (Knight 1995, Landry 2000).

2) The necessity of ensuring inclusion of all city residents. The rationale is twofold. The 'half empty' argument is that excluded citizens place a drag on the community, and not just in terms of social service resources expended directly on the persons excluded. Exclusion of individuals and groups repercuss as dysfunctionalities of the community: e.g. increased crime, devaluation of housing stock, decline of neighborhood social structures, middle-class flight from the city, the threat to community use of public space, as well as the danger of (no longer) public spaces to the community. The 'half-full' side of the argument is that not developing and integrating all citizens into the social and economic life of the city represents a lost opportunity to tap additional diverse perspectives and capacities grounded in other cultural backgrounds.

3) The need to retain highly skilled persons employed in the city's 'trademark' knowledge activities. Though it is difficult to transplant an entire local knowledge network, it is possible for it to suffer from attrition as individuals seek a higher quality of life in another locale. Portfolio workers in a networked economy have more power to decide where to live and work. Individuals' perceptions of quality of life therefore play a bigger role in a city's development prospects. Local governance needs to attend to the amenities available in the city. Key people especially have to be courted to set up shop in the city and should be continuously courted to stay. Highly skilled staff also demand a variety of high quality amenities. Cities aspiring to be home to world-class businesses must provide global-class amenities. Borja and Castells (1996) tend to focus on major cities that are candidates for global-class status, but Sassen (2000) demonstrates that this argument is scalable. Thus, while the archetype of the global city are the historic financial and corporate headquarters cities of New York, London and Tokyo, the ranks

of acknowledged "global urban nodes" has swelled to double digits. As intense, ICT-enabled networking interpenetrates business operations, the number of cities that can be considered technically well-connected into the global networked economy will be greater than the number of cities that will be globally attractive. We may conceive of a gradation of knowledge nodes demanding commensurate levels of amenities, the dimensions of which cannot be prescribed. Medium-sized cities such as Cincinnati, Pittsburgh, and Indianapolis all demonstrate that tapping the local cultural knowledge is one of the surest ways to rebuild a reputation as an attractive place to live and work though none of these three is a pinnacle urban node of the global urban network.

4) Sense of place is a social construct. The built environment provides the warp upon which are woven the multiple threads of local knowledge of a city's history and culture, e.g. culinary arts, local crafts, theater, music, dance, festivals and indigenous traditions (Landry 2000). These cultural assets are the difference between a livable city on the one hand and urban decay and/or a stark and sterile 9 to 5 business center on the other. Living culture provides the "sense of place."

The importance of balanced development of social, cultural, and economic knowledge resources is borne out by a survey of 19 European cities. The survey included questions on the importance and performance of knowledge resources, classified into six broad categories: science and technology; commerce, banking, insurance; industry and production know-how; administration and coordination (national and international); arts and culture; creativity in arts and culture. The principal finding was that cities rated all six different types of knowledge as being important to their competitive advantage (Knight, 1995, p. 235).

5.3 Recognizing synergies between local economic, social, and cultural knowledge infrastructure.

The network structure of the knowledge economy confers benefits of adaptability and robustness to the network, but this does not necessarily increase the stability of individual enterprises, and by implication, that of workers. The interdependence between economic development and social development is much more pressing and complex. Castells defines a circularity of connections between political, social, cultural, and economic development:

Personal freedom (and therefore liberty in its fullest sense) is a prerequisite for entrepreneurship. Social solidarity is critical for stability and thus for predictability in investment. Family safety is essential for the willingness to take risk. Trust in one's fellow citizens, and in the institutions of governance, is the foundation for socializing ingenuity in a given space and time, thus making it possible for others to enjoy the fruits of such ingenuity. In a word [...] social development leads to cultural development, which leads to innovation, which leads to economic development, which fosters institutional stability and trust; and this underlies a new, synergistic model that integrates economic growth and the enhancement of quality of life. (Castells 1998, p.8).

The importance of the local knowledge infrastructure to urban sustainability and development resides in the synergies inherent in local knowledge infrastructure, i.e. interconnections which make the “local” in the local knowledge infrastructure more than just a spatially-bounded subset of the global knowledge network. Basing development on strategies which leverage the value of existing strengths of the city involves less risk than development strategies that depend on attempts to break into new high-growth economic sectors by luring exotic industries into the city (Landry 2000, Borja and Castells 1996, Knight 1995). Local governance’s interest in knowledge infrastructure must also include cultivating the social and cultural knowledge networks, as they are integral to furthering the resilience of the local economy and the deep-rootedness of the community and its members. Local governance can increase opportunities for existing companies, entrepreneurs, and dynamic leaders in public, private and civic sectors to strengthen the economic, social, and cultural bases of the city.

Fostering local social and cultural knowledge networks can also reduce the sense of alienation citizens often feel toward local government which too often appears to serve developers and business elites while paying little heed to the destruction of social and cultural capital vital to the city's continuing sense of place.

5.4 Maximizing creativity in the local knowledge infrastructure.

Building up existing productive capacities is not enough to ensure the continuance of a vital local economy. Whether used in reference to the environment, a company, or a community, “sustainability” means having the adaptive capacity to respond to a changing situation, and further, the capacity to innovate and co-evolve with the context. Chapter 4 introduced the notion of knowledge as process, and the notion of the creation of new knowledge at the boundaries of the old. Another way of characterizing this difference is to compare the use of routinized knowledge versus creativity by businesses. Routinized knowledge is prominent in high-volume production activities. Whether characterized as “white collar” or “blue collar” work, the common features are repetitive activities requiring a limited range of knowledge and skills. Customer service call centers are examples of concentrated routinized knowledge. Call centers, accounting for 1 in 30 jobs in the United Kingdom, “are the industrial factories of the 21st century where telephone operators sort out problems or sell products following standard scripts. Individuality is not valued, yet the work demands intelligence” (Landry 2000, p. 34).

The other end of the knowledge spectrum from routinized knowledge is creativity. Creativity in the private sector uses existing information and knowledge to produce innovation, either to improve productivity to modify or create new productive processes (e.g. JIT, improved product design, improved call center capabilities) or to create new market opportunities (e.g. cable modems to allow Internet access via existing cable television systems). The market

rewards innovative businesses for their investment in creative capacity. To investors, a company's commitment to research and development is a primary indicator of its growth potential.

Obviously, only the extremes along what is a routinized-creative knowledge continuum have been presented. Higher skilled workers such as engineers are valued on the basis of their competence within a wider range of knowledge, e.g. knowledge of design, production and service processes, alternative responses to conditions, established methods, regulations, and standards to produce high quality products and services¹⁰. The divisions between a) competence with a number of alternative design methods, b) the creation of a new hybrid approach to a given problem, and c) innovative reengineering of a design system or product, are indistinct.

The important point is that, particularly in the context of economic globalization, high-volume production, whether done in a call center or on a factory floor, is not the basis for a secure economic future of a city. Local government economic development strategies that measure success on the basis of the number of (routine knowledge) jobs provided rather than the prospects of enriching and benefiting from the existing local knowledge infrastructure are perpetually at risk of losing 'rootless' business to another competing locality. The economic vitality of globally-linked cities rests in adaptability, managing change, and innovation.

The importance of innovation and responsiveness to change in the private sector suggests that innovation and responsiveness rather than "business-as-usual" is also a key criterion in sustaining a city's vitality in all sectors, not just in the economic sector. However, local government faces a different context than the private sector; its planning and operations agenda

¹⁰ These are all examples of the kind of *explicit* knowledge which are the subject matter of digital 'knowledge management systems,' which clearly do not actually store the kind of creative knowledge that is essential to innovation.

are less clear and more complex. Local government is tasked with maintaining dependable services for the well being of all members of the community in both the short-term and the long-term. Local governments also face a greater heterogeneity of stakeholders with often conflicting goals and demands that must be addressed. This is all the more reason to pursue innovation as a development strategy. Local governance must seek to maintain and optimize the value of the capital stock of the city, including public and quasi-public infrastructure, its physical capital, as well as its economic, social, and cultural knowledge capital, most of which lies outside the boundaries of local government.

Managing the local knowledge infrastructure to maximize creative potential casts *innovation* as a critical foundational element for the dynamic city. Local governance needs to develop capacities to monitor and nurture *creative intricacy*, bringing together the varied knowledge sets together to create new knowledge at the boundaries of the old. "Nurturing and strengthening linkages among organizations [...] must become a matter of policy at the city level. The physical presence of knowledge resources in a city is not sufficient," (Knight 1995, p. 244).

Efforts to expand creative capacity should logically include support for academic institutions and 'trademark' private institutions, especially through collaborations with the wider community. Community roundtables, collaborative workshops, standing creativity committees between community and non-profit organizations, and partnering of private sector and local academic research are some of the opportunities for enhancing the creative knowledge infrastructure and deepening ties to the city. Interaction between the private sector and secondary and tertiary academic institutions can be mutually beneficial by a) insuring that curricula provides better potential knowledge employees while b) offering opportunities to inject

relevance into students' studies (e.g. visitation days, introduction of real world problems, simulations of actual project developments, partnering in community activities, internships). Both groups benefit, deepening the intricacy of the local knowledge networks of the city. Managing for increased local creativity can also be opportunistic, rallying existing networked community capacities to address acute problems and/or issues that have captured public attention. Improved community and government responsiveness to citizens' concerns is another means of bonding citizens to the city: their 'home-town.'

5.5 Examples of local knowledge infrastructure management, both good and “mis-“.

To lend some substance to the general discussion, this section provides a few examples of local knowledge infrastructure management. Examples of good management and mis-management are provided in an attempt to highlight the utility of the concept.

5.5.1 The Time Dollar Institute.

The Time Dollar concept is built explicitly on recognizing and utilizing the capabilities of all people. The Time Dollar concept is the brainchild of Edgar S. Cahn, president of the Time Dollar Institute, which encourages Time Dollar programs in communities in the US and in other countries. Presently, there are Time Dollar programs in nearly every US state. The United Kingdom has over 10 programs established and over 30 more in planning stages.

