RESEARCH REPORT
External Research Program

The Information Revolution and Residential Development Summary Report

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CANADA MORTGAGE AND HOUSING CORPORATION

THE INFORMATION REVOLUTION AND RESIDENTIAL DEVELOPMENT

SUMMARY REPORT

March 2000

by

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Cette publication est aussi disponible en français sous le titre "La révolution de l'information et l'aménagement résidentiel"

Executive Summary

Cities, neighbourhoods and urban systems are being reshaped by the information revolution. This research focuses on the implications for residential development. It identifies:
- key drivers of change related to the information revolution that have implications for residential development;
- the state-of-the-art with respect to the use of information and communications technologies (ITT) in neighborhood and community planning; and
- key potential implications for residential development.

What's Driving Urban Change?

Telework is only one of the new forces driving urban change in the information economy. Key drivers include:
- A restructing of national and urban economies toward more innovation and information-intenstive activities.
- A new geography of economic activity.
- The changing nature of work and occupational structure.
- New kinds of workspaces.
- Uneven patterns of diffusion of ITT infrastructure and services.

Telecommunities – The State of the Art

New communities and developments both on the fringe and in urban cores are integrating information technology infrastructure and a broad range of services. New ways of working, playing and living associated with ITT raise issues for community design, which are addressed in some new telecommunities but not others. And while many of these services are still in the experimental stages, what is clear is that services which provide useful, community-based content are the most successful.

Some Implications of the Information Revolution for Residential Development

Changing residental location patterns and factors

The information revolution is reshaping the relationship between the workplace and the home. There are two main forces behind this changing relationship:

- The nature and geography of "conventional" jobs is changing as a result of ITT and residential location patterns are likely to change in response.
- At the same time, the live-work relationship is being altered by ITT and new, alternative types of work and workspaces, particularly telework.

On one side of the coin, telework suggests a looser relationship between the place of residence and the central or conventional place of work, resulting in wider choice in residential location - teleworkers can select locations that are more distant from the current urban fringe.

On the other side, as work moves into homes, there is a stronger relationship between work and place of residence. When choosing a home location, teleworkers have special considerations. They look for "softer" amenities such as the design and quality of the neighbourhood, and access to a variety of services to support their work, such as copy shops, post offices or informal meeting places such as restaurants. Neighbourhoods that are more mixed in use and provide opportunities for accommodating business and personal services and other amenities are most supportive of telework.

- To date, there is limited evidence of massive residential relocation related to telework. However, the evidence also suggests that telework has the potential to cause more significant shifts in resident location patterns in the coming years.

A rural renaissance?

Prospects for a widespread rural renaissance, including truly remote rural communities are likely quite limited, particularly to those communities with outstanding natural, recreational or physical assets and to self-employed teleworkers. Many of the rural communities that will benefit from economic and technological changes are likely to be those that remain within reasonable distance of an urban area.

New urban and neighbourhood divisions

Access to ITT infrastructure is increasingly a factor in determining the desirability (or lack thereof) of different neighbourhoods. This is potentially a new axis along which neighbourhoods will be differentiated. Access to advanced ITT tends to be biased toward larger urban areas and urban agglomerations, and to lag in many smaller cities and towns, rural communities, and inner suburbs.

Residential environments need to be flexible in order to respond to emerging demands and trends association with telework. There are two aspects to this flexibility:
- The inherent flexibility and adaptability of the built form to accommodate new needs.
- The flexibility of the planning and regulatory environment to accommodate new needs.

A polarised housing market?

The changing nature of work and occupational structure has potentially important implications for the structure of housing markets. The obvious implication is a concentration of demand at the high and low ends of the income range, and a diminution of demand in the middle income range. A polarized income structure could particularly impact the demand for conventional new suburban housing, which has historically been driven to a large extent by middle-income households.

Concentration vs. deconcentration

As the makeup of the economy continues to shift towards information-based activities, including both activities with centralizing tendencies and those with decentralizing tendencies, we are liable to see both spatial trends taking place at the same time. Furthermore, the kinds of activities that tend to decentralise are different in nature from those that tend to centralise. Knowledge- and innovation-based, non-routine activities (such as product development, marketing, personalized financial services, multimedia etc.) will continue to centralise in urban areas. More routine activities (e.g. computer manufacture, information processing) as well as some home-based work will continue to migrate to low-cost suburban or exurban locations. One of the effects of ITT here is that these activities can take place at much greater distances from the central city than they have in the past, suggesting the potential for higher degrees of urban sprawl. The overall result may be an urban form that is more highly differentiated between core and suburbs - both in terms of the kind of activities that take place in each location and in urban form.

Planning the Information City

Given that a new logic is driving urban change, we need new frameworks, concepts, models and approaches to interpret and understand the nature of change that is underway in the economy and society generally, and with respect to urban dynamics. New analytical tools and different types of data and information are also needed, as well as new approaches to urban planning.

Specific needs include data and information on the information economy, the changing geography of jobs, social polarisation, patterns of ITT diffusion and emerging urban form patterns. In addition, a great deal more consideration is needed regarding appropriate planning responses, moving toward an integration of the information society and sustainability agendas.

Résumé

La révolution de l'information modifie la forme des villes, des quartiers et des systèmes urbains. La présente recherche porte sur les conséquences de ce fait pour l'aménagement résidentiel. On y trouvera :

- les principaux moteurs de changement liés à la révolution de l'information qui se répercutent sur l'aménagement résidentiel;
- la fine pointe du progrès quant à l'utilisation des technologies de l'information et des télécommunications (TIT) pour la planification des quartiers et des collectivités;
- les principales répercussions possibles sur l'aménagement résidentiel.

Quels sont les moteurs du changement urbain?

Le télétravail n'est qu'une seule des nouvelles forces qui entraînent l'évolution urbaine dans l'économie de l'information. Les principaux moteurs sont les suivants :

- La restructuration des économies nationales et urbaines autour d'activités davantage axées sur l'innovation et l'information.
- Une nouvelle géographie de l'activité économique.
- L'évolution du travail et de la structure professionnelle.
- De nouveaux lieux de travail.
- La diffusion inégale de l'infrastructure et des services en matière de TIT.

Les télécommunautés – à la fine pointe

Les collectivités et les lotissements nouvellement aménagés, tant en périphérie que dans les centres-villes, intègrent l'infrastructure de la technologie de l'information et un vaste éventail de services. Les nouveaux modes de travail, de loisirs et de vie liés aux TIT exigent l'adaptation des principes d'urbanisme, ce qui se fait dans une partie seulement des nouvelles télécommunautés. Et bien que plusieurs de ces services soient encore au stade expérimental, il est manifeste que ce sont les services qui offrent un contenu utile axés sur la collectivité qui connaissent le plus grand succès.

Certaines répercussions de la révolution de l'information sur l'aménagement résidentiel

Évolution des modes et des facteurs d'implantation

La révolution de l'information modifie le rapport entre le lieu de travail et la résidence par le jeu de deux grandes forces :

- La nature et la géographie des emplois « traditionnels » se modifient sous la poussée des TIT, de qui entraînera vraisemblablement de nouveaux schèmes de localisation.
- En même temps, les TIT modifient le rapport vie-travail en offrant de nouvelles solutions pour le mode et le lieu de travail, particulièrement le télétravail.

D'une part, le télétravail laisse présager un lien moins étroit entre le lieu de résidence et le lieu de travail central ou traditionnel, d'où un plus grand choix d'emplacements pour la résidence; les télétravailleurs peuvent s'éloigner de l'actuelle périphérie urbaine.

Par ailleurs, en s'installant à la maison, le travail renforce le lien entre le travail et le lieu de résidence. Les télétravailleurs choisissent l'emplacement de leur maison en fonction de considérations particulières. Il recherchent des avantages moins pointus, comme la conception et la qualité du quartier, l'accès à divers services utiles pour le travail, comme des ateliers de photocopie, des bureaux de postes ou des lieux de rencontre tels les restaurants. Ce sont les quartiers d'utilisation mixte, offrant des services professionnels et personnels ainsi que d'autres agréments, qui sont les plus favorables au télétravail.

- On n'a guère vu jusqu'ici de relocalisation résidentielle massive motivée par le télétravail. Toutefois, certaines indications donnent à penser que le télétravail pourrait susciter des déplacements plus importants au cours des années à venir.

Une renaissance rurale?

Les possibilités d'une renaissance rurale généralisée, atteignant même les collectivités rurales vraiment éloignées, sont vraisemblablement très restreintes et celle-ci toucherait surtout les collectivités présentant des avantages naturels, récréatifs ou physiques exceptionnels et les télétravailleurs autonomes. Les collectivités rurales qui bénéficieront des changements économiques et technologiques seront en toute probabilité situées à distance raisonnable d'une zone urbaine.

Nouvelles distinctions entre les quartiers et les villes

L'accès à l'infrastructure des TIT est de plus en plus un facteur de l'attrait (ou du manque d'attrait) de chaque quartier. Cela pourrait devenir un nouvel axe selon lequel les quartiers se différencieront. L'accès aux TIT avancées tend à se retrouver surtout dans les grands centres urbains et les grandes agglomérations, accusant un retard dans bon nombre de petites villes, de collectivités rurales et de proches banlieues.

Le milieu résidentiel doit posséder toute la souplesse nécessaire pour s'adapter aux exigences et aux tendances associées au télétravail, sur les deux axes suivants :
- La souplesse et l'adaptabilité de l'environnement construit par rapport aux nouveaux besoins.
- La souplesse et l'adaptabilité de l'environnement réglementaire par rapport aux nouveaux besoins.

Polarisation du marché du logement?

