TELEPORTS, SWEATSHOPS, AND COCOONS: 
AN ANALYSIS OF TELECOMMUTING

By

JAMES GREGORY YARDLEY

B.A., The University of British Columbia, 1982
LL.B., The University of Toronto, 1990

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS

in

COMMUNITY AND REGIONAL PLANNING

We accept this thesis as conforming

to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

October, 1990

© James Gregory Yardley, 1990
In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the head of my department or by his or her representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Department of **COMMUNITY AND REGIONAL PLANNING**

The University of British Columbia
Vancouver, Canada

Date **OCTOBER 11, 1990**
ABSTRACT

Telecommuting is a practice in which a person works at home with a computer terminal and communicates with their place of employment by telephone line or data link. Telecommuting is a relatively recent phenomenon, originating during the mid-1970's as a means for lowering energy consumption by reducing the need to commute between home and the workplace. Other factors promoting the adoption of telecommuting include rapid advances in computer and telecommunications technologies, and the shift in the economic structures of Western nations from being based primarily on extractive and manufacturing activities, to the provision of services, and knowledge-based activities in particular.

There is considerable uncertainty about how many people telecommute. This is largely because of conflicting definitions of telecommuting, the lack of reliable or systematically collected data on the subject, and methodological difficulties in identifying telecommuters. Nevertheless, anecdotal evidence and empirical studies have identified two principal types of telecommuters: (1) managerial, technical, or professional employees who generally work at home on an intermittent or part-time basis, and (2) clerical employees who perform routine or clearly defined tasks, usually on a full-time basis.

The effects of telecommuting tend to be unevenly distributed, with professional or managerial workers generally receiving more benefits and being less vulnerable to exploitation than clerical
workers. Benefits to employees may include lower commuting costs, more flexibility in lifestyle and work scheduling, and improvements in working conditions. Potential disadvantages to employees include isolation, career impairment, conflict between work and non-work roles, and exploitation by employers. Advantages for employers include increased productivity, less employee turnover, and lower costs. The primary disadvantage employers face is limitations in managerial style; this may be the primary impediment facing the increased adoption of telecommuting. Suggested benefits to society include lower commuting costs, less traffic congestion, less energy consumption, and less air pollution. Potential societal disadvantages include increased urban sprawl and distortions to land markets.

Factors external to telecommuting that are influencing its adoption include cultural attitudes to the home as a workplace, the development of office automation technologies, reactions by organized labour, and the processes of innovational diffusion.

The spatial impact of telecommuting is uncertain. Research on the impact of telecommunications on urbanization suggests an inherent tendency towards spatial decentralization, and there is considerable speculation in the literature that telecommuting may lead to increased residential dispersion. There is, however, little, if any, empirical evidence supporting the latter notion.

Telecommuting may be useful as a public policy device to promote certain identified societal goals such as reductions in
energy consumption and pollution. This would require a reassessment of current zoning practices which often restrict home-based employment for reasons of doubtful legitimacy. Any policy-based encouragement of telecommuting should be accompanied, however, by the development of employment statutes and enforcement mechanisms that protect telecommuters against potential abuses.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>ii</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>ix</td>
</tr>
<tr>
<td><strong>CHAPTER ONE:</strong> INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 PURPOSE</td>
<td>1</td>
</tr>
<tr>
<td>1.2 KEY TERMS</td>
<td>1</td>
</tr>
<tr>
<td>1.3 PROBLEM</td>
<td>4</td>
</tr>
<tr>
<td>1.4 METHODOLOGY AND SCOPE</td>
<td>12</td>
</tr>
<tr>
<td>1.5 SEQUENCE OF PRESENTATION</td>
<td>14</td>
</tr>
<tr>
<td>1.6 RATIONALE AND JUSTIFICATION</td>
<td>16</td>
</tr>
<tr>
<td><strong>CHAPTER TWO:</strong> THE THEORY AND PRACTICE OF TELECOMMUTING</td>
<td>18</td>
</tr>
<tr>
<td>2.1 INTRODUCTION</td>
<td>18</td>
</tr>
<tr>
<td>2.1.1 The Mechanics of Telecommuting</td>
<td>20</td>
</tr>
<tr>
<td>2.2 CONCEPTUAL BACKGROUND</td>
<td>22</td>
</tr>
<tr>
<td>2.2.1 Early Work</td>
<td>22</td>
</tr>
<tr>
<td>2.2.2 Telecommuting and Quality of Life</td>
<td>30</td>
</tr>
<tr>
<td>2.2.3 Recent Work - Still a Solution Searching for a Problem?</td>
<td>30</td>
</tr>
<tr>
<td>2.3 EXAMPLES OF PROGRAMS REPORTED IN THE LITERATURE</td>
<td>32</td>
</tr>
<tr>
<td>2.3.1 Control Data Corporation</td>
<td>33</td>
</tr>
<tr>
<td>2.3.2 F International</td>
<td>34</td>
</tr>
<tr>
<td>2.3.3 Best Western Hotels</td>
<td>36</td>
</tr>
<tr>
<td>2.3.4 Mountain Bell/Pacific Bell</td>
<td>36</td>
</tr>
<tr>
<td>2.3.5 Southern California Association of Governments/California State Government</td>
<td>38</td>
</tr>
<tr>
<td>2.4 CHARACTERISTICS OF TELECOMMUTERS AND REMOTE WORK</td>
<td>39</td>
</tr>
<tr>
<td>2.4.1 Characteristics of Successful Telecommuting Arrangements</td>
<td>48</td>
</tr>
<tr>
<td>2.5 CONCLUSION</td>
<td>51</td>
</tr>
<tr>
<td><strong>CHAPTER THREE:</strong> OPPORTUNITIES FOR TELECOMMUTING: A CONVERGENCE OF FORCES</td>
<td>53</td>
</tr>
<tr>
<td>3.1 INTRODUCTION: A TIME OF TRANSITIONS</td>
<td>53</td>
</tr>
<tr>
<td>3.2 THE COMPUTERIZATION OF WORK AND SOCIETY</td>
<td>56</td>
</tr>
<tr>
<td>3.2.1 Economic Impacts of Computerization</td>
<td>59</td>
</tr>
<tr>
<td>3.2.2 Organizational Impacts</td>
<td>60</td>
</tr>
<tr>
<td>3.2.3 The Computer as Catalyst</td>
<td>61</td>
</tr>
<tr>
<td>3.2.4 The Computer as Metaphor</td>
<td>66</td>
</tr>
<tr>
<td>3.3 TOWARDS A KNOWLEDGE-BASED ECONOMY (FROM WIDGETS TO DIGITS)</td>
<td>68</td>
</tr>
<tr>
<td>3.3.1 Employment Trends</td>
<td>69</td>
</tr>
</tbody>
</table>
### 3.3.2 The Evolution of Sectoral Analysis

| 71 |

### 3.4 THE INFORMATION SOCIETY

| 75 |

### 3.5 CONCLUSION

| 86 |

#### CHAPTER FOUR: TELECOMMUNICATIONS AND URBANIZATION

| 88 |

#### 4.1 BACKGROUND AND THEORY

- 4.1.1 Technological Convergence and Urban Form  
- 4.1.2 The Wired City

| 89 | 93 |

#### 4.2 THE TELECOMMUNICATIONS INFRASTRUCTURE

- 4.2.1 Teleports
- 4.2.2 Smart Buildings

| 98 | 100 |

#### 4.3 THE SUBSTITUTION OF TELECOMMUNICATIONS FOR TRAVEL

#### 4.4 TELECOMMUNICATIONS AND OFFICE LOCATION

#### 4.5 TELECOMMUNICATIONS AND URBANIZATION

| 102 | 110 | 117 |

#### CHAPTER FIVE: THE EFFECTS OF TELECOMMUTING

| 120 |

#### 5.1 INTRODUCTION

| 120 |

#### 5.2 EFFECTS OF TELECOMMUTING FOR INDIVIDUALS

- 5.2.1 Advantages for Employees
  - i) Elimination or reduction of commuting times and costs
  - ii) Increased flexibility of time schedule and lifestyle
  - iii) Closer ties to family and community
  - iv) Creation or retention of employment opportunities
  - v) Improvement to work environment

| 120 | 121 | 122 | 123 | 124 | 124 |

- 5.2.2 Disadvantages for Employees
  - i) Isolation
  - ii) Loss of status and visibility to employer
  - iii) Distractions and limitations of the home environment
  - iv) Lack of routine
  - v) Conflict between work and non-work roles
  - vi) Conditions of employment

| 125 | 125 | 126 | 127 | 128 | 128 | 129 |

#### 5.3 EFFECTS OF TELECOMMUTING ON EMPLOYERS

- 5.3.1 Advantages for Employers
  - i) Increased productivity
  - ii) Decreased workforce turnover and increased labour pool
  - iii) Decreased costs
  - iv) Public relations value

| 131 | 131 | 132 | 133 | 136 | 136 |

- 5.3.2 Disadvantages for Employers
ACKNOWLEDGEMENT

I would like to thank the following: my wife, Susan Bridgman, for her support, love, and assistance to me throughout the writing of this thesis, including during my detour through law school; my thesis advisor, Professor Henry Hightower, for his patience; and, the Canada Mortgage and Housing Corporation, for their financial assistance.
CHAPTER ONE
INTRODUCTION

1.1 PURPOSE
The purpose of this thesis is to examine the practice of home-based electronic work, more commonly known as telecommuting, and to explore the factors contributing to its origin, its potential benefits and disadvantages, the factors that will likely influence the degree to which it is adopted, and some of the resulting policy implications it presents for urban planners.

1.2 KEY TERMS
Telecommuting is a practice and concept in its infancy; accordingly, there is some confusion and ambiguity regarding appropriate terminology and definitions. The term telecommuting appears to have become prevalent in the literature, although others terms are used including telework, telecomputing, homework, home-based electronic work, cottage computing, electronic homework, and location independent work. Although each of these terms is a legitimate descriptor of the subject of this thesis, the term telecommuting will be used because of its preponderance in the literature, and because the two elements of the term ('tele' and 'commute') are uniquely descriptive of the activity in question: the substitution of telecommunications for travel between home and work. Thus, work that has traditionally been performed at home or work performed at home with a computer that is essentially solitary in nature, such as writing a novel,
is not, for the purposes of this thesis, considered to be telecommuting because telecommunications technology is not used as a substitute for the commute to the workplace.

The term telecommuting is generally attributed to Jack Nilles (1975), a University of Southern California-based futurist who has since become a consultant and telecommuting proponent. In one of the first studies on the subject (see Chapter Two), Nilles et al. (1976) defined telecommuting as an arrangement in which employees "perform their work, using communications and computer technologies, at locations much closer to their homes than is the case now." Nilles did not originally view the home as a telecommuting workplace, but argued that office work would diffuse through a four stage process to neighbourhood work centres, where employees of several organizations would work together.

Having developed in an incremental and dispersed manner, and having had many false starts, there does not appear to be any universally cited definition of telecommuting. Discussion of telecommuting has, until recently, been limited to a relatively small group consisting mainly of futurists, urban theorists, academics from a number of disciplines, business consultants, and proponents of home-based lifestyles. Among these commentators,

---

1 According to the 1989 edition of the Oxford English Dictionary, the periodical The Economist reported the following in January, 1974: "As there is no logical reason why the cost of telecommunications should vary with distance, quite a lot of people by the late 1980's will telecommute daily to their London offices while living on a Pacific island if they want to."
It appears that the use and understanding of the term is often more implicit than explicit, and its definition is frequently tailored to suit the particular interests of the investigator. Among the general public, the term appears to be obscure, although it has been listed in recent editions of several general purpose dictionaries.2

The essential elements of the practice as explored in this thesis are, however, found in the following definition:

A situation in which an employee works at home and transmits his work to his office through a computer and telecommunications channel.3

Neither the frequency nor the type of work performed is pertinent to this definition, as long as the work involves substitution of communication for travel; indeed, available evidence indicates that many telecommuting arrangements are conducted on an intermittent or ad hoc basis, including by "teleguerillas" who work at home without formal permission from their employers.

While this thesis will focus on the home as workplace, the notion of telecommuting has also been applied to two other settings (SCAG, 1985): (1) satellite offices, usually the decentralized worksites of a single employer, and (2) the neighbourhood work centres referred to above. Accordingly, Olson


(quoted in Schneider and Francis, 1989) has provided the following broad definition for telecommuting:

... organizational work performed outside of the normal organizational confines of space and time, augmented by computer and communications technology, not necessarily in the home.

1.3 PROBLEM

During the past two decades, there has been considerable interest in the effects of communication and information technologies on individuals, organizations, and society (e.g., Abler, 1975; Kellerman, 1984; Communications Canada, 1987). The impact that these technologies may have on settlement patterns has been the subject of much discussion; while some have postulated that communications technology is "spatially neutral" and does not inevitably lead to any particular impact on urban spatial form (e.g., Webber, 1963; 1964), Mandeville (1983) has observed an academic tradition associated with Lewis Mumford, Harold Innis, Marshall McLuhan, and others asserting that electronic information technologies inherently leads to spatial decentralization. It has been argued that telecommunications technology will have as profound an effect on the shape and evolution of cities as that produced during the last century by changes in transportation technology, due mainly to the potential of communication to substitute for travel involving the transfer of information (Gold and Barke, 1978). The impact of this technology on the physical landscape has been the subject of speculation that sometimes borders on the visionary:
We will also suggest that, during this period of overlapping technologies, the city, as we have known it, may be transformed into something else that we can now but dimly see; that some highways and networks of roads for human transport may sink back into the natural landscape; that the pattern of our workaday lives will undergo profound transformations; that our social and political and economic worlds will become something quite other than they are now. (from Harkness, 1977, p. 14)

Kellerman (1984) has suggested that telecommunications may cause the city to cease being a place of concentrated population, power, and economic activity, echoing Webber's (1964) notion of the "non-place urban realm" and Custerdon's (1973a and 1973b) "non-city"; Goldmark (1972) has written about telecommunications as the catalyst behind a "new rural society." Empirical evidence, however, suggests that dispersion and centralization are simultaneously occurring (Gertler, 1986). Gottmann (1977) has rejected notions about the dissolution of the city, arguing that communication is only one factor in the urbanization process, and cites counter-balancing centripetal forces including limits to the physical transfer of goods, organizational limits to dispersion, and the social nature of people that led them to live in cities in the first place. Gottmann also observes that technology can produce counter-intuitive results and offers the telephone as an example; while it might be expected that the telephone reduces the need for spatial proximity and face-to-face contact, "it should be recognized that lofty, dense skylines exist as much owing to the telephone as to the elevator."

The question remains unresolved, with supporting evidence available for both sides. For example, for the first time since
it was initiated in 1790, the U.S. Census indicated in 1980 that rural areas and small towns experienced faster growth rates than large metropolitan areas, and that in some cases, the latter experienced population declines in both relative and absolute terms (Hauser, 1981). At face value, this suggests the start of a population distribution characterized by decentralization and has been used as evidence of a shift of social values favouring rural and semi-rural lifestyles that could help stimulate demand for telecommuting (Eder, 1983; Wiegner and Paris, 1983; Calhoun, 1984). There is much controversy, however, about how this data should be interpreted; it has been noted that much of the so-called rural and semi-rural growth has occurred in areas near or adjacent to large metropolitan areas and may merely represent an increase of the functional geographic sizes of metropolitan areas (Blumenfeld, 1982). The census data also raises questions about how to define urban and rural populations, and whether many meaningful sociological differences remain between them (Lang, 1986). In any event, the causal connection between nighttime population distribution and telecommunications technology is, at this time, viewed as tenuous at best.

Nevertheless, there are instances where communications technology may facilitate spatial change. This is found in telecommuting, where the substitution of communication for travel creates, among other things, the opportunity for individuals to have greater residential mobility than is the case when they must live within commuting distance of their workplaces. The notion
was initially articulated by Nilles et al., (1976) who, using a case study of a Los Angeles insurance company as an example, demonstrated how the United States - then in the midst of a crippling energy crisis - could eliminate much of its imported oil requirements by adopting widespread telecommuting. It was not, however, until futurist Alvin Toffler wrote about the "electronic cottage" in *The Third Wave* (1980), in which telecommuting was described as an integral part of "third wave" society, that the notion of telecommuting began to reach its present level of public awareness.

Since then telecommuting has largely been a solution in search of a problem. Research on the subject has followed two basic themes. The first, prevalent during the late 1970's, tended to be model-based in nature and was concerned with measuring the potential macro level benefits of telecommuting, such as total energy savings or reductions in travel demand (e.g. Harkness, 1977). The other theme, prevalent during the 1980's, was oriented towards more qualitative aspects of telecommuting. Largely based on case studies, it examined the benefits and disadvantages of telecommuting as experienced by individuals and organizations, and often assumed a critical perspective (Olson, 1983, 1985; Pratt, 1984; Shamir and Salomon, 1985; Christensen, 1987). The literature also contains much material of the promotional and "how-to" variety, and is directed at providing potential telecommuters and their employers with advice and assistance in starting telecommuting programs (Edwards and
At present, telecommuting is generally viewed as an employment option. Its level of adoption has consistently fallen short of projections made by its proponents (Noble, 1986; "Telecommuting, Staying away . . . .", 1987), due mainly to management and employer resistance, fear of isolation and career impairment by employees, a lack of knowledge about the practice by both groups, and, arguably, the simple lack of desire of many people to work at home.

Theoretically, anyone whose work involves the transfer or manipulation of information, as opposed to providing a personal service or handling tangible goods, can be a telecommuter. Estimates of the potential size of the telecommuting workforce are generally linked to the number of employees in the so-called information sector of the economy, usually taken to be in the range of 40 to 55 percent of the total workforce. In practice, however, there is no clear indication of how many people actually telecommute. Estimates of the number of full-time telecommuters in the United States have varied between 3,000-5,000 (Noble, 1986), to 240,000 (Elmer-DeWitt, 1986), and there are no published estimates of its incidence in Canada. Survey data shows that there is no single type of telecommuter; rather, there are two groups predominantly engaged in the activity: (1) managers and professional employees who work at home on an intermittent basis, usually doing a task that requires concentration and few interruptions, such as report writing, and
(2) clerical workers, who usually work at home on a full-time basis, often being paid per unit of work, and whose employment status is often changed from employee to independent contractor, thus removing their eligibility for employment benefits and making them more vulnerable to unemployment.

As the hyperbole and what has turned out to be unrealistic expectations of earlier forecasts begin to subside, the question becomes one of assessing the implications of telecommuting for cities and urban planning. Telecommuting has been promoted as a means to reduce peak-hour traffic congestion and energy consumption, lower stress levels among commuters, and improve air quality, while increasing employee morale and productivity, and helping to create an increased sense of well-being at the level of the individual, the family, and the community. Alternatively, it has been argued that telecommuting could lead to increased social isolation, worker exploitation, family stress, and the virtual abandonment of central business districts. Beyond the immediate and direct consequences of a shifting workplace, there are questions about the secondary impacts of telecommuting on, for example, urban transportation systems, office and housing markets, the economic viability of cities, and even cultural perceptions of what makes an area "urban" rather than "rural."

Taken to an extreme, it has been suggested that developments in computer and telecommunications technology, of which telecommuting is one example, could lead to the eventual dissolution of the city (Custerdon, 1973a and 1973b; Lehman-
Yet, the degree to which telecommuting will be adopted remains very unclear, and there is no available evidence showing causal connections between telecommuting and the spatial impacts attributed to it. Much of the early research on telecommuting assumed that its adoption was mainly dependent upon the availability of the necessary technology. In practice, however, the availability of technology has been a necessary but not sufficient condition for the adoption of telecommuting. This has been ignored in much of the commentary on telecommuting and technological change, and on forecasts of their potential impacts:

First, there has been a widespread tendency to confine analysis to the macro-level. Broad-brush pictures of future urban society are presented, frequently portraying communication technology as a factor of ever increasing importance in the lives of urban dwellers, but without considering the way that people come to terms with these media. . . . The second, and closely-related, deficiency lies in the way that writers have treated the complex relationship between society and technology. Accurate forecasting demands both informed extrapolation of likely trends of technological development and an understanding of processes of human communication, yet most authors have concentrated on the former. (Gold and Barke, 1978, pp. 1-2)

There are numerous caveats to be considered when estimating the degree to which telecommuting will be adopted. First, while many occupations are conceptually receptive to telecommuting in the sense that they involve the use or manipulation of information, this perception is often based on a superficial analysis of the functional requirements of those occupations, and fails to consider less tangible, yet equally important, factors
such as social camaraderie and co-worker interaction, as well as corporate cultures. Second, while the availability of "off the shelf" computer and communication systems is often taken for granted, and commentators generally downplay the significance of technical barriers to telecommuting, experience has shown that there can be significant and irremediable technical impediments to telecommuting programs (McNurlin, 1982). Third, surveys continue to show that, given a choice, most people would prefer not to telecommute or work from their homes. As noted above, many people look forward to the social interactions of the workplace and often lack the discipline to work effectively without supervision; however, there are others who want greater flexibility in their work arrangements, such as that provided by part-time employment and flextime. Finally, consideration must be given to the heterogeneity of the home-based workforce. The nature of the work can vary considerably; benefits and disadvantages are unevenly experienced by different groups, and there are diverse reasons and sources of impetus for home-based work arrangements. While scenarios portraying neighbourhoods of home-workers and empty downtowns are undoubtedly realizable, there remains a fundamental disparity between the potential envisioned by the proponents of telecommuting and the degree to which it is actually being adopted. This thesis will argue that significant and radical changes to urban structure caused by telecommuting are, at this time, more a matter of faith than fact.
1.4 METHODOLOGY AND SCOPE

Statistical data describing telecommuting that is either verifiable or concordant cannot be found, and is one of the most characteristic features of existing empirical research on the subject (Christensen, 1985). As noted above, estimates of the number of telecommuters, either full-time or part-time, vary widely, with much of the variation due to the lack of systematically collected data on the practice by bodies such as the census, Statistics Canada, and government labour bureaus. This difficulty is further complicated by inconsistent and often loose definitions of telecommuting, and the use of anecdotal evidence, optimistic speculation, and unverifiable or nonrepresentative surveys. Existing U.S. information on the occupational characteristics of businesses located at the home addresses of their owners is so aggregated as to be meaningless with respect to research on telecommuting (Kraut and Gambsch, 1987). Questionnaire results are generally small in scale, usually from non-randomly selected groups, and of illustrative value only (e.g., surveys by Pratt, 1984; Salomon and Salomon, 1984; Olson, 1985; Ramsower, 1985). Empirical research on the subject faces numerous conceptual and practical obstacles; Huws (1984) observes that:

(h)omeworkers are a notoriously difficult group to reach, and one of the most intractable problems for any researcher investigating their situation is identifying and communicating with a representative sample.

Pratt (1987) and Huws (1984) indicate that while many home-based workers, including telecommuters, may be willing to discuss
their work arrangements on an informal basis, they become reluctant to participate in a formal study, even with assurances of confidentiality.4

It was accordingly decided that any attempt to conduct an empirical study of a group of telecommuters would likely be unprofitable for three reasons: (1) initial enquiries by the author found a general reluctance among companies with nascent home-based work programs to formally discuss the subject, (2) the likely sample size (20-25 individuals) would be too small to draw statistically significant results, and (3), the individuals involved would be pioneers and innovators in the activity, and it would of dubious value to try to impart their characteristics to the greater population when assessing the potential implications of telecommuting.

Consequently, it was decided to investigate telecommuting and its potential impacts by conducting a critical review of the literature on the subject. This review drew upon sources from a wide variety of disciplines: geography, urban planning, organizational behaviour, law, labour studies, personnel management, sociology, communication studies, and cultural criticism. References were also drawn from the popular press, government reports, business publications, and the alternative lifestyles literature. It is recognized that there are

4 In a survey of 177 Ontario businesses in which 30 replied that they had a work-at-home program, a follow-up survey was conducted in which only 6 of the 30 indicated that employees could work at home during the day (Duxbury et al., n.d.).
limitations in the literature; the subject is sufficiently new that much of its commentary involves speculation and is of uneven rigor and quality. Nevertheless, it has developed to a sufficient mass that it is possible to identify particular trends, issues, and even latent schools of thought developing.

This thesis is primarily limited to examining the phenomenon of home-based telecommuting. As noted above, there are alternative forms of telecommuting involving satellite and neighbourhood work centres; this thesis will not examine them, except for brief discussions in Chapters Seven and Eight. This thesis is not limited to a place-specific examination of telecommuting. Literature on telecommuting is primarily from American and English publications, and is usually focused on general trends. While the discussion on policy issues in this thesis will focus on British Columbia statutes and home employment by-laws from Greater Vancouver Regional District municipalities, these are mainly used for illustrative purposes; the literature indicates that most of the issues are found in other jurisdictions.

1.5 SEQUENCE OF PRESENTATION

Chapter One provides an introduction to the subject of the thesis and outlines some of the questions raised in the literature on the nature and scale of telecommuting, and the evolving relationship between telecommunications and urbanization. Chapter Two examines the theory and practice of
telecommuting. It reviews the conceptual history of the phenomenon, provides brief summaries of several telecommuting programs, and outlines some characteristics of telecommuters and successful telecommuting programs. Chapter Three provides the contextual background to telecommuting by examining the principal forces that have contributed to its introduction: (1) the rapid growth of computerization and its applications throughout society, and (2) the transition of the economies of the Western nations from being based mainly on agriculture, resource extraction, and the manufacture of goods, to providing services and the creation, storage, and manipulation of information. Chapter Four examines the relationship between telecommunications technology and urbanization, focusing on the development of the so-called telecommunications infrastructure, the substitutability of telecommunications for travel, and the technology-facilitated intra-urban mobility of office activities. Chapter Five explores the relative advantages and disadvantages of telecommuting as experienced by individual employees, employers, and society. Chapter Six provides a review of several factors external to the practice of telecommuting that will likely influence the degree and manner in which it is adopted in the short term. These factors include: attitudes toward the home as a workplace, the introduction and diffusion of office automation and information technologies, the responses of organized labour, and the degree to which a technology is determinative of its outcome. Chapter Seven examines policy
aspects of telecommuting including the municipal regulation of home-based employment, the regulation of employment standards, and the implications of telecommuting for land use planning. Chapter Eight summarizes the thesis, and provides suggestions about areas for future enquiry and policy consideration.

1.6 RATIONALE AND JUSTIFICATION

This thesis seeks to explore a phenomenon of considerable potential significance to urbanization and urban planning; taken to an extreme, telecommuting could conceivably lead to the spatial dissolution of cities. It is difficult to know how much credibility to attach to this potential because the topic has only recently begun to receive rigorous and critical consideration in the literature. It is clear that societies throughout the world are undergoing rapid and profound change, the shape, magnitude, and consequences of which one can only begin to appreciate. While the notion that Western societies have entered an "information age" - in which access to information is increasingly the basis of power - is generally accepted as given, the true nature of these changes, and their effects on individuals, organizations, institutions, and social artifacts, remains unclear. While some, such as Bell (1976), Toffler (1980), and Masuda (1985), assert that these changes are revolutionary in nature and are leading directly to a fundamentally new social order, others such as Stearns (1977), Harrington (1977), Kranzberg (1985), and Roszak (1986), question
how significant these changes may be, and look for the substance behind ever mushrooming quantities of exuberant, but sometimes baseless, hype.

Clearly it is beyond the scope or intent of this thesis to comprehensively address these issues. It is hoped that this thesis will, however, draw attention to the many uncertainties found in these areas and provide a critical perspective to topics that are suffused with hype and frequently treated in an unquestioned and deterministic manner. By having a better understanding of the nature and characteristics of social, economic, and technological change, planners, politicians and others involved in the identification, development and delivery of public policy will be better able to make decisions from a position of informed strength, rather than uninformed weakness. Within the context of urban planning, the value of this approach has been underscored by Globe and Mail publisher Roy Megarry (Science Council of Canada, 1981, p. 39):

... The so-called wired city, has been talked about for over a decade. I think the big danger we now face is that because it has been heralded for so long and still has not arrived - we run the risk of concluding that it will not arrive. One of the mistakes made in predicting the arrival of the "wired city" was the implied assumption that it would develop in a well-planned integrated way. The big danger we now face is that it is arriving but it isn't well planned and it isn't integrated.
CHAPTER TWO

THE THEORY AND PRACTICE OF TELECOMMUTING

2.1 INTRODUCTION

During recent years, numerous articles about telecommuting have appeared in a wide variety of publications (e.g., Maloney, 1982; Paddy, 1982; Nelson-Horchler, 1983; Grieves, 1984; Herteaux, 1985; Kelly, 1984; Lewis, 1984; Wolfgram, 1984; Hellman, 1985; Atchison, 1986), and several books have been published on the subject (Edwards and Edwards, 1985; Gordon and Kelly, 1986; Kinsman, 1987). Yet, as a subject of research, telecommuting contains numerous uncertainties and ambiguities, for while it has received relatively widespread coverage in the academic, popular, and business literature, there are no accurate statistics available on its extent or rate of adoption. Anecdotal evidence is sometimes used as the basis for sweeping statements and projections; forecasts of adoption rates are often based on inconclusive data, small-scale surveys, or questionable causal relationships, and a disconcerting amount of the literature is based on second or third-hand commentary, conjecture, or wishful thinking. Perhaps the best assessment of much of the literature on telecommuting remains the 1977 comment by Harkness that "a great deal of it is reiterative and most of it is highly speculative." This is not to say that these shortcomings are not understandable; telecommuting is difficult to rigorously define because of the many variations in which it can occur, and there is no ready or systematically upgraded base of information from
which to monitor its characteristics. Thus, there is heavy
dependance on the use of survey data, much of which can be
challenged on the basis of representativeness. As Pratt (1987)
observes: "(t)he evolving workforce of home-based workers is
difficult to survey partly because common descriptors such as
"home", "office," and "work" are taking on new meaning."
Depending on the criteria and definition used, Pratt (1987) found
that estimates of the number of people who work at home in the
United States in 1985 varied between 9 million and 23 million, or
between 8 percent and 23 percent of the U.S. workforce.

The history of telecommuting can be characterized by three
phases, each of which reflects the social and economic concerns
of the time. In the first phase, during the 1970's, research on
telecommuting focused on its large-scale systemic aspects, using
model-based approaches to estimate aggregate social and economic
benefits and costs, particularly in terms of potential energy
savings. During the early 1980's, research shifted to case
studies of pilot programs that determined the costs and benefits
to individuals and organizations from a number of perspectives.
Employment issues became more prominent as energy concerns
became less immediate; for example, interest grew in the
potential of telecommuting to allow single parents to work at
home while caring for their children, and to enable the
physically handicapped to work from home. During the latter half
of the 1980's, interest in telecommuting tended to focus on its
benefits to employers interested in increased productivity, and
its potential to employees wanting alternate work arrangements. Telecommuting is promoted as a means for entrepreneurs to start their own businesses, as seen by the introduction of periodicals such as *Home Office Commuting*, several newsletters (e.g., *Telecommuting Review*, *TC Report*, *Microline Moonlighter*), "how-to" books directed at both employers and employees interested in home-based work arrangements (e.g., Gordon and Kelly, 1986; Edwards and Edwards, 1985), and electronic "bulletin boards" devoted to telecommuting and home-based work issues (e.g., Compuserve's *Working From Home Forum*).

This chapter will examine the theoretical basis of telecommuting, provide a brief review of several telecommuting programs reported in the literature, and finish with an outline of some general characteristics of telecommuters and telecommuting programmes based on surveys and case studies from the literature.

2.1.1 The Mechanics of Telecommuting

There does not appear to be any universally accepted definition of telecommuting, although there is general agreement that telecommuting involves performing work at a location that is remote from the central office, and electronically transferring the product of that work to a central office or other location. While this thesis will focus on telecommuting that is performed in the home of a worker, telecommuting is not limited to the home, but can be performed in other locations including hotels, automobiles, clients' offices, and aircraft. Three generic types
of fixed work locations have been identified: (1) the homes of employees, (2) satellite work centres (i.e., decentralized work centres of a single employer), and (3) neighbourhood work centres (i.e., work conducted at a single site by employees of several employers). The scope of this thesis will be limited to the first option: home-based work.

Numerous devices can be used in telecommuting including personal computers, teleconferencing facilities, telephones, fax machines, and hybrid communication devices. This thesis will focus on the use of computers and word processors, either operating as "dumb" terminals or as stand-alone microcomputers; data is transferred between the central office and the remote worksite by modem and telephone line. Using a broad definition, Cross and Raizman (1986) state that reporters have been telecommuting for years by sending stories to newspapers via telephone, teletype or facsimile equipment. It is probably inaccurate to describe this type of arrangement as telecommuting because communications technology is used to replace work-related travel, rather than the commute between the employee's home and workplace.

2.2 CONCEPTUAL BACKGROUND

2.2.1 Early Work

Most commentators ascribe the origin of both the concept and the term "telecommuting" to a study directed by Jack Nilles (1976). Written during the first energy shock of the 1970's,
the study examined the potential substitutability of telecommunications for work-related commuting and estimated its attendant costs and benefits, particularly in terms of net changes in transportation-based energy consumption. Nilles' study was not actually the first to examine the potential of working from home by the substitution of communications for commuting. Jones (1973) estimated that up to 22 percent of all 1965 work-related trips in the San Francisco Bay area were "substitution prone", while Lathey (1975), estimated that substitution was possible for 16 percent of aggregate vehicle miles travelled. The interest in substitutability is apparent when it is noted that in 1969, the journey to work accounted for 261 billion miles, or 33.7 percent, of the total vehicle miles travelled in the U.S. (Harkness, 1977, p. SC-12).

Nilles defined telecommuting as the "total or partial substitution of the daily commute" (1976, p. 4) through the use of computer-mediated communication. Telecommuting was envisioned as a logical response to many of the pressures facing contemporary cities including sprawl, the general inadequacy of public transit systems, and the increased cost and decreased availability of conventional fossil fuels. The study set out to explore the relative costs and benefits of several remote work options, examine the resulting policy implications in terms of the suitability of existing regulatory frameworks, and, to a lesser extent, examine the consequences of telecommuting for urbanization.
The study postulated that there were three factors creating a favourable environment for telecommuting, and upon which its ultimate acceptance was dependent. First, was the presence and continued growth of an "information industry" and, more specifically, "information industry routine workers", that is, employees whose work is related solely to the creation, transfer, processing, and dissemination of information. This was contrasted with work requiring the employee to be "at or near an immovable object or central location", such as a factory or facility involved with the physical processing or transfer of goods that, because of its ties to a particular location, is dependent upon transportation (Nilles et al., 1976, p. 4). The study estimated that the former group consisted of 10 percent of the 1970 U.S. workforce.

