INTRA-METROPOLITAN OFFICE LOCATION AND TECHNOLOGICAL CHANGE

by

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Abstract

It has been speculated that recent technological advances may lead to more extensive office decentralization within the urban region. To better understand the intra-metropolitan implications of technological changes applicable to office activity, the purposes of this thesis are: (1) to determine how technological change may impact upon office location within the urban region, and (2) to suggest how metropolitan policies might respond to changes in the spatial distribution of offices.

The premise taken in this thesis is that technological developments will increase the locational flexibility of office activities with standardized linkages, making it possible for more offices to decentralize; however, economic and social forces are such that office activities with unstandardized linkages will continue to favour a central location. Literature on office automation and office location is reviewed, critically analyzed, and synthesized to produce observations and judgements regarding the validity of the premise.

The primary office location determinant is the nature of the activity's information input and output flows. Innovations in telecommunications and computing technologies are broadening the range of channels available for communications and increasing their capacities and flexibility. These channels may substitute for face-to-face contact in less sensitive, simple, predictable, and regularly occurring information exchanges but, technology is generally perceived of as inferior to face-to-face contact for more complex and variable communications. Obstacles
to the implementation of technological change in the office, specifically, technical problems, lack of evidence of clear financial benefits, difficulty in applying technology to high level office functions, and resistance to change by office workers, may be impeding realization of the potential for organizational change and locational flexibility offered by technological innovations.

Support for the thesis' premise is provided by findings indicating that offices taking advantage of the increased locational flexibility offered by technological advances to move from the core to the suburbs, are primarily the routine information processing activities of large corporations which have standardized inputs and outputs. Offices with unstandardized linkages, primarily corporate head offices, financial, and professional firms engaged in analytical, decision-making, and administrative activities, remain predominantly concentrated in the core in spite of technological change. Factors behind the continued strength of central office locations are the economic advantages available, primarily opportunities for face-to-face communications, as well as non-economic or social attractions.

The main conclusions of the thesis are first, that while technology may in theory increase the possibilities for locational decentralization of offices, there are a broad range of economic and social frictions opposing such movement. The intra-metropolitan spatial distribution of offices is becoming more specialized in response to both centripetal and centrifugal
forces. Technology is not a causal factor; it enables or limits a firm's locational strategy. Second, it is suggested that metropolitan office policy and goals should be more explicitly stated, be sensitive to local characteristics and experience of general trends, adopt a long term perspective, and incorporate more realistic strategies which coordinate a range of government policies relating to land use, economic development, transportation, and public servicing to guide the location and timing of office development in order to ensure efficient resource use.
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I. INTRODUCTION

1.1 Purpose

The purposes of this thesis are first, to determine what changes new office technologies might bring upon the location of office activities in the urban region and second, to suggest how metropolitan policies might respond to the changing spatial distribution of offices within the urban region.

The premise taken in this thesis is that technological changes in office activities will enable greater locational flexibility for those activities with standardized linkages which should make it possible for more office activities to decentralize; however, economic and social forces exist which favour centralization for office activities with unstandardized linkages and, therefore, in spite of technological change, many office activities will prefer a central location.

The evolution of office activities has been largely an urban-based phenomenon. For the urban region, office activities have come to play an increasingly important role in the urban economy. Awareness of the increasing importance of office activities, plus the perception of inefficiencies arising from the over-concentration of office activities and employment in the urban core, has heightened the desire to formulate effective urban policies to respond to, and to direct, the pattern and pace of office development. With this increased policy interest there is now an urgent need to understand the forces underlying the spatial distribution of office activities in the
metropolitan region.

An increasingly important factor assisting the locational changes of offices, is innovations in technologies which process and communicate information, an important input and output of office activities. Although receiving some superficial treatment in the popular press, the spatial implications of technological change in office activities have received little attention in the academic literature (Goddard, 1980). This study is an effort to begin at understanding what these spatial implications might be, how they may interact with other factors influencing office location, and how urban policy might respond. It is hoped that by looking at the factors underlying the locational choices of office organizations and analyzing how technology may impact upon these factors, the technological determinism apparent in some previous commentaries on the issue might be avoided.

1.2 Methods And Scope

To investigate the premise taken in this thesis, literature on office location and office automation was reviewed, critically analyzed and synthesized leading to observations and judgements regarding its validity. The literature available on the intra-metropolitan location of office activities, the role of office activities in the urban region, and metropolitan policy initiatives regarding office development is rather sparse, particularly that which examines the North American metropolitan region. In regard to the effects of recent technological changes on the location of office activities,
there is a paucity of information. It is thought, however, that the literature is suggestive of general trends and, is therefore, sufficient for the purposes of this thesis. It is recognized that the topic area is sufficiently recent to account for the limitations in the literature.

In addition to these limitations in the literature review, four provisos about the scope of the study are offered. First, this thesis is restricted to studying the intra-metropolitan implications of technological change on the location of office activities. Technological change may also lead to significant inter-regional locational consequences and this is touched upon because any particular metropolis is part of a larger urban system.

Second, this thesis does not provide a place-specific analysis of the effects of technological change on the location of office activities. Rather, it offers discussion and insight into general processes in intra-metropolitan office location. It is acknowledged that different urban regions may experience these trends in disparate ways and at different paces, according to their particular characteristics.

Third, this thesis looks at the effects of technological change on the location of private office firms only, because public office organizations usually operate under a rather different set of goals and influences resulting in locational decision criteria somewhat different from those of private firms.

Finally, throughout this thesis the view will be taken that
the public sector, specifically local and regional governments, has a role to play in guiding office location and development. These governments should be mainly concerned with efficient resource allocation and use. The spatial distribution of offices is a result of numerous private (and some public) location decisions and it is held in this thesis that government should take a minimalist approach to intervening in this process, acting to overcome market imperfections, ensuring a competitive market and dealing with negative externalities generated by office development. Increasingly, however, local and regional governments have assumed concern over equity effects of office location and development, considering the broad range of private and public costs and benefits which may arise. While there may on some occasion, be a need to compromise efficiency in order to achieve some public equity goals, it will generally be held in this thesis that equity issues should be dealt with by senior governments and by overtly distributionist policies rather than through land use policy.

1.3 Definitions

The subject of this thesis, office activity, is a difficult term to define, as many authors have noted, because of the intangibility of office work. In this thesis the term will be defined to mean economic activity which occurs in office buildings (either detached or attached to other uses) and which involves: (1) the primary activities of generating, developing and implementing ideas, and (2) the secondary or supporting tasks of collecting, storing, recording, and transmitting
information (Daniels, 1975, p.133).

Flows of information between offices hold important consequences for the location patterns of office activities. Inter-office linkages refer to the connections between offices over which flow the inputs and outputs of office production. Standardized linkages refer to flows of information and services which are simple and predictable in content, and occur at regular intervals, while unstandardized linkages are characterized by variable and complex flows.

The focus of this study is on the intra-metropolitan location of office activities. The term metropolis will be taken to refer to a principal or central city and the "...larger socioeconomic system organized around it...", and metropolitan area or urban region will be used to describe "...the territory over which such a system extends..." (Heilbrun, 1981, p.24).

Finally, much of this thesis will discuss the changing spatial distribution of office activities. A variety of terms has been used to describe this process. The term decentralization will be used to signify "...a general social process involving relative locational shifts of units of capital and employment from the core of the city to the suburbs" (Scott, 1982, p.122). Other terms used to describe spatial change are dispersion, which is a geographical concept indicating a scattered spatial pattern, and deconcentration which means the removal of firms from a concentration or cluster of activity.
1.4 Organization Of The Thesis

Chapter II provides a context for this study, examining why office activities are important to the urban region, discussing the need for policies to deal with office development, and reviewing the status of office location research and theory. Centripetal and centrifugal forces underlying the intra-metropolitan spatial distribution of offices, are reviewed.

With the purpose of providing a basis for assessing how technological change might influence office location, Chapter III looks at technological innovations applicable to office work, the need for these innovations, the pace of their adoption and diffusion, and finally, obstacles to technological change in the office.

In Chapter IV, the implications of technological change for firm size and organizational form are examined in order to determine how organizational changes might in turn impact on office linkage and location patterns and whether technological change might lead to greater intra-metropolitan decentralization of office activities with standardized linkages. Economic and social forces which favour centralization of office activities with unstandardized linkages are also analyzed.

Chapter V examines the policy implications of the issues discussed in Chapter IV. On the basis of opportunities and problems presented by intra-metropolitan office location trends and technological change, and from office policy experience, three alternative policy approaches for metropolitan regions are suggested.
A summary of findings is presented in Chapter VI, along with a review of the study's limitations, suggestions for further research, and the thesis' conclusions.
II. OFFICE ACTIVITIES IN THE URBAN REGION

2.1 Introduction

Office activities have predominantly located in urban regions and have come to play a significant role in the urban region. The purpose of this chapter is to provide a background and context within which, the locational implications of technological change in office activities may be better understood and analyzed in the following chapters.

In this chapter, the evolution of office activities and their importance to the urban region will be briefly reviewed followed by an examination of trends in the intra-metropolitan location of office activities.

2.2 Evolution Of Office Activities In The Urban Region

Prior to the industrial revolution, transactional functions were of limited importance to the economy due to the local scale of business and government and the lack of complexity in these activities (Daniels, 1975). The need for specialized office space was precluded by poor communications, simple production processes, and small organizations (Daniels, 1975). Office activities were, therefore, diffused throughout the city with concentrations around the court or in professional enclaves (Cowan et al, 1969).

With the industrial revolution came growth in office activities and changes in office accommodation and location patterns. Enterprises grew and became more complex with changes in production technology and greater capital investments. The
need to finance, administer, and control markets became very important. Office activities became specialized and separated from production facilities "...when the economic benefits of obtaining and comparing information within the market became greater for the detached office than the cost savings of directing production from a plant attached site" (Armstrong, 1972, p.18). Communications innovations helped to make this separation possible and also increased the volume of office work which could be done. Women entered the labour force providing additional labour for the burgeoning office industry.

With the separation and specialization of office activities, came office buildings and the growth of office quarters which facilitated the rapid exchange of information. The Central Business Districts (CBDs) of large cities provided hospitable environments for these new office activities because of the strong radial character of urban transportation networks, the availability of large, skilled labour pools, and the opportunities for information exchange afforded by the density of activity (Daniels, 1979). By the end of the eighteenth century in Britain, and 1880 in the United States, the office industry was established as a separate, identifiable entity in the large cities, with distinct buildings and a large, specialized labour force (Armstrong and Pushkarev, 1972; Daniels, 1975).

More recently, office activities have grown tremendously. In the United States the increase in office activities accounted for roughly fifty percent of total employment growth from 1950
to 1975 (Armstrong, 1979, p.66). Also indicative of the growth of office activities, is the fact that between 1957 and 1976, the U.S. doubled its stock of private and public detached office space (Armstrong, 1979, p.69).

The major cause for this growth in office activities is the expansion of services in the economy. The fastest growing service activities include non-profit services (health and education), government services, and producer services (for example, financial, legal, or marketing services provided as inputs into the production of other goods and services).

Expansion of these types of services has been variously attributed to the increasingly important need to invest in human capital, to a growing demand for intermediate services resulting from the increasing complexity of the production process, to an increase in government intervention in the economy, particularly in the form of increased regulation of industry and more complicated taxation measures, and to the increasing internationalization of the economy and the related growth of very large, multi-national corporations.

In light of these trends, Gottmann (1970), has termed the traditional classification of economic activity into primary, secondary, and tertiary sectors as no longer adequate. He has defined a quaternary sector which is engaged in decision-making, research, analysis, and transactional activities and employs highly trained managerial, professional, and technical personnel.

Most employees in the quaternary sector are engaged in
activities which might be termed 'white-collar' and are performed in offices (although there are some important examples which do not fit this case, for example, health professionals who work in hospitals). Office work, however, is not exclusive to the quaternary sector, as there are significant numbers of office workers in the primary, secondary, and tertiary sectors. In the U.S., for example, thirty percent of employees in manufacturing industries in 1978, were nonproduction workers (Stanback, et al, 1981, p.50). As Goddard (1975, p.3) has observed, "...in identifying office employment a conventional sectoral classification tends to break down ...". It is, therefore, more relevant to look at the type of activity performed by an office worker or department, rather than the industry in which it is performed.

In any event, it is these rapidly expanding office-based, quaternary-type activities which have favoured large metropolitan regions and central locations, and which have been at the base of the recent growth in office activities.

Because of the increasing importance of office activities in coordinating and managing the economy and because of their tendency to locate in large, urban regions, offices have come to play a central role in most metropolitan regions. There are two aspects to the heightened importance of office activities in the urban region.

First, office activities are increasingly seen as the engine of overall regional growth, attracting investment to the region, bringing income into the region from exports, and
providing direct and indirect employment opportunities. As a result, office activities are now more frequently viewed as a vehicle which will provide opportunities for regional goals to be realized.

Second, because office activities are predominantly urban-based, they are a fundamental force for change in the urban region, producing a variety of positive and negative impacts. Some of the major impacts which have occurred, and will continue to occur, are in the following categories:

- competition for, and allocation of, urban land resources: may contribute to other activities moving out of the downtown core and influences the spatial pattern of housing;

- transportation: the growth of office activities in particular locations, first concentrated in the central city and now becoming more dispersed within the metropolitan region, has created demand for transportation facilities and services;

- built environment: growth of office activities has had significant impacts on the built form of the urban region, influencing the design and density of the city's physical environment;

- municipal revenues and expenditures: commercial land uses now make up a substantial portion of most central cities' tax base, which is significant because property tax is the most important source of locally raised revenue for most municipal governments; however, while office development produces municipal revenues it also creates demands for municipal expenditures on social and physical infrastructure; and

- social structure: the restructuring of employment opportunities is likely to have profound ramifications on the social mix of the urban region, which in turn will influence demands for various goods and services.

Because of this increasingly important role that office activities have come to play in the urban region and the economy in general, there is a growing need to understand the forces
underlying the development and location patterns of office activities. Upon this understanding can be constructed better public policies to deal with the problems and opportunities presented by office development. This chapter will now turn to review the state of research on the location of offices.

2.3 Office Location Theory And Research

The lack of importance accorded to the role of office activities in urban research and in models of the urbanization process has been noted by Cowan et al (1969). Three reasons for this neglect are suggested by Daniels (1975, p.3):

a) the office and its associated employment have emerged comparatively lately as an identifiable component of urban economic and physical structure;

b) failure to appreciate the growing role of office-based activities in the internal structure, integration, and coordination of organizations of all sizes and levels of complexity; and

c) an acute shortage of accessible and suitable data.