L'évolution de la structure du travail et des professions pourrait avoir des conséquences importantes pour la structure des marchés du logement. La plus évidente est la concentration de la demande aux deux extrémités de la gamme des revenus et la diminution de la demande au milieu. La polarisation de la structure de revenus pourrait notamment se faire sentir sur la demande de

nouveaux logements traditionnels de banlieue, qui a toujours été largement tributaire des ménages à revenu moyen.

Concentration et déconcentration

L'économie devenant de plus en plus axée sur des activités liées à l'information, tant centrifuges que centripètes, il se peut que les deux tendances spatiales agissent simultanément. De plus, les activités qui tendent à décentraliser diffèrent par leur nature de celles qui tendent à centraliser. Les activités non routinières axées sur les connaissances et l'innovation (comme la mise au point des produits, le marketing, les services financiers personnalisés, le multimédia, etc.) continueront de se centraliser dans les zones urbaines. Les activités plus routinières (p. ex. la fabrication d'ordinateurs, le traitement de l'information) de même qu'une partie du travail à domicile continueront de migrer vers les banlieues économiques, proches ou éloignées. Un des effets des TIT est que ces activités peuvent se faire beaucoup plus loin du centre-ville que dans le passé, d'où la possibilité d'une accentuation de l'étalement urbain. Le résultat global pourrait être une forme urbaine présentant une plus forte différenciation entre le noyau central et les banlieues -- tant sur le plan des sortes d'activités que sur celui de la forme.

Planifier la ville de l'information
Puisque l'évolution urbaine obéit à une nouvelle logique, nous avons besoin de cadres, de concepts, de modèles et d'approches pour interpréter et comprendre la nature du changement en cours dans l'économie et dans l'ensemble de la société et par rapport à la dynamique urbaine. Il faut aussi de nouveaux outils d'analyse et d'autres sortes de données et d'informations, aussi bien que de nouvelles démarches d'urbanisme.

Il faut notamment des données et de l'information sur l'économie de l'information, l'évolution de la géographie des emplois, la polarisation sociale, la diffusion des TIT et les nouvelles formes urbaines. En outre, il faut s'intéresser beaucoup plus près aux méthodes d'urbanisme en vue d'intégrer les programmes d'actions relatifs à la société de l'information et au développement durable.

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We have been witness to dramatic changes in recent years - in the economy, society, cities. Much of this change has been underpinned by the information revolution - the explosion and convergence of computer, telecommunications and media/broadcast technologies. The "information revolution", as discussed in this report, is taken to mean not just these converging technologies, but includes the increasing role of information and knowledge in the economy and society, and the considerable social and economic restructuring that has accompanied these new technologies.

This report focuses on one aspect of the information revolution - its implications for residential development. Cities and urban systems are being reshaped by the information revolution. Yet there is at present very little understanding or awareness of the nature of this transformation, and what it means for cities, city planning, urban economic development, or the development industry and real estate markets. In urban development and related fields, the focus has tended to be on one factor: the impacts of telecommuting. This report challenges that view, arguing instead that the nature of change that is underway is much more profound and complex, and involves much more than telecommuting or telework.

Given that the information revolution is a relatively new area of interest and debate within the builder, real estate and planning community, the research presented herein is intended to be somewhat broad and exploratory in nature. The specific objectives of the research are:

- To identify the key drivers of change related to the information revolution that have implications for residential areas and development.

- To identify the state-of-the-art with respect to the use of information and telecommunications technologies (ITT) in neighbourhood and community planning.

- To identify key potential implications for residential development and assess their significance, for new greenfields communities, for residential reurbanisation, and for existing "stable" residential neighbourhoods.

This report is a summary of a more extensive report of the same title available for loan from the Canadian Housing Information Centre (tel. 1.800.668.2642).

With respect to its implications for the evolution and form of cities, and for residential development in particular, five "key drivers" of change related to the information revolution can be identified. These key drivers come together in various ways to produce new outcomes for cities, and for residential development, such as new residential location patterns and factors, a polarised housing market, and new urban and neighbourhood divisions (see Figure 1). Some of the potential implications for residential development that flow from these drivers are outlined in more detail in the final section of this report. This section briefly describes the key drivers themselves.

Key Driver #1: The information revolution is shifting the kind of economic activity that takes place in Canada towards more information-, knowledge- and innovation- intensive activities
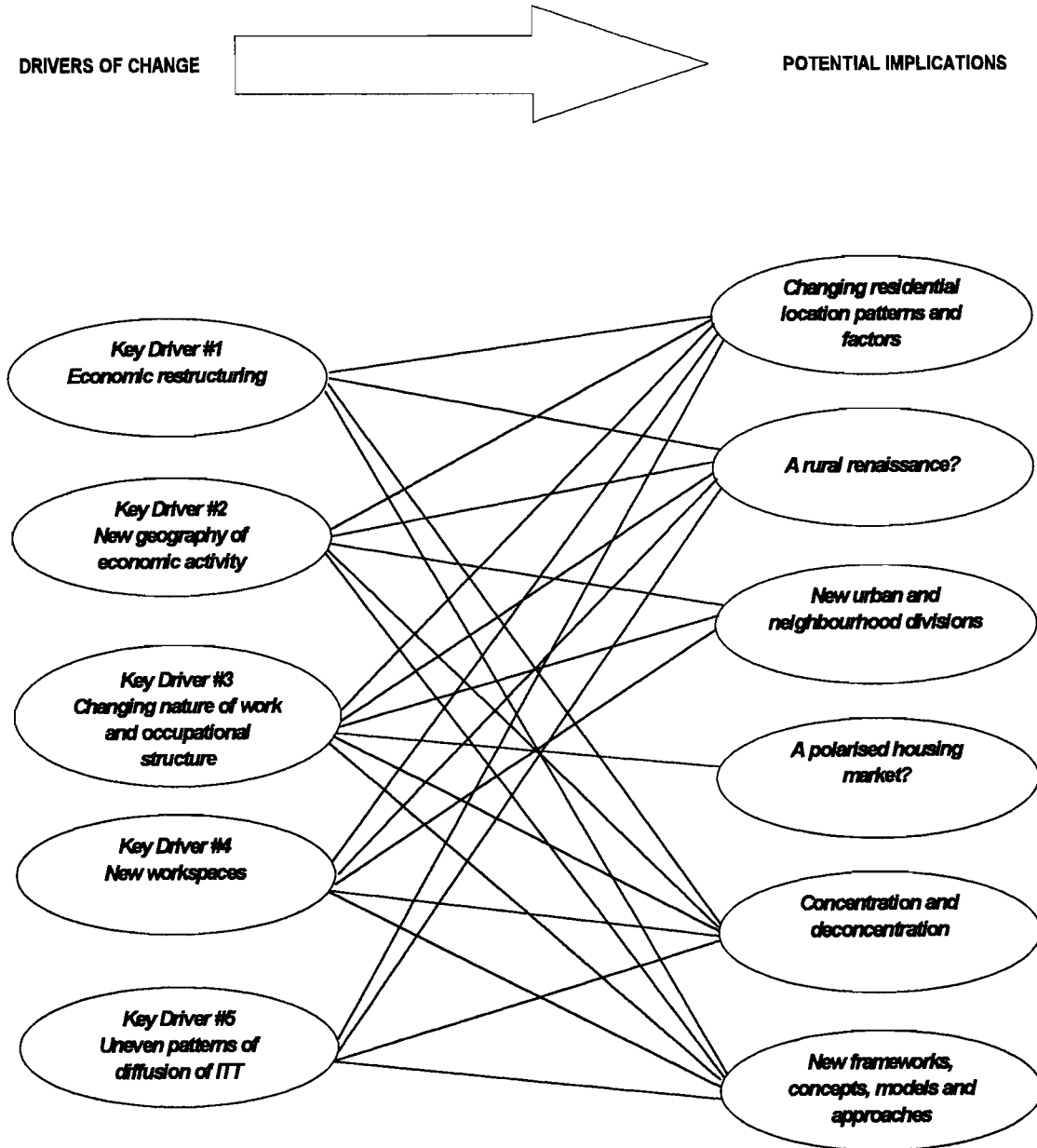
A major impact of the information revolution is that it is dramatically changing the nature of economic activity that takes place in Canada and the composition of the national economy. Since the 1970s, the structure of Canada's economy, like that of other advanced economies, has undergone a dramatic transformation from a manufacturing based economy to a services- or information- or knowledge-based economy. This transformation has been variously tagged as "deindustrialisation", or the evolution of a "services economy", or more recently, an "information economy".

This shift is due to:

- sectoral change - the decline of traditional manufacturing industries, sectors, or establishments related to globalisation and intensified competition, and the creation of new industries and products associated with information technology, knowledge-and innovation-based activities;

- automation and "disintermediation" (or the elimination of intermediary types of activities such as travel agents or stockbrokers as a result of computerisation and the Internet);

- the relocation of certain kinds of economic activities to offshore locations - typically routine data processing or production activities.

As a result of these trends, the national economy has become more specialised in complex, innovation-based, non-routinisable, high value-added activities (e.g. business services, design or financial services). The amount of routine, non-client oriented work performed in Canada is being reduced (e.g. some kinds of manufacturing and data processing). This trend will continue so long as new technologies allow more kinds of activities to be routinised and automated, and improved telecommunications technologies, access and falling costs make even more low-cost, offshore locations possible for a wider range of activities[1].

Figure 1:
Key Drivers of Change and Potential Implications for Residential Development

DRIVERS OF CHANGE

POTENTIAL IMPLICATIONS

Key Driver #1
Economic restructuring

Key Driver #2
New geography of economic activity

Key Driver #3
Changing nature of work and occupational structure

Key Driver #4
New workspaces

Key Driver #5
Uneven patterns of diffusion of ITT

Changing residential location patterns and factors

A rural renaissance?

