INFORMATION TECHNOLOGY AND WORLD CITY RESTRUCTURING: THE CASE OF NEW YORK CITY'S FINANCIAL DISTRICT

by

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A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Honors Bachelor of Arts in Geography

May 1993

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"Staccato signals of constant information,
A loose affiliation of millionaires and billionaires and baby,
These are the days of miracle and wonder.
This is a long distance call."

Paul Simon, *Graceland*

ACKNOWLEDGEMENTS

The author would like to recognize and thank Dr. Peter Rees for his guidance on this project. Without the patient hours of discussion, insightful editorial comments, and firm schedule, this thesis would have never reached completion. The author also thanks the University Honors Program, the Undergraduate Research Program and the Department of Geography at the University of Delaware for their financial support. Many thanks are due to the Water Resources Agency for New Castle County for the use of their automated mapping system.

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ABSTRACT

The effect of information technology on back office location has been discussed extensively. This thesis investigates the relationship between telecommunication and computer technologies and head office location in a major world city. The theoretical basis for this relationship is developed from literature on the world city, information city and telecommunications city. It is then argued that the architectural requirements for the implementation of information technologies are a factor influencing the internal structure of world cities. The case of New York City's Financial District is examined, tracing the decisions about location made by the largest commercial banks and diversified financial service providers. The evidence supports the contention that information technology is a factor in office location and reinforces assertions made by world, telecommunications and information city literature about the continued importance and structure of the central city.

Chapter 1

THE CITY IN A WORLD ECONOMY

For the past 100 years, the skyscraper office building has been the predominant urban symbol. From the Equity Building and the Empire State Building, to the World Trade Center and the Citicorp Building, office buildings have created New York's memorable skyline. In a globalized economy that counts on instantaneous transmission of information for its existence the old buildings may not be sufficient to meet telecommunications and information processing needs. Just as the elevator and telephone facilitated the office building of the past, so information technologies influence today's urban landscape. What fate lies in store for old buildings? Where will the new buildings be? Sassen (1990:330) states that:

> Arguably, a new phase of innovation in telecommunications technology might make the current infrastructure obsolete and lead to the equivalent of the earlier 'suburbanization' of large-scale manufacturing that resulted for the obsolescence of the physical structure that housed manufacturing in the large cities.

The implications of this restructuring are significant on many levels; from the internal structure of central business districts to systems of cities in a world-

economy. This thesis establishes the theoretical and technical context for change led by information technology in the internal structure of world cities, and presents New York City's Financial District as a case study.

The World City

Friedmann and Wolff (1982) first suggested the concept of the "world city", in which global economic power and capital would be concentrated. The world economy, they argued, would be articulated through a select group of world cities. The development of the world city envisioned by Friedmann and Wolff depends on, and is reenforced by, the instant electronic transfer of information and capital. Rapid telecommunications allow the decentralization of certain economic activities and concurrently increase the need for centralized control functions (Sassen 1990:330). Friedmann and Wolff recognized that "these innovations have made the world-wide organization of economic activities possible (computers, communications satellites..." (Friedmann and Wolff 1982:315) Friedmann (1986:73) identifies the growth sectors of world cities as corporate headquarters, international finance, global transport and communications, and high level business services. Castells (1985:18) also notes that new telecommunications technologies "enhance...the importance of a few places as locations of those activities that cannot easily be transformed into flows [of information] and that still require spatial contiguity, thus reinforcing the interurban hierarchy." For the structure of

the city, King (1990:27) postulates that the "expansion of global management and financial services functions, including growth of producer services, has led to the refurbishment of existing office space and extensive new construction of both office space and high class residential accommodation."

These writers identify the importance of the world city as telecommunications hub, both for global and local communication. The insight of world city theory that local conditions may depend more on the world economy than local factors is seen in the implementation of telecommunications technologies into the fabric of world cities. As will be shown, the need to be wired into the world economy is one force shaping the internal dynamics of world cities.