Time Dollars are “designed to reward altruism, to turn strangers into extended family, to rebuild community and to empower persons discarded as useless to define themselves as contributors helping to meet critical social needs” (Time Dollar 2001). The basis of a community's Time Dollar program is that any person providing an hour of service to another member of the Time Dollar community receives a credit of one Time Dollar, regardless of the type of service provided. Participants are encouraged to both earn and spend Time Dollars,

thereby building both community self-help capacity, but also demand for community-based help. Examples of services include driving (chauffeur) and small household repairs, but also piano, art and dancing lessons, language interpretation, help in filling out forms, cooking for events, cooking lessons, and dietary advice.

Participants request services by calling a central matching service, where a coordinator matches the need to a participant who offers the service. Central to each local community Time Dollar program is the development and maintenance of an information base (which may or may not be computerized) of participants and the services they are willing to offer, which they themselves identify. The information base is a description of the knowledge infrastructure of the program participants (Time Dollar 2001.)

5.5.2 Berlin, Germany: reconnecting the social knowledge, the Grandparents Service.

The following excerpt describes an innovation program which taps an undervalued segment of the urban social infrastructure: grandparenting.

“Over-stretched working mothers in Berlin have found a novel solution to the expensive child care problem. For less than £2.00 per hour, and often at no charge at all, busy parents can call on a growing army of substitute ‘grandparents’ eager to dote on their children. The Grandparents Service founded in 1998 rapidly opened its second office to cope with demand. The agency matches families with elderly women or couples who often form lasting relationships with both children and parents. For the carers greater meaning is given to their lives. Grannies are available for a maximum of 20 hours per week. The director Roswita Winterstein believes the secret of their success is taking into account intellectual and social factors in making introductions. [...] *Source: Denis Stauton, Guardian*” (Landry 2000, p38)

5.5.3 Delft, Netherlands: a case of mismanagement of knowledge infrastructure.

The city of Delft, the Netherlands, was the subject of a prototype study highlighting the utility of knowledge as the operative development criteria (Knight 1995). A city of 80,000 residents, Delft had been a thriving manufacturing center until the mid-1980s. Most of the housing stock in the city center was built as social housing for factory workers. Delft is home to

a technical university as well as knowledge-based industry, such as a former producer of brewer's yeast which has become a major biotechnology firm. Highlights of the study include:

- The knowledge sector accounted for 81 percent of employment in export sectors but city residents accounted for only 11 percent of the 6000 knowledge workers. Few of the knowledge workers qualify for social housing and so, the remaining 89 percent commute from elsewhere.
- In order to expand, the technical university moved from the city center to a huge campus on the outskirts of the city. It has become isolated physically, socially and culturally from the city. Local residents rarely visit the campus other than to work and many cultural facilities in the city have closed.
- The biotech firm, once very progressive, also has lost contact with the community. In order to attract and retain key workers it has to offer special assistance so that employees can purchase homes outside the city.
- Knowledge workers account for approximately half of the daily incoming commuters. The indirect benefits resulting from income spending by these workers go to the places where they reside.
- Many residents of Delft commute out to jobs in other cities. Many of these jobs are in the local sector and some of them would be in Delft if the knowledge workers of Delft lived in Delft.

Most important to the city's long-term future, the knowledge resources have become islands of specialized expertise with little contact or synergy between them or the residents of the city. All parties suffer from a lack of interconnection. One person commented on the ramifications of the university's isolation: "how can engineers and city planners trained in such settings ever become sensitive to the needs to humanize science?" (Knight, 1995, p. 243-5.)

5.5.4 San Diego: a public-private sector partnership to enhance science education.

The following is an abridged description (Glaser and Landauer 1999) of a successful effort to tap the local knowledge resources in the private sector to enhance the science education offerings in the San Diego, CA.

Box 5.2 The San Diego Alliance

[...T]he San Diego Science Alliance (SDSA) was formed in July 1994 when a small group of people interested in enhancing science education decided to get together to determine what science-related programs were available for teachers in San Diego. Through networking efforts, the all-volunteer group grew to include representatives from high-tech companies, the biomedical community, higher education, museums, science professional societies and informal educators throughout the county.

Certainly this was a big task for the small group. However, with great determination, enthusiasm, commitment, corporate support and the vision to build a bridge between the education and business communities, their efforts have paid off handsomely.

SDSA developed a Resource Catalog, now in its fourth edition, to alert teachers to a diverse array of science-related education programs in San Diego County, such as field trips, classroom speakers, science fairs, job shadowing and hands-on activity kits. Participating organizations are profiled, highlighting their best-known products or services, Internet Web sites and internship opportunities. The Catalog is provided free of charge to educators countywide.

In addition, a newsletter disseminates information and fosters communication among teachers, scientists and other community organizations interested in supporting science literacy.

An Internet Web site (<http://www.sdsa.org>) has been dramatically redesigned, with over 120 hyperlinks to businesses and public schools. Educators, students, and industry leaders alike can log on to the SDSA Web site and search the online version of the Resource Catalog, read the latest newsletter and find the most up-to-date information on upcoming seminars, workshops or networking meetings.

[...]

Other select programs that SDSA sponsors or participates in include:

- High-Tech Fair. Several thousand students attended the first annual Educational Technology Fair. [...] Students interacted with more than 50 of San Diego's high-tech businesses to gain hands-on experience with scientists and science careers. [...]
- Teachers' Hotline to San Diego Scientists. The Teachers' Hotline was created to tap the wealth of human resources from science and high-tech businesses to help high school teachers make science concepts and careers come alive for their students. Any teacher with access to e-mail can simply send a question in any of 18 science content categories to the Teachers' Hotline, and it is routed to a local scientist who has volunteered his or her expertise to answer questions in that particular category. [...]

Box 5.2 The San Diego Alliance (cont'd)

- Pisces Project. Partnerships to Involve the Scientific Community in Elementary Schools (PISCES) targets elementary science instruction and provides curriculum to schools throughout the county. The highlights of this program include teachers and scientists actively working together to design and implement curriculum that makes sense. SDSA, the San Diego County Office of Education and San Diego State University are helping to provide the critical link among these groups. [...]
- "Science In San Diego" SEMINARS. Periodically, SDSA offers a series of weekly seminars for local educators at a wide cross-section of companies in San Diego's science and technology community. [...]

5.6 Social Capital and Local Knowledge Infrastructure

In *Bowling Alone: America's Declining Social Capital*, Robert Putnam argues that social capital has been steadily declining over the last 40 years. As social capital has been identified in studies as a critical precondition to community socioeconomic development, including better schools, reduced crime, and higher economic development, a decline in social capital is a serious issue. Putnam defines "social capital" as "features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit" (Putnam 1995, p67). Despite the inclusion of the term "networks," the case presented for declining social capital rests primarily on the empirical evidence of declining active membership across a range of social organizations (including bowling leagues). Declines in neighborhood socializing also buttress the argument, while increases in work-based relationships are cited but not pursued. Nonetheless, it seems likely that there has been a decline in social capital across America, including the 'network' aspects of social capital; rates of crime, mistrust, insecurity, lack of confidence in government and politics have all generally increased in tandem over the last decades, while political engagement has declined (ibid.).

While it is not my intention to provide a detailed or empirical-buttressed rebuttal to this argument, it is important to point out that organization membership gives only an indirect insight

into individual community connectedness. Many of the organization memberships mentioned by Putnam were often conditioned or influenced by having a shared workplace or a common employer. Bowling teams, labor unions, and even fraternal organization memberships were/are often predicated by commonality of workplace/employer. Greater neighborliness in past times might well also be traced back to more frequent instances of having a common employer, a declining phenomenon in light of deindustrialization and rapid urban sprawl.

The real import of these musings is to suggest that these measures of social capital may well be suspect or anachronistic, as they were strongly influenced by a single factor, i.e. common, steady employment, a condition which does not much apply today. Meanwhile, the increased rates of women participation in the workforce and increased levels of television viewing clearly play a part in reduced civic participation, however measured. The pattern of forming social capital through communities of proximity (at work as well as neighborhood) cannot be regained. We must therefore seek to foster more and better ties through common interests; i.e. communities of interest. The challenge is to entice an individual away from the TV screen by the promise and realized reward of involvement in something meaningful to that person. Increasing social capital must be approached by fostering increased social interconnections, based on ‘matching up’ individuals’ interest to other individuals and organizations with common interests. At the same time, with recent technical advances to (re-) integrate spatial information with other information¹¹, it should be possible to “localize” groups in the city which share common interests. In short, in an age of reduced “free time” in some cases (e.g. women in general) and more information/ entertainment media competition, the

¹¹ Through development and use of Geographic Information Systems (GIS)

approach to rebuilding social capital should be based on lowering barriers of access to the full range of the available local knowledge infrastructure.

6 Developing a local knowledge infrastructure information base.

6.1 Introduction.

Recognizing the local knowledge infrastructure as a tangible asset that can be managed to increase its value establishes a strategic development goal. Achieving the goal requires a variety of concrete actions, some of which are overviewed in the next chapter. As the discussion moves from normative argument to operationalizing the concept of managing the local knowledge infrastructure, it seems necessary to introduce the concept of a digital information base to represent the (real world) local knowledge infrastructure. The scope of the tasks to be considered, the range of actors expected to take part, and the breadth of information of interest all argue for a digital local knowledge infrastructure information base¹², or “LKIIB” for the sake of brevity.