The second factor was the development of effective and relatively low-cost computer and communication technologies. The third factor, arguably the least understood of the three, was the geographic dispersion and decentralization of offices. Nilles postulated that a four-phase evolutionary process was occurring in patterns of office location: centralization, fragmentation, dispersion, and diffusion. In the centralization phase, characteristic of the traditional concept of a single location office, all work is conducted at one site. Under fragmentation, subunits of a central office relocate to remote locations by either of the following means: (1) "branching", in which the remote office becomes a miniature replica of the main
office and performs most or all of the main office's functions; or (2) "segmenting", in which a coherent functional unit, such as the data processing or accounting department, relocates away from the central office. The third phase, dispersion, involves the establishment of numerous work locations throughout an area, with each employee working at the location nearest his home. In diffusion, the fourth phase, firms maintain a relatively small core staff in a central office and use the services of specialized firms that are dispersed throughout the city, with employees working either at neighbourhood work centres or at home. Nilles does not clearly indicate whether this process is something which he believes is occurring or will occur, and while there is considerable empirical evidence of office fragmentation and some evidence of office dispersion, the diffusion phase does not appear to have yet been observed on any significant scale.

The focus of Nilles' research was a case study of the costs and benefits of the hypothetical restructuring of a Los Angeles insurance company using several different remote work options. The firm was chosen because the repetitive and routine information handling performed by many of its employees could, theoretically, be performed from remote locations by the use of telecommunications technology. Of the firm's 2,500 employees, approximately 67 percent were engaged in routine information handling, consisting mainly of underwriting new policies and updating existing ones.

The study was premised on the following: (1) decisions by
employers would be made on the basis of clear economic benefit; (2) work would continue to be performed in an effective manner; and (3) a sufficient technical base must already be available. Following an examination of the firm's communication requirements and employee characteristics, the study's authors developed an optimization model to measure the relative trade-offs associated with decentralizing the firm to between 2 and 17 locations throughout greater Los Angeles. Each option was reviewed with respect to direct economic cost, technical feasibility, corporate policy, and government restrictions (e.g., equal opportunity legislation).

While recognizing the importance of such factors as job satisfaction and the requirement of a suitable "man-machine interface", the study's authors felt that the key to determining whether an organization would choose to decentralize lay in whether there was an economic advantage in doing so. Thus, the central part of the study was a comparison of the total costs required for telecommuting as opposed to the costs of physically commuting to work. Costs for each option were measured in terms of cost per center, cost per mile of communications link, number of employees, terminal and hardware costs, total network costs, and average commuting distance.

As might be expected, costs and benefits varied according to the scenario under consideration, with the optimal case being a dispersion to six satellite offices, providing a net overall savings of (U.S.) $2.6 million per year. The study identified
savings to the employer resulting from staff reduction, lower employee turnover rates, less employee training, and a reduction in employee benefits through the elimination of free lunches and the reduction or elimination of travel subsidies built into wages. The economic benefits to employees were less clear. While commuting times and costs would be lower, this would be offset by lower salaries and the loss of free lunches. The primary social benefit of the scenario was felt to be the potential savings in energy consumption resulting from decreased commuting.

While Nilles is strongly associated by most commentators with the notion of telecommuting from home, he originally suggested that telecommuting networks would develop in which employees would work from neighbourhood work sites near to, but generally not in, their homes (Nilles, 1975, p. 1143), and that the diffusion stage in organizational location faces numerous obstacles to being accepted by large organizations in the "near future."

The most immediate physical impact of large scale telecommuting programs proposed by Nilles is on the design and operation of transportation and telecommunications systems. This includes the reorientation of transportation systems which are presently oriented to commuter flows, and the development of a more specialized wide-band communications network. In terms of land use, Nilles viewed the "rural city" ("which mixes the familiar downtown business area and suburban living", 1975, p.
as a likely consequence of telecommuting, and saw an increased potential for urban mixed use developments, where "(i)instead of monolithic buildings devoted solely to office use, activity centres may contain a mixture of offices, living quarters, and entertainment facilities."

The next major study of telecommuting occurred as part of a "technology assessment" directed by Harkness (1977). The report included a 1,000-page collection of 25 independent "impact papers", each examining an aspect of the "telecommunications-transportation trade-off", and a bibliography containing over 1,000 entries. The report noted that approximately one-half of all commercial air and journey-to-work travel is made for the purpose of generating and exchanging information (p. vi), and suggested that telecommunications could be substituted for much of this travel and that in many cases telecommunications substitution should be favored because of its low energy consumption, low environmental intrusion, high rate of innovation, falling real costs, instantaneous nature, and convenience.

Three sets of forces were suggested to be behind a fundamental change in "the present pattern of transportation, communication, and the organization and location of human activity around these linking activities" (p. 12). These were: (1) increased opposition on social and environmental grounds to the construction of new inter and intra urban transportation facilities, (2) the likelihood that cheap and portable
hydrocarbon fuel will not be available, and (3) the increased availability and decreased cost of new telecommunications capabilities. As with Nilles' study, Harkness framed his study within several scenarios (five intra-urban, three inter-urban) that "incorporated key elements of the interactions of telecommunications and travel" (p. 26). Two of the scenarios were neighbourhood work centres and working at home. The dependent variables included physical infrastructure, economic infrastructure, environment, energy, retail shopping, office employees, office organizations, and local and national social impacts. Each of the scenarios and dependent variables was then organized on an "impact matrix" which could highlight areas requiring further investigation (p. 30). The report concluded with a review of the overall benefits and disadvantages of telecommuting (called "telework" in the study), but was unable to estimate either its occurrence, or potential acceptability or adoption beyond order-of-magnitude estimates.

Much of the popular interest in telecommuting can be traced to the description of the "Electronic Cottage" by Toffler (1980) in The Third Wave. Drawing largely on anecdotal evidence of firms with home-work options, the result of research conducted by Nilles et al., and an optimistic dose of technological determinism, Toffler argued that "a whole group of social and economic forces are converging to transfer the locus of work" back into the home. These forces include the growth of the service sector, improvements in communications and computer
technology, increases in energy and transport costs, and high office space costs. Toffler also provided a sociological dimension by arguing that there are "deep value changes" occurring which are foreshadowing "a basic shift in attitude toward the family itself":

... we need only note that in the United States and Europe - wherever the transition out of the nuclear family is most advanced - there is a swelling demand for action to glue the family unit together again. And it is worth observing that one of the things that has bound families tightly together through history has been shared work... The electronic cottage raises once more on a mass scale the possibility of husbands and wives, and perhaps even children, working together as a unit.

A central part of Toffler's Third Wave thesis is that western society is becoming increasingly home-centered, and that the electronic cottage is one means of achieving this. Toffler sees a number of positive impacts of the electronic cottage, including greater community stability ("... less forced mobility, less stress on the individual, fewer transient human relationships, and greater participation in community life"), "energy decentralization", reduced environmental pollution, the development of a new group of small-scale computer stores and information services, and "a deepening of face-to-face and emotional relationships in both the home and the neighbourhood". Toffler does not predict that the electronic cottage will become the norm, or even common, in the near future; instead, he offers it as an option for consideration. Nevertheless, Toffler is often cited by writers and commentators as being a strong proponent of telecommuting.
2.2.2 **Telecommuting and Quality of Life**

During the early and mid 1980's, it became increasingly clear that in order for telecommuting to have any impact on energy consumption, there would have to be a massive investment in the telecommunications infrastructure, plus concomitant changes in organizational structure and management philosophies; telecommuting became a solution in search of a problem. As a partial consequence of this, interest in telecommuting shifted to examining the benefits it could offer to individual employees and employers. Unlike the earlier studies, this research was generally based upon actual surveys of pilot telecommuting and other remote work arrangements, and was frequently critical in its conclusions. Included in this body of work are studies by Olson (1983), Pratt (1984), and Huws (1984) that examined the characteristics of telecommuting arrangements and individual telecommuters, and surveys of specific issues, such as the review by Shamir and Salomon (1985) of the effect of telecommuting on quality of working life, and the highly critical examinations by Christensen (1985, 1987) of the impact of telecommuting on women and family life. Much of this work was summarized in a report by the U.S. National Research Council (1985), which included several case studies, and a review of issues and problems encountered to that time.

2.2.3 **Recent Work - Still a Solution Searching for a Problem?**

In recent years, research on telecommuting appears to have
plateaued. Although it has clearly not reached or even approached the optimistic projections made by Nilles and others that 15 percent of the U.S. workforce would be telecommuters by 1990 (cited in Cowen, 1981), there is a growing consensus in the popular, academic, and business literatures suggesting that there is interest in telecommuting as an employment and lifestyle option, analogous to that shown towards flextime and job-sharing, and that it will most likely be used on either a part-time or temporary basis.

Some of the interest in telecommuting has been rekindled by developments in communications and information technology, including the introduction of low-priced fax machines, laptop computers, personal photocopiers, cellular telephones, and telephone options such as call-forwarding (Schwartz and Tsiantar, 1989). These technologies have helped popularize the notion of the "virtual office", that is, that office work does not have to be done within the physical confines of an office, but can be done wherever the worker is located (Giuliano, 1982). Telecommuting is also seen as a means to an end by many entrepreneurs, small business owners, and managers. The periodical *Home Office Computing*, with a 1988 circulation of 420,000, is, as its name suggests, directed towards people who operate businesses, often on a part-time or supplementary basis,

---

1 Source: 1988 edition of National Directory of Magazines. By way of comparison, the circulation of the U.S. issue of *Time* magazine was 4,600,000, the Canadian issue of *Time* was 345,000, and *Sports Illustrated* was 500,000.
from their homes. It includes regular columns on subjects such as the use of databases, word processing and desktop publishing systems, business advice, and finance. It also reviews and compares new products, and reports on trends in home-based work, lifestyles, support services, and ways to improve business. Kinsman (1987) has identified periodicals in the United Kingdom which cater to home-based workers.

2.3 EXAMPLES OF PROGRAMS REPORTED IN THE LITERATURE

Much of the literature on telecommuting and home-based work consists of reports, often anecdotal in nature, of organizations with home-based work programs. Empirical research on the topic often consists of case studies or surveys, with the latter consisting either of participants involved in programs at a particular organization or group of organizations (Pratt, 1984; Ramsower, 1985), or compilations of questionnaire surveys distributed to, for example, readers on a magazine mailing list (Olson, 1985). Results from these surveys will be discussed below. This section will provide a brief review of several programs described in the literature. The purpose of this review is to illustrate the variety of programs that have been attempted and give an indication, where possible, of the degree of success that they have met.

---

2 As an indication of its shifting market, Home Office Computing was titled, until late 1988, Family and Home Office Computing.
2.3.1 **Control Data Corporation**

Control Data Corporation (CDC), a 50,000 employee Minneapolis-based company that manufactures computers and computer peripherals, and provides data, computer, and financial services, has been involved in a high profile home-based work program. Known as Alternate Work Sites (AWS), CDC's program began with sixty professional and managerial employees in a voluntary work-at-home scheme, and was later extended to include clerical employees who used company supplied word processors at home.

One frequently-cited element of AWS is "Homework", a vocational training and employment preparation program for the physically disabled. Begun in 1978, Homework provides training in business applications computer programming using computer-based instruction, and is conducted in homes, hospitals, rehabilitation centres, and nursing homes. Homework participants are trained with the assistance of PLATO software, a computer-based education system that is touted by CDC as providing individualized, student-paced instruction that is integrated into a conventional learning system. A PLATO terminal can be used between 18 and 22 hours a day, seven days a week, providing flexible training schedules. CDC indicates that graduating students are placed into competitive full-time positions as programmers.

A 1982 survey by CDC of AWS participants found that the average employee in the program had 5.5 years of tenure with the
company, and was involved with AWS for an average of 20 months. Use of AWS by employees varied between one day per week to full time, with an average of three days per week. Most participants worked from their homes, although some worked at other CDC sites. Pickup and delivery of work was done by a variety of means, including transport by the employees themselves, the use of computer terminals linked by telephone, inter-office mail, and the post office. Advantages cited by employees included reduced commuting times and costs, and improved work environments, while the most frequently cited disadvantage was reduced interaction with co-workers. Some employees also indicated that they found it difficult to separate work and home and did not know when to stop working. Managers estimated that productivity increased on average by 20 percent, but that it did not increase with all employees. Despite the reported successes of AWS, it was reported that as of 1983, the number of CDC employees involved in AWS decreased to 48, and that CDC did not intend to promote the program for "able-bodied employees" other than to the extent that it provided an option by which "to tailor the workplace to each employee's life situation" (Manning, 1985).

2.3.2 F International

Based in the United Kingdom, FI was founded in 1962 with the specific goal of providing work for women computer professionals who have to stay at home because of family commitments. FI is a computer consulting firm that specializes in integrated office
information systems, data processing services, hardware and software evaluation, software development, user training, and installation support. During the mid 1980's, the firm's revenues from services were approximately $10 million per year. As of 1985, the firm was handling about 200 projects for about 120 clients per month, with work done by teams of between 2 and 75 employees. Approximately three-quarters of the firm's 1,000 employees work on a freelance project-by-project basis, and average 20 hours of work per seven day week (Shirley, 1985). Over 90 percent of the company's workforce is female, and consists largely of women looking after children or elderly family members, the physically disabled, as well as those who like to work from home.

FI is not truly home-based; it has ten offices worldwide, although its offices are used mainly for administrative purposes. Surprisingly (considering the subject of the work) relatively few of FI's workforce have a computer at home, with much work being written or dictated onto tapes from which stenographers make typed copies. Thus, much of FI's work would not come under the definition of telecommuting being used in this thesis. It has been reported, however, that FI employees are beginning to use home computers, partly because of increased speed and efficiency (Collins, 1985). The daily operations of FI are dependent on the use of the telephone and postal system, fax machines, and contacts at the central offices who relay messages.
2.3.3 **Best Western Hotels**

Best Western Hotels provides an extreme example of how telecommuting can be used to provide access to new labour pools. After the hotel chain had difficulty in the mid 1980's finding booking agents who could work at peak times, it contacted the Arizona Centre for Women (ACW), a minimum security prison. Best Western then set up a telephone booking office at the prison which has employed up to 53 inmates at a time. Best Western pays its inmate employees the same wage as its outside reservation agents receive, although the inmates are not eligible for any employer benefits, and 30 percent of the inmates' after-tax income goes to the prison for room and board. According to one report, Best Western hired a number of former inmates after their release from ACW (Rubin, 1984). The use of prison inmates for commercial employment purposes has been criticized, however, because of its tendency to undercut wages paid to employees in the free market (Berch, 1985). Other versions of this form of remote work have been conducted in California and New York (Peterson, n.d.).

2.3.4 **Mountain Bell/Pacific Bell**

Both Mountain Bell and Pacific Bell, two Bell Operating Companies created by the AT&T divestiture, have adopted telecommuting programs. The Mountain Bell program began with a 1980 pilot project involving eight managers who wrote instructional manuals for computer programmers and had no
supervisory responsibilities (Phelps, 1985). After a nine month period, three of the managers returned to their original worksite, citing weight gain, spousal conflict, and loss of social contact. Mountain Bell has claimed that the project resulted in a 50 percent increase in productivity, although there was a drop in overall productivity during the first month, primarily due to individual adjustments to the new work environment.

The Pacific Bell program initially involved 100 employees from a mixed group of job categories who worked from their homes, satellite offices or a neighbourhood work centre (Gordon, 1985). One group of 32 specialists who automate equipment maintenance procedures were transferred to their homes from three equipment offices that were subsequently closed, for an annual saving in 1985 of $40,000. The automation specialists use portable video terminals leased by Pacific Bell to provide access to an electronic mail network they use to stay in touch with each other, and are able to go to one of a hundred maintenance centres when they are unable to work from home or need resources that they do not have at home. Pacific Bell's program has expanded to more than 500 employees, including computer analysts, programmers, engineers, systems analysts, and accounting personnel, (Christensen, 1987), and it has been reported that an additional 400 workers telecommute on an informal basis (Schneider and Francis, 1989). Each employee reports to the office at least once per week.
Olson (1988) has suggested that one of the reasons Pacific Bell and Mountain Bell are interested in telecommuting is the market potential of the technologies that support telecommuting; if telecommuting were to become widespread, there would be an increased market for telecommunications services in the home.

2.3.5 Southern California Association of Governments/California State Government

What may be the most ambitious attempts to implement large scale telecommuting programs have been undertaken by the Southern California Association of Governments (SCAG) and the California State Government. SCAG is the regional planning agency for the Los Angeles and Orange County metropolitan areas. Its program followed a comprehensive two year background study that explored the concept of telecommuting, and considered some of its potential impacts on land use, employment location patterns, the use of transportation systems, and air pollution (SCAG, 1985). A pilot study involving 15 of SCAG's 130 employees was undertaken in 1986, and following an evaluation, a more formalized program began in December 1987. The SCAG telecommuting program was used to help develop a telecommuting program in the California State government. Following a two year pilot program involving up to 150 management and non-management employees in 17 state agencies, the state government has entered legislation creating an agency that will oversee telecommuting arrangements among state
agencies (Wagel, 1988). Three principal concerns were behind the state program: (1) societal issues, such as improving air quality and reducing energy consumption, (2) management issues, particularly improving quality of work, employee productivity, and attraction and retention of employees, and (3) employee issues such as increased flexibility and control over work.

Both the state and SCAG programs have been influenced by the presence of the South Coast Air Quality Management District (SCAQMD), a state authority whose mandate is to control pollution and improve air quality throughout the South Coast region of California (Stevenson, 1988). The SCAQMD has recently shifted its focus from stationary source air pollution to implement transportation regulations directed at improving air quality. One approach that has been adopted is Regulation XV which is directed at reducing automobile traffic between 6 a.m. and 10 a.m., and SCAQMD has encouraged telecommuting as one means of achieving this. As a consequence, a number of major employers, including governments, have taken a variety of steps to reduce the number of employee trips including car pooling, flex-time, and the introduction of telecommuting.

2.4 CHARACTERISTICS OF TELECOMMUTERS

As noted above, there are numerous methodological

3 California Assembly Bill 29-63.

4 Personal communication with David Fleming, Program Manager, Telecommunications Services, California Department of General Services, August 21, 1990.
difficulties in obtaining information about telecommuters, and, consequently, much of the literature is based on anecdotal accounts, such as those found in the case studies outlined above. Nevertheless, case studies and a growing body of survey data have provided a broad overview of the characteristics of telecommuters, although their conclusions often vary considerably, reflecting differences in groups surveyed, the survey methodologies adopted, and target groups.

One clear conclusion is that there is no single model of a telecommuter. Case studies and surveys show that telecommuting is often sought by two types of organizations: (1) large organizations that, for a number of reasons, use innovative technology and work arrangements, and (2) smaller entities, especially one person companies, in which telecommuting or other work-at-home arrangements may be key to the survival and success of the operation. Telecommuting can be permanent or temporary in nature, full-time, part-time, or intermittent, part of a formal trial or program undertaken by an organization, or an ad hoc arrangement taken by individual employees, and done either with or - in the case of "teleguerrillas" - without the knowledge or permission of the employer. There are self-employed individuals who have traditionally worked from their homes, but who are now characterized as telecommuters because they use computers in transmitting the product of their work, whereas in the past they would have used another means, such as the telephone or couriers. Olson and Primps (1984) observe that telecommuting is not always
indicative of work at home, since modem-equipped computers allow employees to work while travelling, and it has been reported that one U.S. company sells a $60,000 luxury van that has a cellular telephone, laptop computer, and cellular fax machine (Schwartz and Tsiantar, 1989).

One of the earliest surveys of telecommuters was conducted by Pratt in 1981 (1984). Based on a series of questionnaire and unstructured interviews with 46 home office workers, she found that they were not a homogenous group, but could clearly be differentiated by job function. Pratt categorized her respondents into three occupational groups: (1) clerical women working full time as employees or on contract performing word processing or data entry work (9 percent), (2) managers working part-time or intermittently at home (39 percent), and (3) professionals such as computer programmers, scientists, consultants, and stock brokers (52 percent). Of the latter group, one third worked at home full-time, while the remainder worked at home part-time or intermittently. Individuals who supervised home-based employees indicated in interviews that several categories of employees were poorly suited for work at home and generally returned to the office. These included unmarried individuals whose social life was based on office contacts, handicapped employees who were unable to spend long hours working at a computer terminal, workers whose families objected to their continued presence in the home, and individuals who lacked enough self-discipline to work without continual
supervision. Of the 27 respondents who evaluated their own performance, 67 percent felt that their productivity increased because they worked at home, 26 percent saw no change in productivity, and the remainder thought their productivity decreased because of distractions in the home. The primary benefit cited of home-based work was flexible work schedules; workers in all categories indicated that they had more spare time because of time not spent commuting, socializing at the office, or being interrupted at work. Many indicated that they could work at almost any time of the day, and only 40 percent of those interviewed started work between 7 a.m. and 9 a.m.

Another early survey of home-based workers (described as people "working from home with new technology") was conducted by Huws (1984) in the United Kingdom. Seventy-eight questionnaire respondents were obtained through appeals in the media. Of that group, 50 percent were computer programmers, 13 percent were computer analysts, 10 percent were computer consultants, 5 percent were computer project managers, 11 percent did clerical work, and the remaining percentage were writers or translators. Unlike Pratt's survey, in which 56 percent of the respondents were male and 44 percent female, 95 percent of the respondents in Huws' survey were female, and most indicated that they worked at home in order to care for their children. All of the respondents had previously worked in offices, and two-thirds had begun working at home after becoming pregnant. The average work week was 22 2/3 hours, just over half worked 5 days per week, and 20
percent worked 6 or 7 days a week. One-third of the respondents indicated that they had periods without work. Seventy-two percent were paid hourly, 8 percent were salaried, and 17 percent were paid "by the job."

The large role played by employees in computer related occupations was found in a questionnaire survey conducted by Olson (1985), although this likely resulted from the nature of the medium used to obtain respondents. Of 958 responses to 5,000 questionnaires sent to readers of Datamation magazine, 434 respondents, or 45 percent, claimed to do some work at home. Sixty percent of those who did not work at home indicated that they would like to do some work at home, while 16 percent of the total indicated they did not want to work at home. Fifty percent of at-home respondents were employed by another person or company, and 34 percent were self-employed (15 percent were "other"). Forty percent listed their occupation as data processing managers, 26 percent were non-managerial computer professionals, and 7 percent were non-computing professionals. While 50 percent of home workers had a separate home office, only 12 percent of respondents worked at home occasionally instead of going to the office, 10 percent worked at home on a regular basis, and 6 percent worked exclusively at home. The most common reason for working at home was increased productivity (56 percent), although 46 percent indicated that they wanted to work at their own pace, and 31 percent wanted to earn more money. Interestingly, only 21 percent responded that they wanted to
reduce commuting time. Unlike the survey by Huws (1984), 89 percent of the respondents to Olson's survey were male, and 83 percent were married. Eighty five percent were at least somewhat satisfied with their at home work arrangements, although when asked about their ideal work arrangement, 71 percent indicated a preference to work both at home and at a central office, and only 10 percent responded that they wanted to work solely at home. As with other surveys, the most frequently cited disadvantages of working at home were working too much (40 percent), and lack of interaction with co-workers (36 percent). Olson concluded that telecommuting was limited by the then available technology, which failed to provide access at home to resources available at the office, and that a further "significant barrier" was lack of exposure to corporate culture. By working at home, employees felt that they lost a sense of belonging, and managers prefer to see employees that they manage.

Duxbury, et al., (n.d.) undertook a survey of Canadian managers' and employees' attitudes towards telecommuting. Conducted in 1985, the survey was sent to Ontario businesses on Datamation magazine's reading list. Of the 177 companies from which responses were received, 30 indicated they had a work-at-home program, although a follow-up telephone survey found that only 6 of the 30 had programs which allowed a worker to stay home at least part of the day. The other 24 companies that indicated they had work-at-home programs provided home computer terminals to employees, but expected that they would be used
outside of regular working hours.

The study also included an attitudinal survey of 317 managers and professionals at workplaces where personal computers were used. Of the 205 responses received, 68 of the respondents were classified as "employees", 78 were "managers", and the remainder were dropped from the survey because of a lack of organizational affiliation. The mean age of the respondents was 42 for managers, and 31 for employees. On average, managers had 14 years experience with their organization, while employees had 8 years, and managers had an average salary approximately double that of the employees' $31,290. Overall, employee respondents had more experience with personal computers than did the managers, a higher self-evaluation of their computer skills, better typing ability, and more positive attitudes towards computers. The questionnaire found that respondents classified as employees were more attracted to telecommuting programs than were those classified as managers. While employees perceived that job-related stress would decrease and quality of work life would increase with telecommuting, managers tended to have no strong opinions on the subject, but did feel that telecommuting would not lead to increases in employee productivity. Managers did feel, however, that their job satisfaction would decrease with telecommuting, which, the study argues, would occur because managers get a large part of their satisfaction from interactions with others. Duxbury et al. concluded that considerable resistance exists among managers to remote work, with most of the
benefits perceived to be going to employees. The employee respondents were generally ambivalent towards telecommuting, although some advantages were cited. Both groups felt, however, that their organizations did not support the idea of telecommuting.

A recent survey (September 1989) of readers of the periodical *Home Office Computing* had somewhat different results. Compiled from 1,100 of 4,000 reader responses to a survey included in a recent issue of the magazine, the respondents consisted mostly (75 percent) of individuals who own and run home-based businesses. Only 17 percent of respondents telecommuted with a central office at least once per week, compared with the 31 percent who brought work home in the evening from a central office. The average age of respondents was 41 years; 68 percent were male, 32 percent female. The most frequently cited professions were: "media relations/PR" (21 percent), "consulting services" (14 percent), and "computer services" (13 percent). The most common reasons given for working from home were convenience (72 percent), starting a business (56 percent), to be boss (51 percent), and to have a more flexible schedule (46 percent). Only 23 percent indicated they worked at home to avoid commuting. The main advantages given for working from home were being able to control work (28 percent), greater productivity (22 percent), and more money (10 percent). The biggest disadvantages cited were distractions by family and friends (21 percent), working too much (15 percent),
and difficulty in finding new clients (13 percent). Sixty-six percent of respondents indicated they work longer hours at home than at a central office, 59 percent take less vacation, 61 percent socialize less, and 57 percent are more involved in community activities. Ninety-seven percent of respondents use personal computers, with the next most common hardware being answering machines (84 percent), modems (54 percent), cordless telephones (46 percent), multiline telephones (29 percent), and photocopiers (26 percent). While the survey is interesting because of its size and currency, its utility is limited because it does not distinguish the proportion of respondents who are full-time telecommuters from those who work at home part-time or operate a home business that is secondary to other employment.

As will be discussed below (Chapter 6.2), there is little agreement on the question of how many people are telecommuters. Figures that have been cited in the literature include 3,000 - 5,000 (Noble, 1986), 240,000 (Elmer-Dewitt, 1986), 7 million (Atchison, 1986), and 20,000 (Lewis, 1988). Kraut (1988, in Christensen 1988a) suggests that the most appropriate approach is to distinguish between people who work at home "a substantial amount", which he calls primary homeworkers, and those who do little work at home, which he calls supplemental homeworkers. Using U.S. census statistics for a study of "home-based white collar employment", Kraut found that the proportion of the U.S. non-farm workforce which worked as primary homeworkers declined from 3.6 percent in 1960 to 1.6 percent (or 1.3 million people)
in 1980, but that a far greater proportion (between 18 and 30 percent) of the non-farm labour force worked at home as supplemental homeworkers. Kraut concluded that primary homeworkers generally worked at home to subsidize their businesses and increase their employment flexibility. He noted, however, that full-time home-based workers tended to earn only 70 percent of the income of conventional workers. Reasons suggested for this include that many homeworkers work part-time, are often self-employed, and, abstrusely, "simply because they work at home." The latter point refers to suggestions in the literature that home-based work is a mechanism used by employers to pay less to workers with few labour market alternatives. Kraut argues against this exploitation model, noting that, overall, home-based workers earn less than other workers whether their occupational status is that of employees or self-employed, and that the income drop is observed among both men and women.

2.4.1 Characteristics of Successful Telecommuting Programs

There is agreement in the literature that successful telecommuting programs require a combination of appropriate tasks, employees, managers, and employers (Peele, 1982; Upton, 1984; Kelly, 1985; SCAG, 1985; Cross and Raizman, 1986).

The most appropriate tasks for telecommuting are usually those that involve either: (1) routine and clearly defined tasks, or (2) mental concentration. An example of the former is data
entry work, while a project-oriented task, such as report writing, is an example of the latter. Regardless of the task, most commentators agree about the importance of having good communication between the employee and the employer, and setting well-defined goals, milestones, and distinct beginning and end points. Tasks involving information manipulation are usually better suited for home-based work than those requiring interaction with other people, and tasks that have more than minimal physical requirements or require a variety of office accessories, such as files or special equipment, are usually not suitable.

Frequently-cited examples of occupations suited to telecommuting include writers, journalists, word processors, data entry workers, securities agents, financial analysts, computer systems analysts or programmers, accountants, telephone operators, travel agents, and insurance agents.

The following characteristics have been cited as common to successful home-based workers: (1) motivation and self-discipline, usually expressed by being organized and following a strict routine, (2) adaptability to social, technical, and managerial problems, and (3) a lack of gregariousness or a preference for solitary work conditions. It is often stressed that employees should volunteer to work at home, rather than being told to do so.

The appropriate choice of managers and management systems is cited as one of the most important and frequently neglected
aspects of many telecommuting programs. Managers must be able to give up direct supervision of employees, and base evaluations of employees on measurements of results and assessments of the actual work done by employees. It has been suggested that managers should have direct experience working as a telecommuter. The need for mutual trust and confidence between the employee and employer has also been emphasized.

Along with having appropriate communications equipment, employers have to be able to deal with people on an individual basis and provide support staff for remote work arrangements. The employer's corporate culture must be able to accept remote work and not allow it to hinder or harm the careers of remote employees. The employer must also commit the necessary planning and resources to the arrangement including a pilot program to determine problem areas and a formal training program so that each participant knows his or her obligations.

According to Cross and Raizman (1986) about one-half of the companies that have had telecommuting programs have abandoned them within two years. The most frequent reason cited is a lack of standards and objectives, although other reasons include poor management, inadequate programing standards and documentation, and poor communication between employees and managers. Technical problems are rarely given as the reason for abandoning a telecommuting program (Cross and Raizman, 1986), and it is the opinion of commentators such as Olson (1988) and Christensen (1987) that managerial hostility, rather than technical
limitations, is the biggest obstacle facing the adoption of telecommuting.

2.5 CONCLUSION

Telecommuting is a form of home-based employment in which computer and telecommunications technology substitutes for the physical commute to a centralized workplace for a worker. The history of telecommuting may be characterized as that of a solution in search of a problem; despite the efforts of promoters and researchers, telecommuting has failed to achieve a level of adoption anywhere near that forecast. This is arguably due to the overdependence of many commentators on a deterministic view of the process of innovational diffusion, a failure to appreciate the heterogeneity of work and work arrangements, and bad forecasting. Accordingly, telecommuting has been adopted in an incremental, often ad hoc manner, and frequently without organizational support or permission.

There is no clear image of an archetypical telecommuter. This is partly due to the diverse definitions used to describe telecommuters, methodological difficulties in identifying them, and limitations in data. Much of what is known about telecommuters has come about through anecdotal evidence and surveys of limited populations. Frequent repetition of many of these anecdotes are found in the literature, possibly creating an illusion that telecommuting is more widespread than it is. Anecdotes and surveys indicate, however, that telecommuting has
been applied to diverse settings and undertakings, and suggests a vast range of potential applications. There appear to be three principal occupational categories of telecommuters: (1) managerial and professional employees who voluntarily work at home, usually on a temporary or part-time basis, (2) clerical employees, usually female, usually working at home on a full-time basis, and (3) self-employed entrepreneurs who adopt telecommuting as a means to start or assist their business. While the latter group does not fall within the definition of telecommuting being used in this thesis, it has recently become an influential element promoting home-based employment, and is likely to influence trends and developments in that area.

Successful telecommuting programs require the selection of appropriate tasks, employees, managers and managerial style, and should only be undertaken by employers that will provide the necessary technical and management support.
CHAPTER THREE
OPPORTUNITIES FOR TELECOMMUTING: A CONVERGENCE OF FORCES

3.1 INTRODUCTION: A TIME OF TRANSITIONS

A premise frequently found in the literature on telecommuting is that there is an inevitability to its widespread adoption, and that this is largely due to a series of fundamental changes occurring throughout society, although the definition of the scope and nature of these changes varies between commentators (Pratt, 1987). Gordon and Kelly (1986), for example, list four "key trends" that underlie the growth of telecommuting: changes in computers and related technology, changes in corporations, changes in the preferences and values of employees, and the increased use and availability of personal computers. Hewes (1981) suggests that telecommuting is part of a larger social revolution in which the workplace is starting to return to the home for reasons of economy, comfort, convenience, and a heightened sense of self-reliance based on a new "pioneering" ethic. Toffler (1980) views the "electronic cottage" as both a stimulus and product of "Third Wave" society, in which concepts of home, work, and leisure are redefined and, to a degree, merged. Cherry (1970) sees telecommuting as a by-product of technological developments in computer and communication technology, that, he argues, are leading to a physical and economic restructuring of society as significant and radical as that attributed to the automobile. Pratt (1987) suggests that the driving force behind home-based work is the desire of
individuals to have more control over their lives, and, echoing research by Olson (1983), views telecommuting mainly as an option that can introduce greater flexibility to work arrangements. Ramsower (1985) also notes that telecommuting may provide a partial solution to the problems associated with ever increasing commuting distances and times for workers, a variation of the energy cost question that stimulated the earlier work by Nilles et al., (1976).

Others, however, such as Gold and Barke (1978), argue that many of these forecasts, and especially those based on technological factors, are of limited value because they fail to address the processes involved in human communication. Naisbitt (1982) also sees a limited future for telecommuting because it fails to fulfill the "high touch" needs that individuals require to counterbalance the introduction of new technologies.

While there are variations among commentators as to the precise impetus behind the introduction of telecommuting, there is a common notion that telecommuting is, if anything, the product of changes occurring in society. In recent years there has been a growing perception that society is in a period of intense, rapid, and perhaps unprecedented flux made manifest by the entry into popular parlance of concepts and phrases such as "the information age", and "post-industrial society." Wilson Dizard Jr. (1982, p. 3) has aptly captured the breadth of this plethora of social theorizing:

The rush to identify the new information age has resulted in a wide array of adjectival cliches. There are George
Lichteim's post-bourgeois, Rolf Dahrendorf's post-capitalist, Herman Kahn's post-economic, Sidney Ahlstrom's post-protestant, Lewis Feuer's post-ideological, and Roderick Seidenberg's post-historic societies. . . . most of these epithets have been left at the post by a phrase popularized a decade ago by Harvard sociologist Daniel Bell: the post-industrial society. The common prefix of these labels suggests an autumnal quality to our age, a sense of ending.