The Information Economy

Information is the lifeblood of the world city. The growth sectors are involved almost exclusively with the production or manipulation of information. Banking, insurance, and management either create or evaluate information. Their continued existence depends on the timely transmission of that information, which make the telecommunications infrastructure of utmost importance. The importance of information in the economy was first identified in 1962 by Malchup, who described the "knowledge worker" (Hepworth 1990a). In 1977, Porat introduced the term "information economy". He found that over 50% of the U.S. work force was involved in occupations producing, processing and distributing information, or

Table 1.1 Information Occupations in the labor force of OECD countries: 1951-1981

	(per cent of labor force)				
	1951	1961	1971	1975	1981
Australia			39.4		41.5
Austria	18.0	22.0	28.5	32.2	
Canada	29.4	34.2	39.9		
Denmark					30.4
Finland	12.6	17.3	22.1	27.5	30.2
France	20.3	24.1	28.5	32.1	
Germany	18.3	23.4	29.3	32.8	33.5
Japan	17.9	22.2	25.4	29.6	
New Zealand				39.4	39.8
Norway				20.8	22.9
Sweden	26.0	28.7	32.6	34.9	36.1
United Kingdom	26.7	32.1	25.6		41.0
United States	30.7	34.7	42.1		45.8

Source: OECD, Update of Information Sector Statistics, Committee for Information, Computer and Communications Policy, February 1985 (from Hepworth 1990a)

providing the infrastructure to do so. Porat saw the growing importance of information in the U.S. economy as a phase of economic development analogous to Bell's 'post-industrial society' (Hepworth 1990a:7).

Table 1.2 Share of information occupations in the US labor force, 1800-1980. (Hepworth 1990a:14)

	Occupational Sector's Percent of Total Labor Force				
Year	Agriculture	Industry	Service	Information	Total (millions)
1800	87.2	1.4	11.3	0.2	1.5
1810	82.0	6.5	12.2	0.3	2.2
1820	73.0	16.0	10.7	0.4	3.0
1830	69.7	17.6	12.2	0.4	3.7
1840	58.8	24.4	12.7	4.1	5.2
1850	49.5	33.8	12.5	4.2	7.4
1860	40.6	37.0	16.6	5.8	8.3
1870	47.0	32.0	16.2	4.8	12.5
1880	43.7	25.2	24.6	6.5	17.4
1890	37.2	28.1	22.3	12.4	22.8
1900	35.3	26.8	25.1	12.8	29.2
1910	31.1	36.3	17.7	14.9	39.8
1920	32.5	32.0	17.8	17.7	45.3
1930	20.4	35.3	19.8	24.5	51.1
1940	15.4	37.2	22.5	24.9	53.6
1950	11.9	38.3	19.0	30.8	57.8
1960	6.0	34.8	17.2	42.0	67.8
1970	3.1	28.6	21.9	46.4	80.1
1980	2.1	22.5	28.8	46.6	95.8

Porat's definition of an 'information worker' is a worker who is engaged in "the manipulation of symbols, either at a high intellectual content (such

as the production of new knowledge) or at a more routine level (such as feeding computer cards into a card reader)" (Porat 1977, in Hepworth 1990a). The distinction made is that of degree not kind. Porat made an inventory of 422 distinct information occupations, which is used by the Organization for Economic Co-operation and Development (OECD) for their statistics. (Hepworth 1990a:16) The significance of information workers as a sector of the economy is increasing in all OECD nations (Table 1.1). By 1981, information activities constituted the largest portion of the United States economy, with a full 46% (Table 1.2).

The Information City

Activities in the information economy center around urban areas. A growing literature recognizes the concept of the "information city" (Hepworth 1985), or "informational city" (Castells 1985; 1989). Hepworth's series of articles (Hepworth and Dobilas 1985; Hepworth 1986; 1987; 1990b) and book (Hepworth 1990a) deal mostly with the interurban effects of information and telecommunications technology. The conclusions reached about the future of the information city converge with those of the world city. Hepworth (1990a:548) predicts:

- centralized and decentralized spatial arrangements of both office and manufacturing production at a larger geographic scale;
- highly complex spatial divisions of labor, enabled by enhanced centralized control over decentralized and occupationally differentiated work processes;

- expanded market geographies for products and services...

Reaching similar conclusions, Castells foresees the "extreme specificity of a few nodal places," and notes that the "expansion of advanced corporate services, supported by office automation, is concentrating companies, headquarters, and their constellation of auxiliary services (both producer and consumer services), in the downtowns of the top metropolitan areas" (Castells 1985:18; 23). Frendreis predicts "nucleic specialization, where different centers (financial, research, data entry, recreational) development within metropolitan areas" (Frendreis 1989:335), while Cook and Beck (1991) support Hepworth's conclusions by documenting the increased prevalence of managerial positions in the work force of large urban areas.

The Telecommunications City

While the literature on the information city concentrates more on occupational characteristics of the information economy, other writings concentrate on the technical aspect of the information economy: telecommunications. These authors, some of whom also contribute to the information city literature, write about the "telecommunications city" or "telecity" (Fathy 1991). The characteristics being observed are those of the world city, but the concentration is on the effects of telecommunications on urban patterns.