6.2 Representing community collaborations in the LKIIB.

A widely accessible information base about the local knowledge infrastructure that reflects the essential elements of the city's' knowledge infrastructure is essential to managing and furthering the development of the local knowledge infrastructure. The information base should provide capabilities to represent the knowledge nodes, including organizations, individuals, and community collaborations, and to represent the interconnections between knowledge nodes. Community collaborations are particularly important subjects for inclusion in the LKIIB. For example, an extant community organization may target at-risk youths who have no motivation in school. Working together with a local school and local companies, a project is developed which

combines student visits to local companies with complementary visits to the classroom by company employees. Working with faculty, students participate in simulations of real world design processes or a production problem and solution. The positive outcomes include motivated students and reduced delinquency, improved engagement between the company and the community as well as active recruitment of local students as employees. This mutually beneficial project is based on a three-way community collaboration involving one or more companies, a school and a community civic organization. The community collaboration is itself a distinct component of the local knowledge infrastructure and an asset to the community, contributing to deepening the interconnectedness of the community, even though the collaboration may not ‘own’ any resources of its own. Information about this community collaboration: which organizations and people participate (the interconnections), the primary activities and interchanges involved, the costs and benefits accrued and to whom (company, students, community, government), etc., would be useful for maintaining the original project and setting up similar efforts. Yet each organization holds its own perspective of the community collaboration, i.e. how that organization is involved in the community collaborations. A chief goal of a LKIIB is to maintain information about community collaborations and the interconnections with the supporting organizations/individuals. The LKIIB provides consolidated, comprehensive data sets of the community collaborations and interconnections as entities in their own right, along with the *qualities* of persistence and accessibility, independent of the supporting organizations/individuals involved. In essence, the objective is to develop an object-oriented data model of the local knowledge infrastructure that provides equal place and

¹² For the sake of integrity of meaning, I have avoided calling it a “database,” for the data is clearly expected to be collected and organized for a purpose and is therefore an “information base.”

accessibility for all knowledge nodes: organizations, individuals and community collaborations, along with their interconnections.

6.3 The importance of a widely accessible LKIIB.

The notion of a LKIIB presented here is still conceptual and does not mean to imply a technical design. Nevertheless, the situation prevailing in most *ad hoc* collaborations, in which each organization or individual holds a unique and partial definition of each community collaboration, constitutes a “design problem.” Without a discrete, self-contained memory trace of community collaborations, the valuable community interconnectivity component of the knowledge infrastructure is likely to be lost precisely when no one is paying attention. This is especially true of ephemeral or incipient community organizations which have not yet built up a ‘presence’ in the conception of ‘local community’ in the minds of the dissimilar participants and contributors which are contributing to these non-traditional collaborations -- the very essence of community-based innovation.

The private sector again provides a ready model for comparison and contrast. Corporations have a purpose and a knowledge framework that informs the actions of employees, partners and subcontractors. The overall strategies and goals of the company are well articulated, i.e. to meet customer demands for quality products and/or service within an investment framework that produces a profit. Everyone understands that his or her efforts fit within a tangible agenda for the business. (This is true even where an employee's view of the framework of purpose is relatively limited.) The interconnection of all actions and processes, whether performed in-house or by subcontractors, relate in understandable ways – including explicit knowledge recorded in operating procedures and “best practices” and tacit knowledge, more commonly referred to as “job competence” – to the enterprise’s objectives. From a more abstract perspective, each agent

operates within and adds to the knowledge infrastructure of the organization. They know who does what, what needs to be done, how to go about the task, and how the task relates to other tasks to meet the overall objectives.

As noted in chapter 4, companies have transitioned over the last few decades to network modes of organization and management in order to tap the benefits of networked intricacy: flexibility, adaptability and increased opportunities for innovation in processes and products. Employees use their understanding of the company's agenda and knowledge framework to perform and refine processes to meet those ends. They may also contribute to adapting and refining the company's agenda. It is important to note the relation of boundaries of a company's knowledge infrastructure. Peter Drucker states, "the role of management [...] is not to command and control, but rather to ensure that all the different parts of the organization get the information and the resources they need, and that they understand the institution's larger goals" (in Surowiecki, 1998). Implicit in this definition of management is that institutional goals are matched by the span of a (collaborative) knowledge framework that informs operational strategy. "Management" does not imply close supervision of the processes (e.g. the activities of collaborating partners or subcontractors), but it does oversee how separate activities relate to each other (the interconnections), based on the overarching knowledge framework.

A similar coincident spanning of goals and coordination of agency does not readily apply to urban development for three major reasons: 1) lack of unified goals and strategies, 2) structural sectorization of agency, and 3) lack of a common knowledge framework, as elaborated below:

1) Lack of unified goals and strategies. "Happy families are all alike; every unhappy family is unhappy in its own way." Jared Diamond (1999, p. 157) uses this opening sentence of Tolstoy's

Anna Karenina to illustrate the complex set of factors that governed the prospects of development of human societies throughout the world. Scholars and practitioners of urban development have painfully gained an appreciation of ‘the Anna Karenina effect’ in their efforts to study and remedy urban decline and foster sustainable urban renewal. Unlike the situation of private sector described above, there is no unifying goal for urban development. Instead there are many stakeholders with competing agendas. The chaotic complexity of urban problems can be said to be comprehensible intricacy of a vital city gone bad.

2) Structural sectorization of agency. Urban development agencies operate largely autonomously (ref. 4.1). Local governments and civic organizations operate within separate institutional and programmatic boundaries. Each organization, whether public, civil, or private sector, operates independently, setting its own goals to address separate subsets of local issues, and cultivating its own resource base.

These two factors produce a self-reinforcing, or “positive” feedback loop. In the face of complexity, local governments fall back on institutionalized vertical sectorization to provide a framework for order. Local government departments seldom coordinate their goals and operations with each other. The civic sector is also hobbled by sectorization, with the exception of true community-based organizations (CBOs), which grasp the interconnectedness of problems as a central development issue but usually lack the corresponding breadth of resources, including knowledge resources.

3) Lack of a common knowledge framework. Civic sector advocates and researchers cite the importance of building managerial and operations execution capacity (see Minkler 1998). Too much demand is placed on 'brawny' goodwill provided by dynamic civic leaders to overcome the lack of community-wide managerial 'know-how'. Local success stories are often sustained by key

people providing vision, managerial know-how, connections (sometimes hard-won), and their personal reputations. Many of these initial success stories ultimately wither as key people step down or move on. Other projects succumb to changing circumstances: external factors that undermine the operations or funding strategies of the civic organization. Much effort expended by civic sector agencies is spent on organizational survival, retaining resources, skills and funding. Each agency is an island of civic knowledge and innovation.

Given the complexity of urban problems and the pressing issues of maintaining an organization, it is small wonder that civic development agencies give scant attention to contributing to a common local information base of their city's knowledge infrastructure. Yet having such a commonly accessible information base of local knowledge resources and established interconnections could provide coherence and complementarity to agencies' plans and operations. This in turn would enhance the continuity and effectiveness of civic development agencies, and provide wider opportunities for citizens to become involved in shaping the urban management and development agendas (Luithlen 1998).

The preceding discussion brings us back to the opening premise of this chapter: the prime importance of recognizing the local knowledge infrastructure as a tangible asset of the city. The first hurdle to overcome to develop a strategy of a cohesive, self-managing city is a change in conception. The city needs to be thought of in terms of "The City, Inc." Stakeholders in the well-being of the city, including its citizens, its various communities and organizations, all have a stake in developing an accessible and integrated knowledge resource framework which encompasses the various types of agency within the city. Without a commonly accessible LKIIB, the habits of institutional independence and isolation continue to be reinforced by the lack of knowledge of the existing knowledge infrastructure. Effort will continue to be wasted as each

agency continues to rely solely on its own agenda and its own knowledge resources to impart a framework of purpose for each agency's activities. In contrast, The City, Inc. should invest in the development of an integrated LKIIB that would represent not only the nodes of knowledge (e.g. the Yellow Pages or Chamber of Commerce directory), but also entire knowledge networks.

7 Activities and programs for managing local knowledge infrastructure for local sustainable development

7.1 From knowing the local knowledge infrastructure to acting: networked local governance.

Local governance, employing a network organizational structure and using a shared information base of local knowledge infrastructure (LKIIB), can build the capacities to plan and coordinate activities of separate agencies to implement community-centric development strategies. A self-knowledgeable city can actively develop the complementary capacities of various agencies to serve community needs and strengthen community resources. Operational knowledge infrastructures of the current islands of civil action can collaborate to achieve synergies in a less haphazard manner. Planning and managing capacities can be collaboratively employed while simultaneously reducing the administrative struggle to ensure the survival of individual civic sector agencies, which often face poor visibility and poor support. Dynamic individuals, who are the heart and soul of many such civic sector organizations, need not be stifled. Instead, their energies can be more fruitfully employed in a more conducive atmosphere of interagency collaboration.

What is proposed here is not without precedent, although the scale suggested may be. Case studies of community-based development (ref. Minkler 1998), especially of Community Based Organizations (CBOs), demonstrate positive outcomes resulting from the coordination of separate agencies to tackle problems on a community basis. These community-action cases are instances of expanding the knowledge framework of agency to better match the boundaries of the problem space. These cases and the example of the networked private sector demonstrate the

means to institutionalize collaborative arrangements in which stakeholders retain their voice in the planning and execution of development projects. Civic sector agencies need not be dissolved nor subsumed by formal government. Instead they can coordinate efforts to achieve synergies, increase awareness of problems, multiple approaches, and community resources; promote community successes; and guard against losing agency capacities that threaten community gains and positive momentum.

Networked governance rests on accessibility of a shared LKIIB. A LKIIB supports strategies both to improve efficacy of community service programs as well as to counteract the influence of vertically-linked sectorization of government and civic sector agencies. Collaborative ownership (use and management) of the LKIIB also facilitates the decentralization of the city's development/management knowledge infrastructure and allows organic development of the knowledge infrastructure within the community itself.

7.2 Activities and Programs for Managing Local Knowledge Infrastructure for Local Sustainable Development

This section provides an overview of activities which, taken together, simultaneously exploit and expand the local knowledge infrastructure. It is not intended as a comprehensive survey of all possible strategies and tasks, but rather to illustrate the range of possibilities offered by collaborative management of the local knowledge infrastructure.