Accompanying this perception of social change is a concern as to where society is heading, and the degree to which these changes may be anticipated and controlled. Concerns are raised as previously accepted solutions prove unable to solve problems that are found to be increasingly complex and insolubly "wicked". Quantitatively-based models and forecasts, limited by an apparent inability to accommodate parameters of realistic uncertainty such as inflation rates, recession, national debt, energy gluts and shortages, and political instability, have frequently been found to be inadequate aids for decision makers in all but the most routine exercises (Goldberg, n.d.). Rather than being knowable, predictable, and linear, our world is increasingly perceived as being unknowable, stochastic, and subject to counter-intuitive and seemingly nonsensical inter-relationships (Goldberg, n.d). What is perhaps most central to this new perception of society is the notion that society is becoming fundamentally different in some manner, and that we can no longer look to the past for clues and answers to help in making decisions about the future:

There is a widespread suspicion that we are at some unique historical crossroads, that we are at the end of the old undeviating path of economic development, that "the subject of history has changed."
(Gershuny, 1978, p. 10)
This chapter will explore the nature and scope of those changes which appear to be behind the origin of telecommuting, and, bearing in mind the uncertainties mentioned above, will focus on two factors which are most frequently found in the literature on the subject:

(1) developments in computer and communication technologies;
(2) the transition of western societies from industrial to knowledge-based economies.

Rather than extensively cataloguing the scale and manner of change occurring in these two areas, which is widespread and well beyond the scope of this thesis, this chapter will focus on those factors that the literature suggests are most relevant to the adoption of telecommuting, and will question whether these changes are as fundamental and revolutionary as some have argued, or are instead a further stage in the evolution of industrial society.

3.2 THE COMPUTERIZATION OF SOCIETY

The impacts that computers have had on society and the everyday lives of individuals, while difficult to accurately assess and gauge, are nevertheless undeniable. Beyond the traditional applications of mainframe computers in large offices, laboratories, and by the military, there is a widespread proliferation of personal and mini computers in smaller offices, stores, factories, and homes, and microchips are assuming an ever increasing role in the control of automobiles, aircraft, weapons, and even such mundane items as VCRs, televisions, washing
machines, wristwatches, and toasters. Equally significant, the business of making, selling, and repairing computers and their allied products has become a major part of the economy (Science Council of Canada, 1981), and is a key component in the development of many contemporary technologies.

The significance of computers to telecommuting is that, when combined with the appropriate telecommunications technology, they provide a technical means for one whose work involves the handling of information in computerized form to do so at a location that is remote - in the case of telecommuting, in one's home - from a traditional centralized office. Computers and telecommunications can substitute for the physical presence of the worker in an office; in effect, they allow work to be brought to the worker, rather than the reverse.

The history of computer technology and the computer industry centers on rapid increases in computer speed, storage capacity, availability, and ease of use, accompanied by corresponding decreases in computer size and cost. The literature is replete with counts of angels on the heads of pins detailing the rapid developments in computer technology. ENIAC, the first large-scale general purpose electronic computer, was built during World War II, although it was not used until 1946, by which time it was obsolete. It weighed 30 tons, covered 1,500 square feet, consumed 140 kilowatts of electricity, cost (U.S.) $400,000, and contained 18,000 vacuum tubes which failed at the rate of one every seven minutes (Shallis, 1984; Foran, 1987/88). It is often
observed that a simple computer, costing perhaps $100 and containing a silicon chip smaller than a contact lens, can outperform ENIAC. An appreciation of the degree to which computer technology has since developed is provided in this assessment by Forester (1985, p. xiii):

if the automobile and airline businesses had developed like the computer business, a Rolls Royce would cost $2.75 and run for 3 million miles on one gallon of gas. And a Boeing 767 would cost just $500 and circle the globe in 20 minutes on five gallons of gas.

A more concrete compilation of the advances in computer technology is provided by Zuboff (1988) who indicates that a computation that currently costs one dollar would have cost $30,000 in 1950, that the amount of time required for one electronic operation has fallen between 1958 and 1980 by a factor of 80 million, and that the error rate in recording data through bar codes is one in three million, compared with one error per three hundred manual entries.

It is difficult to accurately assess the influence which the computer has had on contemporary society, other than to note that it appears to be extensive (Anderson, 1985) and is widely chronicled (e.g., Dertouzos and Moses, 1980; Friedrichs and Schaff, 1982; Inose and Pierce, 1984; Forester, 1985). One indication of the place that computers have assumed in society can be seen with the 1983 choice by Time magazine of the computer as the "Machine of the Year" (Friedrich, 1983).
3.2.1 Economic Impacts of Computerization

In economic terms, the computer industry has an estimated yearly value of $250 billion worldwide although statistics on its size vary widely according to the source and definition followed (Foran, 1987/88). For example, Statistics Canada, using a definition based on its Standard Industrial Classification (SIC) system, estimated that in 1984 the Canadian computer industry generated $7.25 billion of revenue and employed 93,851 people in 2,700 firms, while a 1987 submission by four Canadian computer industry associations estimated total 1986 domestic sales at over $20 billion (Foran, 1987/88). The computer industry's share of the Canadian Gross National Product (GNP) has increased from 1.2 percent in 1980 to at least 1.9 percent in 1985, with the latter figure increasing to 5 percent of GNP if the $23 billion in revenues from firms in the more broadly defined information technology sector is included. In the United States, employment in the electronic computing equipment industry has increased from 144,000 in 1971 to over 355,000 in 1985, and the value of shipments increased over the same period from (U.S.) $6.4 billion to over (U.S.) $55 billion. 1 A survey in The Economist (July 12, 1986) found that one half of all U.S. office employees use a computer terminal, and estimated that between 1986 and 1990, U.S. businesses will spend (U.S.) $116 billion on computer hardware and (U.S.) $127 billion on software.

3.2.2 Organizational Impacts

While the computer has been the catalyst of significant economic growth, what may be of greater relevance and interest with respect to telecommuting is the impact of the computer on organizations, individuals, and in particular, the workplace, with office work systems becoming labelled with terms such as the "office of the future", the "electronic office", and the "automated office" (see Chapter Six). The automated office can be described as an office work situation in which computer and telecommunications technology, such as personal computers, word processors, telecopiers, and fax machines, are electronically linked to enable efficient and rapid processing, storage, and transmission of data. The introduction of computer-based technology is viewed by many as a means to move office productivity rates closer to those of manufacturing, by both increasing output and reducing costs. Word processing may be the most significant office automation technology introduced so far; it allows letters and documents to be written, changed and corrected quickly and easily, and by merging text files with name and address files, allows the production of large numbers of personalized letters. When combined with teletext or fax machines, correspondence can be sent electronically, at high speed and reliability, and at a relatively low cost, reducing the need to use postal systems or couriers. Perhaps the most revolutionary aspect of automated office technology is that any piece of equipment which electronically stores, manipulates, or conveys
information may be interconnected, allowing rapid communication, assuming that they are compatible.

It appears to be too early to assess how successful office automation has been in meeting its productivity goals, although it appears certain that it will restructure office activities, particularly in the case of support staff. While some (ABT Assoc., 1982) predict that office automation will allow many secretarial and clerical staff to take on more management-related duties as "administrative assistants"; others, such as Menzies (1981), have argued that there is a skill gap between secretarial/clerical workers, and professional and administrative positions that allows little mobility between the two and is having a disproportionately negative effect on the female-dominated clerical sector.

3.2.3 The Computer as Catalyst

As a component of the automated office, the computer may be viewed as a machine with no intrinsic value that is used to help facilitate a specific function. For some, however, the computer has acquired symbolic value, and is seen as a metaphor for both the positive and negative aspects of our society and era. Classification of these perspectives can be made along a number of dimensions although the two basic issues appear to be: (1) whether or not the computer is a device fundamentally different from other machines, (i.e., is computer technology revolutionary in nature?) and, (2) who, if anyone, will control the manner and
scale of its applications. Rosenberg (1986) defines the debate in terms of two opposing positions: (1) the computer is a tool and is not different from other tools used in the past; and (2) the computer is not just another tool but one that does things that only people do (i.e., "think"), and because of its potential capabilities, represents a fundamental change in technology about which people should be concerned. The debate can be further characterized by the relative degree of technological optimism or pessimism of the commentator; the consequences of the polarities described by Rosenberg vary depending on whether one views technology as a deterministic or benign force. If the latter, the question of who controls the technology, and in what manner, becomes more relevant.

Much of the strongest optimism and most enthusiastic praise for computers originates, not surprisingly, among computer scientists. An early example is seen in the 1958 prediction by Allen Newell and Nobel economics laureate Herbert Simon that "in the visible future" their research would lead to computers with problem solving capabilities "coextensive with the range to which the human mind has been applied" (Weizenbaum, 1976). In 1970, the unfulfilled prediction of Simon and Newell was restated by noted Artificial Intelligence (AI) researcher Marvin Minsky who predicted that:

. . . (i)n from three to eight years, we will have a machine with the general intelligence of an average human being. I mean a machine that will be able to read Shakespeare, grease a car, play office politics, tell a joke, have a fight. At that point, the machine will be able to educate itself with fantastic speed. In a few months, it will be at genius
level, and a few months after that, its power will be incalculable. (Roszak, 1986, p. 122)

Although these early predictions may appear, with the benefit of hindsight, to be naive and infused with hype, they have helped mold the popular cultural images relating to computers and the potential of computer technology (e.g., Kidder, 1981), and continue to be found in recent statements ranging from that of AI researcher Pamela McCorduck that computers will provide the means to "convert the entire universe into an extended thinking entity," to that of astronomer Robert Jastrow, who has described computers as "the child of man's brain rather than his loins" which will "become his salvation in a world of crushing complexity." It is suggested that the above statements reinforce the overtly critical perspective of Theodore Roszak (1986, p. 39) that "the computer has been cast in the wishful role of a benign angelic protector that will relieve us of adult responsibilities that have become too burdensome."

Much of the popular enthusiasm about computers originates with technological optimists such as Alvin Toffler (1980), who has described computers as one of four "backbone industries" of "Third Wave" society (the others are the space industry, ocean resources, and biotechnology). Although Toffler is generally optimistic about the role of computers in society, he concedes the need for a social control agent ("techno-rebels") to provide limits to their application. This optimism towards computers also underlies much of Naisbitt's thesis in *Megatrends* (1982), and in particular the notion of "computer as liberator" (p. 201), although it is ironic
that in the example Naisbitt cites to back his argument that the computer will be the "lynchpin in the newly evolving network style of management", the management style he propounds is only possible due to a "rigid system of computer controls."

Computers have also been characterized as a social change agent and a means to foster intellectual freedom and expression, and weaken the dominance of established interests. In a controversial program funded by the French government and initially directed by French writer Jean-Jacques Servan-Schreiber and U.S. computer scientists Seymour Papert and Nicholas Negroponte, an examination was made of the computer's potential to develop a new world order based on improved access to information and high technology (Dray and Menosky, 1983). The focus of the program was on improving the economic position of technologically disadvantaged groups and nations by fostering the development of "alternative computer cultures" that would adapt microcomputers to their interests and needs. To Papert, the computer is a "transitional object" or catalyst through which individuals can develop self-help techniques to better attain their goals through networks of common interest. The program has received criticism from those who question its premise that computerization may provide the means for disadvantaged groups and third world nations to "leapfrog" into the information age, as well as from those who view computer technology as a colonial artifact that imposes Western values and concepts of progress on other cultures.

Despite the numerous benefits ascribed to computerization,
there is a growing body of commentary questioning its overall benefit, and whether computers are either as useful or necessary as has been suggested in the literature. Criticisms of computers and their effects on the individual originate in a variety of sources. Within the computer science community, one of the most vocal critics is Joseph Weizenbaum (1976), who achieved prominence after he wrote a computer program named ELIZA, with which one could "converse" in English language conversations on a computer. ELIZA operated by "asking questions" and "making responses" that were based on a series of programmed rules, with the entire conversation following cues in the statements made by the human participant. To Weizenbaum's surprise (and later dismay), ELIZA became very popular among his colleagues at MIT, and was considered by a number of medical and scientific commentators to be the first step towards an effective form of computer psychotherapy. Weizenbaum was startled at the ease with which people conversing on ELIZA became emotionally attached to it and would describe the program in anthropomorphic terms. Weizenbaum has also been critical of the extravagant claims of the proponents of artificial intelligence, such as Herbert Simon, and, coupled with his experiences with the ELIZA program, has become convinced that too many individuals fail to see a difference between people and computers, and that there are certain activities which computers should not be permitted to do, whether they can perform them or not.
3.2.4 The Computer as Metaphor

Computerization has assumed a role as a metaphor for contemporary society. The use of technology and cultural artifacts to define a society or period of time is not new; Innis (1951) characterized historical periods in terms of their primary modes of communication. Perhaps the best known example of technology being used as a metaphor for society and a period of civilization is from Mumford (1934, pp. 14-15):

The clock, not the steam-engine, is the key-machine of the modern industrial age. For every phase of its development the clock is both the outstanding fact and the typical symbol of the machine: even today no other machine is so ubiquitous. In its relationship to determinable quantities of energy, to standardization, to automatic action, and finally to its own special product, accurate timing, the clock has been the foremost machine in modern technics: and at each period it has remained in the lead: it marks a perfection toward which other machines aspire.

Bolter (1984) has argued that the computer is the technology that best defines our age, succeeding the clock and steam engine associated with the industrial age; rather than delimiting the physical world or magnifying muscular strength, computers deal with information and are perceived by some to be entering the realm of consciousness. Unlike past technological metaphors of society, the computer is not a fixed mechanism performing one function; it becomes a new machine by changing its program. The computer has a versatility that is missing in other machines and Bolter suggests this reflects the human mind. To a growing number of people, the computer defines man's role in relation to nature: the computer is giving us a new definition of man, as an "information processor," and of nature, as "information to be processed."
recreates himself, defines himself as a machine" (Bolter, 1984, p. 13).

The computer and its technological retinue have entered popular culture, not only with additions to the vocabulary such as "data bank", "input/output", "download", "program", and "crash", but with concepts and perceptions relating to life, including memory, thought, consciousness, and even death and rebirth. Following a series of studies on the psychology of computer users, Turkle (1984) concluded that the computer is an "evocative" device, analogous to the ambiguous stimuli found in a Rorschach test: "(w)hat people do with computers weaves itself into the way they see the world" (cited in Forester, 1985, p. 182). Encounters with computers, especially by children, lead some to a qualitatively new set of reflections on human nature and what it means for something to be alive. Beyond being just another tool (a "number-cruncher"), the computer raises questions about the nature and substance of mind and thought:

Because they stand on the line between mind and not-mind, between life and not-life, computers excite reflection about the nature of mind and the nature of life. They provoke us to think about who we are. They challenge our ideas about what it is to be human, to think and feel. They present us with more than a challenge. They present us with an affront, because they hold up a new mirror in which mind is reflected as machine. The effect is subversive. . . . If mind is machine, who is the actor? Where is responsibility, spirit, soul? (Turkle, 1984, pp. 307-08)

Whether one views the computer as an evolutionary or revolutionary tool, it appears that in their conduct and without the theoretical pondering reviewed above, many people believe that the computer is something fundamentally new and different,
and something which can be used to dramatically change their lives. It adds an element of discontinuity to existing notions about the use of technology, and provides the potential to be adopted in ways that go beyond those found with prior technologies. As their mimicry of consciousness and human activities improves, many of the existing barriers to the use of computers will decline; acceptance of computer applications is being reinforced by the sheer, simple, and often unconscious practice gained by individuals from using computers in the home, workplace, and elsewhere.

3.3 TOWARDS A KNOWLEDGE-BASED ECONOMY (FROM WIDGETS TO DIGITS)

Of those changes underlying the introduction of telecommuting, the transition of western societies from being based mainly on resource extraction, agriculture, and manufacturing, to services and information is perhaps the best understood, in part because it most easily lends itself to direct statistical measurement and analysis. This is generally done by dividing the economy into sectors based on type of activity. The primary sector consists of resource extraction and agricultural activities, the secondary sector of manufacturing, and the tertiary sector of everything else, although the latter is usually labeled the service sector because many of its constituent occupations involve the provision of services.
3.3.1 Employment Trends

The origin of three sector economic classification is usually attributed to economist Colin Clark, who, in the Conditions of Economic Progress, described economic progress as the shift in the relative share of the labour force from one sector to another based on differential productivity rates. Thus, an increased demand for services follows the expansion of the manufacturing sector, which in turn is based on the growth of national income through increased productivity in the extractive sector of the economy. Clear evidence of this transition is traceable to the beginning of this century as service-based occupations overtook first agriculture, and then manufacturing as the principal employers in the economies of Great Britain and the United States (Jones 1982). In relative terms, the size of the secondary sector of most western nations peaked in the years immediately following the Second World War. For example, by 1945 in Australia, 1947 in the United States, 1948 in the United Kingdom, and 1955 in Canada, over 50 percent of the paid workforce were engaged in service-sector employment (Jones, 1982). More recent data continues to confirm this trend. Employment share in Canada's tertiary sector has grown from 40 percent in 1946, to 70 percent in 1988, while the secondary (including construction) and primary sectors have, over the same period, declined from 32 and 28 percent to 23.4 and 6.2 percent, respectively. The significance of the tertiary sector is even apparent in a so-

called resource-based economy such as British Columbia's, where the relative employment share in 1983 was 7.2 percent in the primary sector, 18.5 percent in the secondary sector (including construction), and 74.3 percent in the tertiary sector.3

Another indication of the shifting balance between economic sectors is seen in changes in the relative share of the Toronto Stock Exchange composite index, which measures the relative value of the 300 companies listed on the exchange with the largest amount of issued stock. Between January 1980 and October 1986, the relative share accounted for by resource sector companies decreased from 47.9 percent to 25.9 percent of the index's total value, while the share of the index made up of industrial and service sector corporations increased from 32.6 percent and 19.5 percent, to 37.3 and 36.8 percent, respectively (Jorgensen, 1986). While the 1980 list of the ten largest companies in the index contained six resource-sector companies, the 1986 list contained only one.

Similarly, a recent study has found that "virtually all" of the 1.2 million net new jobs created in the Canadian economy between 1981 and 1987 were in the service sector, although many of these jobs are part-time work, and tend to pay lower wages than those in the resource and manufacturing sectors (Lush, 1988).

3.3.2 The Evolution of Sectoral Analysis

There are difficulties with using three sector analysis, with one of the most fundamental being a matter of classification; on what basis is an economic activity judged to belong to a particular sector, and into which sector does one place activities that either appear to straddle sectors, or else do not appear to have anything in common with activities in any of the sectors? For example, while transportation and construction are neither extractive nor purely manufacturing activities, do they have enough in common with occupations such as medicine, teaching, or secretarial work to belong in the service sector, and do occupations involved in food preparation belong in the manufacturing or service sector?

Changes in workforce composition have created problems for three sector analysis that include the introduction of new occupations, such as computer programmers and operators, and the rapid growth of others, such as managers and administrators. These have produced a lopsided occupational distribution that makes distinctions between sectors of diminished value except as illustrations of the declining roles of the primary and secondary sectors, and the growth by default of the tertiary sector.

An early attempt to remedy the above deficiencies was provided by Jean Gottmann, who, in his book *Megalopolis* (1961), proposed the subdivision of the tertiary sector into two main groupings: (1) the tertiary sector, which he described as consisting of employment that required "muscular" activity, such
as that found in the transportation, trade, and personal services occupations; and, (2) the quaternary sector. The latter encompassed what Gottmann saw to be a rapidly expanding group of highly trained and specialized — and mainly white-collar — workers, and included occupations such as lawyers, teachers, managers, artists, and government administrators. There are a number of factors suggested by Gottmann to justify this social subdivision and to explain the basis of the accompanying transition in occupational structure. Quaternary sector occupations are mainly characterized as being involved with the production, processing, storage, and distribution of information. As the amount of information increases, there is a subsidiary process occurring in which the quaternary sector undergoes a self-refining division of labour into increasingly specialized fields (Gottmann, 1983). There is also a predilection within the "muscular" occupations in the tertiary sector towards substitution and elimination by the introduction of labour-saving technologies (e.g., the replacement of a multitude of personal messengers by the telephone).

Gottmann's emphasis on the importance of information as a defining factor has been continued by Bell, whose analysis of what he labelled post-industrialism describes knowledge and information as "crucial variables" that define post-industrial society in a manner analogous to the way that natural power and raw materials defined pre-industrial society, and "created energy" (e.g., oil, gas, electricity) and financial capital
defined industrial society (Bell, 1976). Bell's notion of post-industrialism focuses on the changes occurring in the social structure of society (i.e., the economy, technological base, and occupational system), and is based upon a developing transformation, observed by Bell, in the relationship between theory and empiricism, and the relative influence that each exerts in determining the political, cultural, and economic agendas of modern societies. Bell outlined five key dimensions of post-industrialism (1976, p. 14):

(1) Transition from a goods-producing to a service-based economy;
(2) The pre-eminence of the professional and technical class;
(3) The centrality of theoretical knowledge as the source of innovation and policy formulation for society;
(4) The control of technology and technological assessment;
(5) The creation of a new "intellectual technology".

Bell's vision of a post-industrial society is essentially that of a meritocracy that is guided and ruled by a technocratic elite, and in which the possession of information and knowledge is the basis of power. It is a society in which the role of invention and discovery is displaced from the "talented tinkerers" of the eighteenth and nineteenth centuries, who were often outside the scientific and commercial establishment and whose inventions were often based on trial-and-error empiricism and intuition, to the contemporary scientists and engineers who belong to the heavily funded industrial complex that characterizes the twentieth century, and whose inventions are increasingly based on
specialized applications of theoretical knowledge (Bell, 1980, pp. 164-5).

Post-industrialism should not, however, be interpreted as a replacement of industrial society; rather it is an addition to it that results in a "system of superimposed layers, like a palimpsest" (Bell, 1980, p. 4). By using knowledge as a defining characteristic, Bell has produced a form of analysis that seeks to address the over-inclusiveness of the tertiary sector found in three sector analysis.

Jones (1982) has developed a five sector analysis which attempts to better account for the activities of government, the non-wage domestic sector, volunteer work, barter, and do-it-yourself activities, than the four sector analyses of Gottmann and Bell. In Jones' analysis, the tertiary sector consists of "tangible" economic services (e.g., transportation, utilities, retailing), the quaternary sector is based on information processing (e.g., banking, insurance, real estate transactions), and the quinary sector accommodates domestic and quasi-market activities, such as hobbies, home-based occupations, and the unpaid domestic work of homemakers, and the professional provision of quasi-domestic activities (e.g., hotels, restaurants). Jones observes that there are several major characteristics in the transition from an industrial to post-industrial economy, including: a "historic" decline in employment as capital intensive investments in labour and time-saving technology displace jobs based on manufacturing; an increase in service sector employment
following the manner suggested by Bell, Clark, and others; an increase in the value of information as a factor of production, with more employees involved in its collection, processing, storage, and dissemination; and the development of a global economy, characterized by the increased power and influence of trans-national corporations, agencies, and institutions. An advantage that Jones cites for his method of analysis is its emphasis on use value, rather than marketplace value, which he argues provides a more comprehensive image of economic activity due to the inclusion of non-wage activities. By incorporating non-market activities, including those associated with the informal or underground economy, Jones hopes to introduce a more realistic form of economic analysis, echoing an argument made by Burns (1975) who has estimated that the economic value of work done by homemakers in the United States is equal to that paid in wages by corporations in that country.

3.4 THE INFORMATION SOCIETY

While there are variations among the economic classification and analysis schemes discussed above, they are all based on the need to incorporate the increasing numbers of people whose work principally involves the use of knowledge or information. A common and rarely challenged declaration found in both the mass media and among academic commentators states that western society is being transformed into an "information economy." Information is perceived to play an increasingly crucial economic role, and
one of the most salient features of modern business activity is its preoccupation with obtaining faster, more accurate, and more comprehensive flows of information. Bell (1976, pp. 18-26) has described the "primacy of theoretical knowledge" as an "axial principle" of post-industrial society; Naisbitt (1982) declares that the information age is the most significant "megatrend", and Drucker (1978, p. XXVII) has asserted that "(k)nowledge, during the last few decades, has become the central capital, the cost centre, and the crucial resource of the economy."

The main value associated with information is that it reduces uncertainty; "perfect" information is a prerequisite to perfect competition in general equilibrium theory (Bell, 1980 p. 173). Exactly how information and knowledge are defined is not, however, always clear. Not only does the definition of information vary between disciplines, but its definition is often treated in an implicit manner by commentators. A distinction has been provided by Bell (1980, p. 168), who defines information as "data processing in the broadest sense; the storage, retrieval, and processing of data becomes the essential resource for all economic and social exchanges", and is distinguished from knowledge which is "an organized set of statements of fact or ideas, presenting a reasoned judgement or an experimental result, which is transmitted to others . . . (k)nowledge consists of new judgements."

While there appears to be general agreement over the increased role that information plays in the economy, and the
accompanying shift in workforce composition towards those sectors which primarily involve working with knowledge or information, it is less clear how one defines or differentiates an information society from the industrially-based society which preceded it.

One method frequently used in the literature is to try and measure or estimate the economic value of information-based activities, and to emphasize both their rate of growth and sheer magnitude. The first attempts at measuring the economic value of the production and distribution of knowledge were made by Fritz Machlup (1962), who, using national accounts statistics, classified 30 industries into 5 classes of "knowledge industries": education, research and development, media, information machines, and information services. Machlup concluded that over (U.S.) $135 billion, or 29 percent of the 1958 United States gross nation product, was spent for knowledge, and that approximately 31 percent of the labour force worked in that sector. Machlup also estimated that the knowledge industries had expanded at an annual rate of over 10 percent between 1947 and 1958.

A more recent, and frequently cited, measure of the economic scale of information activities was provided by Porat (1977), who, using a six-sector economic analysis, estimated that 46 percent of the 1967 U.S. GNP, 52 percent of employment, and 53 percent of earned income was provided by information activities. Beyond questions of measurement, Porat's study is interesting because of its attempt to develop an information economy input-output matrix that sought to divide information-based
economic activities into primary and secondary sectors, with the distinction between the two based on whether the information is exchanged in the marketplace (primary sector), or used by organizations for internal consumption (secondary sector). Porat estimated that in 1967, 25 percent of the U.S. GNP was based on primary information sector activities, and 21 percent originated in secondary activity. The primary information sector (which was further subdivided into eight classes) included those industries that built information machines or marketed information as a commodity. The secondary information sector was divided into two classes: the public administration sector, and those private bureaucracies whose activities are not included in the national accounts as information-based. This includes activities that are not directly included in the GNP, such as planning, administration, and marketing. The remaining economic sectors consisted of the private manufacturing sector and the public manufacturing sector (i.e., infrastructure construction). Porat examined each of the 422 occupations in 201 industries reported by the U.S. Census Bureau and defined an occupation as being information-based if its income originated primarily in the manipulation of symbols and information. For some occupations, such as medicine, Porat concluded that only a portion of the activity was based on information manipulation. These activities were subsequently excluded from the final total so that any errors in the study were on the conservative side. Ironically, Porat's analysis showed that the most rapid growth in the information
economy occurred in the years prior to 1970, after which it slowed considerably, with much of the most recent occupational growth occurring among activities in the relatively unskilled and poorly paid personal services occupations.

The question arises, however, as to whether these shifts, which are often described as being "fundamental" in terms of their occupational and economic impacts, have become manifested in social and cultural terms. Alternatively, it can be asked whether the changes associated with the widespread use of computers and the development of an information-based economy are revolutionary in nature or do they merely represent a further stage in the evolution of industrial society?

There do not appear to be any widely held definitions of an information society that describe it in its own terms. Instead, most definitions of an information society are based on comparisons with industrial or pre-industrial societies. This type of analysis was utilized by Emery and Trist (1973), for example, who concluded that while most of the industrialized western nations are properly described as "post-industrial" in terms of their occupational and economic structures, they have not yet undergone any significant corresponding changes in "cultural values, organizational philosophies or ecological strategies," which continue to be expressed in industrial terms (1973, p. 158).

Masuda (1985) has employed this comparative technique in describing an information age "Computopia" characterized by the
following: a shift in core technology from that which replaces or amplifies physical labour to that which replaces or amplifies mental labour; the replacement of the mechanical factory as the basic production centre by the "information utility" (e.g., data banks and networks); the development of goal-making within voluntary communities as the underlying socioeconomic principle rather than the enterprise-based equilibrium of market supply and demand; the creation of a multicentred, "functional" society, rather than the class-based, hierarchical form associated with industrialism; and the replacement of material values with the satisfaction of "goal achievement needs". Masuda's image of an information society embraces many of the ideals and sentiments found in other expressions of the concept; information is seen as a liberator, but rather than extending individualism, it is seen as a means of creating a society that is both participatory and self-disciplined. Consumption of goods is replaced by creation of knowledge, the renaissance values of individualism are replaced by the global values of symbiosis between man and nature.

Masuda does not state that we presently live in such a society, and is skeptical about whether it is even attainable due to the influence exercised by government, military, and corporate computer users. While Masuda's notion of "Computopia" is not the only, or even necessarily a likely form, in which an information society might be realized, his characterization draws attention to the social and cultural changes that have accompanied the technical advances in computerization to date; can the scale and
magnitude of the former really be said to be comparable with the latter?

Kranzberg (1985) argues that changes in technologies do not, by themselves, necessarily lead to revolutionary social changes. To do so, he states, there must be a body of related technical advances and an attendant set of changes occurring in the "political-economic-social-cultural context of the times" (p. 36). He argues that the truly revolutionary aspect of the British Industrial Revolution was not only the changes which occurred in technical components and processes, but the fact that the new technologies stimulated a new way of living that directly affected the location and manner in which people worked, lived, thought, played, and worshipped. Perhaps the most fundamental aspect of this was the ascendancy of a new governing ethic, based upon the calculation of "economic necessity" (Rosenbrock, 1985).

This leads to an image of industrial revolution which consists of two components: (1) "fundamental technical changes in the production and distribution of goods" (to which would now be added services), and (2) an equivalent series of social and cultural changes. In the case of computerization and the information age there does not appear to be much dispute over the existence of the first component, but with respect to the second, the results appear to be less clear. For example, while computers and computer-based products and processes are seemingly becoming ubiquitous in the office and most other workplaces, initial forecasts of their reception in the home, doing
everything from storing recipes to preparing income tax returns, have proven to be overly optimistic. The introduction of the computer to the home appears to be more of an exercise in finding a purpose than in fulfilling a genuine need, and has led to an extensive advertising campaign that has attempted to stimulate demand by, among other things, inducing guilt among parents that failure to buy a computer will shortchange their children's future, promising immediate solutions to organizational problems (e.g., the example from IBM's television commercials on saving your hat factory), and, when all else fails, "reminding the consumer of video games" (Rosenberg, 1986). Unlike something with a limited, but straightforward use, such as a car or a toaster, computers have numerous potential uses, but these require an appreciation on the part of users of this potential and - unless the user is a skilled programmer - the existence of an extensive and inexpensive selection of easily-used application programs. As Rosenberg (1986) suggests, the automobile would never have become as popular as it has if one needed the skills of a mechanic to operate it. While computers may be suitable for storing recipes, it appears that, for most people, it is usually faster and easier (and certainly less expensive) to keep a collection of favourite recipes in a recipe box, and anyone whose income tax requirements are so complex as to require a computer should probably have the services of an accountant.

There are other examples in which the relative success of computer applications have fallen far short of original
expectations. While electronic mail and fax machines have become popular among business users, video teleconferencing and videotext services have failed to draw much interest. Again the issue appears to be the existence of practical and straightforward uses for the applications. Electronic mail and fax machines provide a quick, reliable, and relatively economical means of transmitting information, especially when compared to traditional postal and messenger services; video teleconferencing is expensive, has limited applications, and, when compared to telephone conference calls, does not appear to offer enough benefits to warrant its cost and inconvenience to users. Videotext services such as The Source and Compuserve have been hampered by high costs, confusing protocols, and a lack of useful services to all but a limited number of computer hobbyists, and have experienced a dramatic lowering of projected growth rates and the withdrawal of participants such as newspaper publishers Knight-Ridder and the Times-Mirror Company (Field and Harris, 1985; "American videotext failures . . .", 1986). The start up problems associated with home uses for personal computers and videotext services suggests that the diffusion of computer technology throughout society has its limits, and that the "revolution" created by computers and information is not as complete as many commentators suggest.

There are also arguments, however, which suggest that the issue is not the speed with which the information age is getting out of the starting blocks, but whether there is even a race at all. In a wide-ranging critique of Bell's notion of post-
industrialism, Stearns (1977) argues that Bell has failed to come to terms with the magnitude of the changes required to realize a social revolution equivalent to that which occurred in eighteenth and nineteenth century Europe, and, in particular, is hampered by a limited selection criteria that is based on changes in economic activities but fails to address changes in mentality and consciousness. Rather than revealing major social change, Stearns argues that Bell's analysis shows alterations to the existing industrial framework and that many of the changes Bell emphasizes, such as the growth of the service sector and the industrialization and centralization of science and technology, were already well underway in the mid-nineteenth century. Stearns' most fundamental criticism is that neither Bell nor most other commentators address the situation of the population as a whole, but instead concentrate on the social structures of the elites, and thus miss large areas of human activity, including questions about whether basic social values are being replaced. Despite the changes that have occurred to occupational structures during the past century, Stearns observes that economic classes still exist and show no signs of weakening, that much decision-making remains tied to property ownership, and that there is increasing evidence that the growing numbers of white-collar employees are merely replacing the position previously held by blue-collar employees in industrial-era organizational structures.

Bell's assertion that "the long-run historical trend in Western society [is] the move away from governance by political
economy to government by political philosophy . . . a turn to non-capitalist modes of thought" has been also challenged by Michael Harrington (1977), who argues that if Bell is correct, then the outcome of the decision-making by the new elite should be observably different from that of the old order. Harrington argues that, in practice, the basic framework remains guided by a capitalist, profit-maximizing purpose:

the normal tendency of the welfare state - even with the "new men" admittedly much more in evidence and conscious planning taking on a greater importance - is to follow the old capitalist priorities in a new, sophisticated way. . . . (t)he government and the "societal goals" that [the welfare state] articulates are subordinated to private purpose - not the other way around, . . . (1977, pp. 21-22)

Rosenbrock (1985) has also concluded that computerization will not lead to short-term changes of a magnitude comparable to that experienced in England during the Industrial Revolution, but will intensify and reinforce existing tendencies, in particular, the extension of deskill ing and job fragmentation from the shop floor to white-collar and professional employment.