New urban and neighbourhood divisions

A polarised housing market?

Concentration and deconcentration

New frameworks, concepts, models and approaches

Of course, there are still many routine information-processing, manufacturing and service functions that are performed in Canadian cities and that will continue to do so. Many of these activities are tied to other economic activities, suppliers, customers or markets which cannot be served from a distance, such as personal services (e.g. restaurants) or business services (e.g. photocopying).

Key Driver #2: A new national and urban geography of economic activity

The three main forces described under Key Driver #1 (i.e. sectoral change, automation, relocation) are also creating a new geography of economic activity within Canada. For example, ITT permits many kinds of activities to maintain less of a physical presence in local markets, and to service a wider area electronically from a fewer number of consolidated locations. Many formerly local banking functions, for example, have been removed from local branches and are now performed at consolidated telephone banking centres. Overall, the geographical impacts of this and other changes related to ITT can be seen at three scales:

- *Urban vs. rural:* The information revolution is often seen as heralding the era of the electronic cottage and a "rural renaissance". However, the evidence thus far seems to suggest that this effect is probably limited to a small range of economic activities. This includes various types of information-related self-employment (e.g. writing and editing, translation), as well as home-based businesses aimed at local rural markets.

- *Inter-urban:* Structural change and the shift toward information industries seems to be favouring the metropolitan areas. New organisational structures and relocation have resulted in both the relocation of routine functions to more peripheral areas (e.g. data processing), and the consolidation and centralisation of routine service sector functions in major metropolitan areas (e.g. headquarters). However, as advanced ITT infrastructure becomes available in smaller to mid-size, lower cost cities, the advantage of the largest metropolitan areas may erode for some types of activities. As yet, there is no clearly discernible pattern with respect to the impacts on different types of cities (e.g. large versus small) in the Canadian urban system.

- *Intra-urban:* Central cities have seen the decline of traditional, especially manufacturing functions, and the rise of a range of high order services and headquarters functions. Flexible manufacturing districts and new industry clusters, such as the multi-media industry, have also found locations in central cities. However, some high-order service functions typically located in the downtown may find themselves subject to automation, and/or relocation to suburban or other urban locations as technology and applications continue to evolve. In addition, routine information-processing activities and many new information-related activities (e.g. ITT equipment-related manufacturing) have often established themselves in suburban areas.

Key Driver #3: The changing nature of work and occupational structure

Economic restructuring has had a profound effect on both the rate and types of jobs generated in the Canadian economy and cities. Jobs in information-oriented sectors and occupations have grown (e.g. managers, technology-related employment), while jobs in traditional sectors and occupations have either remained stagnant or declined (e.g. manufacturing, clerical). Flexible work forms such as part-time or contract work are also on the rise.

These changes in the nature of work and occupational structure have potentially significant implications for the social and income structure of our cities. The evidence thus far, both in Canada and the US, seems to indicate a trend toward a higher degree of social and income polarisation, and the relative demise of the middle-income wage earner. Other evidence suggests that income polarisation increases as city size increases; the larger the city, the higher the degree of income polarisation. This is largely due to the diminishing importance of manufacturing in larger cities, which tends to provide more middle income jobs.

Key Driver #4: New workspaces

A further important factor is how workers in this new job spectrum are physically accommodated in terms of their specific workspace arrangements. A range of new workspace options has developed as a result of advanced communications technologies. These include telework, telecommuting, satellite offices, telecentres, home-based offices, mobile offices, and hotelling. Telework and telecommuting are significant and growing phenomena in Canada. There were an estimated 1 million teleworkers in Canada in 1997, up from 600,000 in 1993 (excluding self-employed workers). The total number of teleworkers is projected to increase to 1.5 million by 2001[2].

However, not all kinds of work or workers are suited to telework. The diffusion of telework in the workforce is a selective process; only certain kinds of work and workers will be able to work remotely - from home or elsewhere. At present, we do not know what proportion of work will eventually shift to one of the several forms of telework in the future. Those activities that are suited include routine information-handling tasks (e.g. directory assistance, data entry), mobile activities (e.g. sales or service workers), and professional and other knowledge-related activities (e.g. editing, consultants).

Telework is often the major point of departure that planners and others concerned with the impacts of the information revolution on the city focus upon. However, as these Key Drivers suggest, it is just one factor of many that is profoundly altering the shape and composition of Canadian cities.

Key Driver #5: Uneven patterns of diffusion of ITT infrastructure and services

Not long ago, the main telecommunications device was the telephone. The Plain Old Telephone Service (POTS) system, provided over copper wires, offered standard service at mostly standard prices on an

almost universal basis through highly regulated, quasi-public utility monopolies. Technological advances, combined with deregulation of the telecommunications industry, have resulted in an explosion of telecommunications services, and the creation of new kinds of wired and wireless infrastructure.

Unlike the universal availability of POTS, access to new and emerging information infrastructure and services is not universally available in Canada. The deregulation of the telecommunications industry has resulted in many competing firms targeting the most profitable market areas. In Canada, market forces, technical factors and industry structure and regulation produce an uneven pattern of access to ITT infrastructure and services at three scales: between cities, between urban and rural areas, and within cities.

The market-driven diffusion of ITT is resulting in the emergence of a hierarchy of access between urban areas of varying sizes. We are also seeing a two-tiered system emerge, with the private sector serving urban areas and the public sector attempting to fill the gap in rural and remote communities. Communities most likely to have the best access to telecommunication services include those within large metropolitan areas. Smaller urban areas with significant social or economic connections to these cities, or those located along major transportation corridors, are also more likely to gain access to ITT services than more remote communities of a comparable size.

This section has examined some of the major forces driving the transition to an information economy and information society. The potential implications of these key drivers for residential development and markets will be described in a subsequent section. First, however, we look at how the new technologies are being applied in communities, based on an examination of several case studies of leading edge telecommunities.

TELECOMMUNITIES - THE STATE OF THE ART

Introduction

Telecommunities are a recent phenomenon in the residential real estate industry. In this section, we summarise the state of the art - how ITT is being used in the creation of new residential communities. This summary is based on an examination of several leading edge telecommunities in Canada and the US, where the telecommunity trend seems to be gaining steam. Representing both greenfields and reurbanisation projects, the case studies communities discussed are:

- Stonehaven West, Newmarket, Ontario
- Montgomery Village, Orangeville, Ontario
- Highpoint, Romeoville, Illinois
- DC Ranch, Scottsdale, Arizona
- Desert Ridge, Phoenix, Arizona
- Amelia Park, Fernandina Beach, Amelia Island, Florida
- The Presidio, San Francisco, California
- Playa Vista, Los Angeles, California

The case studies addressed the following basic issues:

- What are the basic design elements of telecommunities? Do they differ from conventional communities?

- What ITT infrastructure and services are offered, and how are they provided?

- What markets were targeted, and were the ITT infrastructure and services a factor in the successful marketing of the project?

This section summarises the overall findings from the telecommunity case studies. The full research report presents each case study in greater detail.

Does the design of telecommunities respond to new technologies, ways of working, living, playing and shopping?

Communities must not only address the new information and telecommunications technologies, but much more importantly, the transformations in community life that they are bringing about - new patterns of living, working, playing and shopping. Taken together, the telecommunities surveyed showed a range of responses to these issues. Specific responses and features integrated into the design of the communities and residential units included the following:

The Information Revolution and Residential Development

Figure 2:
Stonehaven West - Newmarket, Ontario
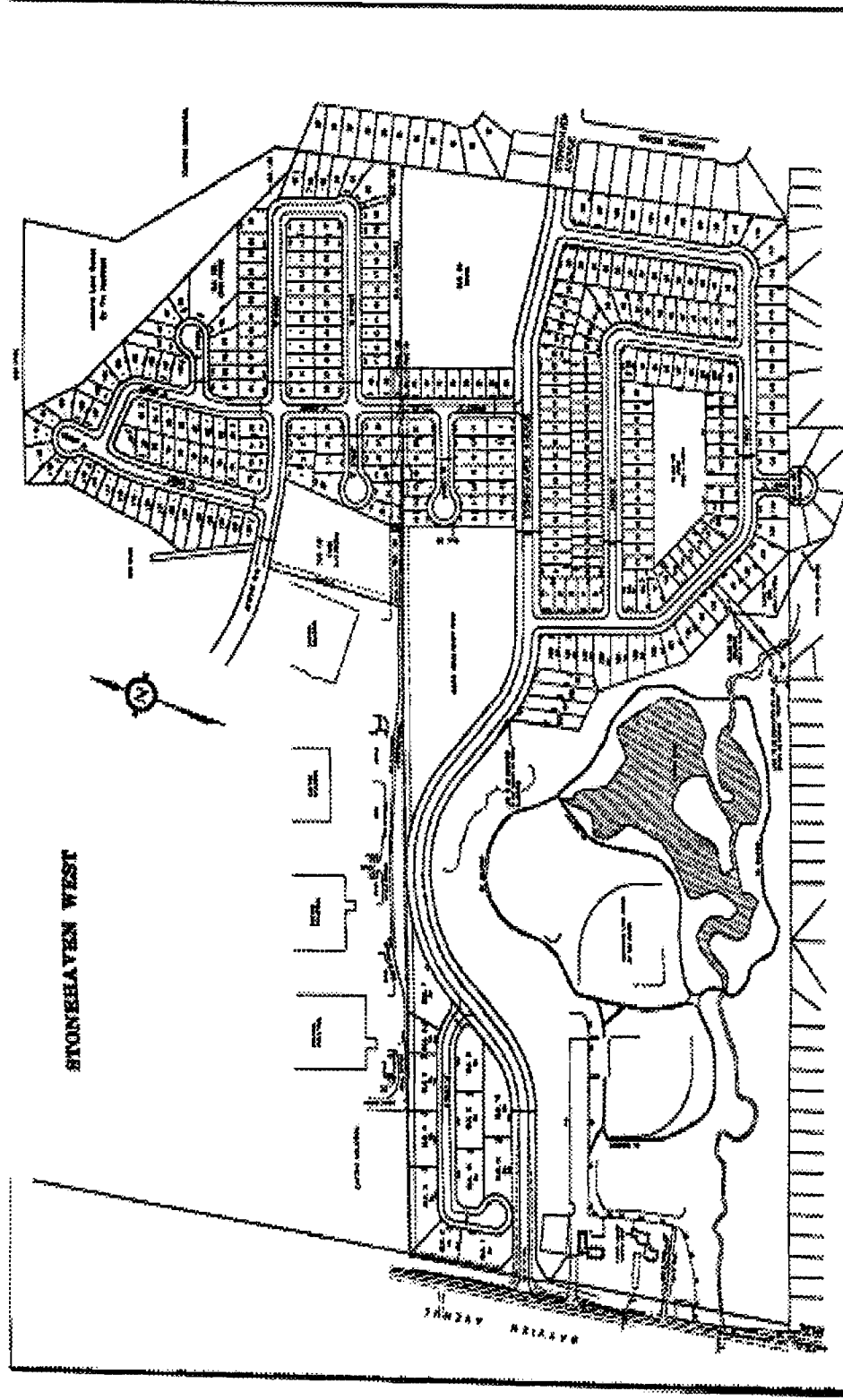
- home offices (within the main house or integrated with a garage)
- some kind of community ITT centre, such as a telecentre or cyber-café
- integration of mixed use at the community scale
- a high quality public realm and
- flexible zoning frameworks, especially for mixed use areas.