7.2.1 Developing a city intelligence capacity, and maintaining a local knowledge infrastructure information base.

Text Box 7.1 provides two examples, Cleveland in the early 1970s and New York City today, of lost opportunities to develop and build on existing knowledge resources, due to misconceptions of the local economy. These two examples illustrate that, without a deliberate

Box 7.1 A Tale of Two Misguided City Governments.

Cleveland's Past-Perfect.

When deindustrialization began to hit the factories of Cleveland in the early 1970s, the young populist mayor and the Chamber of Commerce were convinced that Cleveland's future lay with recapturing its past as an industrial production town, providing blue-collar employment. The mayor "was offering to help corporate managers pack their bags" (Knight 1995, p. 229), though at the time Cleveland has the third largest concentration of major industrial headquarters in the US and headquarters and related services were expanding. Many corporations did move, convinced by the city's political leadership that corporate headquarters expansion needs could not be fruitfully met there (Knight 1995).

New York's Future-Perfect.

Urban manufacturing is still a necessary part of the economies of New York and other many global-class cities, despite these cities governments' own rhetoric about the obsolescence of manufacturing within their territories. The firms are typically small, customer-oriented and part of dense networks of supplier, contractors and subcontractors. They operate in niche markets, often providing crucial functions for leading sectors of the urban economies. Lacking fundamental policy support, many entrepreneurs are forced some into the informal economy to continue operations (Sassen 2000).

intelligence gathering capacity, the breadth and diversity of the real economy is too easily discounted and the true nature of the local economy may be misunderstood.

Research in Massachusetts revealed an economic network or "cluster" of 400+ companies related in some way to medical devices, providing over 39,000 high earnings jobs. Yet the cluster had not been recognized as such because it was camouflaged in several diverse industry categories including electronic equipment and plastic products (Porter 2000). "Seeing a group of companies and institutions as a cluster [] highlights opportunities for coordination and mutual

improvement in areas of common concern with less of a risk of distorting competition or limiting the intensity of the rivalry” (Porter 2000, p18).

Gathering information about local knowledge networks (not just economic), data mining efforts to assess trends and identify networks' strengths and vulnerabilities are the cornerstone activities to managing the local knowledge infrastructure. Local governance should include active maintenance of an inventory of the city's unique competencies, especially the creative knowledge infrastructure. Knight describes how public-private-civic sector collaboration in this effort would yield synergistic results.

Many organizations have already developed competencies relating to their own development and the city could, by creating appropriate mechanisms, access and draw on these competencies when formulating development strategies for the city. Strategic planning and human resource planning have become ongoing processes in many organizations. There would be benefits to all parties involved. The organizations would benefit from having more information about the longer-term development trends and the collective intentions of the cities and regions where their facilities are located and the city would benefit from knowing more about the longer-term intentions and needs of the organizations which form its institutional and power base. [Organizations ...] could also assist in identifying qualities and attributes of the city which need to be conserved and strengthened. (Knight, 1995, p.248)

The collected information about the local knowledge infrastructure: the city's unique competencies, trends, intentions, strengths and weaknesses is an important part of the LKIIB. Local governance must include a capacity responsible for the development, maintenance, and promotion of the LKIIB as a valuable resource, serving the competitive positioning of the city in the global economy and serving the needs of local citizens.

7.2.2 Promoting the city, externally and internally.

To thrive in an age marked by extreme mobility of capital and high-value knowledge workers, the city needs to market itself to outside interests including investors, businesses seeking new locations, and new residents. Promoting the city to the outside world is accomplished by competent marketing of the city based on thorough understanding of the economic, social and cultural offerings of the city. The city can promote its "centers of

excellence" as well as its complementary social and cultural amenities in its promotional efforts. An accurate inventory of the city's resources (the LKIIB) provides competitive advantages by being able to proactively court outside interests. Further, while city marketing is well-established tactic of local economic development, there is often an element of future projection involved (Wolman and Spitzley 1996). Having identified the full breadth of the city's strengths, as well as those areas where additional capacities are needed, economic planning can more accurately target outside interests that would complement the city's local knowledge infrastructure (Luithlen 1998).

Internal promoting of the city to its citizens includes a number of strategies and benefits:

- Building awareness of the local knowledge infrastructure as a community asset in general, and the value and accessibility of creativity bases in particular.
- Providing information about the social and cultural resources of the city.
- Providing an accurate picture of the composition of the local economy (including within the social and cultural sectors) and future prospects for employment and entrepreneurship, as well as forecasted skills needs.
- Acknowledging the contribution of high-knowledge workers/entrepreneurs in the society and demonstrating that their interests are reflected in local policy.
- Strengthening a sense of solidarity and pride and community-belonging. Local governance must project and affirm openness by encouraging public participation in decision-making and management of urban services, and developing transparency of administrative processes.

7.2.3 Managing for creative intricacy, equity, and inclusion.

As described in chapters 5 and 6, development of interconnections between creativity nodes and the creation of multi-stakeholder creative agencies is a strategic objective of the self-knowledgeable city. Creativity can be encouraged by ensuring that all creative agents have

access to the breadth of the knowledge infrastructure, including the assets and problems within the community, and access to other innovative nodes and agents. Strategies include:

- developing and exploiting opportunities to advance inclusion of marginalized groups,
- fostering opportunities to increase the creative capacity of the knowledge infrastructure, especially by encouraging cross-disciplinary community collaborations.
- discovering local solutions to local needs and connecting the involved stakeholders
- engaging citizens with the improvement of their communities and with the governance of *their* city.

7.2.4 Integrating local knowledge infrastructure and physical planning.

Information about the local knowledge infrastructure can provide important inputs to physical land use and infrastructure planning, the usual stuff of many local government planning and engineering departments. The economic and physical aspects of planning need to be fused with non-material aspects of social and cultural internetworking. The study of Delft, the Netherlands (ref. section 5.5) demonstrates the results of ignoring the interconnections between knowledge networks and physical planning. Ignoring the spatial dimensions of the knowledge infrastructure forecloses options for the city's future. "The physical presence of knowledge resources in a city is not sufficient. Proximity without propinquity will limit the city's development unnecessarily. The city's role should be to integrate all new forms of knowledge into the cultural and social life of the city," (Knight, 1995, p. 244).

The Delft study also illustrates the problem of fragmented sectoral policies (ref. section 3.2) which, for example, focus on housing without regard to economic knowledge linkages. Most of Delft's inner city housing stock is social housing. Residents are socially isolated from the knowledge industries and unemployment among residents is high, but income transfers and

social support programs supported by the central government prevent neighborhoods from physically declining.

Placement of ICT infrastructure in particular is an integral part of the knowledge resource-physical planning nexus. Sassen observes that high-capacity business-oriented digital networks have given rise to regional grids of dense strategic business nodes spread over a broader area, as opposed to the classic concentration in the Central Business District (CBD). "Far from neutralizing geography, the regional grid is likely to be embedded in conventional forms of communications infrastructure, notably rapid rail and highways connecting to airports" (Sassen, 2000, p. 136). The places that fall outside of this grid are peripheralized, structurally embedding the 'digital divide' into the topography of the city (Wheeler and O'Kelly 1999). The challenge – and the opportunity – is to ensure that ICT infrastructure planning considers not only the obvious business interests but also promotes new options such as compact, mixed-use neighborhoods (Floeting 1999, Offner 2000, McGrail 1999).

7.2.5 Local economic development and the local knowledge infrastructure.

7.2.5.1 *Knowledge management and knowledge infrastructure.*

The private sector's growing interest over the last decade in the subject of knowledge management has arisen as companies have realized that focusing on ICT systems is not sufficient to enable the 'reinvention' of a company. The networked organization model requires management to consider how to ensure that information is accessible to knowledge-based collaborations that form and re-form within the company and with its various interfacing organizations, including suppliers, clients, and subcontractors. It is in the context of this discussion that the notion of "knowledge networks" has gained currency. However, as noted in chapter 6, the starting point of these business deliberations is that a (reasonably) coherent

organizational network already exists, which simply must be reinforced in a more conscious way as the organization adopts a dispersed network structure. Recasting the problem as one concerning management of the knowledge infrastructure to facilitate substantive knowledge collaborations might well help business leaders develop more cogent knowledge management strategies that distinguish between ICT-based information management system and the larger component of knowledge systems: the *knowledgeable* staff. This would reduce the disciplinary gap that exists between the (private sector-oriented) research on knowledge/information networks and urban studies-based research on phenomenon of local economic agglomeration or clustering (Castells 1998, Borja and Castells 1996, Sassen 2000, Mishra 1999, and Porter 2000). It would also help reduce the gap between these areas of research and research on the importance of a holistic local knowledge that encompasses social, cultural and environmental spheres (e.g. Knight 1995, Landry 2000).

7.2.5.2 Viewing local economic development practice in relation to the local knowledge infrastructure.

Wolman and Spitzley's 1996 review of 10 years of literature in the journal *The Politics of Local Economic Development* outlines a number of issues relating to the motivation, options, outcomes, and efficacy of cities' local economic development (LED) efforts to promote increased business presence within their jurisdictions. Their review provides a useful basis for considering how a focus on local knowledge infrastructure could help define more effective local economic development strategies. To establish a common ground between this paper and Wolman and

Spitzley's review, it is worth noting that their summary of the LED literature found four complementary reasons for the perceived¹³ increase in local economic development activity:

- Increased mobility of capital,
- 2. Slow growth or even decline of many urban economies,
- 3. International economic restructuring has been particularly hard on cities which have been dependent on traditional manufacturing employment,
- 4. Reduced national assistance for local economic development.

In short, these reasons are consistent with the contextual issues presented in chapters 2 and 3 of this paper.

Despite a growing trend in the establishment of agencies within local governments dedicated to local economic development, Wolman and Spitzley note that there is remarkably little clarity of objectives or the means of achieving them.