A final perspective offered on the information age comes from Theodore Roszak (1986), who challenges much of the hype, folklore, and wishful thinking associated with computers and the information age, and, in particular, the often unchallenged assertions that equate information processing with thought, and information with knowledge. Roszak does not discount the potential influence and benefits of computers; but he does challenge many of the representations made by Toffler, Naisbitt, and other "data merchants" who have popularized and deified computers and the
information society while seemingly forgetting the industrial base required for an information economy to exist:

Information technology is an outgrowth of the existing industrial system, which has always been dependent on the "knowledge" that undergirds invention, management, and marketing. Like the electrical, automotive, or chemical technologies that came before it, high tech arises as another stage in the ongoing industrial process. These technologies do not displace one another; they overlap, compound, and must be coordinated. (1986, p.29)

Roszak's concerns extend to politicians who are often too eager to adopt buzzword solutions based on "high-tech", while ignoring the two-tiered society that will result, consisting of numerous poorly-paid, non-unionized, assembly workers, and a few well-paid, highly skilled, professional and managerial workers, and almost no mobility between the two groups. Roszak's strongest criticisms, however, are directed at the "Megahype" associated with selling computers, and the idea that everyone needs one:

In our popular culture today, the discussion of computers and information is awash with commercially motivated exaggerations and the opportunistic mystifications of the computer science establishment. The hucksters and the hackers have polluted our understanding of information technology with loose metaphors, facile comparisons, and a good deal of out-and-out obfuscation. (p. 45)

3.5 CONCLUSION

It is apparent that computerization and the growth of the service sector are of considerable significance to understanding the general direction in which society is headed. It is also apparent that these factors are amenable to characterization from many diverse and often conflicting perspectives.

The forces surveyed in this chapter are significant to
telecommuting for the following reasons: (1) computer and telecommunication technology provide a means for working at locations that are remote from the traditional centralized office; (2) the increasing number of people whose work is based, either wholly or in part, upon the manipulation and use of information and data, provide a constituency for seizing the opportunity provided by remote work technologies.
4.1 BACKGROUND AND THEORY

There is a growing level of interest in the potential impacts of telecommuting and other developments in communication and information technology on the processes of urbanization and their resulting impacts on urban structure (e.g., Custerson, 1973a and 1973b; Pool, 1980; Coates, 1982; Langdale, 1982; Mandeville, 1983; Kellerman, 1984; Nichol, 1985; Gertler, 1986). Pool (1980) has observed that communications technology has made operating at a distance increasingly easy, but rather than leading to a steady dispersal of population from urban centres, it has led to both the formation of suburban sprawl ("exurbia"), as well as encouraging urbanization within "superdense downtowns." There is general agreement that communications technology is influencing urban form, patterns of economic activity, and societal processes, although, as Warren and Donaghy (1986, pp. 1-2) note, there is a "schizophrenic aspect" in attitudes displayed towards it:

While far-reaching spatial effects are attributed to it, there is a readiness on the part of many to admit that we have a limited understanding of what the consequences will be for the form of urban space and how urban planners and decision makers can strategically deal with these effects from a public interest perspective.

Warren and Donaghy observe that most research on communication and information technology is directed towards its effects on economic activity, with the underlying assumption being that spatial consequences follow as a derivative result; consequently,
less inquiry has been directed towards the social or demographic effects of the new technologies.

4.1.1 Technological Convergence and Urban Form

According to Kellerman (1984), the significance of communications and information technology to urbanization has come about from the convergence of the telephone, television, and computer into a "powerful communication system", the "total effect" of which is "the possibility of transferring audio, visual, and data information cheaply to any distance in almost real-time." Collectively, these technologies can be integrated into "versatile systems" (such as local area networks or LAN's) which allow the easy, reliable and relatively inexpensive transfer of information and images between any given set of locations. This involves the application of computer and telecommunications technology in a process labelled by Nora and Minc (1980) as "the convergence of communications." The convergence of computer and communication technology has been labelled variously as telematics, communications, and informatics.

Kellerman (1984) has stated that there are two fundamental characteristics of telecommunications; first, it is a "space adjusting technique" that allows distance to be efficiently overcome by the transmission of information; second, changes to

1 This is similar to the notion developed by Gottmann (1977) of fungibility. Gottmann argues that the development of technology has been directed at making geographic space fungible,
technology and their application are so rapid that attempts to forecast them are obsolete shortly after they have been made. The spatial impact of new technologies is of interest because it has been argued that they provide the greatest opportunity since the invention of money to reduce the constraints imposed by space and the physical environment on the physical location and pattern of activities (Cherry, 1970).

While the implications arising from new technologies - both integrated and standing alone - may be significant in terms of alterations to social values, culture, and knowledge (OECD, 1975; cited in Kellerman, 1984), it is appropriate to observe when anticipating their consequences that a technology does not operate in a contextual vacuum or independently from its environment, and that technology only facilitates change and does not determine its consequences (Gertler, 1986). Accordingly, forecasts of the impact of computer and telecommunications technologies on settlement patterns or the location of economic activity requires consideration of factors including existing decision-making structures and techniques, the lifestyles, values, and cultural norms of the community or region in which the technology is used, and the properties and requirements of human communication (Gertler, 1986).

Interest in the spatial effects of communication and information technology is a departure from more traditional views meaning that "every point in that space would for all practical purposes be equivalent to any other point." (1977, p. 306)
of the underlying forces behind urban structure. Historically, urban growth was considered to be dependent on and influenced by transportation linkages that facilitated the movement of people and goods (Sjoberg, 1960; Moss, 1985-86) and is summarized by Webber's assertion that "the city took the shape dictated by the transportation technologies of the times" (quoted from Nichol, 1985).

As industrial societies become increasingly based on the exchange of information, a perception is found in the literature that the shape, structure, and viability of cities is influenced more by their communications infrastructures and less by their transportation and energy infrastructures. For example, Bell (1980) states that, "(t)he revolution in communications now makes it likely that there will be a major shift in the relative importance of the infrastructure: communications will be the central infrastructure tying together a society." Hall (1984a) describes the CBD of a city as a "machine for producing, processing and trading specialized intelligence" and observes that the relevance of communications to urban structure was recognized as early as 1926 by Robert Haig who argued that intelligence is the commodity with the highest transportation cost, and that information dependent activities are compelled to locate in the highest rent and most accessible urban locations.

Meier (1962) has developed an influential model of urban spatial structure that is based on human communication. He characterizes cities as message exchanges that facilitate and
promote transactions between individuals, households, and organizations; the structure of a city is based on the desire and need to maintain contact with others. A similarly influential model of urban structure that is also based on human interaction was developed by Webber (1963). Unlike Meier, who argued that communications technology would reinforce the dominance of existing urban centres, Webber argued that telecommunications is "spatially neutral", and would lead to a diversity of settlement patterns. Thus, while it could lead to extreme nodal concentration as suggested by Meier, it could also permit population dispersal. Webber described two forms of communities: first, "place community", the local, place specific environment of daily life; second, a "non-place urban realm" created by telecommunications technology which reflects that "increasingly, interaction transcends the places at which people live." Within the physical landscape, networks of social contact and shared interests develop that are not dependent upon the physical proximity of their participants. Choice enters the creation of community and unlike place community, which is largely the product of chance encounters and casual relationships (i.e., you do not pick your neighbours), the non-place urban realm is consciously and deliberately created by its members. Thus, an individual's interests and concerns do not have to be limited to the local affairs of the place community, but may focus - perhaps exclusively - on one or several widely spread non-spatially communities of interest.
4.1.2 The Wired City

There is speculation that telecommunications technologies may lead to a fundamental urban transformation, the manifestation of which is generally labelled the "wired city" (Shostak, 1982). The concept of the wired city was developed in the United States during the 1960's as an element of the Johnson administration's "great society" (Dutton et al., 1987). Chaired by Peter Goldmark, a panel of the U.S. National Academy of Engineering was formed to advise on how telecommunications could (1) improve city living, and (2) influence regional development patterns (Goldmark, 1972). Goldmark's panel reported that cable systems could anchor broadband communications networks in order to support social objectives. The panel's ideas were popularized by journalist Robert Lee Smith in an article in The Nation, entitled "The Wired Nation" which later appeared as a book.

Writing about conceptions of the wired city, Dutton et al., (1987) indicate that the term has been used in two ways: (1) at a conceptual level, referring to a normative forecast of communications in which many communication services are available to homes and businesses, and (2) at a concrete level, it refers to experiments and projects examining the use of electronic information and communication technology for the provision of services. Based on a review of selected wired city projects, they list five "core organizing principles" found in

---

2 QUBE in Columbus, Ohio and Alamenda, Cal., Hi-OVIS in Higashi-Ikoma, Japan, Biarritz in France, BIGFON in West Berlin, and a variety of projects in Milton Keynes, England.
the concept of wired cities (at pp. 8-10): (1) communications is of greater social significance than it has been in the past, (2) new media contain inherent biases towards more decentralized and democratic modes of communication, (3) electronic media should emulate and reinforce face-to-face patterns of communication, (4) communications should be considered to be an electronic highway, and (5) long-range, rational comprehensive planning should guide development. They conclude that while modern industrial cities are wired in a literal sense, no city is an "advanced wired city" in the complete sense intended by proponents of the concept; the wired city has yet to become institutionalized and remains an ideal rather than a reality.

Shostak (1982, p. 77) has suggested that the wired city would be distinguished by the following features:

1) improved education, mainly through electronic aids
2) "dynamic politics" promoted by interactive television
3) home-centered consumerism
4) reduced travel needs, provided by options such as telecommuting
5) improved communications, based on numerous types of devices
6) "leisure plenitude" resulting from a plethora of electronic entertainment devices
7) round-the-clock lifestyle options
8) improved health care resulting from improved monitoring abilities and wider access to specialists
9) gains in public safety, again through 'improved' monitoring
10) "personal empowerment" based on increased feedback, information, and guidance.

King (in Dutton et al., 1987, p. 409) has concluded the following on the basis of wired city experiments conducted during the 1970's and 1980's: (1) initial estimates of the diffusion of wired city innovations were too optimistic, (2) data and
information services are less attractive to user households than traditional entertainment services delivered by broadcast media, (3) success of services depends more on programming content than the infrastructure by which the services are delivered (i.e., the infrastructure itself does not provide a benefit to users), (4) most television users do not prefer inter-active service over traditional one-way service, (5) wired city "success stories" are more of a reflection of life-style preference than the potential of the technology, and (6) institutionally-based wired city experiments tend to be oriented towards attaining technical leadership and demonstrating the system's potential to promote social goals.

Another perspective on future urban change is provided by Coates (1982), who has argued that telematics are the "central physical technologies" of postindustrial society, and that they make it both practical and desirable to disperse information workers: "(t)he postindustrial society also makes obsolete the large-scale highly centralized white-collar work towers of every downtown in America." As with many of the commentators writing in the late 1970's and early 1980's, Coates' projections are predicated on increases in the cost of energy, that, in turn, stimulate the adoption of telecommunication as a substitution for travel. While the role played by energy costs has lost much of the attention it received immediately following the oil shocks of the 1970's, there does not appear to be any compelling evidence to suggest that it will not remain a significant factor
in future urban development. A Delphi-type survey of urban researchers conducted by Newton and Taylor (1985) on trends and patterns in urban development revealed a consensus that both energy prices and the substitution of telecommunications for travel are among the most significant factors likely to affect future development, and dispersed employment distribution and increased non-metropolitan settlement were found to be relatively likely consequences.

While there is much commentary on the impacts of communications technology on urbanization, there does not appear to be wide agreement of what these impacts are. Dutton et al., (1987) indicate that, while communications technology has undergone considerable development during the past few decades, . . . dominant images of the future of telecommunications have remained remarkably stable. In the 1960's we were said to be moving toward a wired society in which all households and businesses would have access to an integrated array of all kinds of electronic information and communication services . . . In 1985, we were said to be moving in the same direction. Only the time horizons varied . . . (p. 4)

4.2 THE TELECOMMUNICATIONS INFRASTRUCTURE

Among the topics that have attracted interest when examining the interactions between communication and urbanization is the development of the intra and inter-urban telecommunications infrastructure (Mahn, 1983; Moss, 1985-86; Keller, 1986; Warren and Donaghy, 1986). Although there does not appear to be any conclusive definition of what constitutes a telecommunications infrastructure, Warren and Donoghy (1986 at p. 10) indicate that an "ideal vision for a properly developed infrastructure" for a
city would include a digitally switched telephone system, fibre optic cables, universal connections to an interactive cable television system, numerous LAN's, satellite linkages, and local value-added networks.

The significance of the telecommunications infrastructure to telecommuting is that it provides the physical means to connect a remote worker with the central workplace; consequently, the cost and availability of the telecommunications infrastructure will be a limiting factor for the amount of telecommuting that can occur in any particular area. The telecommunications infrastructure is less visible and more taken for granted than are the transportation or energy infrastructures; it is also largely owned and built by the private sector, although its operation is closely regulated by government in both the United States and Canada. Because of the large role played by the private sector in developing the telecommunications infrastructure, its growth has been incremental and spatially uneven, and frequently based on business concerns and priorities. In the United States, where inter-city fibre optic long-haul systems are being constructed by firms such as AT&T, MCI, and U.S. Sprint, the density of the systems is much higher in the eastern half of the country, reflecting a heavier demand for high capacity communication systems in the eastern states than elsewhere in the U.S. (Warren and Donaghy, p. 10-11). Intra-urban systems in the United States are being constructed and operated by the Bell operating companies as well as private
communications firms.

Interest in telecommunications has accompanied the development of a more global economy, with telecommunications providing the means to maintain contact with widely dispersed corporate operations, customers, suppliers, and contacts. Communication systems are characterized as "strategic assets" by corporations; according to Walter Wriston, former Chairman of Citicorp, "the most valuable piece of real estate in the world is your desk" (quoted in Moss, 1985-86, pp. 324-25).

4.2.1 Teleports

One manifestation of the globalization of organizations and the importance attached to the telecommunications infrastructure, is the establishment of teleports in several cities. A teleport has been defined as a "centrally located facility for the termination of communications systems and services within a single city for facilities management and/or special networking services." (Mahn, 1983, p. 234) They provide a connection between satellites and ground-based telecommunication facilities, and office and commercial centers in a particular region, and have been promoted as a means to improve economic opportunities for cities and regions by grouping computer and communications facilities, and personnel of organizations in a common, serviced site. Potential users include organizations that use distributed data processing on a national or international scale such as banks, insurance companies, transportation companies, and
government agencies.

Although teleports have been in operation since the 1960's, interest in them has increased following the establishment of a facility on Staten Island in 1983 by the Port Authority of New York and New Jersey. Stimulated by "microwave congestion" within New York, the teleport was originally a (U.S.) $225 million joint venture between New York City, the Port Authority, Merrill Lynch & Co, and Western Union, and was designed to provide access to over 20 domestic and international communications satellites positioned over the Atlantic Ocean. The teleport has since been taken over by Telehouse International Corporation, a consortium of 19 Japanese firms plus a partnership between Merrill Lynch and Western Union ("Merrill Lynch, Japanese Consortium . . .", 1988). The teleport consists of 13 satellite earth stations, and is connected to customers via a 150 mile fibre optic network running through the New York area. The Staten Island project includes plans for 500,000 square feet of office space. As of 1988, there were approximately 20 teleports in operation in the U.S., an increase from 6 in 1984, and Telehouse has plans for projects similar to the Staten Island facility in London and Tokyo. A teleport being built in Boston will be connected to a (U.S.) $30 million, 100 mile long fibre optic network that will provide access to 60 percent of the offices within the metropolitan Boston area (Briggs, 1988, in Schneider and Francis, 1989).

Whether teleports actually stimulate economic growth, or are another example of "municipal chic" is unclear. One report
estimates that the total revenues for teleport services will increase from (U.S.) $91 million in 1987 to (U.S.) $1 billion by 1997 ("Merrill Lynch, Japanese Consortium . . .", 1988), although initial capital costs range from (U.S.) $50 million to (U.S.) $250 million per facility, and their profitability remains uncertain because existing facilities are either privately held or part of joint ventures in which performance data on individual components is not disclosed.

Teleports appear to be perceived as a more important element of development plans in Japan and Europe than in North America (Schneider and Francis, 1989). A teleport is a central part of the International Information City being built on reclaimed land in Tokyo Bay, and is planned to accommodate 44,000 residents and 114,000 workers in buildings containing sophisticated telecommunications facilities. A network of teleports in 29 cities in West Germany is planned by the Deutsch Bundespost. It is expected that 80 communities comprising two-thirds of Germany's national population will be connected to the network by the mid-1990's.

4.2.2 Smart Buildings

Another element in the telecommunications infrastructure is the "smart" building. Also known as electronically enhanced buildings, smart buildings contain the electronic and physical infrastructure to support computer and telecommunication systems. Descriptions of smart buildings frequently characterize computers
as the brains of a smart building, while cables, electronic sensors, and connections are described as its nervous system. Their introduction is claimed to be both a reaction and solution to a perceived lag in office productivity and efficiency.

Smart buildings are usually differentiated from traditional "dumb" buildings by the presence of building management systems and office information technologies (Patri, Hendler, and Reisman, 1986). Building management systems (BMS) are electronic controls over services such as elevators, energy use, lighting, fire safety, air conditioning, and security. Office information technologies, also known as shared tenant services (STS), consist of communication, data processing, and office systems. Communication systems include local and long-distance voice, video, and data transmission, teleconferencing, and electronic mail. Data processing consists of desktop computers and terminals with a central processing unit, and office systems include word processing, copying, and fax systems.

The degree to which building "intelligence" has become adopted remains unclear; while there are many reports in the press proclaiming its potential (e.g., Perry, 1985; Green, 1986), the response of homeowners and commercial users has been restrained, possibly reflecting poor consumer familiarity with the potential of the services offered, concern about information security, and perhaps most importantly, poor marketing by vendors (Keller, 1986). The situation is not universally bleak, however, as observed by the success of Marunouchi Intelligent City, a 32
building complex in Tokyo which is connected by an interactive communications network (Gertler, 1986). Hepworth and Dobilas (1985) observe, however, that the introduction of smart buildings brings with it its own set of problems: "... city planners may have to assume high equilibrium rates of office vacancy for the foreseeable future, as the local business community abandons 'dumb' old buildings for 'smart' new ones."

Building intelligence has been extended into the home and home computer workstations, known in one scheme as teleports, are increasingly promoted as an integral part of a smart house.3 This is tied to developments in office technology such as the notion of the portable or "virtual office" in which the workplace is characterized in terms of activity, and not location (see Chapter 6.3). There is also an increased appreciation that home workspaces should follow design standards equivalent to or better than those used in conventional offices including ergonomically correct furniture and workstations, sufficient electrical and communication support, dedicated telephone lines for computers connected to modems, humidity and pollution control, air conditioning, and proper lighting (Cross and Raizman, 1986).

4.3 THE SUBSTITUTION OF TELECOMMUNICATIONS FOR TRAVEL

The substitution of telecommunications for travel is a topic

3 The household teleport was part of the Eaglecrest development. See Chapter 7.
that has been of interest since the 1970's when OPEC-initiated oil shortages and price increases drew attention to the energy vulnerability of Western economies; accordingly, initial interest in substitutability was mainly viewed in terms of its potential as a means to reduce energy consumption (Polishuk, 1975). During the 1970's, it was also becoming apparent that approximately one-half of the workforce in the developed Western countries could be characterized as information employees, many of whose duties did not require face-to-face interaction, and that there was a growing selection of information and communications technology that could be applied to offer substantial reductions in "unnecessary" face-to-face contact (Kraemer, 1982).

Substitution of telecommunication for travel can be effected by four primary types of technology: (1) video teleconferencing, (2) computer teleconferencing, (3) audio teleconferencing, and (4) office automation (Kraemer, 1982, pp. 41-44). The actual type or mix of technology applied depends on the nature and purpose of the activity for which the travel would otherwise be made.

A number of studies and experiments conducted during the 1970's sought to determine the effectiveness of substitution technologies and assess their relative costs and benefits. While many of these studies were inconclusive and subject to wide

4 The recent conflicts in the Middle East involving Iraq may stimulate renewed interest in travel substitution.
variations in results, they tended to show on an order-of-magnitude level that benefits, including energy savings, could be obtained by adopting substitution technologies. They also revealed, however, roadblocks to implementation including attitudinal resistance among participants, technological, organizational, and regulatory limitations, and factors relating to start-up and operating costs. It was also observed that the telecommunications infrastructure would be costly and complex to build, and that its precise requirements were unclear until further trials and experiments were undertaken and assessed.

Several attempts have been made to calculate the degree that telecommunications could substitute for travel. Lathey (1975) and MITRE (1978) estimated that between 16 percent and 47 percent of commutes to and from the CBD could be substituted. While some maintain that teleconferencing will be a viable substitute for face-to-face contact among businesspersons (Kohl, Newman, and Tomey, 1975), others, such as Abler (1975) and Albertson (1977), argue that social and psychological resistance among users will limit the acceptance of substitution. Nilles et al., (1976) conducted an attitudinal survey of three groups of California residents to determine interest in television and computer-based remote work options. The groups consisted of: (1) a sample of university students who were enrolled in an Interactive Instructional Television (IITV) program (i.e., the students used a classroom located in their workplace connected by an interactive video conferencing system to an instructor); (2) a
group of students who were non-IITV users; and (3) a sample of the "general population" who had little or no exposure to computers and telecommunications technology. Not surprisingly, the survey concluded that the group with the highest affinity towards remote work arrangements were the IITV participants (many of whom were professionals in engineering, aerospace, and information sciences and thus were more likely to be exposed to computer technology). The non-IITV student group also contained professionals who had contact with computer technology, yet only 46 percent indicated that they would use an IITV-type system at home; many indicated a preference for the interaction permitted by working with others at a common location. Of the general population, 51 percent indicated they were not willing to work closer to home via telecommunication links, although those who commuted the furthest were most receptive to the idea of telecommuting.

While Nilles et al. concluded that the general public "did not fully comprehend" the opportunities and potentials created by telecommunications technology, they suggested several conclusions that have been supported by subsequent research including that many people are not willing to substitute telecommunications for travel to work or school, and that those who are willing to substitute will only do so if the remote work arrangement is convenient, simple, and inexpensive. Kraemer (1982) has observed that many people view work or school in positive terms because of the social interaction its provides, and that many people
consider commuting to be a necessary evil, or enjoy commuting, and are unlikely to adopt substitution arrangements on their own initiative.

In a review of factors influencing the substitutability of telecommunications for travel, Kraemer and King (1982) suggest that there are six principal factors that influence the "substitution logic" used in making choices: (1) the nature of the meeting or work for which the telecommunications will be used, (2) the quality and availability of the technology, (3) costs of alternatives, (4) organizational and individual incentives, (5) energy costs and availability, and (6) telecommunications policies of government and organizations. User needs are a significant factor in determining substitutability. Pye and Williams (1977) state that a video channel is often unnecessary — and sometimes a burden — to effective communication, and Kraemer and King (1982) describe the notion that video is required for effective communication as a "widespread myth" that discourages examination of cheaper alternatives because of its high cost. They further observe that the most common reason given in surveys for business travel is "information transmission", usually in the form of documents or letters, which may explain a finding by Cordell and Stinson (1979) that audio and facsimile systems have been relatively more popular than video conferences in surveys conducted by Bell Canada and the OECD. Surveys indicate that teleconferencing systems are effective for meetings involving the simple exchange
of information and routine decision making, or for more complex communication among participants who are acquainted, but that they are less effective than face-to-face meetings for complex communication situations, particularly between participants who are not acquainted. In a comparison of communication by telephone with face-to-face contact, Reid (1977) concluded that the lack of visual contact between participants in telephone conversations has no measurable effect on the outcome of conversations in cases of information transmission and problem-solving, but that in conflict and "person perception" situations, the choice of medium will affect the outcome. Reid notes, however, that the practical outcome of this difference is questionable because "in real life the telephone is likely to be used in conjunction with face-to-face meetings and interpersonal judgements are made in the face-to-face meetings." (p. 411)

The quality of the communication technology is also a significant factor influencing substitutability. Audio teleconferences are often plagued by acoustical feedback, poor sound quality, and protocol uncertainties such as determining speaking order without visual cues. The problems of video conferencing involve limited availability, high costs, technical complexity, limited ability to accommodate multiple locations, and perhaps most important when compared to face-to-face meetings, "the visual image does not provide the same atmosphere, or intimacy, of real contact" (Harkness, 1977, quoted in Kraemer and King, 1982, p. 88). Carey and Moss (1985) indicate that
every video teleconference system that has continued in operation since the 1970's is at a dedicated, on-site premise, and is used on a regular basis by a small and stable (i.e., familiar) population. Marketing efforts appear to be oriented more towards filling the excess capacity of existing systems than fulfilling unmet demand.

While telecommunication is generally less expensive than travel (especially for inter-urban trips), actual costs vary considerably by type of technology utilized. Johansen et al. (1979, cited in Kraemer and King, 1982, p. 89) note that "Picturephone" Meeting Services was five times more expensive than teleconferencing over comparable distances, and Carey and Moss (1985) state that, on average, audio teleconferencing is 50 to 100 times less expensive than video teleconferencing. These comparisons should be qualified, however, by noting that while the actual cost of a teleconference may be lower than the travel costs of the participants, a well developed transportation infrastructure already exists, whereas the widespread telecommunications infrastructure required for effective substitution does not exist.

Kraemer and King (1982, pp. 89-90) have summarized the barriers provided by organizations and individuals to increased substitution of telecommunications for travel as identified by several authors:

- commuting costs are not internalized by organizations, thus there is little incentive to reduce commuting costs;
- rigid salary scales often prevent lower salaries being offered to telecommuters;
- for one employee to work effectively, it may be necessary for an employer to make a much larger investment in new equipment than that which would be offset by savings from telecommuting;
- telecommunications technology is treated by organizations as overhead while travel is seen as a direct cost, lowering the incentive to reduce travel costs; and,
- organizational decision-makers usually do not view communications technology as a major factor in making locational choices.

Organizational savings resulting from telecommuting or other remote work arrangements may be lower than the costs of providing the necessary telecommunications infrastructure. Despite frequent assertions that telecommuting results in considerable productivity increases, it is difficult to assess service sector employee productivity (Grusec, 1985); consequently, there do not appear to be any reliable indications that such increases occur. It has been argued that some firms adopt new telecommunications technologies, such as telecommuting, because of a perceived need to compete with or emulate the competition (Kraemer and King, 1982). This may be an instance where an innovation is adopted before its benefits are clearly demonstrated because a firm fears the loss of a competitive edge, or fears the failure to take advantage of an opportunity which would give it that edge.
Overall, the substitutability of telecommunications for travel is dependent on the task involved. Routine matters and communications between people who know each other are more prone to substitution than non-routine matters or communication between strangers.

4.4 TELECOMMUNICATIONS AND OFFICE LOCATION

As the forum in which the information economy is conducted, the office plays a major role in defining the structure of cities. The growth in the size of office activities is a result of the increased role of services in the economy, seen in terms of activities such as government services, producer services (e.g., financial, legal, marketing services), and non-profit services such as health and education. Harding (1986) observes that, rather than being based mainly on production and distribution, much of contemporary business is driven by marketing, technology, and government-related activities, and this has contributed significantly to the size and composition of the office workforce. Offices are a significant factor in the formation of urban structure; along with competing for urban space and creating demands on transportation and other infrastructures, they stimulate and define the economic nature of a city (Noyelle, 1983).

The office location literature is largely based on research conducted in the United Kingdom that was based on regional development policies directed at decentralizing and dispersing
offices from London (e.g., Goddard, 1975; Daniels, 1979a and 1979b; Pye, 1979). Daniels (1979b) observes that office location research tends to rely more on descriptive and empirical studies than a theoretical base, although there have been attempts to develop a model of office location that is similar to industrial location models (e.g., Malamud, 1971, cited in Daniels, 1979b). Daniels (1975) suggests three reasons for the paucity of research on the role of office activities in urban studies: (1) offices are a late addition as an identifiable component of urban structure; (2) failure to appreciate the role of office activities in the actions of organizations; and (3) a lack of suitable empirical data.

Office location dynamics exhibit both centripetal and centrifugal characteristics, with the dynamic largely dependent on the functions that occur within a particular office. Office activities can be divided into two basic components: (1) front-office, or headquarters functions, and (2) back-office functions (Moss and Dunau, 1986). Front-office activities include organizational development and marketing, and usually involve considerable face-to-face contact with clients and outside consultants, while back-office activities involve routine functions that involve little or no client contact, such as data processing, claims payment, payroll, and other support services. Moss and Dunau (1986) indicate that large-scale, information-intensive firms typically have 55 percent of the employment in headquarter activities, and, of the remaining 45 percent of the
workforce in the back-office, 75 percent are clerical and 25 percent are managerial/professional employees. While the core areas of cities have historically been the primary location of most office activities, there has been a marked decentralization to suburban locations during the past few decades, with the exception of front-office activities, particularly those involving high-level decision making.

The role of communications has played a large part in recent attempts to understand office location dynamics, (Gad, 1979; Pye, 1979). Communication requirements have traditionally been thought of as an important factor in the central location of offices. By their nature, offices rely on the rapid and reliable exchange of information, and, intuitively, office contact patterns can be seen to relevant in determining their location. It is less clear, however, whether observed locational patterns are indicative of how an effective office operates, or just reflect limits imposed by the inertia of locational patterns created when detached offices were first established during the nineteenth century (Gad, 1979). There are some office functions and departments for which outside contact consists of the routine exchange of information, and for which it is essentially irrelevant where the office is located as long as there are adequate communication facilities connecting it with those with whom it exchanges information. In the case of offices in which face-to-face meetings with external contacts play a more crucial role, the question of accessibility, and thus location, is more
relevant, and it becomes more important that an office's location minimizes travel times and costs. Daniels (1979b) identifies three forms of contact between offices that represent: (1) functional interdependencies (i.e., inter-sector office contacts), (2) spatial structure (i.e., intra-sector office employee contacts), and (3) the physical movement of individuals and materials (e.g., documents) between offices. On the basis of empirical study, Thorngren (1970, cited in Daniels, 1979b) has classified contact processes on the basis of being programmed, planned, or for orientation purposes. Programmed contacts are the most routine type, and usually involve routine transactions between individuals who know each other or deal with each other on a regular basis. Planned contact processes generally involve the implementation of actions, and, because they often require specialized advice and assistance (e.g., legal opinions), are viewed by Thorngren as having fewer locational alternatives. Orientation contact processes involve the exchange of information and ideas among members of a broad, divergent network that links previously unconnected parts of the environment. The relevance of these types of contact processes varies by office activity, and, while observing that this schema has been utilized in analyzing contact patterns, Daniels (1979b) notes that it is only of limited utility because studies by Goddard (1975) and others have shown that the number of employee contacts over a period of time tend to increase as one moves up in occupational hierarchy. Thus, the decision-making functions of an
organization choose to locate in central areas because of their increased accessibility and opportunities for face-to-face contact.

The impact of telecommunications and computer technology on office location remains ambiguous. While telecommunication technology is reinforcing the centralization of information-based command-and-control functions, enabling access to business activities without having to be in the city, telecommunication is also viewed as a means to strengthen information-intensive services found in central cities (Moss and Dunau, 1986). Fibre optic systems used for transmitting large volumes of data are being built within and between major cities. Echoing Meier (1962), Moss (1986) argues that this will reinforce the position of dominant cities as focal points for conducting business; cities with the most sophisticated telecommunication systems will have a comparative advantage because of their superior market reach, and front-office functions are likely to become highly centralized in a few information-based centers.

A clearer example of the impact of telecommunications on office location is seen with the location patterns of back-office functions. On the basis of a study of back-office patterns of U.S. banks, Moss and Dunau (1986) note that decentralization has been facilitated by factors including standardization of operations and the use of proprietary telephone lines, and that actual locational choices are a function of three factors: (1) the size of an establishment, (2) the economic dynamics of city
and suburban locations, and (3) organizational determinants. While telecommunication allows the development of suburban back-offices, firms require highly routinized data-processing systems to decouple front and back-office activities; this is usually found in firms that are large enough to internalize the support services found in the CBD. Smaller firms often find it more difficult to take full advantage of telecommunications technology, potentially stimulating mergers and acquisitions in order to remain competitive. With respect to the economic dynamics of city and suburban locations, rental rates for CBD locations are generally 20 to 50 percent higher than those found in suburban locations, although many firms reduce CBD rents through long-term leases. Back-office facilities often have specific facility requirements, such as large floor areas, heavy floor-load capacity, and higher ceilings, that are not found in many traditional office buildings. Operating expenses are relevant, particularly the cost of electricity, and were cited by Dean Witter as the primary reason for moving its data-processing centre from New York to Dallas.

Back-office locations are particularly influenced by access to a productive and dependable labour pool. Suburban locations in the United States are considered to be advantageous in this regard because of the presence of a specific and desired labour pool: "educated women working either before or after childbearing, with low career demands due to their domestic duties and support . . . by husband's wages and benefits"
(Nelson, 1986, quoted in Gertler, 1986). On the basis of her study of the relocation of over 28,000 office jobs during the 1970's and 1980's from downtown San Francisco to suburban areas, Nelson (1986) has argued that back office locational decisions were not made primarily on technical or real estate factors:

... female labour supply is the major differentiating factor between the San Francisco metropolitan subregion now attracting most back-office development and other areas that have not been sought for this type of office development.

Location is also influenced by variables internal to the organization including industry type, management policies, the nature of the control (i.e., the size and scale of the organization), the effects of changes in ownership, objectives of the organization, and whether the organization looks for satisficer or optimizer solutions. While most New York securities firms retain their back-offices on the periphery of lower Manhattan, many insurance companies have located data-processing centres throughout the country, and, as will be discussed below, sometimes overseas.

Following an examination of the potential redistribution of government offices from London to the "Assisted Areas" of the United Kingdom, Daniels (1975) concluded that the amount of "communication damage" that results from geographic separation of offices increases directly with distance, but that the amount of separation that can be permitted varies with the type of work involved. Others, such as Pye (1979), found that when offices are relocated from London, frequency of contact increases with
distance, so that the economic benefits of decentralization do not offset the increased costs of communication.