There is a high degree of variability in the extent to which the design of the community as a whole responds to the new technologies and associated transformations in ways of living, working and playing. In some cases, advanced ITT and services have simply been introduced into an otherwise conventionally designed subdivision. This approach ignores many of the fundamental implications of the new technologies for the nature of living, working, play and for community itself. In other cases, the implications of the new technologies have been thought through more clearly, and the community design responds to these new imperatives. In general, because they tend to be more mixed use and place an emphasis on the quality of the public realm, communities based on principles of New Urbanism tend to support new ways of living and working, though of course this is just one of a range of possible design responses.

Teleworking and other forms of information technology-related work mean that communities must become more multi-purpose, flexible, and cater to a wider range of needs in situ. Community design must respond to these needs. The quality of the environment and public realm, design of streets, houses, and parks is the most essential ingredient - much more so than the technology itself. Briefly, some of the trends associated with the new technologies that have implications for community design include the following:

- *Integrate telework support services:* As more people spend time teleworking from their homes, there is a need to provide the support services they need *within* their communities, such as business services (accountants, lawyers, graphic designers, copy shops, meeting places, cafés) and personal services (daycare, barbers, fitness clubs).

- *High quality public realm:* Again, as a greater proportion of people spend more time in the neighbourhoods teleworking, and as ITT increases competition between projects within a given market (by making a wider range of locations viable for development), the quality of urban design and the public realm, including streetscapes and parks, becomes more important.

- *Flexibility:* Given the rapid pace of technological change, there is a need to build flexibility into community design. This could mean flexible house design, with various opportunities to convert space both to and from home office uses. This might include not just a home office in the main house, but also opportunities for creating office space in conjunction with a garage. Flexibility is also important in the mixed use areas of a community, particularly the ability to convert buildings or parts of buildings easily between residential, employment and combination live-work functions. This flexibility comes from the design and layout of the building, as well as from flexible planning and regulatory frameworks.

Figure 3:
Montgomery Village - Orangeville, Ontario
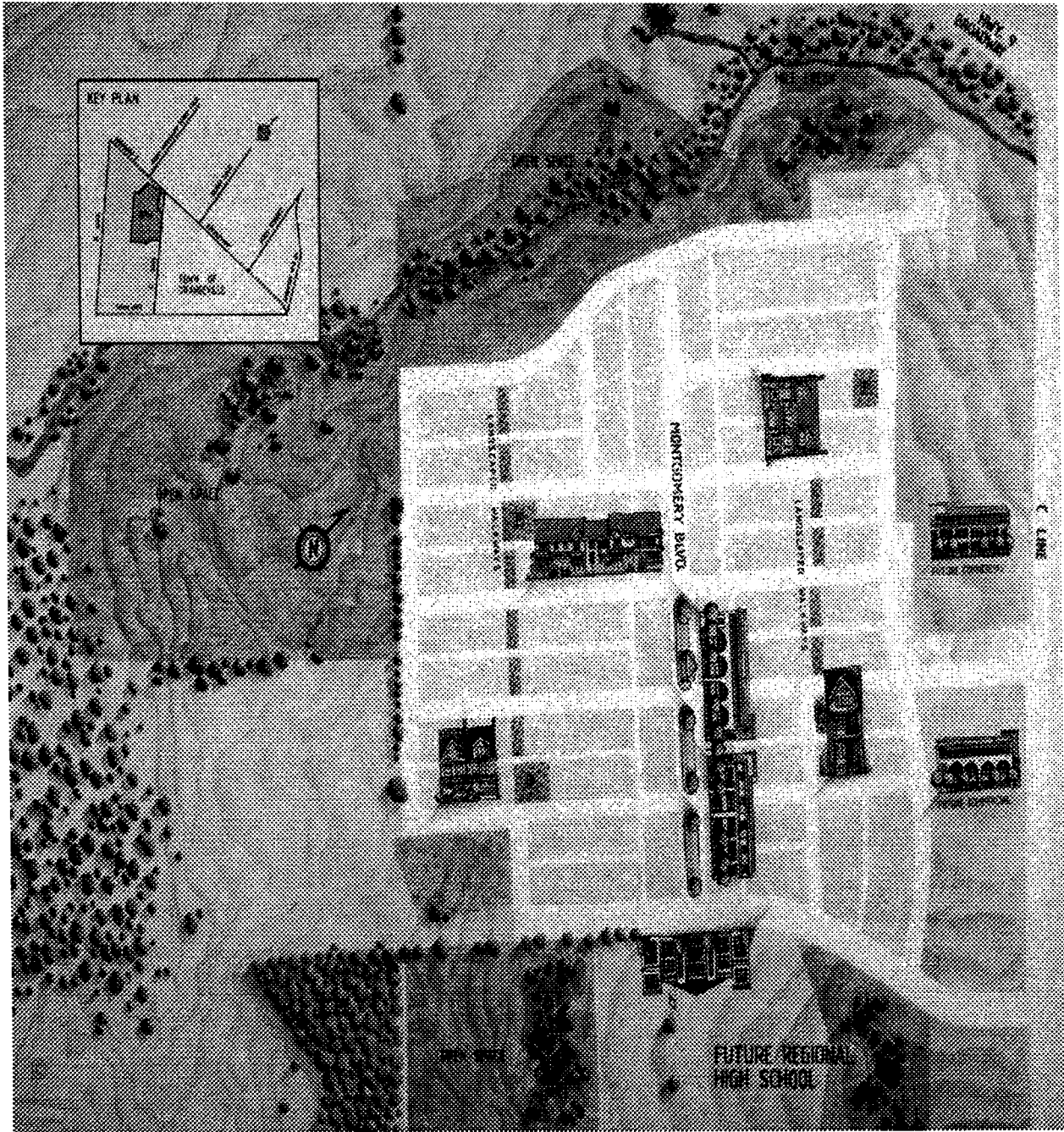
What ITT infrastructure and services are provided and how?

Generally, the telecommunications infrastructure in the case study communities is a hybrid fibre coax system, with fibre running along streets and cable connections from the fibre into individual homes. Where it has been applied, a direct fibre connection to ground-related residential units was not found to be warranted. Other servicing options provide more than enough bandwidth for current and anticipated future applications. In the communities surveyed, coaxial cable was the other option most often used to deliver high capacity bandwidth. However, ADSL (Asymmetric Digital Subscriber Line), provided over regular twisted pair copper phone lines, is another equally powerful system which is being rolled out now in Canadian cities.

In most of the case study communities, individual homes and buildings also had special wiring and other technological features, such as a home-based network and multiple network ports to accommodate phones, fax machines, computers, stereo systems, etc.