LED project objectives. A basic issue is whether the main purpose of cities' LED activities is defined in terms of increased employment and/or income or in terms of increasing local revenues¹⁴. Surveys support both contentions (Wolman and Spitzley, p. 121). The authors argue that both fiscal- and employment-focused LED projects often focus on direct linear gains, with little attention to whether new businesses will add to the strong suit of the city. To recast and enlarge on this criticism, recognition of the importance of a city's local knowledge infrastructure and knowledge as a product of social and community interaction would focus attention on non-linear gains to be had by fostering interconnectivity between businesses and with the rest of a

¹³ Noting the lack of research to test why and how LED activity is being undertaken, Wolman and Spitzley continue, "Indeed, there are virtually no empirical results that demonstrate that local economic development activity has increased over time" (Wolman, Spitzley 1996, p. 145).

¹⁴ Fiscal issues have more keenly registered with local governments of American cities than cities in most other developed countries, which have (had) more institutionalized national revenue distribution.

city's vital factors. The issue is not simply how many jobs are generated, but how those jobs may contribute to the innovative and entrepreneurial potential of the larger community.

Likewise, faced with the concern of the mobility of capital, simply seeking *any* new type of economic activity is insufficient to reduce the vulnerability of the local revenue base. Retaining companies implies accentuating and strengthening the factors that make the city uniquely suited as a place to do business (Borja and Castells 1996, Castells 1998, Drucker 1999, Hall and Pfeiffer 2000, Knight 1995, Landry 2000): a local knowledge infrastructure-based LED strategy.

Measuring LED success. There is a wide range of tools and activities employed for LED and a wide range of how these tools are classified, and the factors which predict the use of certain tools and strategies (Wolman and Spitzley, p. 121-128). What is most notable about this discussion from a critical local knowledge infrastructure perspective is: 1) the emphasis on land use and property exchange values, applied on a property-by-property basis, 2) a narrow field of action involving two parties only: the public sector as regulator of land uses and provider of (physical) service infrastructure, and the businesses being courted. Including the local knowledge infrastructure into the economic development calculus would elevate the interchange of value between the new business and the surrounding community. This implies inclusion of broadly defined *use valuations* of property in addition to the *exchange value* of property into LED strategies in particular.

Development for whom? Attention to the local fabric of knowledge resources and the use value of property would provide a tangible linkage to community equity issues. “Efforts to promote the locality's economic base can often threaten the social and economic survival of [neighborhoods]. The most frequent residential victims of urban development tend to be lower-income

neighborhoods whose geographical location in many large cities (adjacent to commercial and industrial areas), low property values, less skilled workers, and weak political resources make them highly vulnerable to business expansion schemes, highway improvements, and other forms of economic "modernization," (Kantor and David 1988, quoted in Wolman and Spitzley 1996, p137). An accessible LKIIB would empower more meaningful participation by community residents and ensure more thorough consideration of impacts to existing social and cultural networks. A deeper, more integrative development dialogue would be possible, rather than a singular concentration on the introduction of new business or new housing, with the potential of yielding a better outcome for all parties.

8 The World Wide Web and the knowledgeable city: implications for local governance.

The previous four chapters have concentrated on the proposition of networked collaborative governance attending to the local knowledge infrastructure as the basis for a local knowledge-based urban development strategy. Chapters 4 and 5 provide a general outline of a knowledge-based development strategy, while chapter 6 introduces the concept of a shared, accessible repository of information about the local knowledge infrastructure: the local knowledge infrastructure information base (LKIIB). Chapter 7 builds on these previous three chapters, enumerating a variety of different local knowledge-based development actions and specific strategies that can be pursued, each of which exploits, and contributes to, local knowledge infrastructure and its representation, the LKIIB. A fundamental issue of this discussion is information (about knowledge): how it is developed, maintained, and accessed by multiple stakeholders. While chapters 6 and 7 provide details of LKIIB functional requirements, the discussion has steered clear of particular design solutions. This chapter takes up the issue of design by assessing the suitability of the Internet, and the World Wide Web (WWW) in particular, as a potential technology base for an open LKIIB function. The growing ubiquity and expansive functionality of the WWW makes it an obvious candidate for hosting the LKIIB and providing the requisite open access.

This suitability assessment begins with a brief history of the Internet and the WWW as an information resource, highlighting the characteristics of the WWW that make it simultaneously conducive and inimical to the specific desired LKIIB functionality. Strategies are suggested that could address the antithetical aspects of the WWW so that it can be employed as a positive,

supportive tool for implementing specific local knowledge-based strategies. The chapter concludes by considering the feasibility of implementing WWW-supported local knowledge resource development strategies in cities of the developing world.

8.1 The explosion in popularity of the Internet.

The Internet has rather suddenly become an important part of people's lives in the US and other developed countries. Internet access from homes is growing dramatically. Internet access by US households has grown from 18% of all households in 1997 to over 50% in August 2000 (NTIA, 2000). Extending Internet access to all people is an important public issue at the present time. Yet the ICTs which allowed the Internet to grow to its present size have been in place in various forms for over fifteen years. These technologies include dependable virtual connection protocols and information packet switching, automated domain name and connection address management functions, which have accommodated the rapid expansion of an interconnected set of networks that has become known as 'the Internet.' 'Internet' user applications, including common interest chat groups, file transfer from remote servers and email, have been available longer than the Internet itself.

There was little public and commercial interest in the Internet until 1994, as illustrated by the steep rise in the number of network hosts shown in Figure 8.1. The reason for this sudden upsurge in interest is that only then did the Internet embody a new relationship between people and information. The core of this new relationship was the deployment of an easily accessible, true networked information infrastructure: the World Wide Web (WWW).

Hobbes' Internet Timeline Copyright ©2001 Robert H Zakon
<http://www.zakon.org/robert/internet/timeline/>

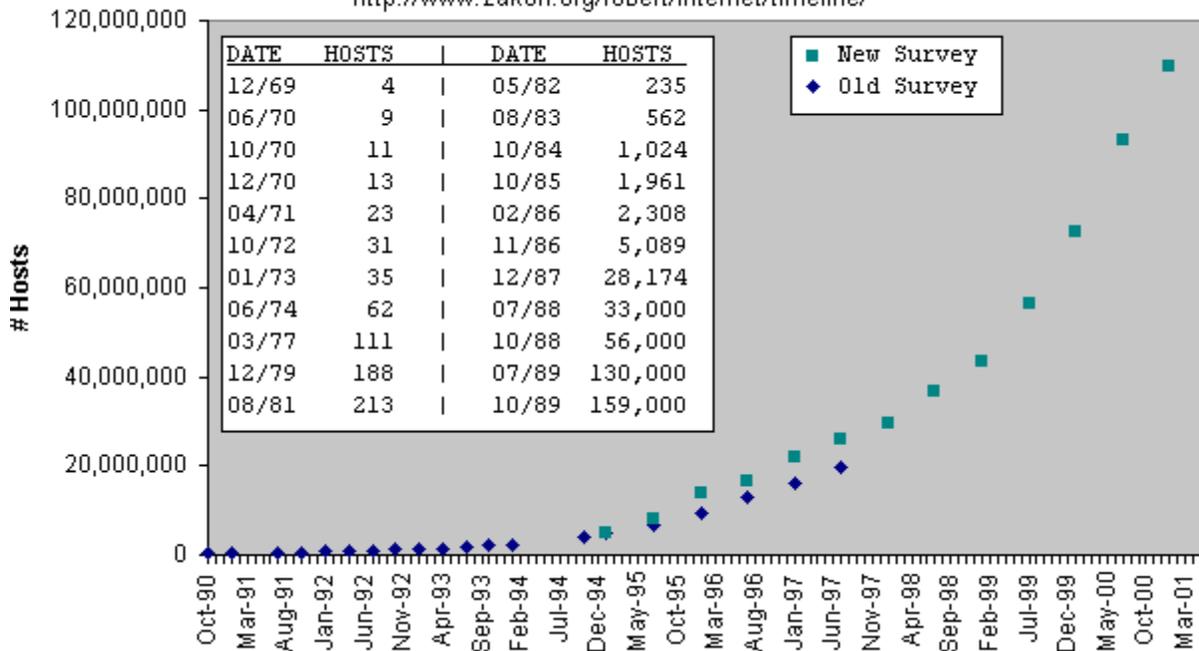


Figure 8.1 Growth in Number of Internet Hosts.

8.2 A revolution in information infrastructure.

The importance of the Internet lies not in the ICT infrastructure on which it is built, but in the creation of a universally accessible networked information infrastructure (NII¹⁵). Historically, access to information was restricted as a result of technology or policy or both. Information access has been limited chiefly through two primary factors. First, information bases were discrete. Libraries and other information bases, whether public or private, held sets of information whose composition was limited by the interests of the clients, budget and space¹⁶. This first factor of limited access is the ‘discrete host’ factor. The discrete host factor is a two-

¹⁵ This is not a standard use of this acronym. In the US, NII refers to the National Information Infrastructure. “NII” is used here to distinguish between the ICT infrastructure and the infrastructure of information itself (i.e. NII) but also to be more specific than the ambiguous term “information infrastructure” (no caps) which typically refers to the ICT infrastructure. The US “NII” is a subset of the information infrastructure.

¹⁶ Including physical and digital storage space limitations

edged sword: increasing the cost of building a 'useful' database while simultaneously increasing the value of the developed database due to its relative scarcity. The second factor of limited access is/was the technical limiting of user access: the number of clients of a discrete host who could access a given information resource is/was limited by constraints of technology, space, and time. Information access was restricted by technical constraints to access (e.g. books, computer terminals served by a database host server), which reinforced policies of access linked to status, education level, and professional standing.

Despite the intentions of the pioneers of the Internet, on a practical level, the traditional paradigm of limited access persisted on the Internet. Digital information libraries were increasingly accessible in a technical sense, and reproducible for minimal cost (time and ICT capacity usage). However, each discrete information host was essentially an independent library each with its own unique information index. Just as with a physical library, you can't use information if you don't know it's there. While there were digital links between the 'libraries', generally a priori knowledge of the existence of information sets held by each node was required.