Daniels (1979b) has argued for the need to consider a wider perspective in the location of offices and to include factors beyond communications and access to contacts. This includes the role played by the supply of labour, the availability of floorspace, tradition and prestige, and, in particular, the influence exerted by development companies and financing sources:

... office location patterns are not simply a product of easily accessible opportunities for information gathering and exchange (communications) but are also determined by complex financial and other vested interests which are on both the demand and supply side, directly or indirectly, of the office market ... (L)ending institutions may look unfavourably upon schemes which abandon 'conventional' location practice. To this degree organizations will tend to conform with the highly agglomerized and centralized pattern of the office industry ... Development inertia therefore leads to location inertia. (1979b, p. 15)

Thus, while computer and telecommunications technology has enhanced the ability to move information between central city and suburban offices, its role in decentralization should be regarded as permissive, rather than determinative (Mandeville, 1983).

4.5 Telecommuting and Urbanization

A theme of this thesis is that the widespread adoption of telecommuting is by no means guaranteed. While interest in it has become more established in recent years, many uncertainties and barriers remain, and it is even difficult to assign accurate order of magnitude estimates of how many people are telecommuters; thus, attempts to forecast its likely impacts on
urban form are problematic. By its nature, telecommuting is spatially decentralizing; work that is performed in a central office is, in a telecommuting scheme, performed at home, in a neighbourhood office, or at some other location remote from the central office. Taken to an extreme, this implies that the widescale adoption of telecommuting could cause existing city centres, or at least their office component, to become "empty shells". However, this notion is clearly premature and assigns an untenable amount of importance to the role played by communications in the locational decision-making calculus of both individuals and organizations, and leads to an oversimplification of the processes involved in urbanization. Pressman (1985) observes that "there are many forces which continuously work in simultaneous fashion (often at cross-purposes) to shape the future metropolitan pattern." Other commentators have noted that population distribution and the shape of urban structure appear to be simultaneously affected by centripetal and centrifugal forces, so that increased centralization and concentration occurs along with the creation of a dispersed urban pattern marked by decentralization.

While telecommunications is thought to be a force favouring dispersion and decentralization through its reduction of spatial impedance, the example of the impact of the telephone on urbanization shows the limits to this argument. The telephone is probably as much a factor promoting concentration as it is of decentralization and dispersion. Gottmann (1977) argues that the
telephone has had a dual impact on office location: "first, it has freed the office from the previous necessity of locating next to the operations it directed; second, it has helped to gather offices in large concentrations in special areas." Goddard (1980) observes that communications and information technology provide a necessary, but not sufficient, condition for locational change, including geographic dispersion. While it is clear that telecommunications provides considerable potential to influence urban form, Mandeville (1983) states that,

"(u)nfortunately, so much of what is currently said about many aspects of the new information technologies is mere unsubstantiated assertion. . . . [and] . . . the inertia of the built environment as well as existing organizational structures are likely to present formidable barriers to radical spatial change."

Technology provides a means towards change; whether that change will occur is dependent, however, on how (and whether) the technology is utilized, which in turn is dependent on existing organizational structures, individual and social values, and the presence of opportunities.
CHAPTER FIVE

THE EFFECTS OF TELECOMMUTING

5.1 INTRODUCTION

On the basis of experience from case studies, and informed speculation, numerous advantages and disadvantages to telecommuting have been identified in the literature. It is apposite to note that the impacts of telecommuting may vary considerably by the group being examined. In the following chapter, telecommuting will be considered in terms of its impacts on individuals, employers, and society.

5.2 EFFECTS OF TELECOMMUTING ON INDIVIDUALS

In reviewing the effects of telecommuting on individuals, the literature suggests a number of dimensions for consideration. Advantages and disadvantages vary according to the type of telecommuting arrangement, and whether the worker's work status is full-time or part-time, temporary or permanent, and self-employed or an employee. Shack (n.d., p. 28) suggests distinguishing between: (1) those who work at home because of constraints or responsibilities that prevent or encumber them from leaving the home (e.g., care of family members, physical handicap), and (2) those who work at home out of choice. On the basis of a survey she conducted, Christensen (1985) distinguishes on the basis of: (1) telecommuters who work at home as an entrepreneur compared with those who work at home as an employee of a company, and (2) organizational status. Appelbaum (1986)
provides a similar distinction between professional employees and clerical home-workers, with home-based work being viewed by employers in the former case as a means to attract and retain skilled individuals, while in the latter instance it is seen primarily as a means to reduce labour costs.

5.2.1 Advantages for Employees

1) Elimination or reduction of commuting times and costs.

This is perhaps the most obvious benefit to working at home; reduced work-related travel time, with a corresponding decrease or elimination in commuting stress and frustration, is reported to be a major advantage of working at home (Olson, 1983) and is frequently cited by promoters of work-at-home arrangements (Edwards and Edwards, 1985). For example, a 1981 U.S. survey reported that employees saved one to two hours per day by not commuting, and that annual monetary savings of not commuting reached $200 for food, $100 for fuel, parking and insurance, and $100 for clothes (Pratt, 1984). As traffic gridlocks and commuting distances increase in major urban areas, this aspect of telecommuting continues to be attractive to employees. Related benefits include a lesser likelihood of being in an automobile accident, lower automobile insurance rates, and a reduced need to own an automobile (SCAG, 1985 p. 16).

Commuting to work is not, however, always viewed in negative terms; 35 percent of the Stanford/USC telecommuters surveyed by Nilles et al., (1976) indicated that commuting was a restful
interlude in otherwise busy lives. Salomon and Salomon (1984) suggest that the journey to and from work provides a spatial and temporal buffer between work and home, giving an employee the opportunity to "cool off" and not transfer stress from one sphere to the other. In any event, the relative significance of commuting to most people's daily lives is unclear; for example, Meko and Harkness (1977) report a survey conducted during the mid 1960's in which nearly two-thirds of household moves did not take into consideration commuting times when looking for a new home.

By not having to work in an office, it has also been reported that employees can save money by spending less on clothes and lunches.

ii) **Increased flexibility of time schedule and lifestyle.**

In its optimal form, working at home is viewed as a means to give a worker more autonomy over how a job will be performed, including its pace and where and when it will be performed. Thus, an employee may try to integrate working hours with other responsibilities (e.g., family care), interests, or peak mental alertness. Working at home may also reduce the need for employment-based relocation or the separation of dual-career families (Communication Studies, 1980, cited in Shack).

According to Appelbaum (1986), however, much of the impetus behind changes in work schedules and arrangements for clerical employees lies with employers who want to replace relatively high-paying full-time positions with lower-paying part-time positions that have fewer or no employment-related benefits,
whose duties are more fragmented and assembly line in nature, and who have more variable schedules. Appelbaum indicates that, as of 1986, there was no evidence of an increased desire for flexible work arrangements by female employees, while Olson (1985) found from interviews with telecommuters that those who chose to work at home on the basis of personal preference were almost exclusively male, and all of the female respondents considered working at home to be a trade-off.

iii) Closer ties to family and community.

Some commentators report that employees who work at home are able to spend more time with their families (Hakim, 1980; Hewes, 1981). This includes allowing a working parent to become more involved with his or her family, and enabling employees to better manage domestic and career responsibilities (Jacobs, 1981; Olson, 1983; Edwards and Edwards, 1985). One manifestation of this was the proposed Family Opportunities Act, which failed to pass the U.S. Congress in 1983 (Christensen, 1988b). The bill proposed tax incentives to buyers of home computers with one of its justifications being that working at home would be beneficial for working mothers. At approximately the same time, Lanier Business Products ran an advertisement of a woman working at home with a computer while her infant quietly played alongside her. It has been observed, however, that raising children and maintaining a household is usually a full-time job in itself, and the suggestion that telecommuting can be a substitute for day care or be a viable means for a single parent to simultaneously work and
babysit is now generally discounted as unrealistic (Christensen, 1987; Olson and Primps, 1984). Nevertheless, anecdotal evidence continues to be found of workers, usually female, who enter telecommuting arrangements in order to better care for their children, either by looking after them for part of the workday, or by reducing the disruption in their lives caused by getting up early in the morning to travel to daycares (Zarzour, 1990).

iv) Creation or retention of employment opportunities.

Working at home has been promoted as a means to employ those with limited mobility, such as the elderly and the disabled (McClintock, 1981), and is reflected in Control Data's Homework program, discussed above in Chapter Two. Pratt (1984) has reported that some handicapped employees view working at home for a corporation as a means to meet people, although the work can be physically stressful. Working at home has also been suggested as a means to continue employment during temporary absences, such as during pregnancy or illness.

With respect to career development, there is a widespread perception among both employees and managers that telecommuting impedes professional development and opportunities (Duxbury et al., n.d.). In Pratt's (1984) survey, women managers reported that even part-time work at home could be "suicidal" to a career, but that it provided a means to avoid quitting work entirely.

v) Improvements to work environment.

This includes a reduction in unproductive interruptions and distractions found in the office (i.e., from co-workers), and
presumes that employees could have more physically comfortable workplaces in their homes. These presumptions are questionable. Some home-based workers report interruptions from family members, friends, and neighbours, who are either unaware or do not believe that the individual is working. Many homes, especially small apartments, are inadequately designed to support a proper home office. This includes not having enough electrical outlets or a dedicated telephone line for modem-linked computers, poor climate controls, lack of workspace, inadequate and non-ergonomically designed office furniture, and poor lighting (Cross and Raizman, 1986; Shack, n.d.).

5.2.2 Disadvantages for Employees

1) Isolation

Since telecommuters work at home, they are more likely to experience isolation resulting from loss of, or reduction in, social and professional contacts. This reflects the notion that many people view the workplace as a social environment and enjoy gossip and informal interactions with co-workers, while for some, work is viewed as a "respite from domestic life" (Mills, 1984). It has been argued that isolation may have harmful effects on the social and professional well-being of home-based employees (Hakim, 1980; Pratt, 1984), although Olson (1983) and others have suggested that electronic mail (or the telephone) may be used to reduce isolation among home-workers of an organization, while others state that arrangements should be made to encourage home-
based employees to come in to the central office on a periodic basis, such as once a week. Toffler (quoted in Rifkin, 1983, cited in SCAG, 1985) rejects the social isolation argument, stating that it is an "historical absurdity [that] presupposes that people were lonely before we had factories to bring them together." While acknowledging that the workplace may have a social value for some employees (e.g., single people), Toffler argues that the primary social needs for many people are obtained from non-work groups such as family, clubs, and community organizations.

ii) **Loss of status and visibility to an employer.**

A number of commentators have suggested the potential that "out of sight, out of mind" may occur to supervisors doing job evaluations, particularly when considering promotions. All of the home-based employees in one survey felt that their off site work hindered their careers in comparison to other employees who worked in the office (Pratt, 1984). Metzger and Von Glinow (1988) have described the loss of visibility of home-based employees as a "career paradox" in which home-based employment leads to early career plateauing; concern about this among employees leads to reluctance to work at home, reducing the likelihood of home-based work arrangements being successfully implemented. This is countered by the argument that performance, and not attendance, should be the basis of evaluation, although this may just highlight management deficiencies for which the home-based worker will suffer. The
literature suggests that working at home results in employees receiving less recognition of their work-role from family, friends, and neighbours, who feel that the home-based employee is not really working. This may lead to a sense of frustration and a lessening of perceived credibility and professionalism for the employee. Employees may also lose a sense of their corporate identity by not being in a central workplace on a daily basis.

iii) Distractions and limitations of the home environment.

In order to work at home, an employee must allocate space for work purposes, which may be expensive and reduces the employee's remaining living space. Experience has shown that it is better to dedicate a specific room for an office, and not, for example, set up a workplace in a corner of a bedroom or in the kitchen. Fifty percent of the respondents to one survey of telecommuters indicated that they worked in a separate office in their home (Olson, 1985).

Working at home may be "too comfortable" for some employees who are distracted by interruptions and demands from family or neighbours that compete with work responsibilities, reduce the employee's ability to concentrate, and result in lower productivity or the failure to meet deadlines (Hewes, 1981). Other potential distractions include hobbies, napping, alcohol, television, pets, the refrigerator, children, unfinished errands, and household chores.
iv) **Lack of routine.**

Along with the distractions found in the home, the lack of a clear daily routine and an ever-present supervisor may be problematic for employees with poor self-discipline or motivation (Brief, 1985). Experience has shown that home-based employees should try to establish and follow a routine that may include wearing what would normally be worn to the office, following regular working hours, starting and finishing work punctually, and seeing people (Renfro, 1982). Accompanying the greater autonomy that telecommuting may provide is the potential that employees may work longer hours than when they worked at a central office.

v) **Conflict between work and non-work roles**

Olson and Primps (1984) state that the failure to physically separate the work and non-work domains and the continual presence of the "work setting" may reinforce tendencies for motivated individuals to become "workaholics". This appears to be borne out in a 1985 survey in which the biggest problem mentioned (by 39.9 percent of respondents) with working at home was working too much (Olson, 1985).

The lack of separation between work and home tends to put pressure on the time allocated for leisure and family activities. One survey participant observed that: "Work makes clear, objective calls on you, and the penalties if you don't meet them are explicit and obvious. The demands, requests, pleas that your family gives you are not so clear and obvious"
Work may be viewed as a time for an employee to get away from his home and family. Many spouses value the privacy and autonomy of having the day to themselves and may find the continual presence of the other spouse overbearing. An alternate view of this is provided by Owen (1987) who has written a brief and somewhat facetious comment on the notion of "work marriage" (i.e., "a relationship that exists between certain people of the opposite sex who work at the same place").

vi) Conditions of employment

Considerable concern has been expressed in the literature about the potential exploitation of employees in home "computer sweatshops" (Mattera, 1983; Berch, 1985; Chamot and Zalusky, 1985; Christensen 1985; Gill, 1985). Concerns include the potential that home-based employees, especially those doing clerical and data entry activities on a piecework basis, will try to supplement their incomes by putting other family members (e.g., children) to work, and that it will be more difficult to enforce statutory employment standards, particularly with respect to controls on overtime. Many telecommuting arrangements involving clerical or data entry work require workers to become so-called "independent contractors", and not employees, so that workers lose employer benefits and eligibility for unemployment insurance. The shift to independent contractor status often requires employees to become responsible for supplying their own equipment, either through outright purchase or by renting it from
the employer, as well as obtaining insurance for the equipment, and being responsible for repairing it if it breaks down.

Home-based work is also a means for employers to shift office overhead costs to employees, who, along with being responsible for providing space for their equipment, may have to pay increased telephone, utility, and dwelling insurance costs, unless they can arrange appropriate compensation from their employer. Home-based employees may also face a lack of support services available in a larger office.

Schneider and Francis (1989) cite a number of ideas from the literature for ensuring greater fairness in home-based work arrangements. These include the following:

(1) Require employers to produce a plan, analogous to an environmental impact statement, showing that employees will not be placed in a disadvantageous position by telecommuting;
(2) Use computers to monitor employee work rates and performance (Nilles, 1985). While this may ensure greater fairness in compensation, it raises questions about employee privacy.
(3) Form home-based workers associations to negotiate conditions of employment with employers.
(4) Combine legislative and collective bargaining approaches. This could, for example, ensure that home-based workers receive the same treatment as office workers performing the same duties.
5.3 EFFECTS OF TELECOMMUTING ON EMPLOYERS

5.3.1 Advantages for Employers

1) Increased productivity.

Increased employee productivity is probably the most frequently cited benefit accruing to employers from telecommuting (Olson, 1983; Pratt, 1984; Kelly, 1984, 1985; Nilles, 1985), although ironically, it is also the most questionable (Kraut, 1985). While some estimates of productivity increases reach 100 percent (Kelly, 1985), the average claimed appears to be approximately 20 percent (Nilles, 1985; Dordick, 1985-86). Alternatively, 67 percent of telecommuters who responded to surveys by both Pratt (1984) and Olson (1985) felt that their personal productivity increased, although Olson and others (Cross and Raizman, 1985) note that the workers may not be working more efficiently, but just longer hours. Fifty-six percent of the respondents to Olson's survey indicated that they began working at home in order to increase their productivity.

Reasons suggested for increased employee productivity include: fewer distractions, greater continuity of work periods, increased motivation, the ability to work at periods of peak mental performance, and less absenteeism (Gordon, 1986; SCAG, 1985).

Part of the uncertainty about changes in productivity is based on the apparent unavailability of a widely agreed-upon definition of productivity for service sector workers. It is arguable that traditional definitions of productivity, which use
the ratio of outputs to inputs, are inappropriate to applications in the service sector (Grusiec, 1985). Hartmann et al., (1986) observe the difficulty of separating technological and organizational innovation from other interconnected factors when attempting to determine changes in output and productivity. In any event, Nilles (1985) states that there have not been any telecommuting programs operating long enough that have had productivity studies permitting long-term statistically significant conclusions to be reached. It is also unclear the degree to which factors such as the "Hawthorne Effect" may be present.

Commenting on reports of productivity increases in pilot telecommuting programs, Kraut (1985, cited in Appelbaum, 1986, p. 300) has concluded that:

"productivity gains associated with telework are probably the result of highly motivated, volunteer workers putting in more time on their jobs when they were working at home than when they were working in a conventional office. The gains may not be sustained with more general use of teleworking by less-motivated workers who have no choice but to work at home."

A survey by Duxbury et al., (n.d.) found that managers of telecommuters perceived that the productivity of their home-based employees decreased, although no reasons for this result were given.

ii) Decreased workforce turnover and increased labour pool.

Decreased turnover is said to occur because employees have higher morale resulting from the increased flexibility of their work arrangements. According to Nilles (1985), "the ability to
work at home is seen as an inducement that is more powerful than salary considerations." Gordon (1988) has stated that it can cost an employer between $30,000 and $100,000 to replace a professional employee.

Labour pool expansion may be in terms of either geographic area or the inclusion of individuals such as the handicapped - or as in the case of Best Western Hotels, prisoners (see above, Chapter Two) - who would not normally be considered for office employment (Pratt, 1984; Dordick, 1985-86; Kelly, 1985). Several commentators describe telecommuting as being particularly well-suited to the recruitment and retention of employees in computer related professions, such as programmers and analysts (Peterson, 1986; Olson, 1988).

iii) Decreased costs

One of the principal benefits to employers of home-based employment is its potential ability to reduce costs. Lower costs may be found in two principal areas: (1) decreased overhead, and (2) lower wages and employee benefits.

It has been often asserted that telecommuting programs are beneficial to employers because less office space is required if some or most of its employees are working at home (Kelly, 1985: Gordon, 1986). Cross and Raizman (1986) state that during the early 1980's, a typical metropolitan area employer annually spends between $4,000 and $6,000 per employee for office space, and that this is two to three times the cost of supporting the employee at home. The latter point is based on the assumption
that the employee does not charge the employer for space used, heating, air conditioning, or cleaning. These savings may be particularly significant for employers located in high-cost, centrally-located sites, and is attractive to employers when considering jobs that have no obvious reason to be located in high-cost locations. Gregory (1985) has characterized employer interest in home-based employment as another aspect of the spatial decentralization of office work from older city centers to suburbs, "Sunbelt" cities, secondary cities, and offshore locations.

The potential realization of cost reductions to employers varies with the type of employee involved and the type of remote work arrangement. For example, high-level employees working at home on a temporary or periodic basis will likely continue to require a workspace in the central office, and may demand one, if for no other reason than to remain "visible" to co-workers and supervisors. In the case of clerical workers, however, there appears to be a greater incidence of costs being shifted to employees by requiring them to purchase, lease, or rent computer terminals, and supply furniture, dedicated telephone lines, heating and cooling systems, electricity, and workspace (Appelbaum, 1986).

The greatest potential for employers to reduce labour costs occurs with clerical employees. According to Gregory (1985), this is the primary motivation for clerical home-based work programs, and occurs mainly by changing the status of the remote
workers from full to part-time, or from being an employee to a self-employed "independent contractor" (Appelbaum, 1986; Christensen, 1987). In both cases workers usually lose some or all of their employment benefits, which may be worth up to one-third of the cost of an employee to an employer, and the basis of payment often changes from salary to piece rates. This often results in markedly decreased incomes for home-based workers, and employers gain by not having to pay for health, disability, and life insurance, social security, unemployment insurance premiums, retirement plans, paid holidays, leaves of absence, and vacation pay.

A variation of the above arrangements is seen with the introduction of "off-shore" telecommuters (Cordell, 1985; "Have Data . . .", 1986; Metzger and Von Glinow, 1988). Several U.S. firms are reported to be using clerical workers located in low-wage countries such as Barbados, Northern Ireland, and the People's Republic of China to process documents that have been taken overseas, with the electronically processed data being transmitted by satellite back to the U.S. Since the skills needed for data entry involve speed and accuracy, and are not linguistic, workers do not have to be proficient in the language of the work being performed, but only have to locate the characters on a computer keyboard (Metzger and Von Glinow, 1988). American Airlines, which in 1986 paid its keypunch operators in Barbados $2.20 an hour compared with $9 an hour for its American employees, has estimated its off-shore data entry
program to be saving it more than $3.5 million per year.

Other potential savings to employers include the following: more efficient use of central computers because scheduling can be adjusted so that remote employees work at non-peak times (Desanctis, 1983); reduced chances of unionization and its likely increases in employee costs because employees are less spatially centralized and more difficult to organize (Gregory, 1985; Townson, 1984); and reduced office relocation costs.

iv) Public relations value

This may arise through high-profile programs that hire otherwise unemployed or underemployed workers, or by highlighting the social benefits of home-based work programs, such as reduced pollution, less downtown congestion, and lower fuel consumption (SCAG, 1985). On the other hand, organizations that cater to a relatively conservative clientele or are involved in confidential or sensitive transactions, run the risk of appearing less credible and unprofessional.

5.3.2 Disadvantages for Employers

1) Managerial constraints

Successfully managing a telecommuting program includes selecting employees and positions best suited to telecommuting, linking telecommuters to the office, planning and implementing technical elements, and training the employees and managers who will be involved in the program (Gordon, 1986). Managerial resistance and limitations in managerial style, and not cost or
technology, may be the greatest impediments to the adoption of telecommuting and other remote work arrangements; pilot remote working programs have been perceived negatively by many managers and supervisors (Duxbury et al., n.d.; Sample, 1981; National Research Council, 1985; Nilles, 1985; Olson, 1985, 1988). Much managerial opposition appears to result from a broader conflict between management control and the freedom of what Hiltz and Turoff (in Mills, 1984) have labelled the "invisible worker". Managers often assert their authority in response to their unfamiliarity with home-based work (Mills, 1984) and their suspicions that employees either are not working when at home, or are not dedicated to their jobs (Jacobs, 1981). According to Olson (1983), management acceptance of remote work requires new techniques of supervision, such as electronic monitoring of work, and, perhaps more importantly, new attitudes towards the nature of supervision. Current management methods place considerable emphasis on face-to-face contact and being able to observe employees at will. Olson indicates that managers are not comfortable supervising employees they cannot see or easily contact and that the availability of open communications at all times is crucial. Olson also found that managers prefer remote jobs to have measurable results or milestones built into them. In a later survey, Olson and Primps (1984) found that remote-work could either increase or decrease the autonomy employees have over their jobs, with the direction of change largely dependent on the employee's job status and the degree to which the
organization views the employee as "an irreplaceable resource." Thus, while clerical employees tend to lose autonomy and control as their jobs change from full-time to permanent part-time status, professionals with skills in short supply and high demand, and who already have a high degree of control over their work, have that control reinforced. In a survey of telecommuters and managers, Duxbury et al., (n.d.) found that both groups felt that management style would have to change, with managers having to place more trust in their employees, although neither group felt that managers would lose control over their remote employees.

Mills (1984) suggests that remote work arrangements will lead to a realignment of two types of management skills; first, conventional office skills (e.g., typing) will be shifted to higher organizational levels; second, it will be necessary for managers to develop new leadership skills, such as being able to persuasively direct dispersed employees via online technology. Mills indicates that managers must attempt to retain "microflow" activities: "those patterns of behaviour people use to give structure to an otherwise unstructured experience . . . [that] give shape to a task and provide a respite from boredom and anxiety." This involves recognizing that many people enjoy work because of its informal social content: "if all the trivial, yet cherished, encounters of civilized working life are eliminated, the life of the telecommuting manager can become quite unrewarding."
Another management-related constraint is organizational inertia. According to Kraut (1985, cited in Appelbaum, 1985), "conventional, 9-to-5 office arrangements support a large number of activities critical to the functioning of any work organization. Radical changes in the conventional office have the potential to disrupt these other activities." The activities identified by Kraut include: socialization of workers, informal information communication, communication of organizational norms, structuring of workers' time, and the segregation of work and non-work life. Olson (1988) states that most organizations do not have the technological infrastructure to allow people to depend entirely on technology to do their work, and notes that the substitution of electronic communication for face-to-face communication is not yet commonplace. Telecommuters, whose means of communication with other employees is, by definition, largely dependent upon electronic technology, find themselves using a different set of tools that is less powerful than that available to employees working at the central office.

A frequent theme in the literature is that management limitations can only be overcome by building and maintaining trust between managers and employees (Duxbury et al., n.d.; Olson, 1983; Blank, 1985). Paradoxically, while remote work relationships may be more physically separated than those located in offices, their employee-manager relationships may be better delineated than those in centralized offices, with standards, expectations, methods of review and feedback, and information
transfer all rigorously defined.

ii) **Start-up and operating costs**

This includes costs for equipment lease or purchase, as well as costs for employee and manager training and procedural adjustments. Experience to date suggests that, given the prevalent employer practice of characterizing home-based clerical employees as either part-time employees or independent contractors, these costs may not be excessive to employers. In the case of professional employees, these costs may be characterized as another element of the remuneration package for high-demand employees.

iii) **Corporate identity**

This concern is partly based on the notion that employees working at home will lose some or all of their sense of corporate identity and may become dissatisfied with their employer, less reliable, and prone to informally undertaking tasks for other employers ("sunlighting"). While this concern has been expressed numerous times in the literature, there does not appear to be any empirical evidence that either supports or refutes it.

iv) **Credibility and security of data**

While some employers view telecommuting as a positive innovation, others are concerned that if an organization uses it, customers and clients may lose confidence in that organization's professional credibility. This is partly based on the suspicion that people who work at home do not work very hard, and, since they are not constantly observed, it is feared that they could
misplace or misuse sensitive or confidential information. There is also a sense of skepticism expressed by conservative clientele about the adoption of innovations that may be perceived as being fads or "flaky." The legitimacy of these concerns with respect to telecommuting should be tempered by the apparent lack of concern about the widespread practice in which employees presently take work home in the evening. Security of data in home-based work environments was not considered to be a major problem by participants in a 1985 symposium on remote work (National Research Council, 1985). A spokesperson for the U.S. Army indicated that its remotely-located employees can change their passwords to obtain access to a system, which also provides automatic notification of abortive attempts to enter a system. Usually, however, classified data is not used in remote locations. Separate file storage is also suggested as a means to protect "live" data from accidental or deliberate damage.

5.4 **EFFECTS OF TELECOMMUTING ON SOCIETY**

The effects of telecommuting at a societal level are, to a extent, an aggregation of the effects on individuals and employers summarized above. Telecommuting does not, however, affect each employer or worker evenly; thus, its cumulative impacts will vary according to the relative composition and profile of the remote workforce.
5.4.1 Advantages to Society

1) Relative decreases in commuting costs and congestion

A basic assumption underlying telecommuting is that it will lead to reduced work-related travel, either in terms of total vehicle miles travelled or by smaller increases in commuter traffic levels. The primary cost associated with commuting is fuel; as noted above, much of the initial interest in telecommuting developed during the energy shortages of the 1970's. The potential benefits from substitution technologies became apparent when it was considered that, during the early 1970's, approximately 25 percent of the total energy consumed in the United States and Canada was for transportation, and that transportation accounted for 54 percent of the petroleum consumed in the United States, and 41 percent in Canada (Tyler, Katsoulis, and Cook, 1976, cited in Kraemer and King, 1982). Harkness (1977) estimated that work-related commuting was the most energy-consumptive type of travel, accounting for 27 percent of U.S. vehicle mileage, and 25 percent of fuel consumption.

With respect to intra-urban travel substitutability, the studies by Harkness (1977) and Nilles et al., (1976) focused on potential energy savings. Nilles et al., concluded that the ratio of the relative energy consumption between telecommuting and work-related commuting by private automobile was 29:1, or alternatively, telecommuting could provide a net energy saving per commuter of 96 percent. They estimated that by replacing 11.8 percent of commuting in 1975 with telecommuting, the U.S.
demand for imported gasoline could have been eliminated for that year. Potential savings dropped to 11:1 when telecommuting was compared with conventionally loaded mass transit, and a ratio of 2:1 for 100 percent loaded mass transit.

Along with reducing fuel consumption, the existence of a significant number of telecommuters could contribute towards a reduction in capital and operating costs for urban transportation systems. According to Tyler and Harkness (1977), reduced peak hour commuting could improve the profitability of local transit systems because the peaked pattern of rush-hour travel means that the equipment used at peak times sits idle for much of the remainder of the day, and drivers must be hired for full shifts even though they might only be needed for a few hours.

Estimates of fuel and transportation system cost savings, and reductions in commuter-related traffic congestion are, of course, dependent on the amount of home-based work that actually occurs, which, as discussed in Chapter One, remains unclear. Even if telecommuting is widely adopted, it does not necessarily mean that work-related travel would decrease. For example, a telecommuter who relocates to a relatively remote area will likely travel to the central office once a week to maintain contacts; the one weekly trip could use the same or more energy than the several shorter commutes that occurred previously.

11) **Decreased air pollution**

This would be a consequence of the reduction in vehicle miles travelled because of the use of telecommuting. This has
generally been portrayed as a secondary benefit of telecommuting, although it has recently attracted greater interest. Regulations directed at improving air quality have been one of the primary factors behind the introduction of a telecommuting program for state employees in California (Wagel, 1988) and telecommuting has been recommended by a Vancouver City Task Force as one means towards reducing emissions of air pollutants (Task Force on Atmospheric Change, 1990).

iii) Community benefits

These include the reduction of some types of crime (e.g., burglary) because more people will spend more time in or near their homes (Freedman, 1985), a stronger sense of community among workers who previously may have viewed their neighbourhood as basically being a bedroom suburb (Ahrentzen, 1986), and the potential to shape land use patterns by moving employment to areas where land and housing costs are lower (SCAG, 1985). The advantage of promoting the latter is not universally accepted; Dillman (1985) states that "development of the electronic cottage and linkage of one's productive work to national networks may draw the most important interactions associated with work away from the locality." Ahrentzen (1986) has observed concern in the literature that the widespread introduction of computers in the home, including the use of telecommuting, may impair community strength if people become more home-centered, and cites a survey in which telecommuters reported that their relationships to their communities had not changed despite the additional time they
spent at home.

One unanticipated benefit of telecommuting occurred in San Francisco after the October 17, 1989 earthquake ("Quake swells ranks . . . ", 1989), where it was reported that the traffic gridlock created by damaged highways and bridges led to an increase in the number of telecommuters, although it is unclear how many people will continue the arrangement after the transport infrastructure is repaired.

5.4.2 Disadvantages to Society

1) Increased potential for urban sprawl

This reflects the notion that since telecommunication helps overcome the friction of distance, it is possible for a telecommuter to live almost anywhere as long as effective communication links exist with the telecommuter's employer. Since numerous surveys report that many people would prefer to live in rural or suburban, rather than urban settings (Dillman, 1979; Zuiches, 1982), it has been suggested that the potential residential mobility offered by telecommuting creates an accompanying potential for increased urban sprawl; many people would presumably try to fulfill their desire to live in less central locations by becoming telecommuters. Dillman (1985) disputes this conclusion, observing (at p. 17): "we are now in a period of history in which most adults have spent their formative years in suburbs. It is not clear whether their preferences will be the same as the generation that preceded them."
There does not appear to be any empirical evidence either supporting or refuting telecommuting-linked urban sprawl, although there are numerous anecdotal reports in the literature of telecommuters moving to rural locations (e.g., Paddy, 1982; Bewer, 1984; Brooke, 1984; Atchison, 1986; Schwarz and Tsiantar, 1989). Whether this is a harbinger of a movement towards increased residential decentralization or is merely a small-scale phenomenon remains unclear.

11) Economic impacts on land markets

It has been suggested that one consequence of telecommuting will be increased vacancy rates in CBD office buildings, as organizations rent or buy less space for their "invisible employees" (Russell, 1978). The economic impacts of telecommuting on urban real estate markets is a complicated issue to address, and beyond the scope of this thesis. While full-time telecommuting arrangements theoretically allow an organization to maintain less office space, there does not appear to be any evidence of employers actually making office space or locational decisions on the basis of telecommuting. In any event, large scale vacancies resulting from telecommuting would presumably be reflected by lower rental rates for office space, which could counteract many of the economic benefits provided by telecommuting to employers.

Tyler (in Harkness, 1977) identified four major types of telecommunication-induced economic impacts that would likely generate costs or benefits of significant importance: (1)
dispersal of employment from CBD's; (2) changes in demographic, economic, and land use patterns in CBD's resulting from slow, zero, or negative growth rates; (3) fiscal consequences of office dispersal for local governments; and (4) changes in spatial form and the social, economic, and environmental character of the metropolitan area. On the basis of a cross-impact matrix using generalized data from U.S. cities, as well as specific data from the San Francisco Bay Area, Tyler concluded that increased CBD office employment is not always, on balance, beneficial to all segments of a city and that telecommunications-based reductions in CBD employment growth would not necessarily be harmful. Tyler noted, however, that the outcome of changes in CBD office employment is partly dependent on the social, economic, and political mechanisms in place in particular cities, and, while CBD employment changes could lead to "creative exploitation of opportunities created by reduced real estate values and rental", the result could also be the intensification of urban decay, and the abandonment of buildings.

5.5 CONCLUSION

The advantages and disadvantages of telecommuting vary depending on the person or entity in question. Telecommuting may increase the flexibility of employee work schedules and lifestyles, although this appears to depend on the worker's employment status and the policies and corporate culture of the employer. Telecommuting requires self-discipline on the part of
the employee, the setting of clear and mutually understood goals between the employer and employee, and an effective means of communication between employer and employee. The primary disadvantage faced by all remote workers is isolation, although this can be partly alleviated by ensuring systematic visits by the employee to the central workplace. Isolation may lead to impairment in occupational advancement, although there is no empirical evidence confirming or denying this. Clerical and lower level employees also risk potential exploitation by employers.