Office studies have been of two main types, with the emphasis on the first: i) descriptive, empirical studies and ii) development and testing of techniques and models which attempt to explain and predict the location of office activities (Daniels, 1975, p.2). Perhaps there is now a need to shift emphasis in office location research to the theoretical side, for as Daniels (1979, p.1) has pointed out, the development of explanatory models of office location behaviour would,

"...help to make public intervention in the location behaviour of office activities more effective or ...help rationalize the case for greater involvement in the forces which generate contemporary office location patterns"
Because industrial location theory is more advanced, there is the inclination to draw upon it to explain and predict the location tendencies of office activities. The objective of neo-classical theories of location is establishment of an equilibrium condition in which it is assumed that every firm is optimally located in regard to markets and to labour, energy, and material inputs. Equilibrium is achieved after a sequence of individual location changes which assume that each firm behaves rationally in order to optimize its circumstances (Daniels, 1975). Transportation costs are, therefore, a major factor in industrial location choice because inputs must be assembled at the production site and outputs need to be distributed to market. Transport costs vary with attributes of the product, variability of product flow, and magnitude and length of linkages, and in theory, locations are selected which mitigate the cost of distance.

In the neo-classical theories of location the emphasis is on accessibility to market, willingness and ability to pay rent for locations of varying distance to that market, and transportation costs of assembling inputs and distributing outputs. Recently, these conventional theories of location have drawn criticism because they have obscured other important parameters influencing the spatial distribution of economic activities. In terms of office activities, Edgington (1982, p.290) foresees that the:

"...processes of organizational and technological change will play a crucial part in permitting and encouraging
...suburbanization ...of all but the highest decision making functions ...".

Along similar lines, Scott (1983, p.23) has suggested that:

"...the deeply-rooted processes of capital intensification and rationalization ...that go on in capitalist production systems are likely to be accompanied by an equally persistent process of the internal dissolution of productive complexes and growth centers, and the reconstitution of production at dispersed sites."

Scott foresees a spatial pattern of office activities with central office clusters in large metropolitan regions housing highly interwoven activities such as management and control functions which are constrained to these locations because of their unstandardized linkages, and the outwards dispersal of routine office activities, such as payroll, billing and data processing, whose standardized linkages make it feasible to maintain these activities at lower cost locations.

While technological innovations may, in theory at least, make it possible for the major input and output of offices, information, to be exchanged successfully from almost any location, offices remain more spatially concentrated than all other types of economic activity (Daniels, 1975). This implies that, at least for some office activities, the advantages of the centre still exert a strong influence on location decisions. The prospects of technological and organizational change, and their decentralizing implications for office location must, therefore, be weighed against the continuing strength of centripetal forces.

Office location decisions often lack the rigour of
decisions involving manufacturing plants because manufacturing location decisions involve the establishment of fixed, capital plants. Non-economic factors have greater influence in the choice of office location. As Daniels (1979, p.5) notes, "...a sub-optimal location in economic terms may well possess non-economic attributes which counter balance any economic disadvantages ...". Attempts to construct office location models should incorporate both economic and social factors and be cognizant that different types of office activities place different weights on various location factors.

2.4 Intra-Metropolitan Location Of Office Activities

The core areas of large urban regions have historically, been the favoured location for most office activities. Since the 1950s there has been a strong trend of decentralization of economic activities and population from central locations. Offices have remained more centralized, but in the past decade suburban office space increases have generally been relatively greater than increments to CBD office space. This has led some observers to suggest that metropolitan structure is changing from a city dominant and suburban dependent structure to a more complex structure with multiple activity centres (Black, 1980; Greene, 1980). Downtown has, however, remained the dominant concentration of office space in most metropolitan regions in the U.S. (Black et al, 1982). Perhaps more importantly, the core has generally retained the most important office activities, those involving decision-making and administrative functions.
The forces underlying the changing intra-metropolitan distribution of office activities are complex, with centralizing and decentralizing forces operating simultaneously. To comprehend the recent trends in office location in the urban region, these centralizing and decentralizing forces will now be examined.

2.4.1 Centripetal Forces

Perhaps the most important reason behind the central location of office activities has been the need to communicate information, information being both a crucial input and output of office-based firms and divisions. Communications involves participants utilizing a variety of channels, from face-to-face contact to telecommunications, to establish linkages through which information inputs and outputs flow.

Thorngren (1970), has observed that there are different types of linkages between office activities, which involve different combinations of actors, patterns, contexts, and types of information. From empirical work in Sweden, Thorngren identified three general types of contact processes:

i) Program processes which involve routine transactions with familiar, well-defined segments of the environment and occur on a regular and frequent basis. These contacts, which were short, dealt with a narrow range of information, and used mainly telephone or telex, accounted for seventy percent of the contacts of the organizations surveyed.

ii) Planning processes are contacts which link changes in the use of existing resources with new parts or opportunities in the environment. Thorngren observed that these types of contacts exchanged information of greater scope, were of longer duration, were well established, and used both telephone and face-to-face channels.
iii) Orientation processes involve a broad, diverging contact network which provides long-term scanning of the environment, linking planning processes to previously unconnected parts of the environment. While accounting for only five percent of all contacts, these processes involved eighty percent of new contacts, which are crucial for the organization to renew itself. These contacts were time-consuming, involved many participants, and used face-to-face contact for an unstructured exchange of information.

The importance of these three types of contact processes varies between different office activities which implies that different activities may find different locations more appropriate for the types of contacts they require. This may partially explain why firms choose to locate their decision-making and control functions which require orientation contacts, in central locations. The benefits from the variety and numbers of contacts available, and the opportunities for face-to-face communication afforded by the density of office activities in the core, outweigh the costs of high rents in the CBD. Many office activities are unwilling to consider a location other than the CBD for fear of damaging important contacts in the CBD. Maintaining such contacts from a suburban location may exceed the rent savings in less central locations. Goddard and Morris (1976) found that firms in central London which considered, but ultimately rejected, decentralization had significantly more external orientation contacts than firms which did select decentralization.

A powerful centralizing force and advantage of core office concentrations have been agglomeration economies, external benefits derived from the proximity of many other firms which may be taken advantage of without direct payment. For the
individual firm, agglomeration economies may lead to greater operating efficiency, lower costs, and higher revenues. There are two types of agglomeration economies: localization economies which result when firms in the same industry congregate at a given place (for example, availability of specialized labour or access to specialized, consulting firms) and urbanization economies which occur when firms in different industries locate in the same place (for example, more efficient transportation systems or access to capital markets).

Another important centralizing force has been the superior accessibility of the core. With many office firms serving metropolitan, national and international markets accessibility is an important location factor. The downtown core has traditionally been the nodal point of the urban transportation system and has, therefore, benefited from the great intensity of service and connections available. With the rise of new transport modes such as the automobile and air travel, increasing congestion in the core, the decentralization of economic activity and population, and the ability to substitute telecommunications for travel, the superior accessibility of the core has been somewhat eroded.

Besides information, another crucial input for office activities is labour. Office work has always been a labour intensive activity and labour is by far the dominant cost component in the expenditures of office operations (Rhodes and Kan, 1971). Firms need to locate where the type of staff they require will be available. One of the advantages of the
downtown core is that, due to its nodal position in the transportation system, it draws upon the entire region for its labour supply and, as a result, the employer has access to a large, varied labour pool. Although this access to labour remains a strong centralizing factor, with improvements in transportation systems, increased car ownership, migration of population outwards, and suburban housing development, the CBD no longer dominates the metropolitan labour market as it once did.

Related to the labour availability factor in office location are more indirect, social factors. Social factors which favour central office locations include the opportunities for interaction afforded by the presence and proximity of large numbers of workers in the core area. These opportunities for the pursuit of personal and career objectives and the conduct of work, are facilitated by the amenities of the core including restaurants, theatres, convention centres, shops, and sports facilities. It is lack of these type of factors which may lead to managerial and professional workers' perception of isolation in the suburbs (Ley, 1983).

Other factors which can be included under this category are the time and ease of the journey to work, proximity to executive residences, and access to good, affordable housing for other employees. These types of social or non-economic factors may increasingly tend to favour suburban office locations.

While none of these social factors should be considered as primary location determinants, they may have an indirect effect
in office decisions because they influence the attractiveness of the location for the worker. This in turn, may influence the firm's ability to recruit and retain labour, and affect employee job satisfaction and, therefore, productivity.

Prestige is often mentioned as an important factor in office location decisions. It is a factor which is not readily defined and its benefits are difficult to quantify. It is thought that a prestigious downtown address can contribute to the credibility of some types of businesses, for example, financial and professional firms (Fernie, 1977). Daniels (1975), believes that survey design has had a large influence on prestige being included as an important factor in office location studies. Without a prompt, prestige is mentioned far less frequently. In view of this, it would seem prestige plays a more peripheral role in most office location decisions.

The role of tradition in office location is similarly vague. This factor suggests that many firms remain located in the centre because they have had a successful, enduring association with a particular location which they are unwilling to break. It is likely that tradition also plays a more secondary role in location decisions.

Besides these factors which continue to produce strong demand for centrally located office space, the continued concentration of the office space supply in central locations is also an important centralizing force. Most office organizations rent their premises so they are very dependent on the availability of rental office space.
The supply of office space and its location pattern is influenced by demand, by local government policies and land use regulations, and by the attitudes of financial institutions and developers. Financial institutions have invested heavily in downtown office buildings and, therefore, have a financial stake in maintaining demand for core office space. Public authorities, through their desire to protect jobs, tax revenues and infrastructure investments may also seek, by policy and regulatory means, to maintain the core as an attractive office location. As well, conservative attitudes of the financial and development communities which view suburban office developments as a more risky investment, have led to a degree of locational inertia in office space construction.

2.4.2 Centrifugal Forces

Suburban areas are capturing an increasing share of new office space, which tends to be occupied by population-serving activities, branch offices, office activities ancillary to production, distribution, and retailing facilities, and to a more limited degree, by headquarter offices and research and development functions. In the United States, where decentralization forces have been stronger, suburban offices have been located in scattered developments with good highway access and in planned office parks. Much suburban office space has tended to locate near to high income housing areas, shopping centres and airports (Jones and Hall, 1972). In Britain, expansion of existing commercial centres is the principal method of suburban office expansion.
The outward movement of population and other types of economic activity is responsible for part of the increase in suburban office development. With population moving to the suburbs due to increased affluence, demand for more spatio-temporal, inexpensive housing, increased automobile ownership and expanding employment opportunities, small population-serving office activities such as lawyers and medical practitioners have grown and expanded. Where demand has reached required threshold levels, consumer service firms such as financial and real estate firms have been established to serve the growing suburban population directly (Alexander, 1978; Daniels, 1974).

Other suburban office activities are attached to decentralized or newly established manufacturing, wholesaling, and retailing operations. Many of these operations have selected suburban sites because of the cheaper cost of land, space for expansion, changes in production processes, better access to highways, and the suburbanization of population.

The suburbanization of population and housing has meant the suburbs can now offer a larger, more varied labour supply, particularly female, clerical workers. This has helped to make suburban locations attractive for routine information processing office functions which require a large supply of clerical labour. Some suggest labour costs are lower in the suburbs, because of less unionization or because of fewer job opportunities, but it is not clear that this differential is very strong or makes any significant difference in location decisions.
Rents and related costs make up a small proportion of office expenditures, on average less than ten percent (Rhodes and Kan, 1971) but the importance of this expenditure varies with firm size. For routine office functions and firms not requiring the contacts of the CBD, an overall cost saving is generally attainable by moving to lower priced office accommodation and this is a major incentive to relocate to the suburbs (Alexander, 1978). The rental differential between central and suburban office space in the U.S., however, has been somewhat obliterated by rising suburban taxes and the building of high rise, prestigious suburban office buildings (Jones and Hall, 1972).

It is also often suggested that the diseconomies of the core, such as congestion, lack of room for expansion, physical deterioration, pollution, crime, and racial problems have acted to push some office activities out of the CBD. In contrast, suburban office sites offer the advantages of an easier, shorter journey to work, more parking, more affordable housing, in some cases better schools and recreation facilities, the opportunity to construct purpose-built offices, and more relaxed, aesthetically pleasing working environments. For some types of office activities these types of suburban locational advantages, plus the rent savings and access to clerical labour, outweigh the disadvantages of the absence of support services, opportunities for interaction, and amenities available in the CBD and the higher costs of maintaining contacts in the CBD (Daniels, 1982b).
In addition to these market factors, a slightly different type of factor has also influenced the decentralization of office activity. In some jurisdictions, primarily the very large metropolitan regions in western Europe, such as London and Paris, public policies using both restrictions and incentives, have been adopted to discourage office development in the core areas and encourage it in outer areas. It is difficult, however, to discern the effects of these decentralizing policies from market forces.

While these types of factors have contributed to office decentralization in the past two decades, it has been suggested that more subtle, fundamental changes in production processes may, in the future, induce more extensive decentralization of office activities (Edgington, 1982). The application of technological innovations to office activities and changes in the organization of office divisions and firms may lessen the demand for centrality and encourage more offices to move out of the CBD to suburban locations and beyond, it is claimed.

The evidence, however, is that office activities, particularly higher level functions, remain highly concentrated in the CBDs of large metropolitan areas. It has been observed that in cities with strong centripetal forces, the core is not a major source of suburban office activity (Gad, 1981; Daniels, 1982a). This suggests that technological innovations have not yet resulted in profound locational shifts of office activities.
2.5 Summary

Office-based activities have become crucial for directing and coordinating all forms of economic activity. Because the development of office activities has been largely an urban-based phenomenon, the increasingly important role for office activities implies positive and negative impacts for the urban region. It is, therefore, important for urban analysts and planners to understand the growth, evolution, and locational dynamics of office activities.

The CBDs of large, urban regions have traditionally held locational advantages for office activities. More recently, the shifting spatial distribution of population and other forms of economic activity and the diseconomies of the urban core, combined with the attractions of lower rents and more spacious surroundings, have resulted in more office development in the suburbs. These factors, it is claimed, may increasingly become secondary to technologically-induced changes in the ways office work is done. The application of technological innovations to office activities may lead to more extensive decentralization of office activities, particularly those activities which require few face-to-face or orientation contacts.

But in face of these centrifugal forces, the CBD has maintained its dominance as the location for the most influential office activities, those that involve analytical, decision-making, and administrative functions. The continued demand for central office space suggests that in spite of technological innovations which may increase the locational
flexibility of some office activities, for other activities the strength of centripetal forces are such that there is still strong demand for a downtown location.