The period 1989-1992 saw the development of a number of tools to address these two access constraints (Berners-Lee, et. al, 1992; Zakon 2000):

- Tools to aid finding information (e.g. Gopher, WAIS, Archie, Veronica, and real-time search engines)
- The development of the "hypertext" document model that allows information of any type, including another document, to be "transcluded" into the document by reference only. A hypertext document is itself a network of information.
- Graphic browsers which hid arcane computer commands and application protocols behind a more intuitive user-friendly interface which allows the user to navigate through the NII.

Information is presented in a consistent form, minimizing the need for user intervention to reformat or translate received data.

These various advances culminated during the 1991-1993 timeframe into the World Wide Web (WWW), based on the hypertext model and “Mosaic,” the first graphic ‘web browser.’ Once the WWW functionality was made available for general use, it was rapidly adopted as the preferred information network structure over the next few years. By 1994, Robert Zakon (2000) notes that: “Mosaic takes the Internet by storm; WWW proliferates at a 341,634% annual growth rate of service traffic.” The rapid spread of the WWW sounded the death knell of arcane information networks and the subsumption of much of their underlying ICT infrastructures into the Internet¹⁷.

The new technologies comprising the WWW have created, for the first time in history, a new relationship between users of information and information. The WWW allows a user to search for information on any subject, regardless of the user's status and location. User access to any particular information subset is virtually unlimited, and the information is readily reproducible. Users can construct “webpages,” hypertext documents that, through transclusion, tie together unique combinations of information based on the knowledge and intention of the creator(s) and/or users. Each webpage owner controls what information is transcluded in his/her own network of information.

The traditional paradigm of information access limited by discrete hosting and limited user access has been supplanted by a "unified global information universe" (Berners-Lee et al. 1992) accessible to any and all users. The realization of a global information universe is having repercussions throughout the world. Nor are the impacts of this change in information access

¹⁷ This is not to say that all non-WWW networks have disappeared. While the WWW provides for wide and transparent access, other user-network/protocols provide better efficiency (e.g. USENET) and therefore continue to be used, particularly by established communities of interest.

paradigm limited to using the WWW on the Internet. After witnessing the potential of open information access, company managers have sought to unlock the value of the stacks of internal information cubby-holed into separate databases, each with their own overly restricted set of users. Data warehousing and Intranets have become the new norm for information management within companies. These technical changes have supported organization re-engineering efforts, such as flattened of decision-making hierarchies processes and empowering of task groups.

8.2.1 The tension between the ‘placeless’ WWW and locality, or the rise and fall of “new community networks.”

The routing functionality of the Internet determines the virtual connection used to route data traffic (in data packets) between the source and user. That this network exists in physical space is outside the knowledge of the routing function. Indeed, there are several layers of mapping between the infrastructure of the “global information universe” and the topography of physical space. Each mapping between infrastructure layers achieves a functional independence of the upper layer from the design and implementation details of the lower layer, with each higher level inheriting the independence gained by the supporting lower layers. The end result of these multiple layered mappings is that physical space is 'immaterial' to the topology of the topmost layer, i.e. the hyperlinked interconnections of WWW; the information infrastructure of the WWW is inherently ‘placeless.’

The placeless character of the Internet is exploited by some of commercial WWW search engines as advertising clients are given priority in the list of sites produced which match a user’s search criteria. Meanwhile, as the information infrastructure is not dependent on spatial dimensions, spatial data is provided in the information content itself only when deemed important, either as part of the subject matter or to support non-digitally mediated interaction

(e.g. billing by mail, shipment of products, location of operations). Currently therefore, it is generally not feasible to use spatial characteristics as a preference ranking mechanism.

For cities, the independence of the WWW information infrastructure from physical space is simultaneously a blessing and a curse. Information users can gain access to all information available on the Internet, no matter where the users exist in real space. Stakeholders in an issue have new means of communicating concerns and ideas. Meetings can be held in cyberspace more easily than in one time-space. The WWW provides access between adjacent territorial governments for policy and program coordination. It supports opportunities for exchange of information and ideas with other cities and with higher level (e.g. state, national, regional, international, and global) institutions. Universal information accessibility provided by the WWW makes it a potentially powerful tool for cities seeking to increase citizen participation in local governance. The WWW provides the means to augment each person's topology of interests with greater options for involvement in community concerns and local governance.

Yet the placeless character of the WWW has combined with the growth in popularity of the Internet to undermine earlier attempts to advance citizen participation through computer-based community networks. "New Community Networks," heralded by Doug Schuler in his 1996 book of that name, were "labors of love" (ref. Steve Cisler in Schuler 1996, p.345) developed by e-citizen activists to provide a consolidated local knowledge resource, or 'virtual place' on the networked information infrastructure. This strategy unfortunately relied heavily on ephemeral technical and social conditions:

- 1) Until the mid-1990s, "being on-line" largely meant having access to a local BBS or some other dial-in, text-based community portal. The point-to-point nature of the communications technology used mirrored the intended local market of community networks (Schuler 1994). A

connection could be made within the local calling area of the dial-in subscriber. The local call cost factor naturally limited the information and knowledge infrastructure content of local community-oriented BBSs to the interests of local community members.

2) Prior to the deployment of WWW functionalities, data mining of the Internet was largely limited to accessing library/database indices and on-line instructions, e.g. Frequently Asked Questions (FAQs), or querying other biological-based, random-access data storage and retrieval devices, that is to say, asking other members of the cyber-community. Communities of local interest were thereby able to network their collective knowledge of available information resources.

3) Prior to 1996, there were few Internet Service Providers (ISPs) to provide access to the Internet for a given community. Until then, due to the expandable nature of the Internet ICT infrastructure, a locally minded entrepreneur could set up a local ISP for a relatively small amount of capital. In the pre-WWW days, the local ISP not only provided a point of access on to the ICT infrastructure, but also typically provided the initial entry point into the information network: the 'community portal' or "home page" for subscribers. One practical implication of the tight coupling of ICT entry point to information network entry point was that it allowed the local ISP to raise advertising revenues from local businesses.

Even as the Schuler's book was being published, conditions were changing that undermined the significance of these community networks, or 'local places,' on the Internet.

- The independent topology of the WWW-based information infrastructure has meant that ISP subscribers not longer have to enter through a local community information portal or 'community homepage' to get on to the information superhighway.

- Internet users have become savvier and, with more choices at their disposal, make their own determination of their information preferences. They may even record their information preferences in their own homepages/information networks.
- Internet users in most metropolitan areas now have a choice of ISPs, including nationally branded ISPs, which are little concerned with local identity for their survival.
- The retail sector and some parts of the service sector expanded their presence on the Internet. The placelessness of the WWW offers advantages to national retailers and ‘dot.com’ businesses with greater advertising budgets than bricks-and-mortar local businesses.

To summarize, the massive growth of the Internet and WWW has overcome the problems faced by the pioneering community network advocates who labored to achieve a critical mass of potential e-citizens. Yet though many the community networks continue to exist today, they are lost in the clamor for attention of all the other accessible sites on the WWW, which has become a towering network of babble. Some community networks have retained their independence from the commercialization of the Internet, but they have generally remained a minor presence, little more than chat rooms and alphabetized directories of local civic organizations, while the placeless WWW has mushroomed around them.

8.3 Employing the WWW for local governance

The WWW is proving a useful tool of policy and program development within broad areas of local government and urban development. The WWW is an effective medium for information exchange between local governments and development organizations around the world. Tools and guidelines, lessons learned, collections of best practices, discussion groups (asynchronous message boards and real-time chat rooms) and email are valuable tools and resources of the global urban development information network.. For example, The Joint Center for Sustainable

Communities operated by the National Association of Counties and the U.S. Conference of Mayors (USCM) provides Web-based best practices information, email and other e-conferencing services, backed up by on-site technical consulting capacities (NACo 2000). Not only are local governments and development organizations contributing to the global dialogue within their own communities of interest, the Internet is proving a useful medium for the organization of political pressure groups.

At the global level, while the membership of the United Nations reflects its name, cities are gradually gaining a voice in international policy, as attested by their representation at the Habitat I and II conferences. The Local Agenda 21 for local action in sustainable development has gained prominence as a lynchpin of the (global) Agenda 21 agenda (Hall and Pfeiffer 2000). Most sustainability issues have specific local roots, yet inter-urban exchanges are valuable to broadening capacities for developing local resources to address local issues.

The WWW is proving a boon for accessing a greater range of information about urban development concepts, methods, tools, and support in general. The Internet and the WWW provide an open and flexible technical foundation for a local networked collaborative governance structure embracing local public, civic and private sectors. However, using the WWW to directly enhance and empower local development within the city at large is more problematic for the following reasons¹⁸:

- The lack a holistic local development capacity as well as the lack of articulated local development strategies (as discussed in Chapter 4). By comparison, corporations which are successfully integrating the WWW into their operations have a strategic agenda and a clear vision of how to realize their objectives.

- The ‘placeless’ character of the Web-based NII is inimical to the reinforcement of local interconnectedness and sense of place.
- Though the WWW may provide new capabilities for social engagement, individualism and capitalism hold the strategic high ground of the status quo (in the US at least) in any dialogue about the direction of change, while the case for alternative, community-oriented development directions will have to be proved.

These three factors reinforce each other, leading toward dissolution of society rather than increased community:

- Individuals “surf” or “webcrawl” through the WWW, each individual threading a unique path through a boundless cyberspace.
- Without any signs or symbols of the (local) community in the WWW information infrastructure, an individual Web surfer has no recognition of being either in or out of the cyber dimension of the local community. “Local place” has no meaning in a space-less cyber world.
- Without a common base of symbols to signal locality and boundary in the WWW, there can be no building of a shared community presence *or future* in the cyberdimension.