A broad range of ITT-based access, services and "content" was available across the case studies, including the following:

Access
- high speed Internet connections
- community Intranets
- closed circuit community television channels for community news
- community-wide video conferencing
- community e-mail listservs
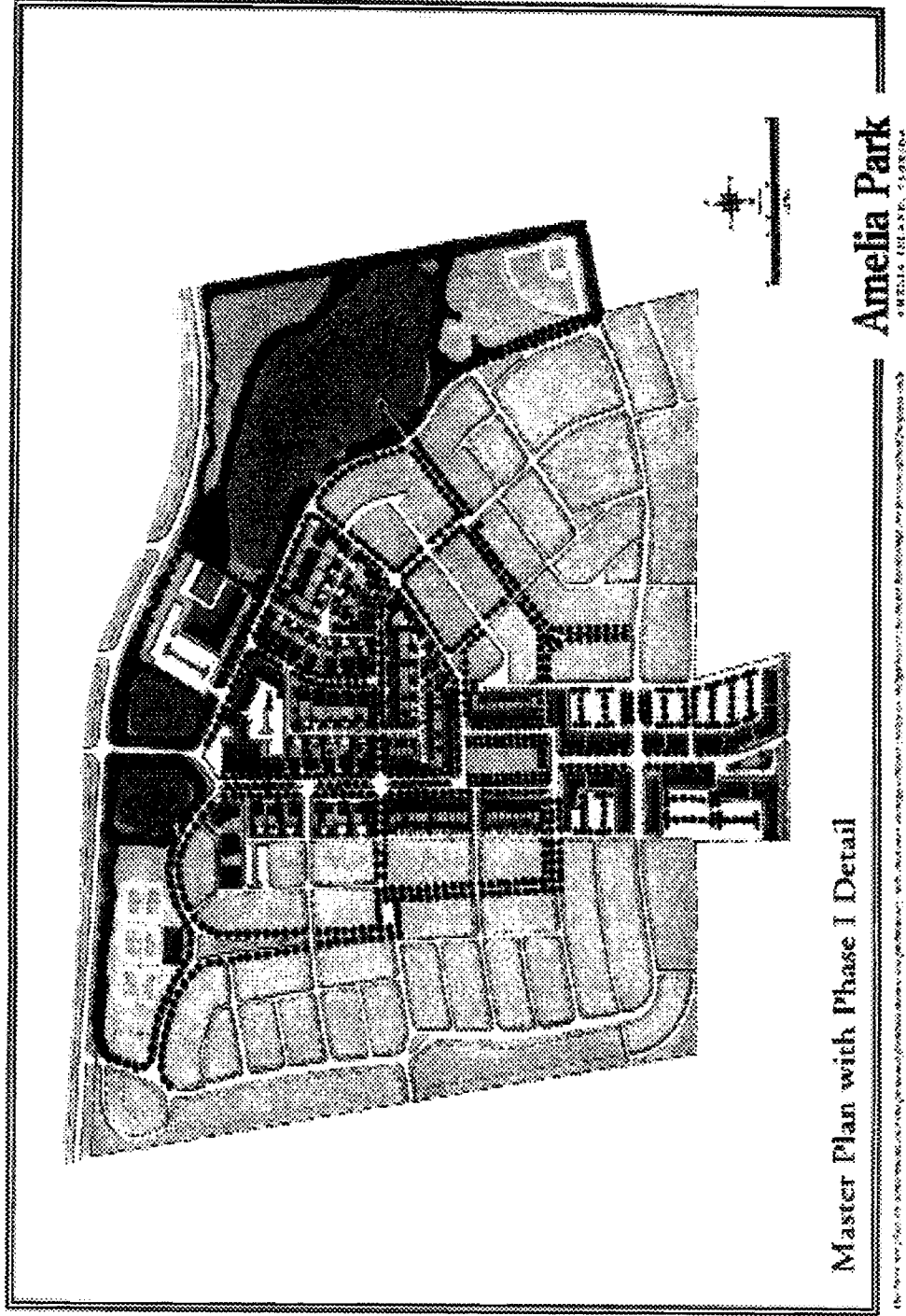- digital television, and
- advanced voice messaging.

Services and content
- electronic community bulletin boards
- community-based Web sites and discussion forums
- on-line health and tele-medicine services, including electronic monitoring, usually in conjunction with a local health services provider
- connections to local schools
- connections to local merchants and facilities for on-line shopping, restaurant or golf reservations, etc.
- real-time information on transit vehicle schedules serving the community.

The setting up and delivery of the ITT infrastructure, content and services is generally undertaken in partnership with local companies. In one case, however, a developer with several telecommunities underway spun off his own content company that creates the information and services offered over the community Intranets within his projects.

Telecommunities are in their earliest stages of development, and the case studies reviewed here can be considered experiments at this point. There are a number of issues that only more time and experience will resolve. For example, given that many projects to date have been pilot projects in which the cost of ITT services and infrastructure was not fully borne by the resident, the level of demand for these services when consumers must pay their full costs is not yet known.

The Information Revolution and Residential Development

Figure 4:
Amelia Park - Fernandina Beach, Amelia Island, Florida

Master Plan with Phase 1 Detail

Amelia Park

AMELIA ISLAND, FLORIDA

Second, in virtually all the telecommunities, there was some kind of community-based organisation that could take carriage of the maintenance and funding of the ITT services and content, and development of new content and services, on an ongoing basis. In some cases this responsibility fell to a Homeowners Association. In other cases a special community-based institutional entity was set up for this purpose. In the Canadian context, where there are no Homeowners Associations, there is no immediately obvious institutional entity that could take on this ongoing role in existing or new freehold communities.

Finally, there is the question of the role of economies of scale. Although we cannot measure it exactly from the case studies reviewed, it seems obvious that a development needs to be of a certain size in order to make the provision of advanced infrastructure and services economically efficient. Or, developers must operate at a scale sufficient to spread the costs over a number of projects. Until such a time as there is more experience in delivering community-based infrastructure, applications and content, perhaps by specialist provider companies, it may be more difficult for small scale projects or developers to offer the same scope of ITT access and services.

Do ITT infrastructure and services improve the competitiveness of a development project?

At this early point in the evolution of telecommunities, it is difficult to tell whether the telecommunity aspect resonates particularly strongly with any particular market segment. Some developers have noted that the ITT angle is, not surprisingly, particularly attractive to the young single professional male buyer. Others have noted that even if the homebuyers themselves are not particularly interested in the technology, they think it is important for their children to have access to it.

The very limited research conducted to date indicates that while ITT and related services may not be *the* most important factor in the home purchase decision, it is now *a* factor, along with traditional considerations such as price, quality of the community, location, and unit design. And, as described above, ITT means that some of the traditional factors, such as quality of the community and public realm, become even more important.

In terms of ITT and services providing a competitive edge, it seems clear from the case studies that what adds value to a project is not the hard infrastructure of cables and wires per se. Very soon - already in some regional markets - all new developments will be serviced with broadband capacity as routinely as they are with water, telephone, electricity and roads. Instead, the competitive advantage comes from what is done with the infrastructure - the level of access, services, information, content and support provided. In general, this means local content and services, as access to global information via the Internet is already available from virtually any location.

> *What adds value to a project is not the hard infrastructure of cables and wires. Very soon - already in some regional markets - all new developments will be serviced with broadband capacity as routinely as they are with water, telephone, electricity and roads. Instead, the competitive advantage comes from what is done with the infrastructure - the level of access, services, information, content and support provided. In general, this means local content and services.*

The Information Revolution and Residential Development

Figure 5:
Playa Vista - Los Angeles, California
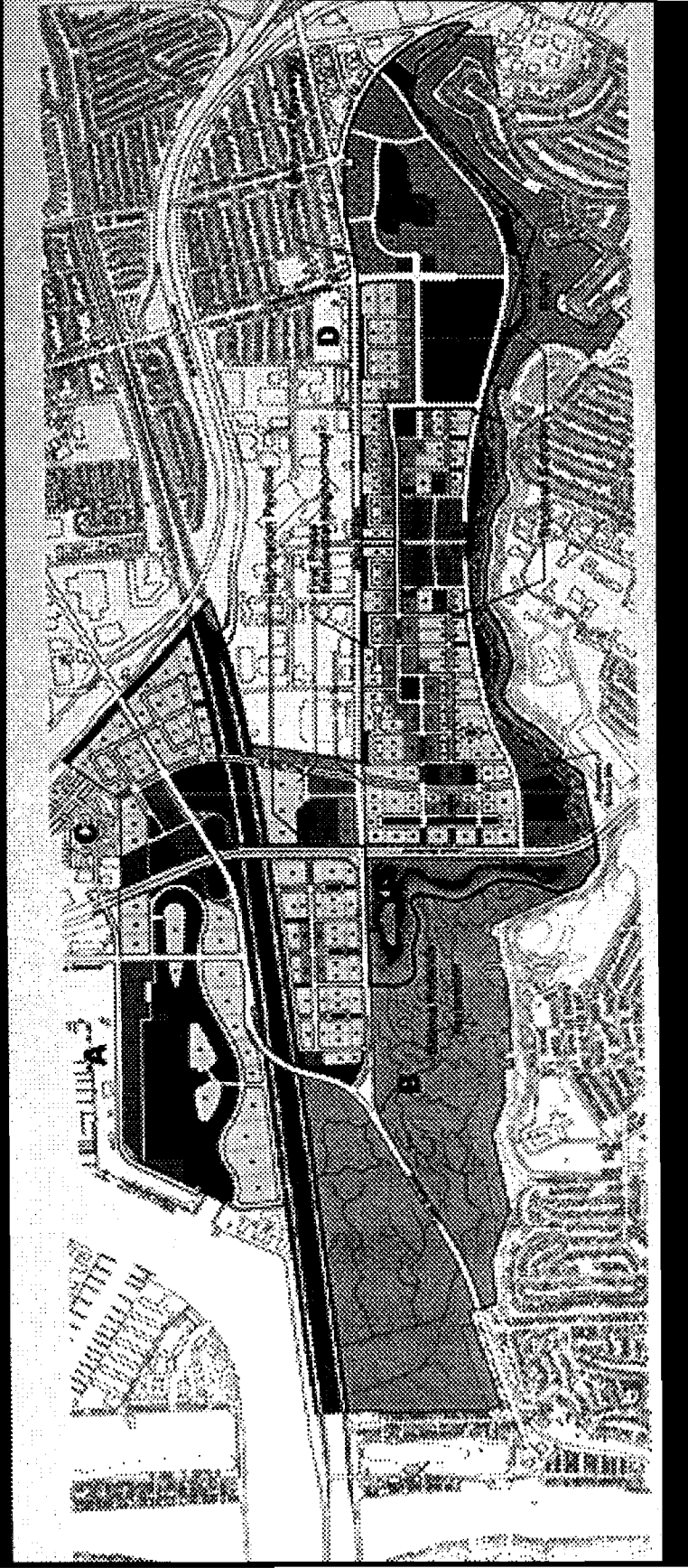
Another impact of ITT on the competitiveness of development projects stems from the fact that within an urban area, ITT connections can make urban fringe or remote sites more viable for development. On the one hand, this can strengthen the marketability of projects at the urban fringe, and exurban projects, such as Montgomery Village, located on the edge of the GTA. On the other hand, the fact that ITT may open up a wider area for development also increases the potential supply of land and viable projects in any given market area, intensifying the competition. As advanced telecommunications technology becomes available in ever more remote areas, we might see competition intensify and broaden as new locations are opened up for feasible development. But the technology does not provide an enduring competitive advantage as the quality of the community, the public realm, building design and flexibility do.