This thesis will now proceed to examine the nature of recent technological innovations and their potential application to office activities, in order that the likelihood of technological change in the office can be assessed. Out of this analysis the implications of technological change on the organization of the firm will be discussed in Chapter IV to gain a better understanding of how technological change is likely to affect the location of office activities.
III. TECHNOLOGICAL CHANGE IN THE OFFICE

3.1 Introduction

It has been hypothesized that technological change in the office will increase the locational flexibility of certain types of office activities and, as was discussed in Chapter II, it is speculated that more extensive office decentralization may result. The purpose of this chapter is to analyze the nature and extent of technological change occurring in the office as background for determining the validity of this hypothesis. Recent technological innovations and their applications, which are providing the basis for technological change in the office, are examined and the need for these devices and systems in the office is discussed. The pace of diffusion and adoption of technological innovations is analyzed and finally, obstacles to implementing technological change in the office are presented.

3.2 Technological Innovations

Technology can be defined as:

" ...any systemized practical knowledge, based on experimentation and/or scientific theory, which enhances the capacity of society to produce goods and services, and which is embodied in productive skills, organization or machinery." (Gendron, 1977, p.23).

The most visible embodiment of technology is machinery and the emphasis in this section will be on reviewing developments in office hardware. It should be emphasized, however, that technology is anything which transforms inputs into outputs and
this can include the skills of labour and the organization of work.

Mechanical devices such as the typewriter, telegraph and telephone were in use in offices by 1900. In the first half of the twentieth century, existing office technologies were refined and new technologies including the teletypewriter, automatic telephone switching, the electric typewriter, duplicating machines and copiers, adding machines and calculators, and dictaphones were introduced into the office (Giuliano, 1982, p.149). A new generation of technology was applied to office work in the 1960s, with most large businesses using computers. More recently, minicomputers, inexpensive copiers, small private branch exchanges, word processors and microcomputers, have become available for office use.

These new machines make use of technologies which have been termed information technologies by Barron and Curnow (1979). They define this term to include technology which assists in the processing, storage, and communications of information. The enhanced capabilities, versatility, accuracy, speed, and lower costs have been the attractions of the new information technologies. Recent technological developments have been in two main areas: computers and their component technologies, and telecommunications.
3.2.1 Computers And Component Technologies

Computers consist of three basic units: the programmable computing or processing unit, memory devices for storing information, and input/output units for external contacts.

A. Processors

Processor technology has gone through three major changes in components from vacuum tubes to transistors, from transistors to integrated circuits, and from integrated circuits to large scale integrated (LSI) circuits. The computer processor built with LSI technology is termed the microprocessor, and it is the microprocessor which is hailed as the key technological development in the information technology field (Barron and Curnow, 1979).

The basic unit is the chip, a rectangle of a semi-conducting material (usually silicon) on which is manufactured many tens of thousands of electronic circuits. Chips incorporating more than one circuit are referred to as integrated circuits; LSI implies a very large number of circuits on one chip. In 1981, one third of a million circuits could be contained on a single chip, and by 1990 a single chip may contain hundreds of millions of components (Tapscott, 1982).

The major challenge to the microelectronics industry is to increase the packing density on the chip by manufacturing more circuits in a given space either by reducing the size of the chip or by increasing the numbers of circuits on the chip (Eaton and Smithers, 1982). There are five main benefits to be derived from this increased packing density (after Eaton and Smithers,
1982):

i) speed - as packing density increases, the time taken for an electrical pulse to travel from one circuit to another is reduced; therefore, the component on the chip will function faster.

ii) performance - because of increased packing density, power requirements of circuits are less; besides energy savings, this means less heat is dissipated which lessens a constraint on product design and also improves the reliability of the chip.

iii) reliability - with high packing density few chips are required for each product which means improved product reliability because fewer connectors, which can be unreliable, are required.

iv) cost - with more circuits on a given chip the cost per circuit falls, and also, for a given function the user requires fewer chips; the overall effect has been to reduce the cost to the user of providing a given function.

v) compactness - the small size of chips makes it possible for the hardware in which they are incorporated to be smaller which enhances the portability and flexibility of the device for the user.

These dramatic improvements in chip technology have had enormous impact on computing systems. Costs for the entry-level system have been considerably reduced and, as well, computational capabilities have been greatly increased. The microprocessor, combined with memory and input/output devices has led to the creation of the microcomputer, often referred to as the 'computer on a chip'. The microcomputer has provided a relatively inexpensive, flexible component for the design of information systems.

B. Memory Devices

There are two basic types of memory devices: primary memory units which store the processor's instructions and the basic data required for its operation, and secondary memory units
which store large amounts of data. The principal primary memory technology has been magnetic core, but microprocessors now use LSI memory chips for primary storage. Secondary memory consists of magnetic disc memory and magnetic tape memory which are mechanical devices. Magnetic tape provides larger capacities and long term storage capabilities but, disc memory provides more rapid retrieval. The net effect of improvements in memory devices has been to provide increasing amounts of storage in smaller space, with quicker access, and at declining costs.

C. Input/Output Devices

There are a wide range of devices which can be attached to processor and memory devices to communicate with the user. The standard input device is the typewriter keyboard but other devices for entering information have recently been developed, such as facsmile scanners, optical character-recognition devices and magnetic-ink recognition devices which read typescript and/or handwriting, screens and tablets that respond to touch, pointers, or light pens, and even voice recognition devices. Output devices include voice or audio units, soft-copy or nonpermanent visual displays including the cathode ray tube used in video display terminals and flat, solid-state panels which can be used in very large and small, portable screens, and devices which provide hard-copy or permanent records including impact and nonimpact printing devices.

While performance and cost of input and output devices have been improving, the pace of this improvement is slower compared to performance improvements in microprocessor and memory units.
The human-machine interface difficulty, the problems involved in communicating with machines, still has not been fully overcome.

3.2.2 Telecommunications Technologies

There have been three major sets of developments in telecommunications, the major benefits of which are more transmission capacity and greater choice of mode:

A. Digital Transmission Systems

Most new transmission systems will transmit information in digital form. In a digital system all material being transmitted is numeric. Unlike analog transmission, the process in digital transmission, at each repeater is to recreate an exact binary one or zero rather than amplifying the original signal. The benefits of digital transmission are its accuracy, increased transmission efficiency through signal processing and coding techniques, and opportunities for greater privacy and security of information transmission.

B. High Capacity Transmission Equipment

Three recent technological developments in physical communications equipment are:

(i) satellites

Satellites are a form of relay station which receive, amplify, and retransmit the signals of earth stations. In a satellite-based communication system the bigger and more powerful the satellite, the smaller and less powerful is the earth station required for microwave transmission. With the U.S. space shuttle program, it will be possible to launch more, and larger, satellites making the economics of satellite-based
communication systems more attractive and providing massive increases in traffic capacity for long distance intercontinental communications.

(ii) fibre-optic cable

Increases in local and intra-organizational communications traffic will likely be accommodated by increased use of terrestrial microwave systems and the introduction of fibre-optics. Fibre-optic cable consists of very fine, flexible strands of highly reflective glass down which, pulses of light, representing binary coded information, travel. Because of its size advantages, fibre-optic cable offers the potential for very high capacity transmission at low cost, and combined with digital exchanges, will likely form the basis for future public telecommunications networks.

(iii) infra-red applications

While satellites and fibre-optic cables will handle communications over long distances, communications and control within and between buildings in the same area may be undertaken by semiconductor devices using the infra-red part of the spectrum. Infra-red offers a compact and inexpensive means of line-of-sight, narrow-band transmission. The need to install communications cables to each machine in an office will be removed.

C. Transmission Protocols

Transmission protocols are an agreed set of technical rules or procedures that govern the exchange of signal transmission and reception between equipment. The trend now is to attain
more efficient use of a physical transmission network by implementing several logical networks on a single physical network. Of interest are two new developments:

(i) packet-switched networks

These general purpose data and message-switching networks are an attempt to achieve more efficient utilization of line capacity by interweaving data from different sources to get the maximum possible traffic down a line. Such networks incorporate intelligent devices in terminals which take continuous data streams and send them over the network as a series of self-contained blocks called packets. Besides being more efficient, such networks permit different types of computers and terminals working at different speeds to communicate with each other.

(ii) local area networks

These networks are designed to assist the communications within a particular building or site by allowing different office systems to communicate with each other. This common communication network permits resource sharing by providing access to high cost facilities.

3.2.3 Integrated Systems

Developments in information technologies are converging to the point where it is difficult to view them as distinct technologies. Microprocessor technology is being applied to telecommunications equipment; for example, it is used in intelligent switching systems, and computing systems rely on telecommunications networks to relay information. It has been said that:
"...the great potential of these systems lies not simply in the power of their individual application, but in the synergy resulting from increasingly profound integration of various systems components (Tapscott, 1982, p.16).

For the user this convergence means more rapid, low cost communication of various types of information, in various modes, transmitted to virtually any location. Integrated, intelligent networks capable of handling voice, data, video, text, and facsimile, will become the norm (Eaton and Smithers, 1982). In the U.S., Satellite Business Systems, a joint venture by Comstat, a satellite technology company, Atena Life Insurance, and IBM, is the first satellite-based, private enterprise, common carrier offering point-to-point services for large communications users. Such an integrated system combines voice, data, facsimile, and other traffic into a single digital bit stream at the sending terminal, and transmits it to a satellite where it is relayed to the appropriate receiving terminal.

3.2.4 Applications

Technological developments such as those described in the previous subsections, are being utilized, and have potential for use, in a variety of products applicable to office work. It has been suggested that the principal activities of the office include the receiving, recording, manipulation, and giving of information. To review the current and potential applications of the new information technologies to these office activities, a three part framework will be used.
A. Information Capture and Processing

With the advent of desk-top input devices, users, including professional and management staff, can originate, format, edit, transmit, and receive a wide variety of information.

Text processing applications permit the capture, storage, manipulation, and output of text. Word processors, perhaps the most extensively used application of new technology, consist of keyboard, display unit, processor, storage devices and printers. They can be used as stand-alone devices or be used in complex shared-logic systems. The primary end product is hard copy, but soft copy product is increasing in importance. The main advantage of word processors is that they reduce repetitiveness in information processing tasks and, thereby, make for more efficient, optimal use of personnel.

Computerized graphics is another recent application which permits the conversion of data into two-dimensional graphic images. The images can be modified by digitizers, scanners, free cursors, or light pens. The advantages include reducing paper and printing costs and ease of understanding or interpretation of data.

B. Information Storage and Retrieval

The new technologies have enhanced ability to store and recall information whether in data, text, facsimile, photographic, micrographic or video signal form. Both means of location, and the information itself, may be electronically encoded, or the system may be semi-automated with electronic search and the information stored on paper, on microforms, or
electronically encoded.

The advantages of electronic storage and retrieval include faster and easier access, reduction in misfiling, storage efficiency through shared access, reduction in amount of floorspace required, portability of files, ability to access at different times and places, and limited dependence on human knowledge of filing techniques.

Developments in storage and retrieval tools and programs have permitted the development of large internal and external data bases which can assist in both decision-support and daily operational information requirements.

C. Information Distribution and Communications

There is a broadening selection of information distribution and communication systems available which transmit various forms of information rapidly, directly, and accurately.

Electronic mail systems provide both computerized and non-computerized delivery of soft or hard copy. Their advantages include faster delivery of information, reduced paperwork and mailing expenses, geographic and time independence, improvement of time management and improved access to personnel. One type of electronic mail system is computer-based message services which retains messages in computer memory and permits users to receive messages on their terminals, from any location, at their convenience. The effectiveness of this type of system is limited by unwillingness or inability of managers to do their own keying. Other computerized mail systems include teletypewriters and communicating word processors.
For meetings among people at physically separate locations, audio and teleconferencing are now available. This can range from conventional long-distance telephone calls to complex integration of audio, visual, and computer elements. Audio and teleconferencing are increasingly popular for many types of business meetings. It is estimated that thirty-four percent of existing business meetings consist of communications the outcome of which would not be damaged by use of audioconferencing and a further ten percent of meetings would not be negatively affected if video was added (Goddard and Pye, 1977, p.26).

Audio-conferencing, which involves audio transmission plus graphics is the most simple, least expensive, and most widely used method of conferencing. Teleconferences use video and audio transmission and are very expensive. The advantages of audio and teleconferencing include fuel conservation, improved productivity, more effective use of time, reduced labour and travel costs, ability to 'attend' several meetings at diverse locations in a single day, quicker solution to problems, and shorter reaction time.

A number of studies have shown, however, that travel for business meetings is more economical the longer the duration of the meeting and the shorter the distance involved. Also, while telecommunications may be appropriate for routine, non-sensitive activities, for those contacts involving bargaining, judgement, and getting to know people, telecommunications may be less effective (Goddard and Pye, 1977).

While this section has outlined recent technological
developments and their applications to office work, technological innovations provide only the means for technological change in the office. Widespread adoption of these systems will depend on their economic viability and social acceptance. These aspects of technological change in the office will now be explored.

3.3 Demand For Technological Change In The Office

Office activities have always been viewed as under-capitalized and labour intensive. It has been suggested that one of the reasons for the previous lack of investment in capital equipment in the office is a longstanding tendency to regard office activities as having a peripheral role in the economy. The under-capitalization of the office environment is also, in part, attributable to the fact that "...factor price pressures towards substitution of capital for labour..." have been weak (OECD, 1981a, p.53). This has been due to a variety of factors: the large, suitable labour supply of office workers available due to rising education levels and increased female labour force participation rates; the previously slower earnings increase for office workers; the lack of scale economies available; and the high cost and limited supply of information technologies prior to the 1970s.

More recently, however, there has been greater attention paid to capital intensification in the office environment due to several factors. The advent of new technological developments in computing and telecommunications and competition in the information technology industries have made available hardware
which is cheaper, smaller and has greatly enhanced capabilities making it amenable to a variety of office uses. Expanding volumes of information, the need for timely and accurate information, and the need to coordinate the affairs of dispersed activities have also prompted interest in office capitalization. But, the primary incentive has been increased concern over rising office costs and lagging office productivity.

Office costs have become a progressively higher proportion of total overhead costs for all firms, regardless of sector. Where office costs were twenty to thirty percent of an average firm's total costs ten years ago, they have now risen to forty to fifty percent in the U.S., and are much higher for firms in the tertiary and quaternary sectors (McNurlin, 1978).