The primary benefit to employers is reduced costs; while there is some evidence of increased employee productivity, there does not appear to be any independent or rigorous confirmation of this, and the issue of measuring service sector employee productivity remains problematic. While employers may attract or retain employees by offering home-based work as an option, it is unclear how many employees value this option. The greatest obstacle to telecommuting appears to be hostility and opposition to it by managers. This opposition appears to be mainly based on a lack of familiarity with telecommuting on the part of managers, and a perceived loss of control over employees. Commentators generally agree, however, that if there is mutual trust and effective communication between managers and employees, quality of work should not be impaired just because it is performed at home.

The greatest uncertainty with respect to the benefits and
disadvantages of telecommuting is found in terms of its societal impacts. Along with difficulties of definition and measurement, there is the question of whether impacts are felt on a zero-sum basis, or whether there are net societal benefits or losses. While there is general agreement that telecommuting should lead to reduced fuel consumption and daily commuting, there is much uncertainty about the amounts involved. There is also speculation that telecommuting may influence urban structure and local perceptions of community, although there is little agreement on the nature and scale of these impacts.
6.1 INTRODUCTION

There are several factors exogenous to the practice of telecommuting that the literature has identified as relevant to the degree and rate at which it is adopted. These factors have created conditions favouring the adoption of telecommuting, acted to facilitate its adoption, and also acted as impediments. While none of these factors are, on their own, determinative of the degree to which telecommuting will be adopted, cumulatively, they are playing a significant role in its future.

6.2 THE HOME AS WORKPLACE

6.2.1 The Incidence of Home-Based Work

During the past decade, there has been renewed interest in the home as a workplace, largely spurred by the emergence of "white-collar office homework" (Christensen, 1988a).

It has been observed that many people worked out of their homes until the Industrial Revolution of the late 18th and early 19th centuries (Klein, 1982; Rybczinski, 1986). While the Uffizi, built for Cosimo I de Medici in Florence between 1560-1574, is generally credited as being the first purpose-built office building (Pevsner, 1976), the contemporary office only began to develop in any recognizable sense during the latter half of the 19th century (The Office, n.d.). Lewis Mumford
(1961) 1 indicates that houses often doubled as offices, banks, and stores during the medieval period and in Georgian and Victorian England, until business expansion forced movement to a separate building. The movement to separate offices was largely the result of the creation of a paperwork-based clerical industry that was a byproduct of industrial growth. As industries became more complex, so did office functions which had to process orders, do invoicing, and maintain accounts.

While there is a general perception that the number of home-based employees has increased in recent years, as in the case of telecommuters, there does not appear to be any clear idea of how many people work from their homes, or how many home-based businesses exist. The 1980 U.S. Census reported that approximately 2.2 million people (2.5 percent of the total workforce) work at home for pay, an increase from the 1.6 million reported in the 1970 Census, and, in 1983, the U.S. Chamber of Commerce reported that approximately 10 million businesses were run from the home (Butler and Getzels, 1985; Pratt, 1987). A 1982 survey by AT&T reported that 23 million people worked at home in the U.S., although this figure included those who "moonlight" to supplement a primary job, volunteer workers, and the 56 percent of total respondents who bring work home from their primary non home-based employment (Pratt, 1987). A study

1 "Except where the industry was small and noisy, where it was often put at the edge of the town or outside the walls, this intimate connection of industrial and domestic life long remained normal: the exact antithesis of the segregated, legally sterilized residential quarter of today." (1961, p. 284)
released in 1989 by LINK resources estimated that at least 15.8 million people in the United States work at home on at least a part-time basis (Farish, 1989). As with the AT&T study, the LINK estimates include employees who bring work home from their primary non-home work employment location.

There do not appear to be any independent or empirically-based statistics on the incidence of home-based employment in Canada (Graham, 1990). Neither Statistics Canada nor Revenue Canada have examined the question, nor, does it appear, have local chambers of commerce. Available estimates of the number of Canadian home-based businesses are based on an assumption that the Canadian total will be 10-12 percent of the U.S. total. Thus, it has been estimated that there are up to 2.5 million people in Canada who work at home either full-time or part-time and that there are 130,000 home-based businesses in British Columbia.

Pratt (1987) has identified several factors that create problems in gathering information about home-based work. These include the following: (1) home-based work has multiple definitions, (2) definitions of "work" and "home" are becoming increasingly ambiguous, (3) it is difficult to adequately

---

2 There is some confusion in the literature regarding the results of the LINK survey, with some reports stating that it found 23 million home-based employees, while others using the 15 million figure. A resolution to the confusion is not facilitated by the proprietary nature of the survey, which Schneider and Francis (1989) report costs (U.S.) $10,000 for access to the results.

characterize "alternative work styles" such as overtime and intermittent work, (4) the underground economy is not included, (5) part-time work and multiple jobholding is undercounted, (6) individuals may operate more than one business from their homes, (7) unpaid work by family members may be underestimated, and (8) nonresponse rates to surveys may be significant.

On the basis of interviews with fifty female English homeworkers, Hakim (1980) concluded that homeworkers were reluctant to participate in surveys for a number of reasons: fear that employers would learn of the interview and cut off the homeworker's supply of work; concerns about the discovery of non-reported income by tax officials; the stigma some attach to the fact that they worked at home, including possible negative reactions by family, friends, and neighbours; and a general concern about privacy that was often reinforced by the husbands of the all-female sample.

A surrogate measure for the size of the home-based office sector is found in an estimate by the president of Canon Canada Inc.'s subsidiary OE Inc. that sales to Canada's home office market are worth between $600 million and $800 million annually (McKenna, 1990). By comparison, the U.S. home office market was recently estimated to be worth (U.S.) $5.7 billion per year (Ambry, 1988). In addition to Canon, Sharp and Panasonic have created separate divisions to sell home office versions of their office products (Schwartz and Tsiantar, 1989), and Ikea has begun to market furniture for home offices.
There are several factors thought to be behind the increased interest in home-based employment. According to Pratt (1987) these include: (1) the potential opportunities created by telecommuting, (2) a "new credibility" attached to traditional home occupations, such as real estate sales, technical writing, and dressmaking, (3) requests by employees to work from home on a full-time, part-time, or intermittent basis, and (4) moonlighting by employees who want to start small businesses. Additional factors suggested by Gray and Gray (1989) include: (1) "cocooning", in which people centre their leisure time around the home in order to eliminate external stresses; (2) advances in computer and communications technology that give home offices much of the sophistication and professional image associated with traditional offices, (3) combined career and family roles, and (4) the opportunities created by the growth of the service sector. The latter factor is reflected in surveys of home businesses, such as by Gray and Gray (1989), Pratt (1984), and the September 1989 issue of the periodical Home Office Computing, whose lists of common home-based work opportunities were mostly in service-related activities.

6.2.2 Attitudes Towards Home-Based Work

There are sharply contrasting views towards the notion of home-based work; many current attitudes towards it reflect a revulsion over past practices, including the exploitation associated with "sweated work" during the nineteenth century (see
Chapter 6.4). Others, however, view the home as the natural forum for advanced technologies to create a revolutionary information age society.

According to Alvin Toffler (1980), one of the principal forces favouring employment in the "electronic cottage" is a shift in attitudes toward the family:

... wherever the transition out of the nuclear family is most advanced -- there is a swelling demand for action to glue the family unit together again. And it is worth observing that one of the things that has bound families tightly together through history has been shared work (p. 219).

Toffler characterizes demand for home-based work as part of the growth of a "home-centered society", the impact of which may include increased community stability, less stress on individuals (because of less forced mobility), reduced energy usage, the creation of a new sector of small-scale information services and computer stores that cater to home-based workers, and "a deepening of face-to-face and emotional relationships in both the home and the neighbourhood."

This may be contrasted with the perspectives of architect Witold Rybczinski (1986), who has written about the cultural and psychological perceptions of the meaning of "home", and is skeptical about the breadth and depth of popular interest in the home as a workplace:

... zoning bylaws are simply one example of how deeply rooted this separation of work and home is, and how most likely it will take a great deal of time to change. It's not something that will take place easily. The fact that a small number of writers, primarily, are able to work at home -- as in fact they always have, with or without computer
linkups -- is not of any great significance. . .

Our cultural ideas change extremely slowly, . . . The longing for home is going to be there for an awful long time. Even after technology causes the home to disappear and we're all living in shoeboxes, we're still going to have that longing. (quoted in Mowbray, 1986)

The idea of the home as workplace was explored in a poll commissioned by Time magazine as part of its "Machine of the Year" issue in 1982. While over 73 percent of respondents indicated that they believed that computers will enable more people to work at home, and almost 62 percent agreed that computers will allow people to have more independence and flexibility in choosing when and how they will work, less than 33 percent responded that they would prefer to work at home, rather than where they were currently working. While entrepreneurial energy is undoubtedly playing a part in the growth of home-based work, Olson (1988) suggests four relatively involuntary factors promoting home-based employment: (1) working parents, usually the mother, who find that they need more flexibility than that offered in the current job market; (2) older women seeking to re-enter the job market after child rearing who cannot find jobs they want or for which they feel qualified; (3) retirees who want a small business to supplement pension income; and (4) laid-off workers who become self-employed because of financial need, rather than entrepreneurial drive.

4 Yankelovich/Time Polls, #8613, 1982.
Office automation is generally considered to be an outgrowth of the introduction to the office of the telegraph, telephone, and typewriter during the second half of the nineteenth century. Collectively, these inventions converted the office into a centre for communication, allowing increasingly large and diversified enterprises to operate separate administration and manufacturing facilities, and to establish branch plants and offices in distant locations. The growth in size of enterprises and the increase in the volume of work performed by clerks led to changes in the nature and social structure of office work. These included the application of scientific techniques to break down and standardize activities into discrete tasks, and the employment of large numbers of men, and later women, as clerks, typists, and stenographers. Whenever possible, individual decisions were replaced with decision-making rules, giving employees more time to spend on the remaining tasks.

There does not appear to be any universally accepted definition of office automation. According to Hirschheim (1985), it "refers to the application of integrated computer, communication and office product technologies and social science knowledge to support the myriad activities and functions in an office environment." A more expansive definition has been provided by Grusec (1986, p. 1):

... any system which uses individual workstations to access several functions from a list that includes: text creation and manipulation, storage and retrieval; messaging or electronic mail; decision support (eg. spreadsheets);
database management; personal support (eg. calendars, diaries, personal files, etc.) . . .

In addition [office automation] often implies some degree of technical and functional interconnection of workstations among members of a group, small or large, so that information or work can be shared, passively or interactively.

Growth in office automation has been facilitated by numerous technological innovations. Computers are seemingly ubiquitous in many work environments as microprocessor technology increases their speed, performance, reliability, and compactness, while decreasing their cost per function and unit of memory. The cost and quality of telecommunications technology has been upgraded through the introduction of digital transmission systems, transmission protocols, and high capacity transmission equipment including fibre-optic systems and private systems that bypass the public utilities. The net effect has been a movement towards an integration of computer and telecommunication technology.

There are numerous reasons suggested for the growth of office automation, with the primary one being increased office productivity (Klein, 1982; Hirschheim, 1985). While office and service sector productivity is notoriously difficult to both define and measure (Grusec, 1985), there is, nevertheless, a widespread perception that the productivity of office workers has lagged behind that of workers in the manufacturing sector. For example, during the mid-1970's it was reported that industrial productivity had increased by almost 90 percent during the previous decade, while office productivity had increased by only 4 percent ("The Office of the Future", 1975; Jacobs, 1980).
It was recently reported that a U.S. Commerce Department study found that "the average output of an American information worker has not budged since the early 1960's - despite huge growth in both the number of information workers and the average technology investment sitting on each one's desk" ("The ubiquitous machine", 1990). In a widely-cited study of 300 workers from 15 organizations, Poppel (1982) reported that knowledge workers spend 25 percent of their worktime on "less productive" activities such as waiting for meetings to start, looking for information, or doing clerical work because of a shortage of support staff, and that the most common activity, involving 46 percent of their time, was scheduled and unscheduled meetings.

Conclusions about the poor office employee productivity are questioned by Grusec (1985), who cites a study by Panko (1984) that shows the arbitrariness of a widely-held assertion that office productivity increased by only 4 percent during the previous decade while the productivity of the economy as a whole increased by 20 percent during the same period. An alternative approach that has been suggested is to examine the effectiveness of office activities, with effectiveness being measured by determining the degree to which an organization's goals have been attained (Doswell, 1981). Giuliano (1982) suggests that the relevant basis of office work evaluation should not be hours worked or items processed, but customer satisfaction and willingness to pay a premium for a high level of service. It is not clear, however, whether Giuliano intends satisfaction to be
used as a measure of, or substitute for, productivity.

The assumption that poor office productivity is linked to low capital investment per employee has stimulated much of the investment that has occurred in office automation technology. Capital investment levels are estimated to have increased from $2,000 per office employee in the late 1970's (Young, 1978, cited in Menzies, 1981), to between $8,000 and $10,000 per employee in the financial services sector in the mid-1980's (Office of Technology Assessment, 1985, cited in Hartmann et al., 1985). By comparison, during the same period, the capital investment per employee in the manufacturing sector is estimated to have stayed at between $25,000 and $30,000 (same sources respectively). Consequently, office costs have assumed a greater proportion of total organizational overhead costs, increasing from between 20 and 30 percent during the 1960's, to between 40 and 50 percent during the late 1970's (McNurlin, 1978), and it was recently estimated that the share taken by office equipment in the stock of U.S. fixed capital, excluding non-residential property, increased from 3 percent in 1980 to 18 percent in 1990 ("The ubiquitous machine", 1990).

Additional benefits of office automation include an increased competitive advantage, and greater responsiveness to customer needs and demands. Competitive advantage is expanded by building information technology directly into products, thus influencing the future actions of customers who become more strongly tied to the suppliers of the technology. Greater
responsiveness enables companies to quickly provide customized products; for example, McGraw Hill is reported to be offering university professors the chance to create custom-made textbooks by choosing individual chapters from a database of texts ("The ubiquitous machine", 1990). Information technology allows a company to continually refresh its information about a customer, enabling better service to be offered.

Other reasons cited for the growth of office automation include: better management of information - it was recently estimated that U.S. businesses have 400 billion documents, and that this total is growing by 72 billion per year (Zuboff, 1988); growing familiarity with computing equipment; a greater concern with competitiveness; and a grab-bag of ideas associated with the arrival of "the information age" (Hirschheim, 1985).

Office automation has been characterized as the latest stage in the evolution of offices. Giuliano (1982) has defined three stages of office organization: preindustrial, industrial, and information-age. Each is defined in terms of its technology, style of management, personnel policies, hierarchy, standards of performance, and human relations. The preindustrial office, which Giuliano states remains common in many contemporary professional, small-business, and some corporate management offices, is dependent on the performance of individuals and often lacks systemization of work routines or modern information technologies. It works well if the nature of the business remains simple and small in scale, but cannot efficiently handle
large or complex transactions that require the coordination of data from a variety of sources. The industrial office is based on principles of work simplification and specialization, and is often compared to a production line, with jobs being simple and repetitive. This approach is considered suitable for handling large volumes of transactions, such as processing insurance claims. Giuliano indicates that many industrial-type offices were established during the early days of computerization when information had to be collected into large batches before being entered into computers that could only perform a few steps of a complex process. Despite its efficiency in dealing with large volumes of transactions, the industrial office has a propensity for allowing errors to develop that are often missed by workers because of the fragmentation of their duties; the boredom experienced by employees also contributes to poor service and low morale. According to Giuliano, the information-age office, with its use of information technology, preserves the best aspects of the other office types, and avoids their drawbacks. Rather than dealing with relatively small aspects of files or accounts in a repetitive manner, workers handle a larger number of activities for fewer files; the worker becomes more involved in, and knowledgeable about, the customer, and can more readily spot and correct errors.

There are fundamental limitations to the potentials of office automation created by difficulties in applying technology to office work, as well as organizational inertia and
bureaucracy; these are summarized by office-automation consultant and MIT computer scientist Michael Hammer: "automating a mess yields an automated mess" (Schlefer, 1983). Strassman (1980) states that automation increases office productivity when activities are simple and standardized, the contents of transactions are relatively stable, and there are large volumes of transactions. Many offices, particularly those characterized as industrial, already have a form of de facto automation in their structure. Strassman suggests that too much attention is focused on technological issues and not enough on organizational form and information management:

The rapidly decreasing cost of computer hardware and software means that ever-larger numbers of applications are candidates for automation. Thus simplification, standardization, and automation are proceeding rapidly. The proliferation of computer hardware and software also means that many information workers are engaged in activities that do not meet these criteria. Instead of increasing efficiency, they are contributing to today's information overload by helping generate redundant information in ever-increasing quantities. (1980, p. 58)

This leads to a perception that office automation may actually decrease office productivity, although, as discussed above, the measurement of this is problematic.

Although there are numerous taxonomies of office types, the most dominant, and for the purposes of this thesis, most relevant, is the distinction between offices that handle routine operations and those that handle less routine functions, also described as the distinction between back office and headquarters functions (Moss and Dunau, 1986). The former is essentially the industrial era office discussed above, and consists mainly of
clerical workers handling large amounts of administrative transactions; the latter is staffed mainly by managers and professionals and deals with non-routine matters such as planning and policy-making. While office automation technology can be applied to both types of offices, it is not necessarily used in the same manner or with similar objectives. This reflects what Walton (1989) describes as the dual potentialities of information technology: "the capability of the same primary technology to produce one set of organizational effects or its opposite" (p. 26). Information technology can be used to increase management's ability to monitor and control employees, or it can also be used to disperse power and promote self-supervision. Similarly, it can routinize and pace the work of employees, or be used to provide increased discretion and innovation. The effects of information technology are largely dependent on the manner in which the technology is applied within the context of the organization.

The adoption of office automation technologies has led to a fundamental change in perceptions of the office. Rather than being defined in physical or spatial terms, offices are increasingly viewed as a locus of transactional activity. According to Giuliano (1982), information technology creates a "virtual" office in which the office is defined by the location of the employee. This does not mean that the physical office is about to disappear; rather, the office becomes a home-base for an organization, providing structure for those who want it, and
housing centralized communication and computer equipment. The relevance of office automation to the adoption of telecommuting is twofold. First, the increased use of the technology by employees at all levels of an organization creates increased familiarity with its application; resistance based on unfamiliarity is reduced and a better appreciation of its potential becomes apparent. Second, the technology and changing organizational structures provide a means to reduce or even eliminate the physical contiguity of office workers, as found in the separation of back office and headquarter functions. The issue becomes whether this loosening of physical ties will extend to allow large-scale office work in the home. It is suggested that this will depend largely on the positions adopted by employers, because they, and not the technology, will have the strongest influence in determining how to adopt and use the new technologies.

6.4 REACTIONS TO HOME-BASED WORK FROM ORGANIZED LABOUR

According to Christensen (1988a), home-based work has been one of the most controversial labour issues in the United States during the 1980's. Organized labour's principal concern about home-based work focuses on its potential to exploit workers, although the practice of telecommuting raises two subsidiary issues: (1) the effect of technological and organizational change on employment levels and quality, and (2) the growth of alternative work arrangements and, in particular, the increased
use by employers of contingent employees.

6.4.1 Worker Exploitation

Home-based employment raises concerns about potential worker exploitation that include: worker isolation, worker health and safety, child care responsibility, monitoring, pay and benefits, and the conversion of positions from full-time to part-time. The issue has been described in the following terms:

... not whether there is evidence that computer homework is abusive (how many exploiters cooperate with academic researchers?), but whether [labour unions] can guarantee that it will not follow the pattern set by other forms of homework and lead to the abuse and exploitation of women, children, minorities, immigrants, and even men." (Chamot and Zalusky, 1985, pp. 78-9)

As a consequence of these concerns, in 1983 the AFL-CIO adopted a resolution calling for an "early ban on computer homework" by the U.S. Department of Labour (Chamot and Zalusky, 1985), and the Service Employees International Union (SEIU) has banned home-based employment for its 780,000 members (Rubin, 1984).

Historically, home-based work has been an integral part of the industrialization process and was used, for example, by merchant tailors in nineteenth century Boston and New York to expand production by sending work to seamstresses in their homes (Boris, 1988). Cutthroat competition, a highly seasonal product and undercapitalization resulted in a system of central shops and

5 Personal communication with R.W. Lang, Canadian Labour Congress, July 17, 1986.
external home-based contractors which eventually came to be labelled by reformers as the "sweating system." Underbidding by middlemen and contractors reduced the piece-rates paid to the seamstresses who also had to absorb the costs of production, the costs of mistakes, and the potential loss of remuneration by contractors who refused to pay for spoiled goods or who might close shop and disappear before paying their seamstresses. With uncertain and variable market conditions and a scattered workforce, strikes and worker organization was problematic; sudden rush jobs resulted in homeworkers enlisting the help of their families and friends. Examples of homeworker exploitation abound; one Department of Labor Women's Bureau study found home-based employees in 1932 earning as little as $1.25 per 42-hour workweek, equivalent to 25 cents an hour in 1983 wages (Chamot and Zalusky, 1985). In response to the exploitation of homeworkers and the often substandard conditions in which they worked, as well as the difficulty of enforcing child labour, hours of work, and minimum wage laws, home-based work came under a licensing and regulatory scheme that limited or prohibited industrial homework in 19 states of the U.S. and culminated in the Fair Labour Standards Act (FLSA) of 1938 (Berch, 1985; Chamot and Zalusky, 1985). Widespread violations of record-keeping by employers caused an administrative ban on homework in seven garment related industries in 1943,6 and, in 1949, the U.S.

6 The industries are knitted outerwear, women's garments, embroidery, handkerchiefs, jewellery, button and buckle manufacture, and gloves and mittens.
Congress defeated an amendment to the FLSA that would have allowed home-based work by a person in a rural area who was "not subject to any supervision or control by any person whomsoever . . ." (Boris, 1988). Despite statutory controls in the United States, Allen and Wolkowitz (1987) observe that home-based work, also known as outworking, remains common throughout the world, and that its incidence is increasing.

Evidence continues to be collected of homeworker exploitation; the Low Pay Unit in Britain found some home-based knitters earning on average between 50 and 90 pence an hour when the statutory minimum was one pound fifty, with some earning only 15 pence an hour (Gill, 1985). In Canada, instances have been cited of homeworkers earning as little as $1 an hour at a time when the statutory hourly minimum was $3 (McQuaig, 1980).

There appears to be a general consensus among labour commentators that home-based employment issues can be defined in terms of employee rank and status, echoing the polarity discussed above in the characteristics of telecommuters (Berch, 1985; Chamot and Zalusky, 1985; Gill 1985; Applebaum, 1986). According to one report on home-based electronic work (Kawakami, 1983; quoted in Chamot and Zalusky, 1985, pp. 81-2):

. . . (t)he traditional differentiation between clerical workers and managers/professionals in conventional offices is apparently being repeated in home-based teleworking projects. Managerial and professional homeworkers tend to be highly paid, possess high status, enjoy payment on a salaried basis and substantially all fringe benefits, are subjected to a low to moderate amount of supervision, and are usually provided with all necessary equipment and materials by employers. By comparison, the clerical homeworkers studied have received considerably lower pay and
less status, are paid on an hourly or incentive basis, sometimes lack certain insurance benefits, may be supervised much more closely (including through on-line computer monitoring), and sometimes are required to pay for some or all of their own equipment and work materials.

6.4.2 Changes in the Level and Quality of Employment

While there are concerns about the potential provided by home-based employment for worker exploitation, telecommuting has been characterized as an element of a wider area of concern to organized labour: the impact of technological change. While there do not appear to be any studies on the effects of telecommuting per se on present and future levels of office employment, there have been numerous studies of the employment impacts of office automation and technological change in general (e.g., Menzies, 1981; Appelbaum, 1985; Gill, 1985; Hartmann et al., 1986). There does not appear to be, however, any broad consensus about the scale or form of the impacts of technological change; instead, three competing perspectives have emerged: (1) employment levels and quality will not be adversely affected by technology, but may even increase, due mainly to the elimination of mundane tasks, increased productivity, and more positive work attitudes; (2) a direct and wide-scale negative impact will be felt by existing workers caused by deskilling, centralization, alienation, increased health problems, and a deterioration of the workplace environment, and productivity gains will lead to increased structural unemployment; and (3) the impacts of automation and technological change will be partially mediated by
factors specific to organizations, such as the manner in which equipment is introduced, pre-existing work patterns, and corporate culture (Clark et al., 1987).

Ginzburg (1982) has noted the job-creating potential of technological change and innovation as a means to maintain economic growth and employment levels. Hartmann et al. (1986) cite as an example in support of this position a study by Hunt and Hunt (1985) of the U.S. finance industry, which underwent considerable office automation without employment decline. While the relative number of clerical employees decreased between 1972 and 1982 from 46.1 to 43.9 percent, employment increased in absolute numbers by 37 percent during the period as total employment in the industry increased from 3.9 million to 5.3 million. Technology advocate Paul Strassmann, former head of data processing for Xerox and a vocal commentator on office technology issues, has argued that office automation will reduce the time spent in unproductive and unnecessary meetings, and will lead to greater employee productivity and national wealth that will, in turn, create more office jobs (Schlefer, 1983). Other studies suggest that technological change will lead to increased specialization of office support employees, stimulating the upgrading of secretarial and clerical positions to include some technical and management duties (ABT Assoc, 1982).

This differs markedly from the conclusions drawn by Menzies (1981) and others who have reported a growing mismatch between the skills held by office support staff and the types of
employment being created in offices. On the basis of several case studies, she found the creation of a bimodal distribution of employment skills, with few clerical employees being transferred into technical and managerial positions because of a fundamental gap between the skills of office support employees and professional and managerial employees, as well as a negative attitude on the part of management about the potential of office support staff. An analogy describing this situation is provided by Cordell (1985, p. 41):

(consider by way of analogy the Boeing 747 aircraft. At one end of the multimillion dollar machine are the skilled pilot, copilot, and navigator; at the other end, are the flight attendants. One does not become a pilot by working for the same airline as a flight attendant; rather, one must drop out and, if possible, be retrained for the more skilled and highly paid job.

The job displacing role of computer technology is illustrated by the telecommunications sector, where the introduction of electronic switching reduced the size of operator staffs in Vancouver and New Westminster by 22 to 40 percent, while the centralizing nature of the technology eliminated operators from many smaller towns (Cordell, 1985). Leontief (1981, quoted in Cordell, 1985, p. 37) has observed that:

Thirty years ago, it took several thousand switchboard operators to handle one million long-distance telephone calls; 10 years later, it took several hundred operators; and now, with automatic switchboards, only a few dozen are required. The productivity of labour . . . will reach its highest level when only one operator remains, and will become infinite on the day that operator is discharged.

Karen Nussbaum, the director of 9-to-5, the U.S-based National Association of Working Women, has projected that office
automation will jeopardize 20 million office jobs (Schlefer, 1983).

In the United States, the Bureau of Labour Statistics (BLS) has projected employment changes in clerical occupations during the period 1982 - 1995 that vary between a 76.1 percent increase for computer operators, to a 20 percent decrease for central telephone operators (Hunt and Hunt, 1985, cited in Hartmann et al., 1986). According to BLS projections, the fastest growing clerical occupations include computer operators, peripheral EDP operators, medical insurance clerks, credit clerks, insurance checkers, claims adjusters, cashiers, and survey workers. Employment growth in these occupations is expected to range between 48.2 and 76.1 percent between 1982 and 1995. With the exception of computer and EDP operators, and cashiers, all of the above occupations are amenable to being performed at home. The clerical occupations with the largest expected percentage declines include central office telephone operators, postal service clerks, data-entry operators, stenographers, purchase and sales clerks, and postal mail carriers.

Hartmann et al. (1986) observe that it is difficult to measure the employment effects of technological change; the effects may not occur until long after an innovation is introduced, and technological change is usually so embedded within a larger context that it may be impossible to isolate specific effects from other factors. They suggest four factors that affect future employment levels: (1) the general performance
of the economy, (2) specific employment policies, (3) changes in
the labour supply, and (4) developments in available technology.
It is problematic, however, to assign specific changes to any one
factor. For example, in the case of technological innovation, the
flexibility inherent in office technologies suggests that their
effects, whether on productivity or employment, will be
influenced by concurrent social and other contextual changes, and
not just technological factors (Hartmann et al. 1986). It has
been argued that this is due to a further set of factors: changes
in equipment occur alongside structural changes in product and
labour markets; technology has varying roles in economic growth
(i.e., while necessity is often the mother of invention,
invention can also be a strong determinant of necessity); there
is much diversity in the way organizations use innovation and
these can have varying employment impacts; the use of technology
may be constrained by external factors such as labour force
availability; there are countervailing tendencies towards both
increased complexity and more simplification in occupational
skill levels; and there is a growing level of interest in the
quality of employment among employers and employees.

An alternative threat to direct job losses is created by the
potential to transmit work over long distances. This was
discussed above with respect to off-shore telecommuting although
it can also occur on a more local scale. Rosenberg (1986) has
cited the ability of employers to transfer work to other
locations as a means of keeping employees from joining or
organizing unions, as well as being used to bid down wages.

Despite the potential gains that employees may receive, there is potential for considerable losses in quality of employment, particularly through job fragmentation and deskilling (Gill 1985; Hartmann et al., 1986). As with other issues surveyed in this chapter, there are differing views of the amount of deskilling that is occurring and the degree to which technological change is responsible. A frequently cited study by Murphee (1984, cited in Hartmann et al., 1986) describes the fragmentation of responsibilities held by legal secretaries in a large firm following the introduction of information technology. Technological change led to increased specialization of job duties and more centralized controls; the variety of the work done by the secretaries was considerably reduced and they assumed a less challenging role as office gatekeepers. Others, however, have stressed the potential of office automation to integrate previously fragmented activities so that, for example, customer service agents can handle an increased number and type of transactions involved with a client's file or account. Hartmann et al. (1986) have concluded that both deskilling and job reintegration are occurring, although it is unclear which trend is predominant. They indicate that this uncertainty is largely due to overly aggregated data, and that proxy measures that are used to measure changes in job skill requirements, such as years of work experience or educational levels, may gloss over detailed qualitative and quantitative information and fail to account for
changes in employer requirements and demographic shifts. They also note that survey results may disagree because of comparisons between organizations that use technology at different evolutionary stages or degrees of adoption, and that the introduction of a new technology may have markedly different effects on the same type of job in different organizations, and is dependent on their relative pre-introduction skill levels.

6.4.3 Alternative Work Arrangements

Between 1980 and 1985, the number of U.S. employees who were leased, temporary, involuntarily worked part-time, were employees of subcontractors, or worked at home, increased from approximately 8 percent to 17 percent of the total nonfarm work force (Pollock and Bernstein, 1986), while in Canada, the number of part-time employees increased at an annual rate of 5 percent during the 1980's, compared with a growth rate for full-time employees of 2 percent (Ward, 1986). Several factors are behind the increase in the number of people participating in alternative work arrangements. Appelbaum (1986) suggests that the increased use of contract workers, also known as contingent workers, is largely based on the desire of employers to reduce their dependence on internal labour markets. While internal labour markets guarantee that employers will have employees available at each skill level when undergoing expansion, many organizations are involved in downsizing and contraction. This leads to employees often being seen as unnecessary expenses rather than
future investments. Temporary employment and the use of subcontractors is used by firms as a buffer to protect highly-valued employees from being laid-off when adjusting workforce sizes, and as a means to contain labour costs by not paying for vacations, holidays, health benefits, insurance, or pensions. In the United States, it has been reported that full-time employees earned (U.S.) $7.05 an hour while, at the same time, part-time employees earned an average of (U.S.) $4.17 an hour (Pollock and Bernstein, 1986). A study sponsored by Labour Canada of 5,000 federally-regulated companies found that 16 percent paid permanent part-time employees less than full-time employees, while 47 percent paid lower rates to part-time employees who worked seasonally (Ward, 1986). As a consequence, employer interest in temporary and part-time help has increased considerably; for example, the value of the U.S. temporary help industry is reported to have grown from (U.S.) $2.3 billion in 1977 to (U.S.) $5.14 billion in 1982 (Applebaum, 1986). Another means by which contingent workers are created is through "employee leasing" in which a company dismisses its employees, who are then hired by another company whose sole purpose is the administration of the employees, who are then leased back to the first company. Employee leasing companies often obtain lower group rates for employee benefits than do the original employers, saving aggregate labour costs.

The advantages provided to employers by contingent employment is the subject of much controversy. Contingent
workers can be hired to work during periods of high demand or on an "as needed" basis, reducing wages that would be paid to a salaried employee. Christensen (in Pollock and Bernstein, 1986) has described the use of contingent workers as the creation "of a second-class tier in the labor force." It has been suggested that the use of contingent employees is a move towards the Japanese enterprise model, in which only a small core of employees have guaranteed long-term employment, and with much work being sent to small subcontractors that use poorly-paid employees who are subject to frequent lay-offs and receive few, if any, benefits (Gill, 1985). Pollock and Bernstein (1986) report the case of a pipefitter with ten years seniority with U.S. steel manufacturer USX who was laid off and hired by a subcontractor to do the same work at the same USX plant, and whose hourly wage rate fell from $13 an hour to $5 an hour and who lost his employment benefits.

The use of contingent workers has been the subject of at least one instance of litigation in the United States, in which it was claimed that the change to independent contractor status was made solely as a means to avoid paying benefits (Christensen, 1988a, 1988b). Eight women involved in a telecommuting program processing insurance claims sued their employer for fraud claiming that the length of their workdays increased up to 15 hours on occasion, removing the flexibility the program was intended to provide (Pollack, 1986). While the case was eventually settled out of court for an undisclosed sum, it is
illustrative of the controversy surrounding the issue of whether a home-based worker is an employee or an independent contractor.

It has been observed, however, that a growing number of workers, mostly women, are interested in more flexible work schedules and arrangements in order to fulfill work and home responsibilities (Applebaum, 1986). A recent survey of 1,000 employed mothers in the U.S. magazine Child found that 71 percent would work part-time if they found a job they liked, while 80 percent of 2,200 working mothers responding to a survey for Ladies Home Journal indicated they would prefer to work part-time (Zarzour, 1990). These results reflect a general consensus that married women who work still tend to do the bulk of household chores and childcare. Thus, there is a growing demand, mainly among working mothers, to balance employment and domestic demands. Part-time professional employment appears to be rare, with employers expressing concern that part-time employees lack commitment to their jobs. It has been argued, however, that there is a growing trend for employers faced with difficulties attracting and keeping valued employees to take a more active role helping employees to balance home and work pressures, including offering flexible hours, part-time work, and job-sharing arrangements (Gorrie, 1990).