CONCLUSIONS: IMPLICATIONS OF THE INFORMATION REVOLUTION ON RESIDENTIAL DEVELOPMENT

Based on the Key Drivers described previously, and the evidence from the telecommunity case studies, we can identify a few key potential implications of the information revolution for residential development.

Changing residential location patterns and factors

The new technologies have potential implications for people's choice of residential location, and the underlying factors which drive that choice. Of particular importance is the changing live-work relationship. Typically, the choice of residential location has been very much influenced by considerations of access to the (conventional, central) workplace. But the information revolution is reshaping the relationship between the workplace and the home. There are two main forces behind the changing live-work relationship: the nature and geography of "conventional" jobs is changing, and at the same time, the geographical relationship between job and home is being altered by ITT and new, alternative types of work and workspaces, particularly telework. The importance of each of these factors for residential location patterns and factors is described in more detail below.

The changing geography of jobs and its impact on residential location

A number of trends are acting simultaneously to redefine the geography of jobs at the urban/rural, inter-urban and intra-urban levels (see especially Key Driver #2). We don't know as yet where this process will end up in terms of overall patterns of

> *As the mix and geography of jobs continue to change as a result of ITT, residential location patterns are also likely to change in response.*

employment distribution, or impact on individual cities. The impacts will vary from city to city and town to town, depending upon the particular profile of industries, economic activities and jobs that make up each urban area's economy, and how these industries, economic activities and jobs interact with the dynamics of the information revolution.

At the intra-urban scale, we have noted that some ITT-related industries and functions have emerged in the core of cities (e.g. multi-media, high level electronic financial services, the "dot com" companies), while other sectors and activities tend toward suburban locations (e.g. computer manufacture, information processing). These employment location patterns no doubt influence the location and type of housing demanded. Indeed, in some of the larger cities with significant concentrations of ITT businesses, we have seen both a resurgence of downtown residential development in recent years (such as loft housing), and continued demand for family-oriented suburban residences.

While overall patterns are still emerging, certainly the mix and geography of jobs continue to change as a result of ITT, and residential location patterns are also likely to change in response. With respect to the residential location implications of telework in particular, however, we can be a bit more specific.

ITT, telework and residential location

The number of teleworkers in Canada is growing exponentially. But it must also be kept in mind that telework is a selective process - not all workers can or will telework. Those workers that do telework will have specific needs, characteristics and approaches to their residential environment.

There are two sides to the changing live-work relationship resulting from ITT and telework. Both of these dimensions must be considered to fully understand the implications for residential development patterns. On one side of the coin, there is a looser relationship between the place of residence and the central or conventional place of work, resulting in wider choice in residential location. On the other side, as work moves into homes, neighbourhoods and residential environments, there is a stronger relationship between work and place of residence.

Wider residential location choice for teleworkers

For those who telework, even part time, the importance of the central or conventional work location as a factor in determining residential location choice is substantially reduced. For example, if an employee of a company teleworks - even if they only do so one or two days a week, the frequency with which they must travel to a central workplace is reduced. This may encourage them to seek residential locations farther away from their central place of work.

Self-employed home-based teleworkers may also have greater flexibility in their choice of residential location. Their home *is* their central place of work, so they are freed altogether from considering access to a central workplace in their residential location decision, though access to clients or support services may still continue to play a role.

Teleworkers are therefore open to a wider range of residential locations within an urban area. In particular, they can choose lower cost locations on the urban fringe. While they may remain tied to the urban area, they are willing to travel farther because they do so less frequently. This means that they can select locations that are even more distant than the current urban fringe, effectively pushing the urban fringe farther and farther out.

The degree to which teleworkers have greater freedom in selecting their residential location depends on a number of factors, such as:

- Do they telework only part-time (working in a central office the rest of the time) or full-time? Full-time teleworkers will have greater freedom of residential location.

- Are they self-employed, independent contractors or employees? Self-employed teleworkers do not have any ties to a central office location, while employees and independent contractors may.

- Is it a one-earner or two earner household? In a two-earner household, one earner may telework but the other may still be tied to a central employment location.

The possibility of selecting even more distant urban fringe residential locations is further reinforced by other key drivers described above. For example, as some information activities continue to suburbanise, including headquarters and back office functions, the "central" office location may no longer be downtown

but in a suburban downtown or a business park, or itself moved to a greenfields site at the urban edge. This too allows teleworkers to live at greater distances from the urban area, but remain functionally tied to it. Small towns on the edge of metropolitan areas may be viewed by teleworkers as ideal residential locations, given their proximity to the urban area, combined with a small town lifestyle.

> *Small towns on the edge of metropolitan areas may be viewed by teleworkers as ideal residential locations, given their proximity to the urban area, combined with a small town lifestyle.*

The effective or functional geographic area of a city is often defined in terms of the commutershed or labour market area. The trends described above suggest that, as those with functional ties to the city move to more distant fringe locations, the commutershed or labour market area of the city is expanding. A larger geographic area now becomes viable in terms of its potential for residential development. Aside from other implications, this suggests the potential for intensified competition between development projects within regional housing markets.

What teleworkers want in a residential environment

As the geographical ties between residence and the conventional workplace diminish, the relationship between residential environments and work intensifies as non-conventional forms of work move into homes and neighbourhoods. And, as the importance of the work location diminishes as a factor in residential location choice, other factors come into play. In short, teleworkers may consider a different set of factors when deciding where to live. Some of these factors are as follows:

- *Amenities:* Freed from the journey-to-work as a top locational choice factor, teleworkers consider other "softer" amenities such as sense of community, local facilities, and the design and quality of the environment. One survey of business service companies located in rural areas in Alberta found that about half of business owners were primarily "amenity seekers", selecting the community in which to set up their business primarily on the basis of quality of life factors. These included: a quieter setting, reduced commuting stress, recreational opportunities, and proximity to nature, friends and family[3].

- *Business contacts and services:* Despite the fact that teleworkers working from residential environments may not need to travel as frequently to a central workplace, they still need access to a variety of services to support their work. This is perhaps even more so than for a worker in a traditional office environment where these services can be provided in-house. Teleworkers will continue to need access to other firms with which they may form work teams, colleagues or clients. Access to business services such as accountants, lawyers, banks, graphic designers, printing and photocopying, post offices, office supplies, or informal meeting places such as restaurants are also essential for teleworkers.

- *Personal services:* As well, teleworkers need access to the usual personal services which are often integrated with the traditional work environment, such as dry cleaners, shoe repair, fitness clubs, daycare, etc.

- *Teleconnectivity:* Of course, teleworkers need to be able to make high quality, reliable telecommunications connections with their central place of work, clients or other electronic resources. As such, they require access to advanced ITT infrastructure, which might include high speed wired

connections such as ADSL or cable. As technology improves and becomes more sophisticated, and more types of complex documents and functions can be digitised (e.g. improvements in document imaging technologies), access to a high capacity telecommunications connection will become even more important. As noted above under Key Driver #5, however, at present this advanced infrastructure is not universally available across urban centres or even across neighbourhoods within the same city.

Again, the degree to which each of these factors will come into play in determining residential location depends in part upon the type of teleworker: full-time or part-time, self-employed vs. employee of an organisation, one-earner or two-earner household.

A Canadian survey assessed the availability of community services to homeworkers (i.e. including but not limited to teleworkers). It found that most homeworkers had fairly good access to basic personal services (it did not assess access to a range of business services). Around 90% of homeworkers had five-minute drive access or 10-minute walk access to shops, personal services, parks, banks, a post office, cafes and restaurants. Copy centres, recreation centres and childcare were less accessible[4].

Still, better access to services and amenities, such as the outdoors, was seen as a significant factor for homeworkers in their decision to relocate or their consideration of relocating (see below). And improvements to their neighbourhood suggested by homeworkers included better transit, improved neighbourhood shops and services, and improved telephone services[5]. Other desired neighbourhood-oriented services and amenities included nearby places for informal socialising, such as cafes and restaurants, walking and jogging trails, or bike paths[6]. Given the potential for social isolation that is often associated with working at home, the need to integrate opportunities for social interaction into community design, including a high quality public realm of streets, parks, greenways and other civic spaces, corner stores, etc. is often cited as a key requirement in responding to increased incidence of homework[7].

Evidence of changing residential location patterns related to telework

Little empirical work has been conducted to date on the actual effects of the changes discussed above, including teleworking, on residential location patterns. The Canadian survey mentioned above assessed the current residential locations of homeworkers, finding that:

- 44% lived in urban areas (20% in multi-family units and 24% in single family)

- 36% lived in suburban areas (29% in areas over 10 years old and 7% in new areas)

- 8% lived in small towns

- 11% lived in rural areas[8].

This breakdown broadly reflects the distribution of the Canadian population as a whole in terms of its choice of residential location, suggesting that at present, home-based workers do not favour certain types of residential locations over others.

In terms of the effect of telework on residential relocation, the same survey found that 7% had moved since working at home[9]. An additional 27% had contemplated moving. Of these two groups, factors in moving or considering moving included:

- a larger home or better layout

- more community amenities such as access to services or nature.

The latter point emphasises the increasing role of services and amenities in determining residential location.