The growth in office costs is mainly attributable to increasing labour costs, estimated to be growing at six to eight percent per year in the U.S. (McNurlin, 1978). Increases in labour costs can be attributed to more unionization of white-collar workers, shortages of office workers, growth in higher paid managerial, technical, and professional occupations, and greater expectations regarding wages and benefits.

The emphasis of office automation efforts have so far, been on the clerical sector because the routine, structured, information processing activities that many of these workers are engaged in are more readily performed by machines than other types of office work. Yet, while $50 billion was invested in the U.S. in 1979 on technological resources for clerical and nonprofessional workers, less than half this amount, $21
billion, was spent to support managerial and professional workers (Poppel, 1980). While managerial and professional staff accounted for forty-two percent of all office workers in Britain in 1976, they accounted for sixty percent of office labour costs (Simpson, 1981, p.6). What is most significant about this fact, is that the managerial and professional occupations are generally the fastest growing in western labour forces. Most in the office automation field feel that the real payoff from office automation may lie in increasing the productivity of professional and managerial workers.

A factor related to rising office labour costs has been the perception that office productivity has been lagging behind that of manufacturing activities. For example, it is often quoted that while productivity in manufacturing activities in the U.S. rose eighty-three percent between 1960 and 1970, office productivity increased by only four percent (Jacobs, 1980). The issue of productivity in office activities is, however, rather controversial. While the productivity of manufacturing activity is increased by either achieving more output from the same input or by getting the same output from less input, the output of office activities is much more intangible. Perhaps a more useful concept is the effectiveness of office activities. Effectiveness is concerned with determining to what degree the organization's goals have been achieved (Doswell, 1981).

Having now reviewed the need for technological change in office activities, the acceptance and spread of technological innovations will be examined in the next section.
3.4 Diffusion And Adoption Of Technological Innovations

3.4.1 Diffusion

Diffusion is the process by which an innovation is spread through time and over space among the members of a population. It is difficult to forecast the rate of diffusion for any particular innovation because innovation is often a continuous process where the innovation is improved and prices changes occur.

Factors which have a bearing on the diffusion rate of an innovation are:

(a) the communications process and the increased awareness and familiarity with the innovation, and

(b) the characteristics of the innovation itself in terms of the costs, risk, availability, and particularly, its advantage over old technologies.

Generally, the diffusion rate of a technological innovation follows an S curve over time. Initially, only a few organizations adopt an innovation then, once the innovation is adopted by influential opinion leaders the adoption rate increases as the opinion leaders are copied by other organizations. Finally, once there are few organizations without the innovation, the rate of adoption declines.

While the market for selling advanced office equipment in the U.S. is apparently very lucrative (sales were $3 billion in 1981 and are projected to be $12 billion by 1986), demand has developed more slowly than anticipated (Uttal, 1982). When it comes to truly integrated office information systems, only a small group of leading edge users exists.
There are a number of hypothesis regarding the spatial diffusion of innovations, most notably the centre-hinterland spread, the urban hierarchy diffusion, and ideas put forward by Pred (1976) that innovations are diffused through the linkages of multi-locational organizations (Brown, 1981). It can be speculated that the spatial diffusion of recent innovations in information technologies has involved, to some degree, all three processes hypothesized above. The fact that office activities tend to be concentrated in the largest metropolitan areas, lends support to the urban hierarchy hypothesis. Support for the centre-hinterland hypothesis may be indicated by the concentration of offices in the centre of urban regions. As well, information technologies play a significant role in making multi-locational organizations possible, so it can be expected that such innovations will diffuse through the linkage structures of large firms.

3.4.2 Adoption

Adoption refers to "...the act of a single organization adopting (an) innovation to its own use" (Aldrich, 1979, p.98). Three categories of factors influence the adoption of innovations:

(a) personal characteristics of managers in terms of their willingness to experiment

(b) structure of the organization - the size or degree of centralization of authority affects the ability to experiment; and

(c) relations between an organization and others in its environment; more competitive industries encourage innovation.
Within an organization, the application of information technologies is thought to evolve over a number of stages. The following four stages of office automation are suggested by Zisman (1979):

(a) initiation - Organizations perceive the opportunities technologies hold and begin to use mechanized office equipment. The emphasis is on more efficient production of paper at this stage. Many large organizations are already in this stage or have passed through it.

(b) expansion - The objective at this stage is to replace the paper flow with electronic information flows. The emphasis is on mechanization of tools as opposed to functions. This is a period of experimentation so there will not be great concern for the integration of these tools into a cohesive whole. For many of these applications to be successful, for example, electronic mail, they must be used by a critical mass of users. The main problem at this stage then, is not the technology, but rather a systems and organization problem.

(c) formalization - The focus at this stage is on the functions of the office. The emphasis shifts from mechanizing devices toward automating processes and from mechanizing tasks to automating functions. It is at this stage that automation, in the strictest sense of replacing people with machines, rather than supporting or augmenting them with machines, occurs.

(d) maturity - This is a period of stabilization as the organization adapts to change.

Zisman draws an important distinction between mechanization and automation. In automation, the machine initiates and controls itself in performing functions, whereas, in mechanization the machine performs only on command from its operator. The distinction is regarded as a technology frontier "...which is continually moving forward ...what we view as automation today will probably be viewed as mechanization in some future period" (Zisman, 1978, p.7).

In fact, most offices are still at the 'expansion' stage,
mechanizing tasks, not functions. Reasons behind the apparently slow pace of diffusion and adoption of technological change in the office, will now be analyzed.

3.5 Obstacles To Technological Change

While there is need and means for technological change in the office environment, there is a variety of factors which have presented obstacles to implementing technological change in the office.

3.5.1 Technical And Supply Problems

Many firms are fearful of investing in equipment which will become quickly outmoded technologically. Also, communications problems between the equipment of various manufacturers, and even incompatibility between the hardware of single suppliers, has slowed the rate of adoption. Manufacturers were initially slow to respond to the new market for information technologies; only IBM and Wang now have complete product lines for the office.

To use many of the technologies effectively requires a critical threshold of users, which having not developed fully, has caused some hesitancy in firms considering adoption. Difficulties in obtaining and utilizing appropriate software have also slowed the pace of adoption.

As well, there is some concern over the ability of telecommunications networks to cope with increasing demands and with agreements between networks to permit the free flow of information (Birchall and Hammond, 1981).
It can be anticipated, however, that many of these technical and supply problems will be overcome because the information technology industry has become very competitive and has better recognized the needs of its market.

3.5.2 Financial Problems

Competition for capital is rather intense in most companies. Office systems advocates must, therefore, clearly demonstrate the benefits to be attained from technological change. Data on these benefits and costs, however, are difficult to obtain.

The productivity implications arising from the application of new information technologies in the office, have been virtually unresearched and the lack of convincing studies has heighened firms' reluctance to adopt technological innovations (Harkness, 1978). To assess the effects of technology on office productivity it is necessary to determine what offices produce, and as discussed previously this is not an easy task. Some authors argue, that organizational productivity may in fact be eroded by technology because of information overload (Mandeville, 1983; Strassman, 1980). Rather than increasing efficiency of the office, automation efforts should be concerned with "...improving the timeliness and quality of management decisions ..." (Jarrett, 1982, p.22). But this of course, raises the very difficult problem of assessing quality of decisions.

One American survey found that "...in all but a few cases, there were few direct cost savings from any current form of
office automation" (Uttal, 1982, p.182). The costs of implementing technological changes may be as high as the capital costs. It is not at all clear, as will be discussed later in this section, that labour cost savings will result because of requirements for fewer workers. Net savings of only fifteen percent of clerical costs are expected by one analyst, because savings will be offset by the need for planning and programming staff expenditures to support office automation (Vyssotsky, 1979).

The difficulties involved in defining office work and measuring its effectiveness and the lack of appropriate measures and data to quantify the results of technological change, will likely remain obstacles in the diffusion and adoption of technological innovations in the office.

3.5.3 Difficulties In Applying Technology To Office Work

Technology works best when it reorganizes the way work is done, breaking down the elements of complex functions into simple tasks. According to Strassman (1980, p.58), increased office efficiency and productivity is likely to result from automation when:

- activities are relatively simple and easily standardized,
- patterns and contents of transactions are relatively stable, and
- there are reasonably large volumes of transactions because this allows amortization of the fixed costs of automation across a large base.

Most large organizations have already broken down their more routine information handling functions into smaller
components and many of these tasks have been automated. Many office workers, however, are engaged in activities that do not meet Strassman's criteria. Because it is difficult to break down and specify the steps that managers and professionals go through in doing their jobs, it is difficult to automate many of these functions.

An American study has found that managerial and professional staff spend approximately sixty-six to eighty percent of their time in unstructured, oral communications usually on a face-to-face basis or via telephone (McNurlin, 1978). It is thought that the more routine functions of managerial and professional staff can be automated, however, the potential for automating the larger part of their functions remains questionable. With the increasing importance of analytical and decision-making functions and with the increasing numbers of managerial and professional workers, the adaptation of technological innovations to the unstructured flow of this type of work, will be a difficult task.

3.5.4 Resistance To Technological Change By Office Workers

Perhaps the most high-profile obstacle to technological change is resistance by office workers, both managerial and clerical. A United Kingdom survey of executives' perceptions of obstacles to technological change in the office ranked resistance to change by staff as the most serious obstacle followed by the need to prove cost effectiveness (Jarrett, 1982). This resistance stems from two sets of concerns - concern over the impacts of technology on the quality of work
and fear about technological unemployment.

A. Quality of Work

The application of technology to office work implies breaking office work down into the basic tasks which combine together to compose the functions of the office. As a consequence, many expect the quality of working life in the office to become worse. The basic theme is that technology will lead to many jobs, particularly clerical jobs, becoming very standardized, repetitive and low-skilled. It is claimed that office automation "... holds potential for alienation, stifling of creativity, job fragmentation, dehumanization of communications, regimentation, and (easy) monitoring" (Tapscott, 1982, p.25).

Many managers view technological change with some alarm. Few managers have experience with new office systems and they often see new technology as potentially disruptive and, furthermore, due to their lack of awareness management often fail to grasp the opportunities presented by integrated technology.

But as Tapscott (1982, p.24), has also observed, "...improvements are not inherent in technology, technology is not inherently bad or injurious, whether ...benefits are derived will depend on how the system is designed and implemented." Technology may allow more flexibility in the design of office jobs. New integrated work stations may enhance job enlargement and job enrichment so that an employee can assume responsibility for a reasonably complete function. It is from this point of
view that some believe a well-designed and implemented office automation system can improve the quality of work life by reducing the time devoted to tedious tasks and freeing more time for satisfying work.

Overall, the effects of technological change on the quality of office work will depend on the sensitivity and enlightenment with which new technologies are introduced. Because few managers have been exposed to the new information technologies and do not fully understand the opportunities available, it may take some time and mistakes before improvements in the quality of office work become more widespread.

B. Number of Jobs

Fears of technological unemployment have been expressed by those that view the new technologies as fundamentally different from previous innovations because they are spreading much more rapidly and will eventually permeate all office work situations. It is held that as a result, productivity gains will lead to massive, structural unemployment. Concern is particularly expressed over the impacts on the clerical work force, because this type of work is most readily automated. In Europe, where the debate is most vocal, it is estimated that many of France's 800,000 clerical workers could lose their jobs, while in West Germany, two million of five million clerical jobs could be eliminated (Zeman and Russel, 1980). If these predictions come true, it is feared that there will be serious impacts for the female labour force due to the concentration of women in clerical work. Displaced clerical workers may have difficulty
finding alternative employment because their skills will be obsolete, their education levels tend to be lower, and they lack continuity in employment (OECD, 1981a). Declining clerical job opportunities, combined with anticipated increases in female labour participation rates and patterns of socialization and employer attitudes which orient women to clerical employment, it is claimed, imply bleak prospects for the female worker (Menzies, 1982).

Technological change may also effect the numbers of middle management positions in office work. The OECD (1981a, p.40) foresees:

"...a reduced proportion of employees in lower managerial and supervisory occupations in all ...sectors with a more restricted role in preparing and transmitting information to higher levels of management for those still retained."

Others go as far to predict that the whole gamut of white collar office workers, including professionals, will be in less demand if office systems can be applied to unstructured knowledge work.

In spite of some of these predictions, it is not apparent that technological change in the office is causing massive, structural unemployment in either the clerical or managerial-professional occupations (Stanback, 1978; OECD, 1982b). In fact, recent indications in the western developed nations are that both clerical and managerial-professional job categories have experienced rapid growth. In the U.S., for example, clerical employment between 1960 and 1978 increased seventy-three percent from ten million to seventeen million workers (Zeman and Russel, 1980). In the U.K., managers and
professionals made up 8.6 percent of the labour force in 1966, increasing to 11.6 percent in 1976 (Simpson, 1981, p.6).

Historically, technological change has resulted in net employment gains. Productivity improvements typically lead to rising incomes and falling prices which increases demand for output, thereby increasing employment. If the economy continues to expand, if new technologies are utilized to increase the volumes of work handled or to expand services provided, or if working hours are reduced, net unemployment should not be the result of technological change in the office.

Pessimistic forecasts regarding the employment effects of new information technologies may be based upon overestimates of the speed of development of technological innovations, the pace of their diffusion and adoption by offices, and the applicability of technological innovations to office work. As was discussed previously, there have been constraints in all of these areas.

Although aggregate job displacement may be equalled or exceeded by job creation, the displacement effects will likely not occur evenly across job and skill categories. As a result, significant labour market adjustments may have to occur with migration of labour and provision of re-training.

In summary, it can be said that reduced employment levels are not an inevitable outcome of technological change in the office. There is no strong indication that this is occurring at present or is likely to occur in the future; however, pessimistic forecasts continue to concern office employees.
This section has shown that there are obstacles in the way of implementing technological change in the office causing firms to be hesitant about adopting new technologies and slowing the pace of diffusion of technological innovations. Many of these obstacles may be overcome, others not so readily. It is evident that technological change in the office is an evolving, gradual process rather than a revolution.

3.6 Summary

Technological change in the office, has been made possible by the advent of recent technological developments in computing and telecommunications and made more necessary by the increasing importance of office activities, the need to cope with increased volumes of information and concern over lagging productivity and increasing labour costs. The pace of diffusion and adoption of technological change in the office is somewhat slower than anticipated. Most firms are still at the early stages of adoption because of hesitancy over technical problems, unclear financial advantages, difficulties in applying technology to many types of office work, and workers' resistance to change due to concern over the quality of work and fears of unemployment.