The large proportion of telecommuters, especially in clerical positions, who are employed as independent contractors, suggests that telecommuting will provide opportunities to expand the number of contingent workers. As with other aspects of
telecommuting and remote work, the use of contingent workers provides both potential opportunities and disadvantages to workers, and its primary benefits appear to be to employers.

6.4.4 The Ideology of Telecommuting

Telecommuting, and its role as a catalyst creating either increased isolation and exploitation or the attainment of entrepreneurial and lifestyle independence, has become a target of ideologically-based commentary and debate. Berch (1985, p. 37), writing in *Monthly Review*, observes that: "(w)hile there are similarities between "electronic cottaging" and pre-industrial homework, they speak more to the endurance of gender roles and patriarchy than do similarities in production processes." Berch characterizes telecommuting and out-work as a means for employers to evade labour standards and save wages by exploiting docile groups that includes homebound wives, prison inmates, the disabled, and third world workers. This perspective is echoed by Mattera's (1983) description of "home computer sweatshops", in which telecommuters are described as being "compelled or pressured" to accept remote work arrangements.

An opposing view is provided by Rubin (1984), who challenges Mattera's conclusions by stating that "little evidence of impending serious consequences was adduced" in his article. Rubin characterizes telecommuting as a means to open the job market to people who might not otherwise be able to work, including new mothers for whom he indicates telecommuting "offers
Rubin characterizes opposition to telecommuting by organized labour as being based on union concerns about organizing clerical employees during a period of declining union membership, and dismisses issues about the actual or potential exploitation of home-based workers as an historical artifact.

Another perspective on home-based work was the Family Opportunity Act, introduced by Republican Congressman Newt Gingrich in the early 1980's. The Act, which did not become law, would have given tax credits to families that bought computers for educational or work purposes, and is reported by Mattera (1985) to have been praised at a Moral Majority sponsored forum as a means for women to earn money without neglecting their families. The debate about home-based work crystalized during the early 1980's when a group of Vermont knitters sought a repeal of the ban against industrial homework created by the Fair Labour Standards Act. The U.S. Circuit Court of Appeals overturned a decision by the Labor Secretary lifting the ban, describing the action as "arbitrary and capricious" (Kleiman, 1984). While proponents of the ban viewed the Administration's actions as an example of the Reagan administration's attack on organized labour and affirmative action, opponents of the ban saw it as an impediment to a basic right to work in one's home.
6.5 FACTORS INFLUENCING RESIDENTIAL LOCATION

One of the principle potential benefits attributed to telecommuting is the reduction or elimination of work-related commuting. There are suggestions in the literature (Bewer, 1984; Dillman, 1985), backed to some extent by anecdotal reports in the press (Brooke, 1984; Atchison, 1986; Zarzour, 1990), that independence from commuting may shift the residential location patterns of telecommuters, with the archetypal migration being from a central urban area to a rural area or smaller settlement on the edge of a metropolitan area. This type of migration would conform with the results of surveys in the United States which have shown that, given a choice, many Americans would prefer to live in small towns or rural places, and that large cities are the choice of fewer people than reside in them and are the least preferred choice of many people (Dillman, 1979; Zuiches, 1982). The most desirable residential locations appear to be smaller communities within the daily commuting range of large cities; Fuguitt and Zuiches (1975) have reported that only 9 percent of Americans want to live in a city of greater than 500,000 people, and that many want to live in a small town or rural area within 30 miles of a large city. This is reflected in the 1980 U.S. census results in which, for the first time since the census was originated in 1790, areas classified as rural had greater growth rates than metropolitan centers (Hauser, 1981). One manifestation of this is the rapid population growth of suburban "megacounties" such as Orange County between Los Angeles and San
Diego, Fairfax County, adjacent to Washington D.C., and Gwinnett County near Atlanta, Georgia (Church, 1987). According to Hawley (1971, cited in U.S. Department of Transportation, 1985), a suburban exodus has been occurring in the United States since the turn of the century and the populations of New York, Chicago, Philadelphia, Cleveland, and Pittsburgh were larger in 1940 than in 1980.

It is difficult to deny that urban structure is strongly influenced by transportation configurations and technologies. Blumenfeld (1971) observed that the three to four mile radius of the pre-industrial city was largely determined by the distance that could be travelled by foot, and, more recently, the creation of freeways has been a major stimulus of the suburbanization process. The notion of telecommuting as a liberating technology that enables individuals to leave the high costs, congestion, and grime of city centres is largely a product, however, of a surprisingly long-lived neo-classical conceptualization of the urbanization process in which the predominant role of physical accessibility is summarized by the 1903 statement by the American land economist Hurd that "value depends on nearness" (Ley, 1983). Hurd's conclusion is echoed by Alonso's (1971) influential market-based theory of urban land-use patterns in which land uses are characterized as the outcome of a competitive bidding process among land users in a particular area; users in central locations pay higher rents for better overall accessibility while users who cannot afford center city rents, or do not need the superior
accessibility of city centers, are located in lower rent locations towards the periphery of a city. The competitive bidding for land is viewed as a means of obtaining maximum accessibility: ". . . one might say that the structure of the city is determined through the dollar evaluation of the importance of convenience" (Ratcliff, 1949, quoted in Ley, 1983, p. 26).

The origins of Alonso's model are found in the locational theories of Von Thunen and Christaller (Ley, 1983), in which uniformly distributed and economically rational players with complete information make locational decisions on an isotropic plain that has equal accessibility in all directions. In Alonso's model, residential locations are chosen on the basis of their place utility: satisfaction is maximized through a trade-off between accessibility to work (distance) and housing consumption (space). Consumers "seek to balance the costs and bother of commuting against the advantages of cheaper land with increasing distance from the center of the city and the satisfaction of more space for living" (Alonso, 1971, p. 157). The trade-off may be represented by a bid rent curve in which the costs of commuting are inversely related to the value of land.

The fundamental limitation of this characterization, however, is its overwhelming dependence on the role of transportation costs and mathematical modelling, whether measured in terms of time or money. While not disregarding a role for work-related commuting in the residential decision-making
process, the literature has more recently begun to recognize that
the choice of a residential location is complex and usually
depends upon a wide variety of factors including its price, size,
age, type, and quality, the physical characteristics of the
neighbourhood, the quality and proximity of schools if there are
children in the household, the availability of recreational
facilities and public services, access to shopping areas, the
presence or absence of hazards such as busy streets and noxious
factories, crime rates, prestige, perceptions of an area's
social, ethnic, and demographic composition, and whether any
changes are occurring in that composition (Brown and Moore, 1971;
Meyer and Miller, 1984). The notion of economically rational
decision-making is also challenged by migration studies that
stress non-economic quality-of-life factors which can be of
greater significance than increased income or occupational
opportunities when making residential location decisions
(Zuiches, 1982). Similarly, the decision to move can be based on
"push" factors, such as negative evaluations of current
situations, as well as attempts to obtain particular residential
qualities (Morrill, Downing, and Leon, 1986). A more extreme
view of the forces underlying urban structural change is
provided by Rogers (1971), who argues that the complexity of
human behaviour and the numerous interactions that occur in a
city make any attempts to develop a deterministic model of
spatial patterns futile, and that the random nature of human
behaviour suggests that stochastic models may be a more
appropriate approach for evaluating the elements of urban change. Hanson and Pratt (1988) reject the abstractions of much of the model-based research on the links between home and workplace, noting limitations in the assumption that the location of work takes precedence over that of home, the failure of residential models to adequately address gender differences and occupational characteristics in commuting patterns, and suggesting that more attention should be given to the contextual interdependence between home and workplace.

Ley (1983) observes that there is little empirical evidence to support the role of commuting costs as a major constraint on residential locational decisions. He cites a 1973 study of 380 Toronto homebuyers in which only two and one-half percent of respondents indicated that their move had been prompted by their distance from work, and a similar study in Seattle in which no evidence was found that workplace access was an important locational factor. Similarly, in an early critique of mathematical locational models, Stegman (1969) observed that American survey data has shown that a majority of families that move to the suburbs are more concerned with neighbourhood quality than access to work. In a study of the journey to work in Vancouver, Wolforth (1965) concluded that workplace location was of little relevance to residential location except for a limited group of workers for whom alternative explanations for their short commutes were generally available. He also stressed the importance of the existing spatial structure of the city to the
determination of commuting patterns.

Alonso (cited in Ley, 1983) has acknowledged that there are inherent limitations to his theory's premises, and market-based locational theories in general have been criticized for being too dependent on transportation modelling (Stegman 1969). Richardson (1976, cited in Ley, 1983) lists additional simplifying assumptions found in market-based locational models including a monocentric city with continual rent and density gradients peaking in the CBD, clear segregation of land uses, uniform accessibility, a minimized planning role, and dependence on market processes to create land use patterns.

The theoretical limitations and lack of supporting empirical evidence for market and transportation-based models of residential location collectively discredit the notion that proximity to work is an important factor in the choice of where to live, and challenges the potential role of telecommuting as a determinant of residential patterns. Rather than being a deterministic factor, telecommuting may help allow an individual to continue residing at a particular location, especially if that individual perceives commuting to work as being too difficult, time-consuming, or expensive. For example, telecommuting could allow an employee to remain in his present location if his employer moves to a more distant location or if commuting times and costs become more onerous. The latter instance was reported in the case of an employee who began to telecommute from her home in Guelph, Ontario, in order to avoid 13 hours per day of work
and travel time to her employer's office in Toronto ("Working at home . . .", 1990).

6.6 THE DIFFUSION OF INNOVATION AND THE CONTROL OF TECHNOLOGY

The literature on innovation and technological change frequently asserts that the introduction or use of a given form of technology will lead to a particular social, economic, cultural, or organizational impact. This type of statement is also found in much of the commentary about telecommuting in which its adoption is described as inevitable and its structure as given. It is arguable, however, that these statements are inaccurate and fail to address the complexities found in the innovational diffusion process.

6.6.1 The Diffusion of Innovation

Technological change and the adoption of innovation usually occur unevenly. Hartmann et al. (1986) indicate that the time between invention and the first commercial adoption of an innovation usually ranges between 5 and 20 years, and the period for major innovations, such as electricity, may take up to 50 years. In his seminal work, Rogers (1983) observes that advantageous innovations do not always sell themselves, even when their benefits are known to potential users. He cites the nearly 200 years the British Navy took to adopt citrus fruits to combat scurvy, and the nearly complete nondiffusion of the so-called dvorak keyboard on typewriters and word processors, despite its
numerous advantages over the more common querty keyboard. Alternatively, some innovations are adopted at surprisingly rapid rates; the president of Bell Cellular Inc. recently observed that his 1985 projection of 49 employees and a $500,000 annual capital construction budget by 1989 fell somewhat short of the 700 employees and $200 million capital budget the company actually had by that year (Surtees, 1990).

Carey and Moss (1985) argue that "instant success is the exception, not the rule, in many of the new telecommunications services" and note that cable television, which is often regarded as a highly successful technology, had taken 34 years (as of 1985) to penetrate only 39 percent of U.S. households. They list several technologies which have declined in overall popularity including CB radio, vinyl records, instant cameras, the telegraph, and home movie cameras, plus two outright failures: quadrophonic sound, and videophone.

Rogers (1983) has defined diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system." An innovation is an idea, practice, or object that is perceived as new by the user, and often involves technology, which Rogers defines as "a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome." Technology usually has two components: (1) hardware (i.e., the tool that embodies the technology), and (2) software (i.e., the knowledge used in the application of the tool). The literature
on the origin of innovative activity is characterized by two principal models: demand pull and science push (Freeman, 1979). Proponents of the former, known as externalists, assert that market demand is the dominant influence on scientific and inventive activity, while proponents of the latter theory, known as internalists, state that internal developments within science and technology determine or permit changes in products and processes.

According to Rogers, the adoption rate of an innovation is based on the characteristics of the innovation as perceived by its users. These, in turn, are based on the innovation's relative advantage, compatibility, complexity, trialability, and observability. The decision to adopt an innovation has been characterized as having five stages: (1) knowledge of the innovation's existence, (2) persuasion of the decision-maker, (3) the decision to implement, (4) implementation, and (5) confirmation of decision. Not all members of a social group adopt an innovation at the same time; members of a social group can be classified into adopter categories (innovators, early adopters, early majority, late majority, laggards) based on their relative receptivity to innovations, with the adoption of an innovation usually following an s-shaped curve over time. The adoption of innovations by organizations is influenced by their structure, with their ability to experiment further influenced by their relative centralization of authority and the environment in which they operate; competitive environments often encourage
experimentation and innovation. According to Carey and Moss (1985), the diffusion of new telecommunication technologies accompanies the convergence of several factors that include: price acceptability among potential users; service advantages relative to competing technologies; user interest and need; ease of use and motivation to change existing habits; a favourable regulatory environment; and, the presence of support equipment and distribution paths.

While the adoption rate of an innovation may be determined by empirical study, it is difficult to forecast because it is a continuous process, and innovations may go through periods of re-invention where improvements and cost changes occur. It is often more difficult to observe the specific consequences of a particular innovation because innovations are not introduced in a social vacuum, but are applied into existing contextual structures. The effects of an innovation are not only based on the inherent characteristics of the innovation, but also on the manner in which it is introduced and applied, since this will determine the extent to which it interacts with other structures.

Freeman (1979, p. 211) has observed that there is a great deal of uncertainty in the introduction of innovations:

The fascination of invention and innovation lies in the fact that both the marketplace and the frontiers of technology and science are continually changing. This creates a kaleidoscopic succession of new possibilities and combinations. An unexpected twist of events may give new life to some long forgotten speculations.

This is particularly apposite in the case of telecommuting, which
has gone through several stages in which its proponents have cited a succession of reasons favouring its adoption, only to see it remain on the sidelines. According to Freeman, innovation is a coupling process along a continually changing interface between science, technology, and the market. To some extent, telecommuting has failed to reach its potential because of a mismatch between what the technology provides and what the market, viewed in terms of employers and employees, wants. Because of its inherent flexibility, and the changing nature and demands of the market, telecommuting is finding increasing acceptance. Nevertheless, this emphasizes Freeman's conclusion that chance plays a significant role in the success of innovations, and that the process of adoption is intermittent, uneven, or cyclical, rather than smooth or incremental.

6.6.2 The Social Control of Technology

During the twentieth century, an increased awareness has developed of alternatives and choice in the application of technology, and this has been embodied in a debate over whether science and technology is neutral or deterministic in nature (Lipscombe and Williams, 1979; DeBresson, 1987). The notion that technology is neutral in its consequences is perhaps best summed up by historian Lynn White (1962): "Technology opens doors; it does not compel men to enter." This echoes the pre-World War II optimism of Lewis Mumford found in Technics and Civilization (1934), where he states that, "The machine itself makes no
demands and holds out no promises, it is the human spirit that makes demands and keeps promises." According to Rybczinski (1983), Mumford's optimism was based on an assumption that technology would be assimilated into a culture that would remain nontechnical, but this assumption was based on a belief that many technical limits had already been attained.

Mumford's early optimism about technology was replaced in later years by warnings about technological subversion ("the megamachine"). In *The Myth of the Machine* (1970), the modern industrial state is characterized as a manifestation of constrained human choice and suppression of spirit that occurs periodically throughout history, with other instances found in Pharaonic Egypt, among absolute monarchies, and in fascist and communist states.

A more deterministic view of technology, although equally critical, is provided by French sociologist Jacques Ellul (1964, p. xxv) who introduced the notion of technique:

The term technique, as I use it, does not mean machines, technology, or this or that procedure for attaining an end. In our technological society, technique is the totality of methods rationally arrived at and having absolute efficiency (for a given stage of development) in every field of human activity.

In Ellul's analysis, technique is a relatively recent phenomenon, having developed out of eighteenth century industrialism as concerns about ethics and aesthetics were replaced with efficiency. Ellul has defined technique in the following terms: automatism of technical choice (i.e., a self-directing system); self-augmentation (i.e., technique does not need human guidance);
monism (i.e., its components are self-reinforcing); the necessary linking together of techniques (i.e., there is a mutual interaction that underlies the progression of techniques); technical universalism ("Today technique imposes itself, whatever the environment" p. 118); and the autonomy of technique ("Technique has become a reality in itself, self sufficient, with its special laws and its own determinations" p. 134). Technique is not so much involved with the technical aspects of tools and processes as with the values that underlie their use. Ellul's principal concern appears to be the general lack of awareness that individuals have about the degree to which they are conditioned by technology; individuals adapt to technology rather than the converse and technique has become so powerful that politics and economics are situated within it, rather than influenced by it. Ellul's notion of technique has been criticized for failing to acknowledge that the benefits of technology may outweigh its costs (Rosenberg, 1986).

The impact of technology has played a prominent role in Canadian thought and has helped shape the works, for example, of George Grant, Marshall McLuhan, and Harold Innis (Kroker, 1984). In a review of the Canadian telecommunications industry, Babe (1990) has described technological dependence and its dual doctrines of technological imperative and technological determinism as a "virulent myth" that has shaped Canadian public policy literature:

The former holds that the march of engineered artefacts is necessary, 'in the order of things,' subject to little human
direction or control. The latter posits that all important human phenomena - cultures, distribution of power, belief systems, industrial structures, and so forth - are explainable by the evolution of these same industrial devices. (1990, p. 9)

Babe details numerous instances where government documents and policy papers describe the information revolution as inevitable and beyond political control while omitting to refer to the vast expenditures made each year by governments to bring about the same information revolution. Rather than being influenced and guided by leaders and social institutions, the shift towards an information society is often characterized as being driven by technology:

There are in these declarations, and others like them, scarcely veiled allusions to the doctrine of technological determinism. In each, 'technology' is said to be imposing new rules, new goals, new values, new ethics, implying that it is retrogressive and futile to apply old criteria, old goals, and old values and ethics to direct, shape, or modify deployment of 'new technologies'. The 'good,' in other words, is neither given nor is it to be discovered; values are mutable, and imposed by exogenously evolving 'technology.' (1990, p. 13; footnote and italics omitted)

Much of the literature on the information revolution embodies a reverential attitude towards technology; the effects of information technology are viewed by many as inevitable and irresistible. Perhaps the preeminent exponent of this is Alvin Toffler (1980) who enthusiastically states:

A powerful tide is surging across much of the world today, creating a new, often bizarre, environment in which to work, play, marry, raise children, or retire. . . . Value systems splinter and crash, while lifeboats of family, church and state are hurled madly about . . . The grand metaphor of this work, as should already be apparent, is that of colliding waves of change.

Langdon Winner (1984) has described the utopian determinism found
in the context of information technology as "mythinformation": "the almost religious conviction that a widespread adoption of computers and communications systems and broad access to electronic information will automatically produce a better world for mankind." He observes that the romanticism that surrounds information technology is similar to notions found in previous "revolutions" (e.g., steam, electricity, electronics) that promised freedom, democracy, and justice on the basis of material abundance. In the case of information technology, there is an often-stated maxim that knowledge is power; it is assumed that access to information through information technology will become a great equalizer, empowering the disadvantaged and altering for the better existing inequities of social power and control. Winner observes, however, that little consideration is made about the appropriate design of the new institutions that will facilitate the great equalization; instead, commentators often assume that improved democratic processes will materialize because of improved information availability. This would not appear to be the case according to Danzinger (1982, cited in Winner, 1984) and others who argue that the socially powerful are adapting and using computers to enhance their positions of control.

Gordon (1988) offers three explanations of the role of technology in the adoption of telecommuting: (1) technology is a driving force because personal computers and telecommunications technology require people to rethink how and where office work
should be performed; (2) technology is a catalyst because it allows a selective reorganization and decentralization of the office; and (3) technology is an obstacle because it overwhelms because of the choices available in computers and telecommunications technology. Gordon rejects any deterministic model, noting that many of the obstacles facing telecommuting are not technological in nature, but are based on organizational and psychological factors. He suggests that technology, particularly the use of personal computers, is a facilitative factor that is used to implement choice. The available evidence about telecommuting does not support a deterministic view of technology, either in terms of its adoption or its consequences. Predictions by Nilles, Toffler and others that millions of U.S. workers would be telecommuting by 1990 have failed to materialize. The greatest impediments to increased adoption have been managerial resistance, corporate culture, and concerns on the part of employees about isolation and exploitation; to date, technology has played a relatively minor role in determining the adoption of telecommuting.

6.7 CONCLUSION

The history of telecommuting is largely that of a solution in search of a problem; it is illustrative of an innovation that has yet to be matched with its potential, but has been found to be suitable in a limited number of instances and will likely continue to have an incremental and uneven rate of adoption.
This chapter has suggested that several factors will help influence the degree and rate by which telecommuting will be adopted. Despite conflicting statistics on the number of people who work at home, the notion of the home as workplace appears to be gaining increased acceptance. This is based on several factors including an increase in the number of small businesses, the need for many to find alternative working arrangements in order to better balance domestic and work responsibilities, an increased credibility shown towards home occupations, and opportunities to work at home created by technology, including telecommuting. Increased acceptance of the home as workplace facilitates acceptance of telecommuting, both among employers, who often assume that those who work at home are unproductive, potentially disloyal, and probably not working very hard, and among employees, who may feel stigmatized and fear a loss of credibility from neighbours and colleagues.

Developments in information technology are likely to facilitate telecommuting by providing the technical means to efficiently and effectively work in decentralized settings, and by fostering the notion that the office does not have to be limited to the physical confines of a building. The home can be viewed as a functional extension of the office and the latest stage in its evolution. At present, however, it appears that information technology is best suited to promote the spatial dispersion of activities in two types of situations and occupational groups: (1) distinct, routinized and predictable
transactions, such as data entry and word processing, performed by clerical employees with little or no need for interaction with other employees; and (2) intermittent, non-routine activities, such as report writing, by professional or managerial employees, who have little or no need for face-to-face contact with colleagues.

The reactions of organized labour, particularly in the United States, may limit the extent or nature of telecommuting. Based mainly on concerns about worker exploitation, potential losses in employment levels and quality, and the difficulty of organizing a spatially dispersed workforce whose employment status is unclear, some labour unions have called on the U.S. government to ban telecommuting as a work option. An outright ban on telecommuting is unlikely, however, because home-based work is increasingly viewed as an advantageous option by employers seeking to reduce capital and operating costs, and many employees wanting more flexible work arrangements.

The issue of increased flexibility of residential location created by telecommuting does not appear to be as relevant as some proponents of telecommuting have suggested. The relationship between the locations of work and home appears to be limited at best, and many other factors such as personal taste, prestige, economic resources, and proximity to recreational, shopping, and educational facilities are also relevant. Rather than stimulating residential mobility, telecommuting may provide a means by which employees continue to live in their present
homes, and eliminate costly or time-consuming commutes to work.

Finally, there is a growing acknowledgement that the role of technology in the adoption of telecommuting has been overstated, especially in the early literature on the subject. While technology provides a means to an end, it is not determinative of either its manner of adoption, or its consequences.
CHAPTER SEVEN

POLICY CONSIDERATIONS OF TELECOMMUTING

7.1 INTRODUCTION

The previous two chapters illustrate some of the many disciplines with which telecommuting and remote work interact, and suggest many areas in which policy considerations are appropriate. It is beyond the scope and purpose of this thesis, however, to enter into a detailed examination of each of these considerations. Instead, three areas that are arguably of greatest current public policy significance will be reviewed: (1) municipal regulation of home-based work, (2) regulation of employment conditions, and (3) impacts on settlement patterns and processes. These policy concerns all involve provincial or municipal jurisdictions. Omitted will be issues of federal jurisdiction, such as telecommunications policy, pensions, unemployment insurance, taxation, and transborder data transfers.

7.2 THE REGULATION OF HOME-BASED WORK

7.2.1 Municipal Regulation of Home-Based Work

Home-based work is frequently the object of regulation and control by local levels of government, usually through their powers to regulate land use. In Canada, authority to control land use is primarily held by provincial governments, which delegate this power to various bodies, including municipalities. In British Columbia, the provincial government delegates planning authority and exercises broad powers of supervision over
municipalities through the Municipal Act, and, in the case of Vancouver, the Vancouver Charter. Urban land uses are controlled primarily through land use zoning, in which municipal councils pass zoning by-laws that regulate land development within specifically demarcated areas (s. 716(1)(b) Municipal Act, s. 565(b) Vancouver Charter). Zoning provisions allow municipalities to prohibit uses within a zone; this is generally accomplished by listing the permissible uses within a zone and prohibiting all others. Conditional uses, where certain uses are allowed with the approval of Council, are not permitted under the Municipal Act, although they are allowed under the Vancouver Charter (s. 565A(d)).

Home based work was one of four "high-tech innovations" about which the American Planning Association's (APA) Planning Advisory Service reported it had received numerous inquiries (Longhini, 1984). A 1984 survey by the APA of 1,100 local planning agencies in the U.S. found that 90 percent of the nearly 600 respondents regulated home-based employment (Butler and Getzels, 1985). The APA survey found several common elements in home occupation ordinances, although all of the following were not usually found in any one ordinance: (1) a definition of home occupations; (2) the history of the ordinance; (3) an intent or

1 RSBC 1979, c. 290, as ammended.
2 SBC 1953, c. 55, as ammended.
3 The other three were television dish antennas, newspaper vending machines, and automatic teller machines.
policy statement describing the reason for the regulations; (4) a list of permitted or prohibited home occupations; (5) conditions or performance standards that home occupations have to meet; (6) a statement of review procedures, and (7) enforcement procedures.

The origins of home occupation by-laws vary by jurisdiction. Frequently cited rationales include the potential for home-based businesses to create traffic and parking congestion, the use of noisy or otherwise offensive machinery and other work-related devices, the creation of physical conditions that detract from, or conflict with, local residential surroundings and, a general incompatibility between commercial and residential uses. It has been argued, however, that home-based work has a legitimate and beneficial role and that regulation of it should strive to maintain a balance between the needs of home-based employees and those of neighbouring residents (Butler and Getzels, 1985).

Rohan (1989) observes that zoning authorities often allow "modest business activities" in homes because it is both difficult and overly intrusive to narrowly define residential uses. While many ordinances allow home occupations that are incidental or subordinate to the principal use of the property, others enumerate specifically allowable uses that are limited to occupations "customarily" conducted in the home. The rationale for allowing incidental uses is that secondary uses conducted on a small scale presumably have a minimal negative impact on neighbouring residential users. Incidental use ordinances typically require that the occupation be carried out in the
actual residence of the owner or in an accessory building, and will bar the occupation if it begins to dominate the residential use, although there does not appear to be any clear formula for determining when that occurs. Alternatively, municipalities may use performance controls to minimize the negative effects of home occupations on neighbouring users. Standards usually limit traffic, noise, dust, and odor levels to those otherwise found in the neighbourhood, limit the proportion of interior space used by the occupation, and prohibit external evidence of the occupation, although they often permit a small sign. Ordinances frequently limit the number of employees to the owner or the owner's immediate family. Rohan (1989) observes that the basis of the customary use requirement is less clear than that for incidental uses, but suggests that it may be based on early zoning practices which often took communities as they were at the time they were first zoned and allowed existing types of home occupations to continue in operation. Rohan notes that a literal application of this requirement limits the class of customary uses to occupations in existence at the time the first ordinances were enacted.

The operation of professional offices in the home is often allowed on the basis of the customary requirement, although the office must usually remain incidental to the property's primary residential use. There does not appear to be any clear criteria for determining what constitutes a professional use, and ordinances may or may not list qualified uses. In other
instances, enumerated uses act as a guide for dealing with unlisted uses. Frequently permitted professional users are lawyers, doctors, dentists, and architects. While musicians and artists are sometimes determined to be professionals, many cases have held that real estate agents, insurance agents, beauticians, and undertakers are not professionals.

The National Alliance of Homebased Businesswomen (NAHB), a U.S. organization formed in 1981 with the goals of eliminating isolation among home-based working women and combating its "cottage industry" image, has drafted a model zoning ordinance for home-based businesses. The model ordinance suggests the following requirements for home businesses or offices: the employment use is to be clearly secondary to the use of the dwelling for residential purposes; no objectionable noise (0 db above ambient levels at property lines), noticeable vibration, or objectionable odor to be created at property lines; no waste or unsightly conditions created that are visible from off the property; no interference created with radio or TV reception of neighbouring properties; no more than two full-time non-resident employees on the premises; no signs visible from the street except as permitted by by-law; occupation of no more than 25 percent of the dwelling's floor space; sufficient parking for residential and business use; and no creation of traffic volumes "inconsistent with the level of traffic on the street on which it is located" (NAHB, n.d.).

The enforcement of home occupation ordinances varies by
jurisdiction, although it is frequently made on the basis of complaints by neighbours (Freedman, 1985). One example of a vigorous enforcement policy was provided by Chicago columnist Mike Royko (1984) who reported the story of a husband and wife who moonlighted on their regular teaching jobs by doing freelance educational writing in their basement. Acting on a complaint by a neighbour, the City of Chicago ordered the couple to "close the subject premises and keep said premises closed and vacated until further notice" because they were doing commercial business in a residentially-zoned neighbourhood. In this case, the "subject premises" was the couple's basement, which was also used for laundry and other domestic uses.

In Canada, local governments have adopted a position towards home-based employment that varies between passive acceptance and open hostility. For example, on the basis of a concern about "commercial creep" by businesses into residential areas, the City Council of North York, Ontario voted to keep home offices illegal, with enforcement to be made on a complaints basis, while Toronto has extended an already severe limitation against home-based employment by removing exemptions allowing home-based doctors and dentists offices on the grounds that the exemptions discriminated in favour of some professions (Demb, 1986).

An informal survey, conducted by the author, of the

4 Exceptions are provided for in-home "emergency or consultation" uses by doctors, dentists, druggists, and chiropractors, as well as private music teaching to no more than one student at a time in detached, single family homes. The maximum penalty per violation is $1,000.
regulation of home-based employment by municipalities and districts in the Greater Vancouver Regional District (GVRD), found wide variations in attitudes towards home-based work and methods of regulation. The survey was initially conducted in July 1986, and involved contacting the planning or licensing departments in each of the 18 municipalities, obtaining a copy of relevant by-laws, and asking questions about the enforcement policies of the municipality. Information in the survey was updated by telephone in August 1989 and September 1990.

Home-based employment in GVRD municipalities is regulated primarily by a combination of zoning and business license by-laws, and is permitted in every municipality with the exception of Port Coquitlam, which prohibits home-based employment with the exception of daycare centres operated within the home.

A variety of regulatory mechanisms are used. Several municipalities list specifically permitted home occupations, usually in zoning by-laws. Permitted occupations often include the professions, craft or artistic based activities, day care centers, and bed and breakfasts. By-laws prohibiting certain occupations are also used by some municipalities, although less frequently. Several municipalities do not refer to specific occupations, and instead list a set of performance requirements that home-based workplaces must meet. These include not producing offensive amounts of noise, odor, vibration, smoke, or electrical interference, not having any external indications that the home is being used for employment purposes, such as
having a sign or materials stored in the yard, and not allowing the home occupation to exceed a specified proportion, usually one-quarter, of the dwelling's floor space.

The enforcement of home-employment regulations also varies considerably. Many municipalities require home-based workers to have business licenses, although some, such as Burnaby, do not require licenses if the work is being done by an employee of a company. A distinction also exists in some municipalities between employees whose employers are in the same municipality as the employee, and those who work for an employer located in another jurisdiction. Most regulations are enforced on the basis of complaints, although some by-law enforcement officers indicated that they sometimes check telephone numbers of businesses advertised in newspapers to see if they are located in a residential area. Each municipality that required a business license for a home-based workplace indicated that, upon finding an unlicensed workplace, they would inform the resident of the requirement to have a license, and only prosecute if the resident refused to obtain one.

Penalties for not having a business license range between $50 and $2,000 per day of offence, and up to 60 days imprisonment. Violations of zoning by-laws can carry heavier penalties; the maximum penalty under Port Moody's zoning bylaw is $5,000 and 30 days imprisonment. Attitudes expressed towards enforcement ranged between relative indifference and vigorous

5 By-law 1890.
zeal, and usually reflected the position adopted by the local council in the restrictiveness of the bylaws. The most aggressive approaches towards enforcement were found in the inner suburban areas (e.g., Surrey, West Vancouver) which had policies directed either at maintaining the residential nature of the area, or preventing the creation of light-industrial eyesores.

It is arguable that ordinances prohibiting or seriously impairing home offices do not have the same normative basis as that found in the regulation of potentially more intrusive home occupations such as dance studios, repair shops, garages, and beauty parlours. The archetypical contemporary home office is virtually indistinguishable from a private study. The origin of many home occupation by-laws appears to be concerned not with the actual work carried out in the home, but with externalities such as increased traffic and neighbourhood disturbances created by the business transactions that may accompany small businesses. Accordingly, it is more appropriate for home occupations to be regulated on the basis of performance standards. This avoids the somewhat arbitrary and frequently unjustifiable criteria applied in determining customary uses, and creates by-laws that provide a better balance between the interests of individual residents who would like to work at home and the wider community that may be affected by their activities.

The sometimes officially sanctioned antagonism towards home-based work is inconsistent with contemporary realities concerning energy efficiency and environmentally sensitive planning, such as
that expressed in the report of the City of Vancouver's Task Force on Environmental Change (1990), which recommended the encouragement of "appropriate" home-based occupations in order to reduce commuting levels. It is also inconsistent with the social and economic realities that underlie much of the interest in telecommuting and other alternative work arrangements. Many telecommuters are essentially forced into home-based work by employers seeking to cut costs, or by economic circumstances in which home-based work is used to supplement primary employment; in other cases, telecommuting is a means to reduce the rigors and stresses of increasingly costly or onerous commutes to work.

There are a number of instances where communities are reported to have actively encouraged home occupations. For example, Oak Creek, Wisconsin contains a subdivision in which 20 homes were specifically built to accommodate occupations such as dentist's offices and craft studios, and Lynwood, Illinois has permitted a development where one-acre lots are "dual-zoned" to accommodate residential and commercial uses (Butler and Getzels, 1985). Probably the most widely cited attempt to build homes specifically for telecommuting is Eaglecrest Village in Foresthill, California (Perry, 1985; Wilson, 1985-86). Three hundred and sixty homes, priced between (U.S.) $200,000 and (U.S.) $250,000, were planned for the development, with each one containing extensive wiring for data communications and a
"teleport" office in which the resident could work. The development was designed to attract persons employed as computer programmers, engineers, or consultants from the nearby city of Sacramento, and the Silicon Valley area. The development went into bankruptcy, however, after only two homes were completed.

7.2.2 Regulation of Home-Based Employment Standards

Conditions of employment and the potential for worker exploitation are among the most controversial aspects of telecommuting and remote work. In Canada, the principal jurisdiction over labour and employment matters lies with the provincial governments under s. 92(13) of the Constitution Act, 1867. In British Columbia, the two primary statutes governing employment standards of home-based workers are the Employment Standards Act and the Workplace Act.