In terms of where they had moved or would contemplate moving to:

- 51% indicated the same city
  - 46% indicated the same neighbourhood
  - 12% indicated a move closer to the city centre
  - about 9% indicated a move farther from the downtown
- 19% indicated a move outside the city[10].

More extensive research would be required to come to firm conclusions regarding the impact of telework on residential location and relocation. The limited evidence described above suggests that to date, the actual impact on residential location patterns may not be massive. However, the evidence also suggests that telework has the potential to cause more significant shifts in residential location patterns in the coming years.

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This may be especially true as workers have teleworked over longer periods of time, giving them more time to assess teleworking and make desired changes to their residential environment. (That is, teleworking is still a fairly recent phenomenon, and teleworkers may simply have not amassed enough experience with it yet to make changes.) In addition, as the makeup of the economy continues to move toward greater prevalence of information activities and more flexible work arrangements, and as technology continues to improve to allow better tele-connections and more types of work to be undertaken by ITT, we can expect that a growing proportion of the workforce will be willing and able to telework part-time or full time.

A rural renaissance?

Development in ITT, coupled with changes in the economy and work, have led some to suggest a rural renaissance is underway. This is based in part, on the idea of the "electronic cottage", in which workers are free to operate from home in virtually any location.

For example, one Alberta study of business services in rural communities concludes:

> Advances in and availability of communications technology, the lifestyle options available to the highly skilled, and more general market forces have combined to overcome some of the real and perceived disadvantages of rural location.... Telecommuting has reduced the importance of location, particularly metropolitan area location, in the choice of where people live and work. It is reasonable to conclude that the revolution in communications technology will continue to improve, on average, the comparative advantage of smaller communities.... The rural renaissance taking place in Alberta is an exciting story.[11]

Others suggest a trend toward residential development in remote rural communities, particularly those that are recreation-based, with outstanding natural or recreational amenities[12]. Indeed, a reversal in rural to urban migration patterns has been suggested as an outcome of the new technologies[13]. These trends would suggest a boon to rural residential housing markets and development opportunities.

However, these trends are likely overstated. Telework is restricted to certain kinds of work, and only some teleworkers have full flexibility to live completely away from an urban environment. The truly footloose teleworkers may include those involved in professional activities and who are self-employed (e.g. writers, translators), and those that set up a business specifically to serve a local/rural market (as was the case with almost half of the respondents in the Alberta study). Employee teleworkers who have a central place of work elsewhere will likely not be able to unhinge themselves so completely from that central work location. And, as has been noted above, many types of conventional work locations have not been freed from urban and metropolitan locations. For example, 95% of data entry and processing employment in the US remains located in metropolitan areas[14].

In the Canadian context, based on a review of the prospects of high order services to rejuvenate rural areas, Coffey also concludes that "...there is very little cause for optimism concerning the capacity of high-order services to have an impact on the level of economic development in non-metropolitan regions"[15].

In other words, the prospects for a widespread rural renaissance, including truly remote rural communities, are likely quite limited in scope - particularly to those communities with outstanding natural, recreational or physical assets and to self-employed teleworkers. Many of the rural communities that will benefit from economic and technological change are likely to be those that remain within reasonable distance of an urban area.

New urban and neighbourhood divisions

ITT and the information revolution have the potential to cause new types of divisions between neighbourhoods. This is due to variations in the ability of different types of physical residential environments to adapt and be flexible, and due to the variability in access to ITT infrastructure and services within and between cities.

Flexibility and adaptability: rethinking residential environments

The information revolution suggests new roles and needs for residential environments. For example, as telework shifts work to residential environments, accommodating the needs of teleworkers with respect to business and personal services, and other amenities within their neighbourhoods becomes an important issue.

This is particularly true if telework is to achieve the reduced automobile travel that is often claimed to be a primary benefit. If the needed business and personal support services are not accessible to residential areas, teleworking could mean *increased* automobile trips rather than acting as the widely heralded solution to auto dependency. In a recent survey on home-based businesses, respondents from five different Canadian cities were equally divided on whether car use was minimized as a result of working from home. Essentially, it was concluded that community design largely determined the frequency of car use by home-based workers[16].

Conventional work environments that are compact, mixed use and pedestrian-oriented centres allow many work-related and personal activities to be undertaken on foot, while work-at-home in a single use, low density environment may require separate and lengthy automobile trips for each business meeting, lunch date or trip to the dry cleaners. In other words, if telework is not situated within a supportive residential environment, it could actually act to increase automobile travel rather than decrease it.

Residential environments need to be flexible in order to respond to emerging demands and trends associated with telework. There are two aspects to this flexibility:

* The inherent flexibility and adaptability of the built form to accommodate new needs.

* The flexibility of the planning and regulatory environment to accommodate new needs.

Different types of urban environments and residential communities are more amenable to accommodating demands associated with the information revolution. The variation in flexibility of different types of neighbourhoods - whether inherent in the built form or cultivated in the planning and regulatory environment - is a potential axis which may act to further differentiate different kinds of neighbourhoods, making them more or less attractive as markets and places to live.

Flexible residential form

Some neighbourhood forms better support telework than others. Neighbourhoods that are more mixed in use and provide opportunities for accommodating business and personal services and other amenities are most supportive of telework. This is particularly true when these uses can be integrated on a very local scale, allowing the teleworker to walk or cycle from home to support services rather than drive.

As such, denser, more mixed-use neighbourhoods, and those with nearby mixed-use main streets are generally supportive of telework. These are typically the pre-war neighbourhoods. New greenfields communities can of course be planned for more compact development and the close integration of telework support services. In many instances, however, new neighbourhoods do not take teleworkers' needs into account. They are conventional in design, low density, and do not allow for closer integration of non-residential uses, necessitating travel by car for these services. New Urbanist communities may hold higher potential for supporting telework, providing higher densities are actually achieved and non-residential uses and activities are actually closely integrated with residential development.

Probably the most problematic residential environment from a telework-support perspective is the existing conventional, low-density, single-use suburb. The conventional suburb tends to segregate commercial activities at considerable distances from homes, and major roads and arterials are frequently back-lotted, precluding commercial or mixed-use development. Generally there are few opportunities for integrating non-residential activities closely with homes. One possible opportunity lies in the "corner convenience plaza", which at present is the non-residential development that is most closely integrated with and accessible to surrounding residential development. These generally single-level mini-malls, with parking lots in front, could be redeveloped to contain three or four floors of development, and allow the integration of a wider range of services to support telework, such as professional offices, telework centres, satellite offices of local public libraries, restaurants and photocopy shops, as well as other community activities.

As telework continues to grow in importance, so too will the need to develop viable retrofitting strategies

for conventional post-war suburbs - not just from a telework-supportiveness perspective, but from other (compatible) perspectives such as transit viability.

Flexible planning and regulation

The local planning and regulatory context can also play a role in determining the suitability and adaptability of neighbourhoods in accommodating telework. Even in some neighbourhoods where the physical form inherently supports telework, telework can be discouraged because of inflexible zoning regulations or other municipal standards and by-laws which may restrict or prohibit neighbourhood- or home-based work.

Examples of restrictive planning, zoning or building regulations requirements for legal home offices include:

- zoning by-laws that limit the scope of home-based occupations

- zoning by-laws that limit the adaptability of housing to accommodate an office - either within a main house with a separate entrance, or in an accessory building at the rear of the lot

- onerous off-street parking requirements

- sign restrictions

- official plans and zoning by-laws that preclude retrofitting of neighbourhoods and the introduction of non-residential uses that support telework, such as services, telecentres, etc.

Recent research suggests that many municipalities have adopted more flexible regulations surrounding work at home. However, it is noted that policy change has largely occurred due to pressure exerted by residents, rather than having been instigated by local government[17].

Availability of ITT infrastructure

The information economy operates according to a different logic than the mass production economy which preceded it. As the economic importance of information, knowledge, innovation and the ability to tele-communicate continues to increase, access to information infrastructure becomes increasingly important - to a firm's competitive position and to

> *As work continues to infiltrate residential environments, access to ITT infrastructure will increasingly be a factor in determining the desirability (or lack thereof) of different neighbourhoods.*

a worker's ability to do their job. And as work continues to infiltrate residential environments, access to ITT infrastructure will increasingly be a factor in determining the desirability (or lack thereof) of different neighbourhoods. This is potentially a new axis upon which neighbourhoods will be differentiated.

As noted above under Key Driver #5, access to high-speed ITT connections is not universal. There are significant differences in availability of advanced ITT infrastructure such as ADSL or cable Internet connections between urban and rural areas, between cities, and within cities. In particular, access to advanced ITT tends to be biased toward larger urban areas and urban agglomerations, and to exclude many smaller cities and towns, and rural communities - except those that find themselves in the shadow of larger

urban centres or along major transportation corridors. These differences in ITT service levels can come into play in determining the desirability and viability of these locations for residential development (and employment locations).

In terms of the impacts on different types of neighbourhoods within a given city, it is at present very difficult to discern a recognizable urban pattern to the supply of advanced ITT infrastructure. The pattern depends in part on the characteristics of the network itself, such as the ease with which existing networks can be upgraded, distances to central offices, etc. However, this does not mean that the variations in network conditions do not translate into an urban pattern. More research would have to be conducted on specific cities to determine each urban area's "access map", and whether there are consistent patterns in ITT infrastructure availability across cities.

However, the telecommunities case studies have pointed to a couple of important factors that could affect ITT availability in different types of neighbourhoods. The first is the potential effect of economies of scale on the provision of ITT infrastructure, and in particular, services and content. While the limited case study evidence presented here is not conclusive, it seems logical that a certain threshold community size, particularly in terms of residents and employees, would make the provision and maintenance of ITT services and content more economically viable. This could create a bias, particularly in new developments, against smaller development projects and communities and in turn against smaller developers and builders. With time, however, these effects may be offset as new specialist companies emerge with products and services aimed specifically at providing local "content" and services to new communities.