Technological developments are providing a greater range of channels with improved capabilities, capacities and flexibility for information exchange. As was discussed in Chapter II, there are different types of linkages between office activities which involve different types of information and utilize different communications channels. Technological improvements in the ability to communicate information imply greater locational
flexibility for office activities engaged in programming and some planning contacts. Higher level office functions involved in orientation contacts will likely continue to rely on face-to-face information exchange, because new technologies are generally perceived to be inferior for these types of information exchange and are often more costly at the intra-metropolitan level.

The possibilities of substituting capital for labour presented by recent technological advances should, in theory, give offices some flexibility in terms of the need to locate near their labour supplies and the locational attributes favoured by labour. This may hold some degree of locational flexibility for routine office tasks which are more amenable to automation, but indications are that capital will not readily substitute for labour in higher level office activities.

In view of the evidence presented in this chapter it would seem that the locational flexibility which information technologies might, in theory, provide for offices is being impeded by the relatively slow pace of implementation of technological change in the office. Technical feasibility will not necessarily lead to widespread acceptance. Technological innovations must be economically viable and socially acceptable before their locational implications will be fully realized.
IV. TECHNOLOGICAL CHANGE AND THE LOCATION OF OFFICE ACTIVITIES

4.1 Introduction

Given that recent technological innovations will increase capabilities to communicate information, a crucial input and output of office activities, the objective of this chapter is to determine how such technological change might influence the location of office activities. Specifically, the purposes of this chapter are: (1) to examine the effects of technological change on the organization of the firm and how these organizational changes may impact on office linkage and location patterns in order to determine if, as hypothesized, technological change will result in greater intra-metropolitan decentralization of office activities with standardized linkages, and (2) to investigate the validity of the hypothesis that economic and social forces exist which favour the centralization of office activities with unstandardized linkages.

4.2 Implications Of Technological Change For Organizational Form

It has been observed that "...organizational forms are limited by the nature of the existing technology" (Aldrich, 1979, p.178). This section will explore how technological changes may impact on two aspects of organizational form - firm size and the centralization/decentralization of decision-making - and what the consequences for the linkages and location of office activities might be.

These effects on organizations need to be examined because
technological determinism should be avoided in assessing the implications of technological change on the location of office activities. As Goddard (1980, p.97) states, "...the impact of new technology in the office sector needs to be seen in the broader context of the factors influencing organizational structure and strategy in a spatial setting."

4.2.1 Firm Size

It has been argued that large firms predominate in the introduction of technological change in the office, because only very large firms have the scale of operations to justify, and can afford, the capital investments and provide the planning resources required to implement fully integrated office information systems (McNurlin, 1978). Advances in information and telecommunications technologies have enabled, and accentuated, the growth of large corporations (Edgington, 1982; Mandeville, 1983) but, technological change has not been the cause of this growth. Rather, forces underlying the growth of large firms and their apparent increasing domination of the economy, relate to the firm's goals and the environment in which it operates, such as:

- drives to attain economies of large scale production and distribution,
- desire to achieve scales which are more effective for sales promotion,
- drives to restrict competition through mergers, elimination, or exclusion of rivals,
- desire to acquire strategic advantages through control and possession of patents or resource supplies, and
- tendencies of "outsider financial interests" to wish to
perpetrate mergers in order to reap financial profits (Peterson, 1978, p.85).

It is argued by Edgington (1982) that larger firms will increasingly substitute external economic linkages for intra-firm linkages, thereby, reducing the need for proximity to other firms and lessening the traditional locational attractions of the CBD for corporate offices. If a firm is of a scale large enough, the internal provision of specialized, office-based services such as legal advice, marketing and personnel, can be more readily justified and new technologies can aid communications between dispersed company locations. This decrease in the necessity for external linkages may increase the importance of other locational attributes which favour suburban office sites, for example, more spacious and attractive working environments, proximity to production facilities and journey to work considerations, and may make the 'push' forces such as decline and diseconomies in the CBD, more significant in location selection.

It can be argued, however, that in spite of the growth of large firms, substitution of inter-firm linkages for intra-firm linkages, at least in office activities, does not appear to be occurring to a great degree. Evidence to support this is indicated by the growth of the specialized producer services industry which provides a variety of professional services such as financial, legal, advertising, and engineering services. These firms sell much of their output to intermediate demand and rely on "...identification and aggregation of many intermittent sources of demand..." for their viability (Stanback et al,
The growing complexity of the economy and production processes has increased demand for these specialist services and the resulting increases in market size have led to specialization in the producer services industries, for example, legal firms that concentrate on international law. The growth of these specialized producer service firms indicates that many large firms continue to rely on 'out-of-house' provision of service inputs and, therefore, require office locations in proximity to producer service firms to establish and maintain these linkages.

What does seem more probable, is that growth in firm size and the resulting large volumes of transactions, may make it more feasible to apply technological innovations to more routine office activities, such as data processing, payroll and billing. The specialization of these 'back office' functions may make it more possible to separate and shift these activities out of the CBD to take advantage of lower rents, more spacious accommodation and proximity to clerical labour in suburban locations. Such activities are generally engaged in program and planning contacts and, therefore, can utilize information technologies to maintain their standardized linkages with other locations. Such a trend of dispersion of routine office activities with standardized linkages has been observed in Toronto and other large metropolitan regions (Gad, 1981). A core location may be necessary for only those higher level office activities requiring numerous face-to-face contacts for which technology is not seen as a substitute.
But others argue that large corporations, in their present form will not continue to exist (Macrae, 1976; Toffler, 1980). Reasons given for the demise or alteration of these corporations include:

- their inertia and built-in resistance to change, the lack of incentives and rewards for creativity and innovation,
- underestimation of demand for new products and services; the nature of products may change faster than large corporations are able to react,
- costs and difficulties of coordinating growing volumes of transactions and far-flung activities; growing bureaucracy and diseconomies of scale,
- overinvestment in older technologies and production processes, and
- employee motivation - today's educated workers do not care for a hierarchical organization structure and incentives will have to become more individualized which is difficult for the large hierarchical corporation to accomplish.

Macrae (1976, p.42) argues that corporations will devolve into "confederations of entrepreneurs". While he suggests that some activities will be managed by large firms, Macrae describes a scenario where the future corporate 'whiz kids' will be those who "...make big business more efficiently small...", where large firms increasingly rely on sub-contracting, and where small enterprise flourishes.

For the small firm, information technologies can extend their capabilities without the need to hire additional labour, and can help the firm adjust quickly to exploit changing demands more rapidly than large firms. Indeed, the small firm can be initiated to take advantage of a technological innovation.

Most small firms, however, are not well advanced when it
comes to office automation and remain labour intensive. The strength of small business has been the "...loyalty, understanding, and mutual respect..." of a small group of people who are committed to a common goal (Giuliano, 1982, p.158). But the low cost and improved flexibility and capabilities of new information technologies will make it increasingly possible for more small firms to have access to these new technologies and to put them to effective use.

Small firms generally need to be situated in close proximity to other firms, as Scott (1983, p.20) states:

"...industries and offices that are small in scale, unstandardized, labor-intensive, and functionally interrelated find themselves under heavy pressure to locate close to one another in geographical space."

The benefits of clustering include lower transportation and communications costs for assembling inputs and disseminating outputs, access to specialized labour, and opportunities for sub-contracting.

Clustering opportunities for small firms have traditionally been available in the CBD. For small firms, however, rent is typically a more significant part of total expenditures and, therefore, small firms may tend to pay greater attention to intra-urban rent gradients. With improved information technologies, some small firms may consider short distance moves from the CBD to inner suburban office centres which have appropriate concentrations and levels of activities. This would permit firms to take advantage of lower rents, but still be close enough to maintain important contacts in the CBD.
In summary, technological changes applicable to office activities will not 'cause' there to be more large firms or small firms. Information technologies only enhance or limit economic forces which underly the organization of firms. It is probable that there will continue to be a mix of firm sizes. In some industries, particularly those engaged in unstandardized, complex, rapidly changing production and newer industries, small businesses will proliferate, while in other industries where inputs and outputs are more standardized, there will be mergers and concentration in a few very large multi-national firms, to take advantage of scale economies.

Small firms need to locate close to other firms, so core office locations and suburban office nodes with sufficient levels of activity will be attractive locations. Because of the increasing importance of control and planning activities and the need to obtain specialized service inputs, large firms will generally maintain higher level office activities with unstandardized linkages in central locations. The more routine office functions with standardized linkages will increasingly be decentralized from CBD locations.

4.2.2 Centralization And Decentralization

Organizational centralization is defined as the transfer of information flows, resources, and decision-making from a lower node in the organizational structure to a higher one, and decentralization, any transfer from a higher node to a lower one (Rice, 1980; Simon, 1979). In what direction will technological change in office activities move the balance between
centralization and decentralization? While technology does not 'cause' either to occur, it enhances the feasibility of both by aiding the organizational structure to change to one more suited to its environment (Rice, 1980).

It is generally held by organization theorists, that as environments become more dynamic, heterogeneous and turbulent, the structure of an organization adapts by becoming more decentralized (Aldrich, 1979). With the increasing complexity of the economy, the increased volumes of information, the speed of transactions, growing internationalization of the economy, and growth in very large conglomerates, it should be expected that, aided by new information technologies, more organizational decentralization will occur.

Those who foresee the alteration of existing, large corporations, expect that these firms will evolve into organizations with more 'organic' or non-hierarchical structures. The locus of decision-making may become more diffuse as "...all sorts of organizational and extraorganizational sources ...(provide)...inputs..." (Simon, 1979, p.222).

Technology, of course, can also lead to greater centralization within organizations. Some suggest that while there may be more decentralization of day-to-day decisions, management in headquarters offices will, through the aid of technology, exert stronger control over decisions made elsewhere in the organization. Summing up the implications of technological change for organizational structure, Simon (1979,
"Whether we employ computers to centralize decision-making or to decentralize it is not determined by any inherent characteristics of the new technology. It is a choice for us to make whenever we design or modify our organizations. The technology does offer us a wide range of alternatives for fitting our decision-making systems to our requirements, whatever they may be."

Pitt and Booth (1983, p.201) believe, however, that organizations will adjust only slowly to the improved capabilities of technology because "...new innovations in organizational design may well be resisted if they upset the status, reward and legitimation systems of the organization". The apparent inertia of existing organizational structures is, therefore, seen as a barrier to significant spatial change in the location of offices (Mandeville, 1983).

The office location implications of the centralizing and decentralizing effects of technological change on organizational structure are more likely to impact at the inter-regional level. The attraction of both CBD and suburban office centres may be influenced by the centralizing capabilities that the new technologies provide, for example, central areas may lose or gain regional administrative offices as headquarters functions are consolidated in one centre and suburbs may lose or gain the offices of manufacturer's agents.

The centralizing capabilities presented by technological innovations may work to the advantage or disadvantage of any particular metropolitan region. Gottmann (1974) has observed the tendency of quaternary activities to locate in large cities,
and "...more particularly in certain ones rather than others ...")(p.19). Cities likely to develop as centres of quaternary activity are those which provide the best environment for transactional work. Factors such as highly educated labour, universities and major institutions, specialization in dynamic fields, physical and cultural amenities, and good airport facilities are important in creating this environment. The centralization of corporate office activities in one region will have positive spinoff effects on local producer service firms and support office activities, but the converse will be true for regions losing substantial corporate offices.

Technology may also assist in the functional and locational decentralization of office activities to other metropolitan regions, or even out of the country in order to better coordinate dispersed production facilities, to penetrate new markets, or to be near to specialized services available only in other cities. The dispersal of routine office activities outside of the metropolitan region to smaller cities and other countries may occur in the same way that manufacturing has shifted production facilities in search of lower taxes, better subsidies, and cheaper labour. Citibank, for example, has moved its credit card operations from New York City to Sioux Falls, South Dakota and, at least one company, Satellite Data Corporation, is having its routine clerical work done in Barbados and relayed back to New York via satellite (Smith, 1982). The impact of this type of dispersal should be felt more strongly by the suburbs because of the tendency for routine,
clerical office functions to locate in the suburbs.

To summarize this discussion on the centralizing and decentralizing potentials offered by recent advances in information technologies, radical organizational change seems unlikely at present which, makes radical locational change seem remote. Recent technological innovations can be both centralizing and decentralizing, but it is expected that a pattern of decentralization of routine and branch office activities, with centralization of control functions in headquarters offices, is most probable. Some metropolitan regions, those that provide the best environment for higher level office work, will benefit from these trends, while other regions will lose activities.

The findings of this section on organizational form indicate that technology does not cause an organization to adopt a certain structure or become a certain size. Rather, the effects of information technologies, are to enable or limit the firm's chosen course of action in regard to its goals and the strategy it selects in relation to the environment it operates in. The firm's locational choices arise from these goals and are part of its strategy.

On an inter-regional basis, it is expected that centralization of higher level 'control' office activities in metropolitan regions which offer the best environment for this type of work will occur, along with the decentralization of routine and branch offices to other regions, smaller cities, and out of the country. At the intra-metropolitan level,
technological changes should make it increasingly possible for office functions with standardized linkages to locate in non-CBD locations. Headquarters offices will generally continue to maintain central locations because of the importance of their unstandardized linkages for the firm and the need for face-to-face contacts to establish and maintain these linkages. Small, specialized office firms with unstandardized linkages and need for agglomeration economies, will also locate in the CBD or, in some cases, in concentrated suburban office nodes which are close to the CBD.

4.3 Implications For The Location Of Office Activities

In spite of claims by some that technological innovations will break down the rationale for concentration and make spatial clustering unnecessary (Berry and Cohen, 1974), offices remain more concentrated than any other type of economic activity. This section will explore the factors behind the continuing concentration of office activities in central locations.

At present, the increased locational flexibility offered by technological innovations is being restricted by the slow and uneven pace of adoption of technological change. Factors causing this inertia, covered in Chapter III and the first part of this chapter, include the difficulty in applying technology to higher level office activities, resistance by labour to the implementation of technological change, management skepticism regarding the financial benefits of these technologies, hesitancy because of technical and supply difficulties, and the lag in organizational form adjustment in response to the
capabilities of technological innovations.