Making the WWW a tool for increasing citizen involvement and commitment to the city is a therefore a difficult, two-fold proposition. One part of the problem is the need effectively attract and retain the attention of the WWW user and bridge the gap between the role of Web surfer and active citizen. To do so, local governance needs inculcate the inherent advantages of locality (chapters 4 and 5) into the WWW by managing the development and deployment of the

¹⁸ Leaving aside, for purposes of this discussion, issues of unequal access to the information technologies including the Internet: the “Digital Divide.”

full range of information about local knowledge resources information. (This is a task that cannot be left to the market. An inclusive result is desired, not a competitive one.)

Secondly, a strategy is needed to weave the local knowledge infrastructure information into the fabric of the information infrastructure of the WWW if cities are to tap the full potential of “the Internet” to reinforce local discourse, collaborative innovation, and improvement of community well being. Without providing some *navigable* representation of the network of knowledge resources of the city, Web ‘local content’ consists mostly of distinct “cyber spaces” - - e.g. websites, chat rooms and bulletin boards -- counterparts to social places in the physical world but which have little navigable connection or relation to each other. The burden of providing connectivity between the separate counterpart cyber spaces falls to mechanisms of social association in the geospatial world, which I noted from the outset are under severe strain because of the patterns of development in modern society.

Contending forces of the democratic (some would say anarchic) nature of the Internet, the normative thrust of inclusive, collaborative development, and the entrepreneurial nature of US society (at least) dictate that any such localizing strategies must be negotiated and voluntary.

8.4 Developing a WWW-based local information infrastructure.

As localness is not reinforced on the Web by immutable physical or technical constraints, strategies must be employed to establish a recognizable 'local place' on the Web; one that not only effectively competes for the attention of citizens, but also allows exploration of this new local cyberspace, which is simultaneously socially heterogeneous and individually negotiated and defined. To do so, the concepts of “localness” and “interconnectivity” must be embedded into local Web content, through the structure of the information, modes of information access, and information content. The commitment of the collaborating parties involved in local

governance to commit to developing a readily identifiable, easily accessible, local information network on the WWW is a natural cornerstone to establishing a rich local place on the Web. Making local knowledge infrastructure information equally accessible to all stakeholders removes at least one barrier to greater citizen participation.

Several general strategies are offered here that go beyond current first efforts to use WWW technologies to support community building:

1) Spatial information can be integrated into the Web-resident local information infrastructure.

This can be accomplished through a number of strategies.

- Include spatial information in local private, public, and civic sector websites and in consistent form. Encourage website managers to cooperate in the strategy by promoting the benefits to the community and their own operations (access to common GIS functions, greater customer 'hit' rates).
- Space-neutral information search functions could be enhanced or supplemented by "place-based" search capabilities, (e.g. street addresses, names of organizations, agencies, events, relative distances (via selected/different modes of transportation), relative to personal daily transit routes).
- Provide a web-hosted user spatial preferences profile which could be employed away from home and work. For example, a doctor recommending a type of outpatient therapy could confer with the patient while in the office on the best options for the patient, taking into account the types and quality of services offered by alternative therapy centers as well as the patient's own locational preferences.

2) Encourage the development of a metadata¹⁹ standard for local knowledge infrastructure information to support a virtual topology of proximity and complementary local browsing

¹⁹ Metadata is "data about data." In other words, it is data about what data is: the definition of data (type, format, description (meaning), rules, etc. Providing a metadata standard for local knowledge infrastructure data would facilitate exchange and use.

functions to provide an efficient 'local surfing' within a multi-dimensional (but bounded) local information infrastructure.

- Establish a better standard of hyperlinking and website design so that surfing within the local information space is a better, competitive experience. The WWW today is plagued by dead-end links and links to generic home pages. Devising a general standard for linkages and monitoring local webpage offerings would improve the user experience within the 'cyber-dimension' of the city. (This adopts the monitoring-improvement process cycle, employed by corporate websites, to local community offerings as a whole.)
- Develop a city "brand" or "brands" to be incorporated in local websites to reinforce the sense of local place.
- Provide website frames that exploit local information 'metatags' to provide a localized Web-surfing experience.

For example, a simple means of inculcating localness into local Web content would be to prescribe a voluntary hyperlink highlighting standard that graphically differentiates between local links and external links. Other management standards could address the maintenance of hyperlinks and outdated page content to build citizen confidence in her community's Web presence.

3) Deploy a well-designed LKIIB onto the WWW that can be readily integrated with more general local information. The LKIIB should have a multi-dimensional topology to meet various user needs. The topology could include the following aspects (which are not mutually exclusive):

- Local organizations (knowledge nodes) within all sectors (private, public, and civic), well categorized, (not just cursorily and largely accessible by name only as is prevalent today).
- Knowledge interconnections: the instances and types of exchanges between the organizations.

- quality of life indicators, accessible by quality factors and drillable by territorial layers (region, city and county, neighborhoods, blocks) and time (history)
- Communities of interest, community collaborations. Community collaborations need not be spatially circumscribed, but place or space information should be included when there is potential for promoting social interchange beyond cyberspace.
- Community social resources, both formal social services and informal communities
- Community plans and development projects -- developed and managed with community participation.
- Local human capital demand, accessible by organization as well as region, skills required, training available, schedule (days of the week, full-time/part-time). The time dimension should be represented: e.g. business and employment trends, future plans for business and education, in addition to traditional current employment/job placement services.
- Cultural and social information access schema.
- A history of the city and its communities, with special attention to history of collaborative development, not only in terms of outcomes, but also in terms of agency and process. A major objective of this history would be institutionalize appreciative inquiry: focusing on what has worked in the past rather than on problems, on existing resources rather than deficits, and on the known (past accomplishments) as a platform for new efforts.

The LKIIB should be accessible (and drillable where appropriate) through spatial dimensions; i.e. territory layers (e.g. region, city/county, neighborhoods, blocks), proximity to a specified location, such as a home, business, or civic agency office.

4) User-centric functions should be developed that match personal locational, time, and interest preferences to the local information offerings, especially the local knowledge infrastructure information. Currently, typical community web offerings²⁰ are little more than alphabetized list of links organizations' home pages. Internet users, whether potential clients or providers of

services (or both), have to ‘crawl’ through each organization's web pages to find relevant information – with no guarantee that the desired information exists at all. By taking a user-centric approach, versus the current organization approach (borrowed from the marketplace), it would be possible to organize consolidated community information that would benefit both community organizations and individual citizens.

5) Employ Web-based advertising campaigns that promote the inherent advantages offered by local business and non-profits when comparing suppliers of goods and services. Emphasis the advantage of higher accountability, wider options of communication and service, the circulation of ideas and money in the community, and increasing the human (knowledge) capital of the community.

6) Exploit the city’s 4-dimensional space. There is plenty of potential to exploit the concept of the shared community timeline as a local community reinforcing tool.

- The calendars found on most community websites are largely ad hoc, entertainment and government event driven and short-term. Considering just this usual notion of an events calendar: make it tailorable and searchable according to user preferences, linking nearly everything going on in the city by providing an open event metadata definition for easy submission of events/meetings by all kinds of organizations. Such a capability would answer once and for all the complaint of “nothing to do,” particularly for citizens that have become socially isolated.
- Well considered use of the long-term time dimension within the LKIIB could allow local governance to demonstrate the value of strategic planning for the future of the city and its residents. For example, while employment ads are a standard feature of community

²⁰ E.g. the Blacksburg Electronic Village.

websites, including commercial sites such as Boston.com, this short term view of the issue could be supplemented by an overview of the types and numbers of jobs currently found in organizations, past, current and projected employment trends, connections to relevant educational offerings (not just hyperlinks to academic institution homepages), and contacts for further information.

- 7) Promote the benefits of citizen participation in the operation and management of "The City, Inc.", de-emphasizing institutional boundaries.
- 8) (In support of the previous point,) provide multiple avenues for contribution from the general public. Put as much information about projects, opportunities, upcoming decision and processes to be used (including Internet-based dialogue), skills needed, skill training opportunities, etc.
- 9) Using the LKIIB as a core information base of local knowledge infrastructure, develop a true interactive "community presence," on the Web, including:
 - A "good news" space to celebrate community events and achievements.
 - Promotion of the city's private sector centers of excellence.
 - Promotion of the city's cultural offerings.
 - Headlines and in-depth analysis of quality of life trends.
 - Guidance, tools, mentoring, and contacts on tapping community resources for empowerment of individuals and community action groups.
 - Promotion of neighborhoods. This could include a web presence for neighborhoods to develop and take pride in.

8.5 A techno-centric development strategy for the developed world only?

The preceding discussion may appear to suggest that developing a WWW-based LKIIB requires Internet access for all citizens. The digital divide will remain an issue for quite a while,

and has different dimensions in different parts of the world. Within the US and countries of Western Europe, the issue is ensuring extension of the ICT infrastructure to all parts of the country and attenuating the effects of household socioeconomic condition on gaining Internet access. On the other end of the international spectrum, the least developed countries have limited Internet access, though the Internet ICT backbone has reached most major cities. The objection is often raised that ICTs, and the Internet in particular, are irrelevant to families living in poverty. Several third-world community activists attending the Urban 21 conference in Berlin in July 2000 identified ICTs with the evils of Western-dominated corporate globalization, not an illogical connection given most of these people's exposure to ICTs (personal observations). I don't think that it is a case of either/or, good or bad. No matter how well-intended, to suggest that poor families cannot benefit from broad information access is shortsighted and paternalistic. Internet access will not magically deliver food to the family table, yet access to information, especially information about local conditions and opportunities is a critical key to changing the situation over time.

While access to the local information infrastructure from every home is a distant ideal, it is possible to deploy the overall concept of a publicly accessible LKIIB using transitional and duplicate modes of access. The following paragraphs highlight some of the strategic options and issues related to achieving this goal.