Second, the telecommunity case studies suggested that in order to provide and maintain local on-line content and services and relationships with providers, some form of community-based institution is required to take over from the developer in freehold projects. In the US, this role can and often is fulfilled by the Homeowners Associations. However, in Canada we do not have any parallel form of organisation that could readily fulfill this function. Unless some way of dealing with the ongoing maintenance of local ITT services and information is found, this could mitigate against the provision of such services in our neighbourhoods and employment districts.

The lack of local on-line services and content may be even more pronounced in the existing, stable neighbourhoods - as compared to new communities or development projects where a developer often takes the lead role. Again, these effects may be offset in time, as the market and new specialist companies step in to take over this function, or a new way is found to establish new community-oriented organisations which would support and manage such services.

A polarised housing market?

The changing nature of work and occupational structure, outlined above under Key Driver #3, has potentially important implications for the structure of housing markets. In particular, important ramifications would result from the emergence of a polarised occupational structure (which translates into income and social polarisation) associated with the shift towards the information economy.

The post-war suburban residential expansion was fuelled to a large extent by a burgeoning middle class. As described above, the portly, middle-heavy profile which has characterised Canada's social structure since the Second World War may be showing signs of change. Though still emerging, the evidence

indicates increasing earnings polarisation. This has been coupled with significant changes to the social safety net and taxation system both federally and provincially which have undermined their ability to compensate for earnings inequality, as they have done in the past.

In terms of housing market demand, the obvious implication is a concentration of demand at the high and low ends of the income range, and a diminution of demand in the middle income range. A polarised income structure could particularly impact the demand for conventional new suburban housing, which has historically been driven to a large extent by middle-income households.

A polarised income structure could also imply greater pressure to provide affordable, possibly non-market housing, as the lower income segment of the population grows.

The effects of the information economy on occupational and income distribution will likely vary considerably from city to city, and housing market to housing market, just as the impacts of the information revolution generally affect cities differently, based on their varying economic bases and approaches taken to dealing with the nature of change that is underway.

Concentration vs. deconcentration: Manhattan surrounded by Scottsdale?

Many planners and others involved in the development of cities often assume that information technology inevitably means greater urban sprawl, as more work is conducted from homes and those homes are liberated from their ties to central workplaces. In fact, as the discussion of the Key Drivers has shown, above, the reality is much more complex. Many different forces related to the information revolution are acting upon cities at the same time. Often these processes are very selective in nature, targeting certain industries, activities, types of organisations or jobs. We have also seen, above, that while certain processes may result in more dispersed, sprawl patterns of development, there are also other forces at work related to the information revolution which result in concentrated patterns of development.

For example, tendencies toward dispersal derive from the rising incidence of home-based telework, and the relocation of routine activities and some other functions (such as headquarters functions) from central to peripheral locations. As noted above, these trends suggest an expansion of the physical urban area of cities. On the other hand, knowledge- and innovation-based, non-routinisable activities (such as product development, marketing, personalised financial services, etc.), which are making up a growing share of the economy, will continue to centralise in urban areas.

In short, as the makeup of the economy continues to shift towards information-based activities, including both activities with centralising tendencies and those with decentralising tendencies, we are liable to see both spatial trends taking place at the same time, rather than a simple one-way process of decentralisation. Furthermore, the kinds of activities that tend to decentralise are different in nature from those that tend to centralise. The result may be an urban form that is more highly differentiated between core and suburbs - both in terms of the kind of activities that take place in each location, and the urban form. This raises issues of potential sustainability and cost-of-servicing implications associated with an expanding urban area.

Urban cores will continue to focus on the high-value added, non-routinisable kinds of activities, taking

place within a dense urban environment that facilitates informal and formal contacts. More routine activities as well as home-based work will continue to migrate to low-cost suburban or exurban locations. One of the effects of ITT here is that these activities can take place at much greater distances from the central city than they have in the past, suggesting larger urban areas and the potential for higher degrees of urban sprawl. For example, the term "New York surrounded by Phoenix" has often been used to describe the Toronto region's urban form. The trends described above suggest that if anything, this pattern will intensify as a result of the information revolution - Manhattan surrounded by Scottsdale?

Planning the Information City

The framework described above in this report, and the discussion of some key potential implications are really describing a fundamental transformation in the nature, organisation and evolution of cities. This is being driven by a new logic: that of the information revolution. New information and telecommunications technologies play a key role in this process, but their role must be considered within the broader context of their economic and social function. The technologies do not drive change in isolation of this broader context.

Given that a new logic is driving urban change, we need new frameworks, concepts, models and approaches in order to be able to interpret and understand the nature of change that is underway in the economy and society generally, and in this context with respect to urban dynamics.

What is clear is that the traditional approaches to understanding urban change are not particularly relevant to the new realities of the information economy. We need a new theory of urban change that reflects the quantum shift from the mass production manufacturing-based economy of the 1920s through the 1970s to the information economy of the 1990s and beyond.

At the same time, new analytical tools, approaches and categories are needed. It is difficult if not impossible to analyse change in the information city with existing tools: it's like trying to diagnose a problem in a computer using a wrench. We are not asking the right questions or getting the right information about the information city.

We also lack a theory of planning the information city, with appropriate planning concepts, and responses. Many planning concepts, categories, approaches, instruments and solutions are also, of course based on notions related to the industrial city.

Better awareness of the impacts of ITT on cities and towns of all kinds is needed, along with additional research and (ironically, perhaps) improved dissemination of available information. For example, we need a better understanding of the changing geography of jobs and its impacts. Key questions and potential responses to emerging issues need to be established. For example, how can urban planning adapt to the information society while supporting sustainability objectives? What strategies should be explored for ensuring potential negative effects, such as urban sprawl, be avoided? What can more remote communities do to be sure to be a positive part of the information revolution? Developing appropriate responses to these issues will help communities to prepare for information society, and to harness its positive, community-building and sustainability potential.

1   U.S. Congress, Office of Technology Assessment, *The Technological Reshaping of Metropolitan America*, OTA-ETI-643, Washington, DC: U.S. Government Printing Office, September, 1995, p. 144.

2   Statistics Canada figures, quoted on the InnoVisions Canada/Canadian Telework Association website, "The Canadian Telework Scene" (http://ivc.ca).

3   Edward J. Chambers and Mae Deans, *The Rural Renaissance in Alberta: Some Empirical Evidence*, Western Centre for Economic Research, Faculty of Business, University of Alberta. No.50, May, 1998.

4   Penny Gurstein, *Planning for Telework and Home-Based Employment: A Canadian Survey on Integrating Work into Residential Environments*, Centre for Future Studies in Housing and Living Environments, Canada Mortgage and Housing Corporation, March, 1995.

5   Penny Gurstein, *Planning for Telework and Home-Based Employment: A Canadian Survey on Integrating Work into Residential Environments*, Centre for Future Studies in Housing and Living Environments, Canada Mortgage and Housing Corporation, March, 1995, p. 48.

6   Penny Gurstein, *Planning for Telework and Home-Based Employment: A Canadian Survey on Integrating Work into Residential Environments*, Centre for Future Studies in Housing and Living Environments, Canada Mortgage and Housing Corporation, March, 1995, p. 55.

7   See, for example, Bill Clark "The Implications of Telecommunications and Information Technologies for Residential Development", *ULI on the Future*, Washington, D.C.: Urban Land Institute, 1996.

8   Penny Gurstein, *Planning for Telework and Home-Based Employment: A Canadian Survey on Integrating Work into Residential Environments*, Centre for Future Studies in Housing and Living Environments, Canada Mortgage and Housing Corporation, March, 1995.

9   Penny Gurstein, *Planning for Telework and Home-Based Employment: A Canadian Survey on Integrating Work into Residential Environments*, Centre for Future Studies in Housing and Living Environments, Canada Mortgage and Housing Corporation, March, 1995.

10   Penny Gurstein, *Planning for Telework and Home-Based Employment: A Canadian Survey on Integrating Work into Residential Environments*, Centre for Future Studies in Housing and Living Environments, Canada Mortgage and Housing Corporation, March, 1995.

11   Edward J. Chambers and Mae Deans, *The Rural Renaissance in Alberta: Some Empirical Evidence*, Western Centre for Economic Research, University of Alberta, Number 50, May 1998, p. 30.

12 Bill Clark "The Implications of Telecommunications and Information Technologies for Residential Development", *ULI on the Future,* Washington, D.C.: Urban Land Institute, 1996.

13 See, for example, Bill Clark "The Implications of Telecommunications and Information Technologies for Residential Development", *ULI on the Future,* Washington, D.C.: Urban Land Institute, 1996, and Mike Flehr and Malcolm Cooper, "Land Use Impacts of Telecommunications", Shaping Our Communities: The Impacts of Information Technology, Resource Guide Article, Planning Commissioners journal web site .

14 See Key Driver #2.

15 W.J. Coffey and M. Polese, "Producer Services and Regional Development: A Policy-Oriented Perspective", *Papers of the Regional Science Association,* v. 62, 1989, pp. 71-80, quoted in William J. Coffey, *Employment Growth and Change in the Canadian Urban System,* 1971-94, Canadian Policy Research Networks Inc., Working Paper No. W02, 1996, p.129.

16 James E. Randall, "Home-Based Businesses, Local Economic Development and Land Use Policy: Conflicts and Opportunities", Report prepared for Canada Mortgage and Housing Corporation, August, 1997, p. 73.

17 James E. Randall, "home-Based Businesses, Local Economic Development and Land Use Policy: Conflicts and Opportunities", Report prepared for Canada Mortgage and Housing Corporation, August, 1997, p. 91.