Even assuming that technological changes were more readily adopted and extensively applied to office activities, economic and social forces favouring centralization, continue to prevail in the location decisions of office activities with unstandardized linkages. The factors behind the strength of these centripetal forces are:

(a) need for face-to-face contact to mediate unstandardized linkages

Face-to-face contacts are still required for the establishment and maintenance of many unstandardized linkages necessary for the most important, high level office activities, activities which are increasing in importance to the firm. These types of linkages are important for corporate administrative offices, especially those of firms in the tertiary and quaternary sectors which deal in products which are rapidly changing, for financial firms, and for professional firms which provide services to corporate offices. It would be generally more expensive in terms of travel, labour, and communications costs to maintain these types of contacts from decentralized locations and suburban centres do not usually provide the density and variety of contact opportunities to substitute for those available in the core.

(b) agglomeration economies

The prospects for cost savings and higher revenues available to firms due to the concentration of activity in the CBD, continues to be a strong locational attraction,
particularly for small firms. Availability of a large, skilled labour supply, access to specialized services, opportunities for sub-contracting and the development of a large market are the types of external benefits available to firms located in the core. Suburban office sites do not typically have the intensity of activity to provide the same degree of economies available in the CBD.

(c) accessibility

If relatively congestion-free access to the CBD has been maintained, this can be considered as a factor favouring centralization. Considering the export orientation of many core office activities, access to airport facilities is particularly important. The importance of accessibility as a locational attraction of the CBD, depends on the nature of the transportation system, its efficiency, and the density and size of the metropolitan region.

(d) office space supply

Downtowns have generally remained the dominant concentration of office space in most metropolitan regions. Developers continue to construct office space downtown, (although on a cyclical basis), because it provides a good return on investment, demand for central office space continues to be strong, and financiers support downtown construction because it strengthens the value of their existing downtown investments. For the office firm, downtowns usually offer a great variety of types and prices of office space including older, lower rent space which makes the core an attractive
location for small and new firms.

(e) social factors

Social factors are the opportunities for interaction, learning and career advancement that are available in the core because of the intensity of activity and proximity to large numbers of office workers. Such interaction is supported by the cultural amenities, conference facilities, and institutions located in the core. Suburban centres do not usually possess the numbers of workers, intensity of activity or support facilities that the CBD has to offer.

While social factors do not have a direct affect on a firm's profitability, because of their effects on the availability and productivity of labour, particularly managerial and professional personnel, they can be considered important factors favouring central locations. A related factor is the CBD's proximity to higher income residential neighbourhoods and renewed inner city housing areas which are attractive to many younger, childless managerial and professional office workers because of the proximity to their work and to the amenities of the downtown core.

In summary, it appears that office activities which have unstandardized linkages requiring face-to-face contacts, employing managerial and professional staff, requiring accessibility to larger than local markets and requiring specialized services will continue to favour a central location, in spite of advances in information technologies.

It can be expected that metropolitan regions will
experience the impacts of technological change in the office in slightly different ways or degrees because of:

- local variations in the pace of adoption of technological innovations due to lower wages, union strength, firm size, and occupational mix within the office sector,

- the composition and health of the local economy, particularly the importance of office activities to the local economy,

- the existing urban structure - the size, density, and age of the region and the existing distribution of economic activity, residences, and the transportation system,

- the mix of public policies regarding office development, and

- the relative strength of centripetal and centrifugal forces.

4.4 Summary

Information technology enhances or limits forces which underly the organization of firms and their locational choices, it is not a causal factor.

Technological changes in office activities should make it increasingly possible for office activities with standardized linkages to locate in non-CBD locations to take advantage of the available locational attractions. This would include those small office firms and office functions of large firms which are engaged in routine activities and involve program and planning contacts which do not require face-to-face information exchange.

Despite the increased locational flexibility offered by technological changes, office activities with unstandardized linkages continue to prefer a central location because of the economic and social advantages available in such a location. Corporate offices, small specialist office firms, and other
office activities which require unstandardized linkages are likely to continue to locate in the central areas of large metropolitan regions, particularly those regions with an environment favourable to this type of activity. The advantages of these locations include the intensity and variety of contact opportunities available, but also the availability of highly educated managerial and professional labour, superior accessibility to regional, national and international markets, amenities and opportunities for social interaction, and agglomeration economies such as access to highly specialized office-based services.

The office market is becoming increasingly specialized and spatially differentiated. The CBD will become more specialized with office activities based on the corporate complex - corporate offices, specialized producer service firms, financial firms, and support office services. Suburban office activities will consist of routine clerical functions of large firms and other functions with standardized linkages such as research and development activities, smaller, footloose firms not requiring CBD locations, offices providing services to local markets, and offices ancillary to manufacturing, distributing, and retail activities. Within suburbia the spatial pattern of office activities may become quite dispersed depending on the density of population, the existence of suburban office nodes, the nature of the transportation system and public policies regarding suburban development.

These office location trends may be experienced
differentially by various urban regions. Technological change may assist in impelling more extensive office decentralization in regions with declining CBDs. Alternatively, in those regions with strong traditions of office centralization, which have maintained their central advantages, and which have not developed strong suburban office centres, economic and social forces favouring central office locations will be very strong. Such differential experience of intra-metropolitan office location dynamics, requires different public policy approaches. This will be the subject of the next chapter.
V. POLICY IMPLICATIONS

5.1 Introduction

Office activities, their location, growth, and impacts have been somewhat neglected in the formulation of urban policies. The economic emphasis of such policies has been on manufacturing activities, perhaps reflecting the bias held by some politicians and planners that office work is non-productive and only local in nature. Because of the implications for existing policies and investments and because of the opportunities and problems office activities present for the urban region, metropolitan authorities are now increasingly addressing the question of the role of office activities, their development, and location in the urban region.

Having reviewed and analyzed the changes new office technologies are expected to effect upon office activities and their location in Chapter IV, this chapter will focus upon the second purpose of this thesis - to suggest how metropolitan policies might respond to the changing spatial distribution of office activities within the urban region. The opportunities and problems presented by intra-metropolitan location trends will be discussed, along with a general discussion of office policy form and instruments, a description and analysis of policy experience, and policy recommendations.
5.2 Opportunities And Problems For Policy Formulation

Technological change, as it relates to office location, presents both opportunities and problems for urban policymakers.

It has been observed in Chapter IV that technological innovations will help those activities with standardized linkages to move to the suburbs or entirely out of the region. For the strong central city the out-migration of those office activities that do not require a CBD location may ease congestion problems and stabilize pressures on adjacent land uses and transportation facilities. The decentralization of such office activities may provide some limited opportunities for suburban areas to strengthen and diversify their economic base, thereby providing more direct and indirect employment opportunities and increasing local taxation revenues.

For the region as a whole, the decentralization of routine office activities may assist in overcoming housing-employment locational imbalances and, thereby, reduce inefficiencies in land and energy use and provide economies in public servicing if the emerging settlement pattern is polynucleated rather than spatially dispersed. Improving the regional imbalance between jobs and residences, may also be more equitable in terms of providing more employment opportunities close to affordable housing and raising revenues for suburban governments to provide better public services.

On an inter-regional basis, technological change may support the centralization of corporate office activity in
'transactional' centres which may impact on linked activities such as professional firms and support services. This trend is obviously a 'double-edged sword' presenting opportunities for regions with features attractive to corporate offices and employees, and problems, in the form of loss of activities for those regions not so endowed.

On the problem side, the decentralization of routine offices may result in a more specialized CBD leading to downtown becoming the 'executive city'. Inner cities cannot rely on office activities to provide jobs requiring the skills of residents displaced by the decline or relocation of manufacturing activities. In cities with a highly centralized supply of office space, characterized by strong centripetal forces, office development may accelerate the displacement of other types of economic activity and low income housing, although this may, in some situations, be viewed as an opportunity. This process may be assisted by new construction or renovation of existing structures for specialty commercial facilities and high income housing attractive to managerial and professional office workers. The resulting high prices of inner city housing may force younger office workers and clerical staff into long commutes from more affordable housing in the suburbs (Ley, 1983). This commuting pattern may be disruptive to existing neighbourhoods, lead to the need for further transportation infrastructure investments, and conceivably, could lead to shortages of clerical workers in the CBD.
For the central city in decline, the costs involved in the decentralization of office activities aided by technological change, may be very large. Decentralization erodes the tax base causing either an increase in taxes or a reduction in services, such as transportation, garbage removal, and policing. Either way, the result is usually even more decentralization of economic activity.

Because the routine office functions which are likely to take advantage of technological innovations to move to suburban locations require few linkages with other suburban offices, they are apt to locate in a somewhat dispersed pattern. For suburban communities this, plus the fact that much suburban office development is attached to manufacturing, wholesaling, or retailing facilities, makes it difficult to build up office nodes and threshold levels of demand to support more specialized services (Ley and Hutton, 1983; Daniels, 1982a). In turn, the lack of specialized services and amenities makes it difficult to attract higher level office functions to suburban office centres.

It should not be assumed that office decentralization will inevitably bring about net social benefits (Daniels, 1975). A dispersed spatial pattern may increase the expense of providing infrastructure and may hold implications for housing, agricultural and recreational lands, and transportation policies. Many suburban municipalities are now increasingly concerned about the cost of servicing office development and related growth. Aside from this, it must be pointed out that
the clerical jobs of the routine offices are most amenable to automation or to transfer to areas or countries with lower labour costs.

This brief outline of some of the opportunities and problems presented by shifting office location patterns indicates that policy-makers should be aware of the conflicts and trade-offs which usually have to be made in policy formulation. For example, while decentralization of routine office activities may relieve inner city congestion, suburban office development, if it occurs in a dispersed spatial pattern, may result in inefficient resource use. As well, the locational changes discussed in this thesis will be experienced differently by metropolitan regions due to their varying growth and spatial characteristics. The decentralization of routine office activities may offer high growth CBDs the opportunity to ease some of the more negative pressures of office development, but the decentralizing potential of technological innovations may compound the problems of declining CBDs.

It is the types of opportunities and problems discussed here, and the trade-offs they present, which have increased the need for public policies to deal with office location and development.

5.3 Office Policy Form And Instruments

Office policy is a form of public intervention which seeks to influence the pace, pattern, and location of office development in order to attain some public goal. Public goals regarding office development may be explicit or implicit.
Policy may be implied through public infrastructure investments or be expressed in the form of zoning and development control regulations regarding the location, siting, density, and design of office buildings, although the increasing significance of office activities for the metropolitan region has recently favoured a more direct approach. Office policy may now be incorporated as an integral part of municipal and regional land use plans and economic development strategies. Policy form will vary according to a variety of factors such as the importance of office activity in the urban economy, the immediacy of the problems and opportunities generated by office activity, and local jurisdictional arrangements, powers, and resources.

To implement the goals and objectives of office policy, a variety of instruments has been developed. Most prominent in public sector attempts to influence the location and pace of office development, have been the use of negative controls or disincentives. The purpose of these instruments usually is to restrict office development in high growth areas and to deflect it to targeted receptor areas. Such instruments range from more blunt techniques such as moratoriums on office development in growth areas, to the use of zoning regulations and land use policy to control the timing, location and densities of office space construction, to infrastructure spending constraints which may indirectly constrain office development. More sophisticated instruments, such as taxation measures and development charges which theoretically cover the costs of negative externalities generated by office activity, and requirements which compel
office developers to provide some type of benefit such as housing or public amenities in return for construction permission, have been developed to deal more directly with the costs of office development and to broaden the range of benefits derived.

While many of these measures are relatively simple to administer and are in line with the traditional regulatory role of planning, they can be criticized for their distorting effect on the office space market and the often, negative, unintended consequences that result from their application. Many of these instruments are only realistic in high growth areas and office development may already generate surplus municipal revenues under normal taxation regimes.

Due to these problems with disincentives, and because of the growing recognition of the opportunities presented by office development, incentive techniques are increasingly being used to direct office activities to targeted areas. These more positive approaches include the establishment of promotion agencies to provide information services and develop marketing plans, the relocation of government offices to target areas, subsidies in the form of land write-downs, tax concessions, grants and loans to assist with employment and moving costs, public land assembly to attract office development, and coordination of land use, housing, and transport policy to influence the pace and pattern of office development.

Many of these incentive instruments, however, are not available to local governments and, in any event, it is
questionable whether some of them have a very strong effect on private office location decisions. The integration of land use, housing, and transportation policies is probably most realistic because it permits the guiding of market trends. This approach, however, requires a long run perspective.

The next section will analyze the experience of specific metropolitan regions with the use of these policy instruments.

5.4 Policy Experience

The development of policy to deal with the location and development of office activities is more advanced in the western European countries than in North America, due in part to a greater acceptance of public intervention in the affairs of the economy and also, to a more active role of central governments in inter-regional and intra-regional affairs (Ley and Hutton, 1983). Policy has been formed in response to two trends: (1) the perception of over-concentration of offices in the core areas of metropolitan regions and concern over the resulting inefficiencies and inequities; and (2) the inter-regional imbalances in offices and, therefore, in regional power, employment opportunities, and spinoffs.

In North America, there is greater reticence within the public sector about becoming actively involved in directing office development, although highway investment policies and housing policies in the United States have encouraged suburbanization and have indirectly assisted market forces in impelling office decentralization. Recently it has been recognized that office activities might assist in revitalizing
declining American inner cities. In Canada, downtown cores remain strong office centres and office policies have been mainly concerned with dealing with the perceived diseconomies arising from downtown office concentrations. Additionally, in both the U.S. and Canada, the central and state/provincial governments have played little direct role in office development policies.

The experience of office policy in London will now be reviewed and then three examples of North American policy experience - Toronto, Seattle, and Vancouver - will be discussed.

5.4.1 London

In response to public concern over rapid office development, the British government, in 1964, placed a temporary ban on further office construction in central London. Later a system of office development permits, which were required for any significant office space construction in central London, was put in place along with a program of subsidies and loans to induce office relocation, and plans to disperse government offices.

While the decentralization of office employment increased rapidly in the late 1960s, it is difficult to determine whether this might have occurred, due to market forces, without the controls. It is almost certain that it would have occurred, but probably not at the same pace or in the same pattern. The controls have been criticized for distorting the office space market by creating a supply shortage which resulted in high
rents for existing space. High rents may have resulted in an inefficient allocation of office space, because those activities forced to relocate may not have been best suited to dispersal. Besides this type of inefficiency, the controls have inequitably distributed the benefits to existing landowners and imposed costs on tenants and their customers.

In the early to mid 1970s, however, the conditions which originally brought about the ban and permit system had subsided and concern shifted to the detrimental effects of office dispersal on declining inner areas of London. The already existing, Location of Offices Bureau (LOB), an information and research group, was charged with the responsibility of increasing office employment in these inner areas. But, with the election of a Conservative government which disapproved of restrictionist policies, and in view of concern that foreign firms were avoiding London and Britain in favour of locating in European centres, the permit system was revoked in 1979 and the LOB was disbanded in 1980.