The Employment Standards Act (ESA) sets out minimum and non-waiveable standards of employment including wage protection, maximum hours of work, overtime, annual vacations, termination of employment, child employment, maternity leaves, and employee protection from misrepresentation and improper treatment. The

6 The 360 homes in the development were to be served by 4,000 telephone lines.

7 Telephone conversation with Dean Prigmore, Senior Planner, Placer County, California, July 12, 1990.

8 U.K., 30 & 31 Victoria, c. 3.

9 SBC 1980, c. 10, as ammended.

10 SBC 1985, c. 34, as ammended.
ESA only applies to the relationship between employers and employees, and it has been observed that these terms tend to be defined "in terms of striking circumlocution" (Christie, 1980). For example, in the B.C. Act, an "employee" is defined to include "a person . . . in receipt of or entitled to wages for labour or services performed for another", and "wages" include "salaries, commissions or money, paid or payable by an employer to an employee for his services or labour" (section 1). To resolve the circularity of these definitions, reference is made to judicial interpretation in the case law. In his treatise, Christie (1980) refers to a widely cited common law test that provides the following as indicia: the power of selection, payment of wages or remuneration, the right to control the method of doing the work, and the right of suspension or dismissal. Christie notes that the "control" factor has received special emphasis in Canadian courts, although he observes that interpreting this as meaning the power to tell someone what to do and how to do it tends to break down when the individual in question is a skilled professional or tradesperson. Even if someone is held to be an employee, section 1 of the ESA limits its own application to telecommuting arrangements by defining "work" as:

. . . the labour or services an employee is required to perform for an employer and includes the time the employee is required to be available for his employment duties at a place designated by the employer but does not include the time spent by an employee in his own living accommodation, whether on or off the employer's premises.

While the latter provision was presumably not drafted with telecommuting in mind, a literal interpretation would appear to
exclude the application of the ESA from a telecommuter's home.

An alternative to the employer/employee relationship is for a telecommuter to be characterized as an independent contractor. The most frequently cited basis to determine whether someone is an independent contractor is the case of Montreal v. Montreal Locomotive Works Ltd.11, in which Lord Wright of the English Privy Council outlined a fourfold test: (1) control; (2) ownership of the tools; (3) chance of profit; and (4) risk of loss. Christie (1980) states that in practice these factors are only treated as indicia; for example, many people in employment relationships, such as carpenters and mechanics, own their own tools. Similarly, the issue of potential profit and loss refers to whether the person in question has some form of financial investment in the business. When an individual employs others to perform the services that he has undertaken to provide, this is generally considered to conclusively indicate that the individual is an independent contractor and not the employee of another.

Section 5(2) of the Workplace Act permits the provincial Cabinet to make regulations to protect the health and safety of homeworkers, and requiring employers and homeworkers to register with the Worker's Compensation Board. Section 5(1) of the Act defines an "employer" to be "a person who employs a homeworker in the employer's trade or business", and defines "homeworker" to mean "a person who for wages in the performance of work in his

residence provides labour only." Other than section 1(1) of the Act, which specifically excludes "a private house, room or place used as a dwelling" from being a factory, office or shop for the purposes of the Act, the Act and its Regulations make no further reference to home-based employment, although the regulations make specific provisions covering the general quality of workplace environments.12

It is unclear the extent to which, if any, the worker's compensation system applies to home-based work. Under section 1 of the B.C. Workers Compensation Act 13, a "worker" is defined to include those engaged under a contract of service, and the Act authorizes the Worker's Compensation Board to deem other people, such as managers and professional personnel - who are excluded from the ambit of much of the employment standards regime - to be "workers". So-called "independent operators", who are neither employers nor employees, but similar to the independent contractors discussed above, may apply to the Board for coverage. This is consistent with the legislative intent that coverage by the Act be compulsory and not be waived by agreement. While the traditional test to determine whether a person is an employee or independent operator has in the past followed the criteria used in employment and labour law, Ison (1989) indicates that, where a person works exclusively or almost exclusively for another person, the relationship will probably be characterized as

12 B.C. Reg. 128/74 O.C. 722/74.
13 RSBC 1979, c. 437, as ammended.
employer/employee. Unlike most other Canadian jurisdictions, casual employees in British Columbia are not within the compulsory coverage requirement of the Act (s. 2(2)).

The general principle behind worker's compensation is that "compensation must be paid for injuries arising out of and in the course of the employment" (Ison, 1989). One criteria used to determine whether an injury occurred in the course of employment is whether the injury occurred on the premises of the employer. This can be an elastic concept; for example, in the context of the construction industry, "premises of the employer" refers to the location where the employees work, and premises are not excluded because the employer has no legal title over the property (Ison, 1989). This could give employers an incentive to take an active interest in the condition of a telecommuter's home because access to and egress from the premises of employment are considered to be part of employment for worker's compensation purposes. Similarly, if an employee's home workplace can be brought under the responsibility of the employer, the employer may become liable for injuries to persons other than the employee or for injuries to the employee occurring at times outside of working hours under either the doctrine of strict liability or the Occupier's Liability Act.14 Alternatively, employers could choose to actively disassociate any interest in, or responsibility over, the conditions of a telecommuter's home, although this would not necessarily be a bar to either tort or

14 RSBC 1979, c. 303, as ammended.
statutory liability.

When an employee chooses the path and method of commuting to work, the journey is not considered to be in the course of employment. If, however, the employer provides or otherwise directs the method of travel, the commuting is considered to be in the course of employment (Ison, 1989). Whether an analogy could be extended from physical travel to electronic commuting remains to be determined, although it is difficult to see how a reasoned justification for the distinction could be maintained in the case of employers who mandate that a worker work at home, either as an employee or independent contractor. Injuries arising out of the use of residential premises provided or arranged by an employer are compensable, although it may be difficult to characterize an employee's personal residence in this category because the residence is provided by the employee.

Despite the existence of the above employment, workplace, and worker's compensation provisions, the substantive aspects of the current legal regime encompassing home-based employment are essentially a void and fail to directly acknowledge or address any of the issues raised by telecommuting. To a large extent this is not surprising; telecommuting is a recent phenomenon and there is no indication that its occurrence is widespread in British Columbia. There does not appear to have been any telecommuting-related case law involving the statutory provisions reviewed above, and the only known litigation directly involving telecommuters is the California case referred
Nevertheless, there are several employment-based issues which require consideration by policy makers in order to avoid the resolution by default that will otherwise occur. These include the following:

- should existing definitions of employee status be used for telecommuters?
- if a telecommuter is characterized as an employee, what reporting regime, if any, should be established to ensure that hours of work, overtime, and minimum wage protection provisions are followed; who is responsible for enforcing the reporting regime?
- in the case of union certification attempts, how are appropriate bargaining units to be determined?; is a telecommuter's home part of an employer's premises for the purposes of section 4(1) of the Industrial Relations Act 15 which prohibits anyone acting on behalf of a trade union from attempting to persuade an employee to join a union during working hours on an employer's premises?
- in the event of industrial conflicts such as strikes, may a telecommuter's home be picketed?; would a telecommuter who works during a strike be characterized as a strikebreaker?
- should occupational environment regulations be applicable to home workplaces?; if so, who is responsible for providing any necessary changes to home workplaces and to what extent

15 RSBC 1979, c. 212, as ammended.
should the regulations apply to the telecommuter's living space, and how is the boundary between living and workspace to be determined?
- if a home workplace is subject to occupational environment regulations, will home workplaces be subject to inspection by government authorities?; who is liable for any violations that occur and what sanctions can and should be applied?
- to what extent, if any, is an employer responsible for injuries or property damage that occur in a telecommuter's home work area?

7.3 TELECOMMUTING AND LAND USE PLANNING

A theme found throughout the telecommuting literature assumes that technology will often determine the consequences of its application. Commentators such as Toffler (1980) and Coates (1982) have applied this in a spatial context by predicting that the adoption of information technologies may lead to the dissolution of concentrated locations of economic and social activity because the technologies make it both practical and desirable to do so. This thesis has argued against a deterministic view of technology, instead advocating a view that the consequences of a particular technology depend on how it is adopted and used, and that this is ultimately a matter of choice. Accordingly, innovations such as telecommuting present land use planners and urban policy makers with a tool to help direct the
future of cities and settlements, as well as effecting a variety of public policy goals.

Telecommuting can be characterized as one element in the development of what are sometimes described in the literature as information cities or post-industrial cities. There does not appear to any general agreement about how to define a post-industrial or information city; discussions on the matter tend to focus on occupational, economic, and social characteristics, rather than spatial form (Hepworth and Dobilas, 1985). In an often-cited study of the 1976 employment characteristics of the 140 largest U.S. Standard Metropolitan Statistical Areas (SMSA's), Noyelle (1983) argued that a four-tiered urban system is emerging that consists of: (1) diversified advanced service centers; (2) specialized advanced service centers; (3) production centers; and (4) consumer oriented centers. Noyelle observed that while the postwar period has been characterized by a shift to service activities, services have not grown independent from manufacturing, and the services that have grown the most tend to be closely linked to manufacturing.

Arguably, the changing workplace is the most significant element shaping the spatial form of post-industrial cities. The shift towards a post-industrial economy and society is mainly a product of changes in the composition and nature of work and the workforce; the most direct spatial impact of these changes is on the place of work, which is increasingly becoming the office. As discussed in Chapter 4, a simultaneous process of centralization
and decentralization is occurring among offices, and is having a significant impact on the social, economic, and spatial structures of cities. A basic policy question that arises is whether or not any attempts should be made to direct or influence the locations of offices and other service sector workplaces, such as by promoting decentralization to regional centers or reinforcing the attraction of the downtown core.

Along with first order impacts on the location and spatial pattern of workplaces, policies that attempt to influence office locations may result in numerous second and third order impacts. Increased home-based employment should reduce demands on transportation systems, especially during periods of peak use. Reduced traffic levels - or at least a slower rate of growth - reduces the need to build new roads and highways, or to expand existing capacity, and should reduce costs required for maintenance and repairs. Telecommuting is viewed by the City of Los Angeles as one alternative to spending between (U.S.) $42 to (U.S.) $110 billion for new roads to relieve traffic and pollution problems (Schneider and Francis, 1989). The misallocation of resources for roads and freeways becomes apparent when one considers that the capacity of transportation systems is governed by two periods of the day when people commute between home and the workplace, and that roads remain relatively empty for the remainder of the day.

Reduced automobile commuting would directly lead to lower levels of fuel consumption. Commuting accounts for approximately
one-half of the automobile energy consumed in California (JALA Assoc., 1985), and, it should be remembered, potential fuel savings was the original benefit that stimulated interest in telecommuting (Nilles, 1975). Automobiles remain one of the principal sources of air pollution, producing approximately 40 percent of the nitrogen oxides that lead to acid rain, 80 percent of carbon monoxide emissions, and 50 percent of the hydrocarbons that contribute to smog (Lyman, 1990). Burning petroleum also releases carbon dioxide, contributing to the greenhouse effect.\(^\text{16}\) In the United States, automobile emissions are estimated to have caused annual yield losses of wheat, corn, soybeans, and beans of between (U.S.) $1.9 billion and (U.S.) $4.5 billion (Lyman, 1990).

Beyond being directed towards specific policy goals, such as those mentioned above, telecommuting can be used to permit the development of new spatial patterns for settlements. This is related to the notion that telecommuting offers individuals the ability to move from cities to more remote locations. The reasons for this apparently widespread desire to leave cities are, however, unclear.

A sense of ambivalence and contradiction can be identified in social and cultural attitudes towards cities. At one extreme there is the tradition associated with Henry Thoreau, Frank Lloyd

\(^{16}\) Approximately one-quarter of all carbon dioxide emissions in Canada are produced by transportation. One car driven 16,000 kilometers (10,000 miles) per year, at 14.3 lites per 100 kilometers (20 miles per gallon), produces 5,100 kilograms of carbon dioxide (Task Force on Environmental Change, 1990, p. 10).
Wright, and, to a lesser extent, Ebenezer Howard, that views the city in relatively negative terms and espouses, to varying degrees, the abandonment of cities in favour of lower density settlement patterns. According to Wright (1953):

Civilization always seemed to need the city. The city expressed, contained, and tried to conserve what the flower of the civilization that built it most cherished, although it was always infested with the worst elements of society as a wharf is infested with rats. So the city may be said to have served civilization. But the civilizations that built the city invariably died with it. Did the civilizations themselves die of it? (p. 181)

To Wright, cities were originally built because of necessity, but, with the introduction of more rapid and relatively universal means of transportation and communication, the necessity for cities disappeared and was replaced by habit and tradition: "The thoughtless human tendency in any emergency is to stand still, . . . To meet this human trait of staying right where we are, the skyscraper was born and, as we have seen, has become a tyranny." (p. 186) Wright saw technology as the solution to many of the problems of the city; rather than providing adjustments, however, he advocated a complete overhaul:

The machine, once our formidable adversary, is ready and competent to undertake the drudgeries of living on this earth. . . .

This, the only possible ideal machine seen as a city, will be invaded at ten o'clock, abandoned at four, for three days of the week. The other four days of the week will be devoted to the more or less joyful matter of living elsewhere under conditions natural to man. . . . It will soon become unnecessary to concentrate in masses for any purpose whatsoever. . . .

Even the small town is too large. It will gradually merge into the general nonurban development. Ruralism as distinguished from urbanism is American, and truly democratic. . . .

An acre to the family should be the democratic minimum
if this machine of ours is a success! (pp. 191-92)

It is difficult to determine how wide the support is for views such as Wright's. As noted above in Chapter 6, some surveys indicate that many people would prefer to reside in relatively small settlements, usually located on the periphery of large metropolitan areas. Similarly, there is empirical evidence showing declining central city populations in the largest American cities (Hauser, 1981). Blumenfeld (1982) has observed that this decline and accompanying suburbanization is often characterized as a "flight from the city", and suggests, however, that the influence of what Ebenezer Howard described as the "rural magnet" is of at least equal importance.

Despite the persistence of anti-urban traditions of thought, population growth in metropolitan areas continues, with the exception of the five SMSA's with populations greater than five million in the 1980 census (Blumenfeld, 1982). Blumenfeld has attempted to clarify this finding by noting that population levels increased in areas between 50 and 70 miles from the centers of the five large SMSA's, which he has interpreted as showing the growth in area of the metropolitan fringe of the SMSA's, and, at a more conceptual level, the replacement of settlement types as being either urban or rural by an urban-rural

17 Blumenfeld (1982, at p. 13) observes: "... the conventional suburban response to Ebenezer Howard's "two magnets" is to some degree self-defeating: the more people adopt it, the further they have to move away from the city, and the further the country moves away from them."

18 New York, Los Angeles, Chicago, Detroit, and Philadelphia.
According to architect Eberhard Zeidler (1990), cities are not being abandoned by people, and the centrifugal forces favouring dispersion are being counterbalanced by the desire of many people to remain in cities and experience the excitement, complexity, and stimulation they offer. Cities can also be characterized as a symbol for the hopes and dreams of people:

By 1893, when the western frontier was declared officially "closed" by Frederick Jackson Turner at the World's Columbian Exposition, Americans had come up with a new repository for their aspirations: the city. It was a place of promise and striving, a place, it was believed, where all would succeed if they just worked hard enough. And the urban fabric itself was now believed to be an organism that could be manipulated to achieve any desirable form. To the progressive mind it was just a matter of time.

But this optimistic image faded in the face of economic pressures, and the American family withdrew to suburban lands. (Nissen, 1988, p. 8)

Nissen goes on to observe that, during the 1960's, there was, in the United States, a technologically-based renewal of interest in "progressive urban ideas", one manifestation of which was the wired city. Instead of helping "foster a superdemocracy", however, the wired city "failed to deliver on its promise, as its theorists discovered that simply introducing networks on information conduits did not change the world." (1988, p. 8)

Despite the continued incremental development of a telecommunications infrastructure (see Chapter 4), there is no fundamental policy-based commitment in North America that seeks to adopt telecommunications technology as a tool for guiding urban development. According to Nissen (1988, p. 9):
American planners by and large seem disenchanted with large-scale interventions into the urban environment (think of Pruitt-Igoe); with contemporary critics, they share a common agreement that there are no overriding answers. Without a controlling scheme it is not easy to address a concept like that of a civic-minded "information city." Such a vision cannot seem to hold the American vision.

A different and far more interventionist approach is found in Japan, which, during the last decade, has actively begun developing "teletopias" and "intelligent cities" with an intensity and sense of risk-taking that some commentators state appears to contradict both the reserved nature of Japanese society and cultural conventions, as well as its earlier negative results with wired-city trials (Droege, 1988; Newstead, 1989). The Japanese interest in wired cities originates in several sources. Droege (1988, p. 39) states that after developing into "dense and drab containers of economic activities" during the postwar period, Japanese cities have recently "come to be understood as articulators of "civic" aspirations and potent spatiovisual sculptors of social reality." This is accompanied by a process in which city governments are attempting to develop individual identities and images for their cities, and emphasize their relative livability. Newstead (1989) observes that there is "an almost obsessive attachment" to the concept of information cities in Japanese urban planning, and that it appears to be an outgrowth of an economic policy that seeks to enhance the role of information industries in its national economy.

The Japanese interest in wired cities appears to be partly a byproduct of the transitions occurring in its society,
particularly its new-found role on the global stage. New information-handling techniques are diffusing throughout its society, offering opportunities for participation by public and private-sector policy-makers and decision-makers. According to Droege (1988): "(m)any of Japan's cities serve as experimental settings for their own transformation into communities enhanced by the purposeful application of advanced information technologies." The Japanese Ministry of International Trade and Industry (MITI) has been involved since 1983 in the development of "advanced information cities and new media communities" that are directed towards serving particular needs, and, in 1983, the Ministry of Posts and Telecommunications (MPT) initiated a program to develop over one hundred "teletopias", similar to the Staten Island teleport in New York.

The most frequently cited example of a Japanese information city is Kawasaki, a city of 1.3 million people located between Tokyo and Yokahama. Kawasaki was used as a test case in a 1988 workshop on information cities that included a design competition which received more than 200 entries from over 20 countries (Droege, 1988; Newstead, 1989). The city has sought to change its economic base through a series of metropolitan plans beginning in 1960. Originally developed as a heavy industrial centre, it later changed its focus to light industry, and in the early 1980's, began to emphasize community needs and services, citizen participation, and quality of life. In 1986, the plan of Kawasaki Campus City was developed, in which the city
was envisioned as a series of "linked specialist areas", combining concepts of Kawasaki as an information city and city of knowledge-based industries.

A major element of the 1986 workshop's proposals for Kawasaki's development was the concept of the "neighbourhood office" (NO) (Newstead, 1989). Approximately one-quarter of Kawasaki's residents commute daily to Tokyo, and the average commuting time exceeds two and one-half hours. Along with disadvantages to home-based work identified in the North American context, such as isolation and career impairment, the adoption of telecommuting in Japan is further impaired by cramped living quarters, excessive noise, and cultural limitations. Accordingly, the NO has been proposed as an alternative approach to help reduce the volume of commuter traffic between Kawasaki and Tokyo. It has been estimated that up to 100,000 Kawasaki residents could work from NO's, with each NO accommodating approximately 1,000 workers, although the exact number would vary to suit community needs, and to balance economies of scale that favour increased size, with reduced travel distances and times that favour smaller and more numerous NO's. Linked by optical fibre networks between Kawasaki and Tokyo, each NO would include fax terminals, speech and data channels, dedicated channels for remote data access, word processing facilities, personal picturephone services, and wideband transmission facilities. The estimated capital cost for the telecommunications system is under $2,000 per employee in a system of ten or more NO's, and
the annual savings per year per employee by eliminating 200 return commutes to Tokyo is estimated to be approximately $1,580 (Newstead, 1989). 19

It is too soon to determine either the extent to which Kawasaki will develop as an information city, or the degree to which it will fulfill its stated purpose. Newstead (1989) has expressed reservations about a possible hidden agenda on the part of the Japanese government in its participation in information city development. He indicates that there is conflict and a lack of coordination between government agencies, and an overly deterministic perception of the potential of technology to solve social problems. He argues that the primary goal of the exercise is not to improve the access of citizens to information, but to restructure Japan's economy, and to test and promote new information technology applications.

An experiment in neighbourhood work centers was undertaken by the Swedish Council for Building Research between 1982 and 1984 (Engstrom et al., 1986). The project involved the construction of a neighbourhood work center in the town of Nykvarn, a bedroom community of 6,000 inhabitants approximately 50 kilometers west of Stockholm. The experiment involved eleven permanent participants from nine employers, plus five to six other employees who used the center for shorter periods. Jobs performed included specialized banking services, data entry, 19 This figure is based on a monthly travel fare of $65, and an hourly travel cost of $2.
engineering, and business consulting. Despite encountering fewer problems and more benefits than expected, the experiment does not appear to have stimulated adoption of either home-based telecommuting or neighbourhood work centers in Sweden following its conclusion. To some extent this is because of government subsidization of public transportation, favourable tax rules for company cars, and strict rules for tax deductions for home offices, which collectively reduce any financial incentives for remote work. Engstrom et al., (1986, p. 45) concluded that:

Even if there is much in favour of the idea of neighbourhood work centers, one must be aware that they are not a form of work-place that springs up spontaneously where there is a need. It is rather a fact that several interested parties must coordinate their efforts to bring about a joint place of work.

This is perhaps the primary lesson about telecommuting from a policy perspective. Despite the potential benefits it offers, telecommuting requires an element of coordination and a positive response from policy-makers if it is to attain a significant level of adoption. One example of the difficulties faced by initiatives to promote home-based work is seen with the New American House competition (Nissen, 1988). Sponsored by the Minneapolis College of Art and Design and the National Endowment for the Arts, the 1984 competition involved 1,200 registrants who developed housing designs for members of non-nuclear households who wanted to perform professional work at home. The winning entry, designed by architect Troy West and professor of planning Jacqueline Leavitt, consisted of six units, each of which had a work area attached to the living room. According to Nissen,
attempts to build the project were met with financing delays, difficulties in obtaining planning variances, and several of the areas designated for workspaces had to be converted into small apartments.

7.4 CONCLUSION

Telecommuting provides a new element of choice in the planning of cities. While it can be used to help achieve certain specified goals, such as reducing traffic volume and fuel consumption, it also provides an opportunity to fundamentally reconsider what cities should be and how they should be designed. There is general consensus in the literature that telecommunications technology will likely lead to increased decentralization of economic activities, accompanied by the centralization of control within a few, increasingly influential centers. While this may indeed be the case, public policies must recognize that telecommuting is a permissive, rather than a determinative, factor in locational and organizational decision-making. The issue that will remain to be resolved is how the opportunities provided by telecommuting will be used.
8.1 CONCLUSIONS

During the latter half of the 1970's and early 1980's the notion developed that the combination of high energy costs, developments in computer and telecommunications technology, and the growing proportion of service sector employees in the workforce would lead to the widespread adoption of telecommuting and other remote work arrangements. Telecommuting is generally defined as working at home by using a computer terminal that is electronically linked to one's place of employment. Numerous potential impacts were ascribed to telecommuting, including the demise of the traditional industrial-age office, the dispersion and decentralization of settlement patterns, and, in extreme scenarios, the dissolution of cities. Predictions of the number of people who would be telecommuters and its rate of diffusion have, however, consistently been overstated, and, despite the potential benefits it offers, there does not appear to be any widespread demand for telecommuting among either employees or employers.

It is clear from the literature that it is difficult and inaccurate to make sweeping generalizations or characterizations about telecommuting; not all telecommuters or telecommuting arrangements are alike and its impacts can vary considerably by context. Depending on the definition used, the telecommuting workforce can be divided into several groups that includes self-
employed entrepreneurs, managers and supervisors, professional and technical employees, and clerical employees. These groups differ widely in terms of employment status, income, control over work content and working conditions, and potential to be exploited. The benefits and disadvantages of telecommuting have a similar uneven distribution; telecommuters in professional and managerial occupations tend to receive more benefits than do those in clerical occupations, and the differences often increase if the employment status of a clerical worker changes from being an employee to an independent contractor.

The adoption rate of telecommuting has been influenced by several factors exogenous to the phenomenon. There is growing acceptance of the home as workplace, brought about by a resurgence of interest in entrepreneurialism and small business creation, coupled with the increasingly common practice of using a personal computer to do work brought home from the office after regular working hours (Glitman, 1986); these factors are helping to break down much of the culturally-imposed separation of work and home that developed in western societies during the Industrial Revolution. The social acceptance of work at home removes much of the stigma that may be experienced by home-based workers, and helps to allay feelings of suspicion and distrust towards home-based work held by some employers.

Developments in office and information technologies are laying the groundwork for increased telecommuting. Along with providing the technical means for remote work, these developments
are helping redefine the notion of what constitutes an office. Rather than just being a space enclosed by a structure in which work occurs, the office is increasingly perceived in terms of function and activity; emphasis is on the work produced, and not only the physical characteristics of the workplace.

There are concerns, however, that telecommuting may be one means by which the level and quality of employment may be impaired, especially for clerical workers. Opposition has been expressed to telecommuting by organized labour, which is concerned about potential exploitation of home-based workers through low wages, long work hours, a reduction in or loss of benefits, and the lack of an effective means to obtain collective representation. Despite these concerns, there appears to be interest among some workers for alternative working arrangements including part-time work, job-sharing, flex-time, and telecommuting.

The regulatory environment for telecommuting and home-based work created by local government bodies varies between benign disregard and outright hostility. Most municipalities place a variety of restrictions on home-based employment, and, while these are justifiable when responding to or reflecting informed community sentiment, they sometimes appear to be based mainly on historical inadvertence. Even if one ignores telecommuting, the growth of interest in home-based employment in general requires a reassessment of restrictive local policies towards work in the home. This is especially apposite when
developing comprehensive planning programs that seek to incorporate policies such as the promotion of efficient transportation systems, decreased energy consumption, and better air quality.

There is a similar lack of statutory advertence to the employment conditions of home-based workers. This is particularly true in the case of workers who are relatively susceptible to exploitation, such as clerical workers whose employment status often shifts from being employees to less protected independent contractors. There is also much uncertainty regarding legal liability and responsibility for home workplace standards.

There does not appear to be any clear understanding of the impact, if any, that telecommuting and remote work is having on either settlement patterns or the urbanization process. There has been considerable speculation - still unresolved - about the existing and potential impacts of telecommunication technology on urban structure. Some, most notably Webber (1963), Goldmark (1972), and Milles (1975), have expounded on the decentralizing potential inherent in communications technology; others, such as Meier (1962) have suggested that telecommunications technology will centralize and reinforce existing structures of power and authority. Gottmann (1977) has observed that transportation and communication reinforce each other and cites the telephone as an example, which, rather than replacing the need for face-to-face contact, stimulates meetings and has been a principal factor in
the development of office towers and high density central business districts. Others, such as Mandeville (1983) reject deterministic perspectives of the spatial impact of information technologies, and remind us that the effects of technology are based on the manner and context in which the technology is applied.

Empirical study suggests that all three perspectives are to some extent valid; rather than imposing one impact, communication technologies have stimulated a duality of movement in which massive concentrations of economic activity locate in a few specialized urban centres (Gottmann, 1983; Noyelle, 1983), while there is a simultaneous movement of routine office activities to suburban, exurban, and in some instances, offshore, locations. Pool (1980, pp. 11-12) observes, however, that it is simplistic to attribute too much to technology:

Usually the physical nature of a technology in its early and primitive form is fairly determinative of its use. At that primitive stage, there is little understanding either of the underlying laws that are embodied in the device or of the technical alternatives. . . . Later, intellectual understanding of the technology advances, and as technicians learn how to make the device do what they want it to do, the degree of technological determinism declines. Social values, goals, and policies take over, and the technology is shaped to serve them.

In its early days, telecommunications technology had a significant effect on the character of the modern city, mainly leading to urban concentration. Later, a more flexible telecommunications technology allowed people increasingly to escape urban concentration.

In prospect now is a still more flexible and malleable communications technology that will give people still more choices about how they will use it.

The acceptability and adoption of telecommuting will also be influenced by present value systems with respect to work and the
home. If, for example, Toffler's (1980) notion of Third Wave society proves to be accurate, it will represent a fundamental departure from many widely-held and rarely-questioned norms. Such a transition will undoubtedly develop incrementally and face considerable opposition and many false starts.

Telecommuting is particularly relevant to urban planning because of its potential impacts to transportation systems, land uses, and labour markets. Intuitively, the most obvious impact of telecommuting is a reduction in work-related travel; it has been observed, however, that the increased locational flexibility provided by telecommuting could generate extra travel, especially if it stimulates residential dispersion. Aside from a few anecdotes, there is no empirical evidence supporting the notion that telecommuting will lead to widespread residential dispersal. What appears more likely in the short term is that telecommuting will be adopted in many situations as an employment option by workers who want to reduce or eliminate costly, time-consuming, or stressful commutes to work. Rather than stimulating residential migration, telecommuting would act to preclude residential movement to a location more proximate to the workplace, or enable an individual to remain living in a preferred location and not search for alternate employment nearer to home. Apart from this remedial aspect, it does not appear that the relationship between work and residential locations is so determinative that the locational flexibility offered by telecommuting will stimulate significant residential relocation,
or that it will be strong enough to counteract other factors that are part of the locational calculus. Residential settlement patterns are also influenced by real estate markets, the economic resources of buyers, proximity to a variety of activities, perceptions of safety and prestige, the existing building stock, zoning restrictions, and less tangible factors relating to finding a neighbourhood that one likes.

While telecommuting offers far-reaching opportunities, it is not the only technologically-based phenomenon influencing transportation and land use (SCAG, 1985). Telecommunication and information technologies are superimposing choice-based communities of interest onto the landscape, allowing options of equal or greater innovativeness than telecommuting with respect to shopping, banking, education, and other activities. While the potential created by telecommuting should not be ignored, it should also not be overstated.

8.2 AREAS FOR FURTHER WORK

A fundamental limitation to research on telecommuting is the inadequacy of existing statistical information, which makes it difficult to develop informed policy judgements about whether to encourage, discourage, or ignore telecommuting.

Pratt (1987) observes that the home-based workforce is difficult to survey because traditional definitions of "home", "office" and "work" are often inappropriate; "(h)ow do we classify the employee who works three days at the firm and two
days in his home writing computer programs?" Information on the size of the home-based workforce is relevant for many public purposes including studies on the economic impacts of small businesses, labour policy and standards enforcement, taxation, child-care support systems, transportation planning, and zoning policy and enforcement.

The range of estimates for the U.S. home-based workforce (between 9 million and 23 million) belies the most basic limitations of the existing data base for policy purposes. Anecdotal reports and surveys of relatively limited size and scope form the basis of most of the existing information base concerning home-based workers and telecommuters, and other estimates are based on proprietary sources and educated guesses. Not only are there no systematic surveys of telecommuters by either the governments of Canada or British Columbia, but there does not appear to have been any surveys or measurements of the general home-based workforce by bodies such as Statistics Canada or Revenue Canada. While this is understandable in the case of telecommuters, considering the novelty of the phenomenon, it is less understandable in the case of the general home-based workforce, especially when considering its potential size and impact as observed from the U.S. experience.

There are two principal aspects of telecommuting about which much uncertainty remains and require further examination that are of potential significance to urban planners. First, it remains unclear how widely telecommuting will be adopted. This is
difficult to forecast because of the complex interactions between factors influencing its adoption, and, as the literature on the diffusion of innovations shows, adoption periods for seemingly useful innovations may stretch for inexplicably long times. Policy makers can help stimulate the adoption of telecommuting if they decide that its net advantages outweigh its net disadvantages by creating a more receptive regulatory atmosphere, primarily by loosening unnecessary zoning restrictions on home-based employment. If this occurs, however, worker exploitation concerns should be addressed by developing a regulatory regime that ensures that at least minimum employment standards are met.

The second area of significance to planners is the impact of telecommuting on residential location patterns and dynamics. The literature reviewed in this thesis suggests that the relationship between workplace and residential locations is weaker than that predicted by mathematical models. This implies that the potential spatial independence offered by telecommuting should not be, by itself, determinative. There does not yet appear to have been any empirical examination either supporting or refuting this presumption. If changes to residential settlement patterns occur, however, they will likely stimulate a number of indirect effects, including changes in the demand for transportation and various local services.

Telecommuting can be used by planners as a means to shape the development of cities. Home-based work and neighbourhood
work centres reduce traffic pressures on congested downtowns, reduce energy consumption and air pollution, and may promote a stronger sense of community. While telecommuting has real and potential disadvantages, these can be identified and actions taken to avoid or diminish them. Despite its many false starts and uncertain impacts, telecommuting offers more than enough advantages to merit the support of public policy makers.
BIBLIOGRAPHY


"American videotext failures suggest possible redirection." Vancouver Sun, 1 April, 1986, p. F3.


Communications Canada. (1987), Communications for the Twenty-First Century. Ottawa: Ministry of Supply and Services Canada.


Duxbury, Linda E., Higgins, Chris, and Irving, Ric. (no date), *Attitudes of Managers and Employees to Telecommuting.* London, Ont.: Faculty of Business Administration, University of Western Ontario.


Field, Anne R., and Harris, Catherine L. (1985), "Videotext has gone nowhere, so why are big players jumping in?" *Business Week*, 24 June, 1985, p. 104.


Gottmann, Jean. (1977), "Megalopolis and Antipolis: The Telephone and the Structure of the City." In The Social Impact of the


Urban Land Institute.


"Have Data, Will Travel." Time, June 23, 1986, p. 44.


Jones, D.W. (1973), Must We Travel: The Potential of Communication as a Substitute for Urban Travel. Palo Alto, Cal.: Institute for Communications Research, Stanford University


Lewis, Mike. (1984), "If you worked here, you'd be home now." Nation's Business 72(4): 50-2.


Lipscombe, Joan and Bill Williams. (1979), Are Science and Technology Neutral?. Toronto: Butterworths.


"The Office of the Future." (1975), Businessweek 2387: 48-84.


———. and Edeyn Williams. (1977), "Teleconferencing: is video valuable or is audio adequate?" *Telecommunications Policy* 2(2): 230-41


Royko, Mike. (1984), "City's Efficiency Gone to the Dogs." Chicago Tribune, 13 April 1984, Sec. 1, p. 3.


Shack, Joel. (no date), Environmental Design Implications of Work-at-Home. Mimeograph.


Menlo Park, Calif.: Stanford Research Institute.


Wilson, Josh L. (1985-86), "Electronic Village: Information