- 1) The first point to note is that the discussion of developing an open LKIIB relies on the WWW, i.e. the model for a global information universe, not "the Internet" per se. This has the advantage of using widely deployed technology to bind local agencies together into a collaborative whole while reducing the technical risks of doing so. This strategy does not mean however that all citizens must have constant in-home access for a Web-based LKIIB to be useful

to the community. Much of the information maintained on a Web-based system can be transferred to print or broadcast media as needed. An example of this is the Kantor Berita 68H radio network in Indonesia. Journalists based in eastern Jakarta prepare regular national news bulletins, which are sent via the Internet for rebroadcasting by local radio stations (23 stations in mid-1999 with plans to serve 50 by the end of 1999) (Richardson 1999). This mix-information media mode can support progress towards openness, accountability as well as responsiveness by government.

2) The broad public access model does suggest that computer resources to maintain and access the LKIIB should not be confined to official government agencies. It is certainly desirable to avoid further institutionalizing of aloof city management where it does exist, particularly in countries where democracy is not deeply rooted in society and its institutions. Rather, community based organizations (CBOs), NGOs, and other civic groups should be provided with the resources and training as full partners in local governance planning and management. This has direct knock-on effects of opening up access to local information and ensuring accountability of all parties. It also builds technical skills and provides incentives for involvement within the community. The United Nation's Community Development Programme has employed this strategy in seven Central American countries (UNCHS 2000). Providing WWW access enables local community-based organizations to reduce the digital divide between themselves and donor NGOs and provides access to other information and knowledge resources available on the Internet. Any program to "computerize" local governance should not be restricted to local government, but should include a wide range of stakeholders from the onset (Moor 2000). Incorporating this strategy into international aid policy could be used as leverage for establishing

joint civil-public sector community service centers to stretch the computer resources among organizations and ensure their physical dispersal out into the community.

3) Initial information infrastructure policy could be patterned on an Intranet-style of implementation, providing access to public employees and community services groups first. A later stage of deployment could support public access through public kiosks or installations in community centers.

4) Finally, a note about current e-governance design strategy. An international consultant to local governments utilizes a Web-based approach for "one-stop" client service centers. The user interface is designed with the end user in mind. The user interface used by personnel staffing walk-in service desks and telephones at the client service centers is the same interface that a citizen can access via the Internet. Direct consequences of this design philosophy are that transparency is supported while governance personnel are given insights into both sides of the client/service provider interchange. This gives operations personnel a stake in the quality of the information system, as well as the capacity to ferret out repeating bugs in the applications.

Finally, the system is positioned to transition service demands smoothly to the telephone and the Internet as citizens' access capabilities improve (Price Waterhouse Coopers, 2000). This design strategy has merit in the US, where many households have Internet access, as well cities of the developed world in which telephones are a privileged luxury.

In summary, it makes sense to promote information technologies as part of the urban development process. Certainly the digital divide is a real issue. Just as certainly, many underserved people in developing nations would find ways to benefit from improved information access. Development of an *Intranet*-like, common WWW-based local information infrastructure, as promoted by the UNHCS, facilitates the development of public-civic sector collaboration,

provides improved community services for all citizens. It can also serve as a logical first step toward wider public access to information resources, demonstrating that ICTs can be harnessed to benefit all citizens, not just the technocratic elite.

9 Conclusions

9.1 “Knowledge infrastructure” vs. “knowledge network.”

This paper has developed the concept of a networked regime of local governance that valorizes the local knowledge infrastructure as a key urban management and development strategy. It could be argued that the more common term “knowledge network” carries a similar meaning and is therefore sufficient for this discussion. Is a new term really needed? There are four reasons why I have preferred to employ the term ‘knowledge infrastructure’ rather than ‘knowledge network’ in the context of urban governance and urban development:

- 1) To emphasize that the composite knowledge networks within a locality comprise a tangible distributed public good – like other public infrastructure, e.g. water, sewer, electrical and telecommunications services. The knowledge infrastructure is more than a metaphor. It is a community asset that can be managed: monitored, measured (even if the metrics and frames of reference are not initially well identified), planned for, and expanded through deliberate action.
- 2) To illustrate that, like any other infrastructure, managing the local knowledge infrastructure requires a number of activities. The local knowledge infrastructure must be mapped and modeled like any other infrastructure. Unlike other, *physical*, infrastructures however, mapping and modeling of the local knowledge infrastructure contributes directly to increasing the accessibility and value of the local knowledge infrastructure. Open access of the LKIIB (the model of the local knowledge infrastructure) induces further ‘build out’ of the knowledge infrastructure without the need to place a bond referendum on the local ballot.
- 3) To emphasize the importance of internetworking the local knowledge networks (e.g. economic and cultural) through innovative interdisciplinary collaborations, which benefit the

community at large. Cross-sectoral interdisciplinary collaboration is by its very nature experimental and tentative, often maintained only through the efforts of champions willing to operate outside of organizational boxes. Consequently, cross-sectoral collaborations are more vulnerable to collapse than need be. A local governance framework that promotes internetworking of the various local knowledge networks is essential to nurture community-based and community-oriented innovation.

4) Developing the local knowledge infrastructure is not only a goal in itself, (though there are good reasons for establishing a development strategy based on this (ref. Chapters 5 –7)). Managing the local knowledge infrastructure lends support and clarifies other substantive development program strategies and goals.

Within the context of urban governance and urban development, I believe that the notion of a local knowledge infrastructure conveys an appropriate and useful insight for city leadership and management activities.

9.2 Progressing from the “knowledgeable society” to the “knowledgeable city.”

A 1963 issue of *Daedalus*, the journal of the American Academy of Arts and Sciences, begins, “Everywhere in American life, the professions are triumphant.” Comprised of contributions from a wide range of professionals, the issue captured the prevalent mood of confidence in “the spectacular proliferation of new professions and the increasing professionalization of business life,” (Lynn 1963 p. 649).

Commenting on the *Daedalus* issue twenty years later, Donald Schon (1983) noted two dissonant notes in the celebratory volume:

1) A fairly common complaint from many contributors, the issue of overload: overload of data, multiplicity of demands, and the difficulty of coordinating the proliferating professions.

2) A more jarring concern of professional sufficiency, registered only by representatives of divinity and city planning. The former was troubled by the “problem of relevance,” the latter was concerned by the profession’s ‘lagging understanding’ leading to unsuitable remedies to urban problems.

Twenty years after publication of the *Daedalus* issue, technical rationality had been disproved; professionals could no longer substantiate a claim to a special expertise or an overriding vision of the truth, nor claim to be selflessly serving of the community. “The expression of lagging understandings, unsuitable remedies, and professional dilemmas has become the norm, and the note of triumphant confidence in the *knowledge industry* [emphasis added] is hardly to be heard” (Schon 1983, p. 9).

Still, discrediting one obsolete paradigm does not define a new, operable one, nor automatically bring about its realization. Schon argued that the traditional concept of professional competence “modeled in terms of application of established techniques to recurrent events” (ibid, p. 19) is inadequate to address the complexity, uncertainty, uniqueness and value conflict that characterizes situations in the real *messy world*²¹. Schon advocates redefining professional competence in terms of adaptability, the ability to frame the problematic situation through tacit knowledge and creative “reflection-in-action.”

This paper extends Schon’s argument to governance of cities today. Cities are complex systems nested within a wider milieu of complexity and uncertainty driven by globalization and instantaneous flows of information and power, even as each city’s situation remains unique, intractable to universal prescriptions of improvement. At the same time, we are becoming more

²¹ The current emphasis in the planning field on community involvement and planning advocacy reflect a partial response to the problem by ensuring that all facets of a given situation and all stakeholders’ interests are considered.

attuned to the adaptive power of knowledge networking: knowledgeable persons, including recognized professionals and ‘laypersons’ alike, working together to recognize and respond to new threats and opportunities, and creating wholly new possibilities based on the pooling of community resources.

I suggest that knowledge management in the best sense -- of enabling persons to access what they need to empower themselves and to participate in creative and adaptive collaborations, defining both problems and solutions – is a fundamental strategy for urban governance in the Information Age. Further, knowledge management in its worst sense – a glorified extension of ICT-based information management systems – does not capture the knowledge-in-action of spatially concentrated knowledge networks, which are the chief assets of cities in an era of globalization based on (footloose) information. Cities depend on the gravity of knowledge, not information.

ICT-based information systems can however usefully support local knowledge networking, not only within the economic sphere, but within social, cultural and civic dimensions of the city as well. The recent advent of the WWW, a “unified global information universe,” (Berner-Lee et al. 1992) has fundamentally transformed the valuation of information (i.e. the more information is used, the more valuable it becomes) and provides the technical means for all citizens to take part the interconnected knowledge networks of the city. Ultimately, this can lead to wider, more organic involvement by citizens in urban governance and in defining urban development in ways that benefit all stakeholders of the knowledgeable city.

The vision of urban governance presented here will not happen without forethought and effort, but it is possible and, I believe, necessary if we wish to address the problems facing cities of the 21st century: increasing inequality and insecurity, social fragmentation, isolation and

exclusion, thoughtless damaging of the environment and environmental injustice. These are not new problems, but the context is changing. New tools and capacities are available to leverage the unique knowledge resources of our cities, thereby interactively influencing and shaping both threats and opportunities that arise. It is for us, as active, knowledgeable citizens and leaders, to act to improve the conditions of and within our cities.

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Vita

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I enrolled at the University of Minnesota in September 1973, in the then fledgling program of environmental biology. I earned my Master's Degree in Urban and Regional Planning from Virginia Tech in May 2001. In between these two events, I enlisted in the Air Force for four years, thus beginning a 21-year stint in computer systems engineering, working on military command, control, and communications (C³) systems and Air Traffic Control (ATC) systems. From 1982 on, I worked in other countries, often in field locations, working with customers and technical staff of several nations. Looking to apply my skills and experience to a different vocational context, I earned a bachelor's degree from Western Illinois University in 1998, concentrating on urban studies, before enrolling in the MURP program at Virginia Tech.

I am currently pursuing a Ph.D. in the Environmental Design and Planning program at Virginia Tech, my research based in part on the concepts identified and developed in this paper.