Within the London metropolitan area, the Greater London Council, as part of its overall development plan, has attempted to direct office activities to a hierarchy of twenty-eight suburban office centres. The objectives of this office strategy are to promote a better spatial balance between employment and housing and to encourage office activity in areas of the region deficient in such activity. While some of the suburban centres, notably Croydon, have experienced substantial office development, there have been some difficulties in implementing
the strategy due to lack of cooperation of some local councils and the lack of authority of the Greater London Council.

The London experience with office policy illustrates the undesirable, negative consequences which may arise from the arbitrary application of containment instruments. It also indicates that public policy must be flexible and well-informed in order to deal with changing market forces. In addition, it shows that the benefits of office activities should also be assessed along with the costs, in formulating policies responding to office development.

It should be recognized, however, that the London situation is somewhat unique because it is an extremely large metropolitan area, it is a world business centre, it has a long history as an office centre, it has a long tradition of planning, and the central government has played a key role in the development of office policies.

5.4.2 Toronto

In what has been termed an "unprecedented effort in North America" (Code, 1977, p.1), the City of Toronto, in 1976, enacted a system of office development controls as the central part of its plan for the core of the city. The purpose of the controls, which took the form of zoning and building intensity regulations, was to contain the expansion of office development "...in order to prevent a complete subjugation of the inner parts of the city to the demands of the central office district..." (Gad, 1981, p.9).

Office space in metropolitan Toronto has, however, remained
highly centralized and as Gad (1981, p.9), has observed, the "...decentralization process in Toronto is not particularly fast and does not involve a substantial exodus from the central district." While metropolitan plans favoured a multi-centred spatial structure for the region, no strong suburban office centres have yet emerged (Gad, 1979).

Analysis of the effects of the city's office controls has been mixed. Gad (1981) claims that the controls have "stabilized the inner city environment" and recommends their continuance in view of the strong centripetal growth pressures. But, Code (1977) criticizes the strategy on three grounds (which are similar to criticisms levelled against the London controls): (1) a supply shortage will result causing rent increases which will lead to the displacement or termination of some core area office activities, although not necessarily those activities best suited to suburban locations, (2) total costs will outweigh total benefits and costs will be inequitably distributed, and (3) lower productivity may occur in office activities which require a CBD location but are forced out of the core by high rents, particularly if suburban offices are not concentrated.

The Toronto policy experience again illustrates the problems which may result from the application of blunt instruments. The containment strategy has not encouraged those office activities with weak linkages to decentralize, only those that cannot afford the higher rents. In addition, the Toronto experience illustrates the need to cooperate at the metropolitan level to develop a few concentrated suburban office centres so
that activities deflected from the core by the central city's policies have viable, alternative locations.

5.4.3 Seattle

Like Toronto, Seattle's office space is highly centralized in the downtown area and there is only limited out-migration of office activities. But unlike Toronto, both the central city and suburban counties are, in their policies, emphasizing the benefits to be derived from office development.

The City of Seattle is promoting the CBD as the focus of the regional economy. Reflecting concern over the decline of older, suburban business districts, job-residence distances, and the need to reduce pressure on transportation facilities, neighbouring King County has adopted a policy in which activity centres connected by a transportation system will act as the focus of jobs, services, shops and housing. The strategies of the two jurisdictions conflict to some degree, as King County's policy is based on the ability to attract offices from the CBD. After analyzing the Seattle office market, Daniels (1982a) concludes that both suburban areas and core should be optimistic about the role of office activities in their economic development. Downtown Seattle remains an attractive office location as evidenced by the low level of office out-migration, but also, suburban centres should expect to expand their office base due to population growth and more new firm formation.

What can be learned from the Seattle policy experience is that rather than being regarded as a liability, there is a positive role for office activities to play in urban
development. It also illustrates the need for a region-wide policy and strategy regarding office development as the present strategies conflict. Strategies should emphasize retaining and attracting those office activities whose location requirements are best satisfied by the characteristics and advantages of the CBD and the various suburban centres.

5.4.4 Vancouver

Vancouver is similar in size to Seattle and also remains quite centralized with seventy-nine percent of the region's office space located in the central city (Ley and Hutton, 1983). In the mid-1970s public concern over rapid growth caused the Greater Vancouver Regional District to adopt a growth management strategy, the Livable Region Plan (LRP). Included as a key component of this five part strategy was the designation of four Regional Town Centres (RTCs), two in the inner suburbs and two in the outer suburbs. The RTCs were to function as suburban foci for employment, shops, services, and housing and were to act as nodes in the transportation system. Office activities were to serve as the catalyst for development of the RTCs. The City of Vancouver has tacitly supported the strategy.

In spite of the LRP and RTCs, the City of Vancouver has remained an attractive location for office development. It is apparent that the strength of centripetal forces was underestimated in formulating the strategy; like Toronto and Seattle, large-scale office decentralization is not occurring. While office development in suburban areas has certainly increased, it has located in a dispersed manner or has occurred
in suburban centres which were not originally designated as RTCs. The apparent failure of the LRP strategy in this regard, can be attributed in part, to a poor understanding of office market trends and office location requirements, as well as to the lack of support from some municipalities and the lack of regulatory authority of the GVRD.

The experience of office policy in Vancouver illustrates that coordination of public transportation, land use, housing, and economic policies is a long-term strategy and demonstrates the difficulties involved in producing a region-wide strategy and gaining cooperation in implementation. Additionally, it points to the need for policy-makers to have a good understanding of the characteristics and dynamics of the local office market. Public policies can guide development, but they can not make it occur without incurring very heavy costs.

Overall, it can be observed from the policy experience of London, Toronto, Seattle, and Vancouver that in dealing with office development public policy is moving from viewing office activities as a liability to be controlled, to perceiving them as potentially beneficial if guided properly. As a result, there is a movement from negative, arbitrary policy instruments to more finely-tuned, positive measures. In general, there is a need for region wide strategies which acknowledge that some office activities are best-suited to core locations because of their location requirements, while others may be more appropriately located in a few suburban office centres.

The policy experience of these regions also illustrates
that jurisdictional fragmentation and local and regional government's lack of authority and resources may impede the formulation and implementation of effective strategies dealing with office activities.

5.5 Policy Alternatives

Based on metropolitan policy experience, this section suggests three policy approaches for metropolitan regions to deal with recent intra-metropolitan office location trends and the locational implications of technological change in office activities. These policy alternatives are built upon two features: (1) the market status of a region - whether a region as a whole is experiencing high growth or low growth rates and (2) metropolitan spatial structure - the spatial distribution of offices and the degree of concentration of offices in the core. These features were selected because they have important influence on the opportunities and problems presented by office location and development.

5.5.1 High Growth Regions, Dominant Core

For regions experiencing high growth rates and having highly centralized office space systems (for example, cities such as Toronto, Vancouver, and Seattle) the emphasis of policy regarding office development and location should be to distribute growth in order to attain a more efficient distribution of office activities. The objectives of such policy might be to mitigate the negative aspects of central office concentrations, to achieve more efficient use of land and
energy resources, to attain a better job-residence locational balance, and to achieve greater economies in public servicing.

To achieve these objectives, the central tenet of the strategy should be to develop a multi-nodal metropolitan spatial structure, with the CBD as the dominant office concentration along with a few suburban office centres. A major principle of the strategy should be to encourage only those office activities which require a CBD location to be sited there, deflecting activities with standardized linkages to suburban office sites. This will ease demand pressures for downtown office space and may relieve congestion problems, as well as increasing suburban employment opportunities and tax base.

This might be accomplished through the instigation of an agency which could help make firms more aware of their location needs and provide information on available alternatives. Also, measures which charge or tax those responsible for the costs of centralization might be considered, for example, transportation tolls or increased fares, higher development charges, centrality taxes, or requirements to provide public benefits.

The CBD should emphasize corporate offices, professional service firms, financial firms, and other office activities with unstandardized linkages and requirements for face-to-face contacts. The health of the downtown office sector can be supported by providing and maintaining good access to the CBD and by encouraging and strengthening support facilities and amenities.

Suburban centres should be developed to act as foci for
employment, commercial and public services, housing, and transportation. These centres should be few in number and should be planned for locations with market potential, for example, sites with good access, near growing population areas and close to facilities such as major shopping centres or airports. These sites may not necessarily coincide with existing suburban centres.

Activities in suburban centres should be concentrated in order that the location requirements, for example, need for agglomeration economies, of some types of office activities can be satisfied. Many suburban office activities, however, do not have these location needs and, therefore, may be quite spatially dispersed. Suburban office centres should be designed to attract office activities which are normally suburban. Inner suburban centres likely have a good chance of attracting some smaller office firms from the CBD because of their lower rents and good access to the CBD. It must be recalled, however, that in regions with strong cores, the decentralization process is slower and suburban sites must rely more on new firm formation and expansion of existing activities rather than out-movement from the core. The potential for suburban office development may also be limited by the extent of corporate "back office" functions located in the region.

There must be good access to the core from suburban centres and easy circumferential movement. Although improved access to the core will benefit the centre, it is necessary for suburban offices to maintain important CBD contacts and improved
transportation between suburban centres is necessary to deal with cross-suburban commuting and consequent congestion. Development of a multi-nodal settlement pattern permits the concentration of demand for transit which should make its operation more efficient.

The development of suburban centres must be viewed as a long-term strategy, which involves coordination of land use, transportation, and capital spending policies. While there are public policy instruments available to attract office firms to suburban centres such as land assembly, land write-downs, tax exemptions, and subsidies, businesses locate where they can make a profit. Policy-makers must have a good understanding of office market trends and be realistic about the ability to attract office activities to suburban centres.

A major difficulty in developing a multi-nodal metropolitan spatial structure is fragmentation of jurisdiction and resulting goal conflicts. The development of a metropolitan-wide strategy regarding office location requires a regional consensus. This must include cooperation of the central city and willingness of suburban governments to support subcentre development by directing office development and public spending to these sites and away from others. Another major problem is the lack of resources and regulatory capability of local and metropolitan governments which impedes the latter's ability to implement effective strategies. These two problems, along with public sector misunderstanding of local office market trends, represent the major obstacles to attempts to realize a more efficient
distribution of office activities in high growth metropolitan regions.

5.5.2 Low Growth Regions, Core In Decline

Urban regions experiencing low growth rates and stagnation in their economies, such as some centres in the U.S. northeast and north central regions and some British northern provincial cities, require a different policy emphasis. The central cities of these regions have been adversely affected by the structural adjustments occurring in the economy. The core areas of these regions have declined as manufacturing centres because many of their goods producing activities are "sunset" industries, because firms have moved to suburban locations seeking cheaper, more spacious sites and better transportation access, or because manufacturers have moved from the region entirely, in search of cheaper labour. Retailing activities have relocated to suburban shopping centres in pursuit of more affluent customers and office activities have also begun to decentralize to suburban centres and office parks to take advantage of better working and living environments. Some headquarters offices have moved to more amenity rich regions.

Policy objectives should be concerned with adjusting to structural changes, retaining and attracting dynamic activities to the region and revitalizing the stagnating central city economy to make more efficient use of inner city infrastructure. The strategy must deal with the problems which create the perception of these regions and their CBDs, as unprofitable and unpleasant places to live and work because office activities and
high technology manufacturing activities are looking for high quality environments. There also must be recognition that long-term economic rejuvenation will not be accomplished by protecting and maintaining non-viable manufacturing activities. Further, there needs to be acceptance that economic revitalization involves change.

For the region as a whole to build a stronger economy requires economic development strategies which focus on developing an economic base of activities which are on the rise, such as new and small manufacturing firms and export-oriented office activities, and to build on existing specializations, for example, ports might encourage development of a strong business service sector associated with shipping activities. Many of these regions have retained assets which blend well with office activities and support them, such as educational, research, and medical institutions and highly educated labour.

Revitalization strategies must nurture those activities with location requirements usually satisfied by downtown locations. As was observed earlier, these are primarily corporate and financial offices, professional firms, and other office activities with unstandardized linkages which require face-to-face contacts. Improvements in downtown accessibility, circulation, provision of support facilities such as conference centres and availability of amenities like restaurants and hotels may assist in making the core an attractive, profitable location for these office-based activities.

To revitalize the core areas of these low growth urban
regions, requires senior government assistance, as many of the seemingly intractable problems of declining central cities, such as poverty, crime, and physical deterioration, are not solvable by local government action. Indeed, many of these problems may not be amenable by any government action. Central cities do not have the tax base nor the revenue-raising abilities to provide the services and infrastructure necessary to promote and facilitate redevelopment.

The renewal of inner city housing and resettlement by office workers should assist in retaining and attracting office activities to core areas by providing nearby labour supplies and, as well, it will increase the tax base, increase consumer spending power, provide physical improvements for the inner city, and generally assist in reversing the negative image of the central city. The social costs of displacement will be high and without effective redistribution policies, these costs will be borne largely by current low income, low skilled residents. Subsidizing the poor to remain in the city, however, will in the long term, be a more costly policy, as opportunities to adapt to structural changes in the economy and changing locational requirements of economic activity, pass by.

5.5.3 High Growth Regions, Spatially Dispersed

Metropolitan regions in the American 'sunbelt' typify this case, with very high growth rates due to the in-migration of population and economic activities from other regions. Transportation systems are predominantly automobile-oriented and the urban spatial structure is quite dispersed, with weakly
developed CBDs. Policy emphasis in this type of region should be on achieving a distribution of office activities which assists in fostering more efficient use of land and energy resources.

The strategy of policy dealing with office development should be to develop a multi-nodal spatial structure which will serve as foci for jobs, services and housing. Such concentrations of activities will help to attain a better match between work and residence locations, thereby reducing or stabilizing the need for commuting, much of which is in the form of cross-suburban travel. This concentration may in some cases, assist in building up demand sufficient for the efficient operation of transit systems, which should conserve energy resources. Reduction in the need for land consuming road networks and provision of higher density housing should assist in reducing demand for land resources, land which is often in agriculture use.

Much of this thesis has concentrated on the office location patterns in more highly centralized urban regions because of concern due to the over-concentration of office activities in core areas, but the type of metropolitan region under consideration in this policy alternative exhibits quite highly decentralized office systems. Houston, for example, has thirty-seven percent of its office space located in the downtown and Dallas' CBD contains forty-five percent of the metropolitan region's office space (Daniels, 1982a, p.62). Office activities have located in the suburbs because the population in these
regions is highly suburbanized and because office parks, offering many of the agglomeration economies traditionally provided in core locations, have been developed at nodal points in the highway system.

Recently, however, the CBDs of many of these regions have been experiencing very rapid rates of office space construction. In downtown Houston, for example, office space has increased from thirteen million square feet in 1970 to twenty-five million square feet in 1979 (Black et al., 1982, p.10). Many headquarters and regional corporate offices have moved to these regions attracted by the amenities, climate, and business atmosphere they offer, and have located in the CBDs providing a basis for central office expansion. The establishment of stronger CBDs can be supported through the development of mixed-use comprehensive projects, involving both private and public sector, providing offices, shops, high density housing, amenities like restaurants and theatres, and public facilities such as museums and libraries, which effectively create the core attractions, present in other regions, attractive to office activities. Los Angeles, perhaps the most extreme example of this type of region with only thirty-four percent of office space in its downtown (Daniels, 1982a, p.62), is presently attempting such a development in its CBD.

The development of more concentrated nodes of economic activities and housing, is a long-run strategy. The public finance picture in these growing regions is somewhat brighter, which provides them with the capability of fostering
concentrated urban development. It should be emphasized, however, that existing dispersed development patterns and high growth rates in these regions have generally been implicitly, and explicitly accepted and encouraged by the 'laissez-faire' development attitudes of local governments. Perhaps only another energy crisis will compel these regions to consider the inefficiency of their present approach to land use and to formulate more explicit policies to deal with the location and development of economic activities.

5.6 Summary

The varying locational requirements of different types of office activities, primarily determined by the nature of their linkages, which are leading to a more specialized office location pattern within the metropolitan region, presents both opportunities and problems for urban policy-making. Due to the growing recognition of the importance of office activities in the urban region, policy regarding the pattern and pace of office development is being expressed more explicitly in separate statements or within land use policies and economic development strategies.

Policy experience with restrictionist measures has been rather dismal producing negative, unintended consequences while incentive instruments tend to be ineffective because they do not usually influence prime location factors and, in addition, local and metropolitan governments do not typically have the resources and powers to implement such measures. A more realistic approach is to integrate land use, transportation, and capital
spending policies to guide office development to appropriate locations but this requires a long-term perspective.

The varying political, economic and spatial characteristics of metropolitan regions will result in the differential experience of intra-metropolitan office location trends and also lead to different policy responses. Because of this, three policy approaches for metropolitan office policy are suggested based on regional growth characteristics and the spatial structure of the metropolitan region. All three policy alternatives are built upon the goal of achieving more efficient resource use and emphasize a long-term approach which seeks, through the coordination of land use, housing, transportation, servicing, and economic development policies, to guide market trends and adapt to changing locational requirements of office activities and to structural changes in the economy.
VI. CONCLUSIONS

6.1 Introduction

In this chapter, a summary outlining the main findings of the thesis is provided. The limitations and weaknesses of the study are then reviewed and suggestions for further research are offered. Finally, the conclusions of the thesis are presented.

6.2 Summary Of Findings

1. Office activities have traditionally located in the core areas of large, urban regions and the CBD remains the dominant location for offices in most metropolitan areas. Factors behind the continued strength of the CBD as an office location are: the preference of office activities with unstandardized linkages for communications via face-to-face contact which is facilitated by the concentration of office activities in the CBD; agglomeration economies; availability of a large, educated labour supply; good accessibility to regional, national, and international markets; social factors, particularly opportunities for interaction, learning, and career advancement facilitated by the presence of large numbers of office workers and amenities available in the core; and the concentration of office space supply in the core offering a variety of prices, sizes, and styles of premises.

Suburban areas are generally experiencing relatively greater increases in office space construction than are core areas. Factors propelling the increased suburbanization of office activities are: market expansion caused by population
growth; out-movement of other types of economic activity; accessibility to labour; lower rents; availability of more spacious, suitable accommodation; diseconomies in the CBD; and social factors, such as better journey to work, proximity to good, affordable housing, and more pleasant working environments. It is speculated that recent technological innovations and resulting changes in the way office work is done, will lead to more extensive office decentralization.

2. Recent developments in computing and telecommunications technology are providing more channels, with greater capabilities, at lower costs for information communication. Increased interest in implementing technological change in the office is motivated by recognition of the increasing importance of office activities to the profitability of the firm; concern over rising office costs, particularly labour costs; concern over the apparent lagging productivity of the office; need to cope with increasing volumes of information; need for accurate and timely information; and the need to coordinate and communicate with activities in physically separate locations.

These technological innovations and their applications may substitute for face-to-face contacts involving information exchanges which are less sensitive, less important, and more standardized. For more unstandardized linkages, technology generally continues to be regarded as inferior to face-to-face contact and, in some cases at the intra-metropolitan level, is more expensive.

Obstacles to technological change in the office, however,
are slowing the pace of adoption of technological innovations. These obstacles include: technical problems, lack of evidence of clear financial benefits, difficulty in applying technology to high level office functions, and resistance by office workers due to their concerns over the quality of office work and technological unemployment. These obstacles may be overcome to varying degrees, although the problems in extending technology to higher level office work and the lack of evidence of cost-effectiveness of many applications, are likely to remain as difficulties.

3. Technology does not cause locational change to occur; its availability enhances an organization's locational strategy, assisting the firm to take advantage of economic and social locational factors important to the particular activity's effectiveness. Technology is assisting office activities with standardized linkages to decentralize. Routine office activities of large firms, for example, can move to the suburbs to take advantage of the availability of clerical labour, lower rents, and purpose-built structures. Activities with unstandardized linkages, for example, decision-making and analytical activities of large firms, remain located in the core because of economic attractions such as opportunities for face-to-face contacts, agglomeration economies, superior accessibility, labour availability, and social attractions.

4. The metropolitan office market is becoming more specialized and the pattern of location more spatially differentiated. The CBD is dominated by higher level office
activities with unstandardized linkages serving larger than local market areas, including corporate head offices, financial firms, and specialized producer service firms, while the suburbs generally host office activities with standardized linkages such as corporate back offices and research and development functions, activities serving local markets, and offices ancillary to other economic activities. The spatial distribution of offices within suburbia may become quite dispersed because many suburban office activities do not have a strong requirement to concentrate.

5. The increasing spatial differentiation of office activities is presenting both opportunities and problems for urban policy-makers. The decentralization of offices with standardized linkages may: ease growth pressures on land uses adjacent to the downtown office district and reduce demand for transportation to the core; diversify and strengthen the suburban economic base, providing greater tax revenues and employment opportunities; and assist in overcoming spatial housing-employment imbalances thereby reducing the need for long commutes. Growth of high level office functions in the core may present opportunities for renewal of deteriorating areas of the inner city through construction and restoration of office buildings, higher priced housing, and specialized commercial facilities, and also provide greater municipal tax revenues.

Problems presented by the decentralization of offices with standardized linkages include: the erosion of the tax base of declining central cities which usually results in tax increases
or service reductions and leads to even more decentralization; reduction in employment opportunities for low-skilled, inner city residents; and dispersed suburban patterns of office location which may increase the expense of providing infrastructure and public services, make it difficult to build up suburban office centres, and contribute to development of irreplaceable agricultural lands. Problems presented by the concentration of high level office functions in the core include: the destruction of lower priced housing which may force clerical and younger workers into long commutes from affordable suburban housing, which in turn may increase the need for transportation infrastructure, disrupt existing neighbourhoods, or lead to shortages of clerical and younger workers in the core and the displacement of other economic activities by office buildings will also reduce job opportunities for low-skilled, inner city residents.

6. Office policy experience has, however, been rather dismal. Problems have arisen from the inefficiencies and inequities resulting from the application of restrictionist policy measures and the more positive, incentive instruments have usually been rather ineffective in influencing private office location decisions. Office policies have often been based on an inadequate understanding of parameters important in location choices of different types of office activities and have attempted, unrealistically, to subjugate economic efficiency in order to achieve social aims. Lack of regulatory power, resources, and region-wide cooperation have impeded the
implementation of policies.

In response to these difficulties, metropolitan policies are moving toward more direct statements of goals and objectives regarding office development, incorporating more realistic strategies which seek to guide market trends through the coordination of land use, transportation, economic development, and capital spending policies.

7. Metropolitan regions will experience the general location tendencies of offices in different ways and at different paces according to local variations in the adoption of technological innovations; the composition and health of the local economy, particularly the importance of office activities to the local economy; the metropolitan spatial structure; the relative strength of centripetal and centrifugal forces; and public policies regarding office development.

Because of the variations in experience of office location trends within different metropolitan regions, policy approaches which acknowledge the varying characteristics of metropolitan regions are required. Three policy alternatives are suggested which are based on regional growth rates and spatial characteristics:

(a) For high growth regions with strong, dominant cores, it is recommended that a multi-nodal spatial structure be pursued, with the CBD as the dominant office centre accommodating office activities requiring the locational advantages of the centre and a few suburban office centres housing activities serving the suburban market and those with more standardized linkages.
Through this strategy, some of the negative aspects of growth pressures on the downtown areas may be relieved, a better match between the spatial distribution of employment and housing may be accomplished, greater economies in the provision of public infrastructure may be achieved, and more efficient use of land resources should result.

(b) Regions experiencing rapid growth, but with dispersed spatial structures and weak cores, should also attempt to foster a multi-nodal spatial pattern developing centres, including a stronger core, which will serve as foci for jobs, services, housing, and transportation systems. In this way, more efficient resource use might be fostered. The CBDs of these regions can be strengthened by building up the core attractions attractive to higher level office activities, which are present in older regions. But this approach requires acceptance of a more active role for local government in directing office development.

(c) Low growth regions with cores in decline require a different policy emphasis. Policy should be concerned with attracting dynamic economic activities to the region to replace declining activities and with revitalizing stagnating central cities to make more efficient use of existing infrastructure. Strategies should be built upon the assets retained by these regions. Senior government assistance is required to deal with some of the problems which create the perception of these central areas as undesirable places to live and work.
6.3 Limitations And Suggestions For Further Research

This study has endeavoured, through review of the literature on office technology and office location, to describe and analyze recent trends in the intra-metropolitan spatial distribution of office activities and more specifically, to examine the implications of technological change for the location of offices. Because office location has developed comparatively recently as a field of study, there are, as pointed out in Chapter I, a number of weaknesses in the literature. The lack of a generally accepted theory of office location, which incorporates both market and non-market factors underlying the location of office-based activities, might have made the task of determining the locational effects of technological change in the office less onerous and aided in the formulation of policy responses. The lack of studies on the effects of technological change on the intra-metropolitan location of offices has made it difficult to compare and evaluate the soundness of both the methods used in this study and the validity of the findings.

To rectify these weaknesses, there is need for more research into the effects of technological change in the office on location patterns, both at the intra-metropolitan level and the inter-regional scale. The inter-regional implications of recent innovations in information technologies may be more profound. The centralizing capabilities technology offers may assist in consolidation of high level office activities in regions with favourable environments. The centralizing and
decentralizing capabilities of technology may influence regional economic and power imbalances.

6.4 Conclusions

Those who foresee large scale decentralization of offices resulting from technological change in the office are discounting a broad range of economic and social frictions. Offices tend to locate where they can most effectively pursue and accomplish the activities they are engaged in. The primary locational determinant is the nature of the activity's information input and output flows. Recent innovations in computing and telecommunications technologies are providing a greater range of channels, with improved capabilities and lower costs, for information exchange.

Offices with standardized linkages, that is activities with information flows which occur regularly and are simple, brief, and predictable in content, can more readily utilize these technological developments to maintain their required contacts. Technology can be used to substitute for face-to-face information exchange, freeing the activity from the need for clustering. Locational decentralization is, however, likely to occur only if there are economic and social advantages in doing so. For example, improved availability of clerical labour, lower rents, more spatious, purpose-built structures, and shorter journeys to work. Offices taking advantage of this increased locational flexibility to move their operations to suburban sites are primarily the routine information processing activities and research and development functions of large
corporations. The potential locational flexibility offered by technological change in the office is restricted somewhat by the rather slow pace of adoption of technological innovations which is attributable to management skepticism arising from technical problems, lack of evidence regarding cost effectiveness, difficulty in applying technology to many types of office work, and employee resistance to change.

Office activities with unstandardized linkages which are characterized by variable, complex, and sensitive information flows, tend to continue to favour central office locations because of the strong economic and social advantages available in core locations. Corporate offices, producer service firms, and financial firms, which are involved in high level activities such as decision-making, analysis, and negotiation and have unstandardized linkages, have generally tended to remain concentrated in the CBDs of large, metropolitan regions. Favourable economic factors include, primarily the opportunities for face-to-face contacts which are regarded as superior for mediating required information flows, but also, the availability of highly educated and specialized labour, the superior accessibility of the core and the presence of agglomeration economies. Because of the importance of the labour input to such office activities, social or non-market factors, primarily opportunities for interaction, personal and career advancement afforded by the intensity of activity and amenities of the core, have an important, although not primary, effect on office location decisions. The most important products of offices are
decisions which influence the entire organization and these types of social or non-market locational factors can influence the quality and effectiveness of decisions. Non-economic factors need to be accorded a more important role in office location theory.

In response to centripetal and centrifugal forces the intra-metropolitan spatial distribution of offices is becoming more specialized with the more important high level office activities with unstandardized linkages located in the CBD and population-serving activities, routine activities with standardized linkages, and offices ancillary to other economic activities occupying suburban office space. This pattern may be experienced somewhat differently, depending on regional characteristics.

The pattern and pace of office development have a variety of impacts on the economy, spatial structure, built environment, social mix and government finances of the metropolitan region, presenting both problems and opportunities for urban policy making. This thesis has held the view that local and metropolitan government should have an important role to play in guiding office development to ensure efficient resource use. Such policy needs to be based on a good understanding of the factors involved in office location decisions and requires on-going monitoring of location trends. Different regions require different policy emphasis because of their economic, spatial, and political characteristics which influence their experience of intra-metropolitan office location trends. Because of the
problems and opportunities presented by office development and the general significance of office activities in the urban region, policy and goals regarding the pace and pattern of office development should be stated more explicitly in the form of land use policies or economic development strategies. Given the experience with other types of policy instruments and the capabilities of metropolitan government, the most realistic strategy to realize public goals in regard to office development is to guide market trends through the coordination of a range of policies such as land use, transportation, and capital spending, to ensure efficient resource use. Such an approach requires region-wide cooperation and a long-term perspective.
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