In the telecommunications literature, office location has been the subject of much study. Businesses are the largest users of telecommunications services and are influential in shaping land-use patterns concerning the effect of telecommunications. Two major schools of thought emerge; one heralding decentralization of office activity away from the city and one predicting centralization of control and decision-making functions with a decentralization of routine functions. The basis for these predictions was the early conventional wisdom that telecommunications would eliminate the need for the central city by replacing face-to-face contact (Moss 1987). In a study of Pittsburgh, Kutay (1986) predicted that telecommunications would accelerate the decentralization of office activity from the downtown based on current trends.

While telecommunications technology may have allowed the decentralization of back office activities, other researchers point to the continued strength of the central city as an economic center. This strand of telecommunications literature, like the world city and information city literature, foresees the use of telecommunications to maintain centralized control over a larger geographic area of secondary activities.

Several authors support this centralization with decentralization hypothesis. As a result of telecommunications advances Downs (1987:163) predicts the "centralization of administrative control within many large organizations" and "a reinforcement of the importance of those few, very large

central business districts that act as major telecommunications nodes." Gillespie and Williams (1988) note that "computer networks operating over space through telecommunication channels have obviously increased the ability of multisite organizations to integrate their activities over space." Moss (1987) "explores the way that telecommunications technologies are leading to the centralization of business services in a small number of principal world cites." Apparently the role of the city as an economic control center is not diminishing with continuing improvements in telecommunications technology.

Implications for the Central City?

The literature about the world, information and telecommunications city is all describing the same set of dominant cities, and reaching similar conclusions from different approaches. The consensus about the central business district is that it is retaining its importance as a center of management, facilitated by the capacity to manipulate and transfer information using an infrastructure of telecommunications and information technology. Yet, little of this literature has addressed how the internal form the central city may be altered as its activities are shaped by new telecommunications technologies. Only Sassen (1990) and Moss (1987; 1991) have suggested possible morphological changes but neither has systematically examined this issue.

The remainder of this chapter outlines the technological nature of the new information infrastructure found in world cities and establishes its integral role in financial services. The thesis will then address the geographic restructuring of the central city prompted by the design considerations of the new infrastructure, using New York's Financial District as an example.

The Information Infrastructure

The information infrastructure is centered around telecommunications. The telecommunications infrastructure has three discernable components: long-distance systems; metropolitan regional systems; and intra-building or intra-complex systems.

Long Distance Systems

Systems of fiber optic wire are increasingly providing long distance telecommunication. Their advantages over traditional copper wire include a large carrying capacity, high speed, more security and higher signal strength. Because fiber optic wire is not easily spliced, its use favors high-volume point-to-point communications. The fiber system was therefore used to connect major communications hubs--reinforcing the existing urban hierarchy. Fiber systems are built along existing right-of-ways including railways, waterways, highways, and bicycle paths (Moss 1986a; 1986b).

Metropolitan Region Systems

Metropolitan regional systems are also built with fiber optic wires. There are several fiber-optic networks in New York City. Citicorp, Olympia and York and the Teleport all have their own fiber optic networks, and New York Telephone has three fiber networks around Manhattan (Moss 1987:537; 1986b). The effect of such regional networks on the internal structure of a central business district is probably minimal. For example, any reasonably placed building in Manhattan can gain access to a fiber optic wire (Atkinson 1992). Fiber optic links to regional and national systems are sufficiently ubiquitous in logical areas of development so that access to them is not a factor for office location. However, given their high cost of installation, regional fiber optic networks do reinforce the prominence of major cities as information centers on a macro-scale.

Intra-Building and Intra-Complex Systems

At the scale of intra-building and intra-complex communications, telecommunications and computer technologies converge. Local and Wide Area Networks (LANs and WANs) link computers together using combinations of traditional coaxial cable and fiber optics. The same wiring system may also be used for voice and video communications. Taken as a whole these technologies are known by a variety of names: "telematics", "information technology", or "infostructure". In the 1980s buildings that incorporated advanced

telecommunications and information technology were advertised as "intelligent" or "smart" buildings.

Urban Effects of the Information Infrastructure

It will be argued in this thesis that the use of advanced information and telecommunications technology in office buildings does the most to contribute to restructuring of downtown areas. Businesses with a high demand for information processing and transfer must find office space that can accommodate those needs. The new generation of office buildings require large, high load-bearing floor areas, raised floor and ceilings for communications and electrical wires, and an increased energy capacity for operation and cooling equipment. These new demands, Moss contends (1991:183), have "led to the need for new office buildings capable of meeting modern technological and spatial conditions." He further states:

> The migration of the Manhattan financial district from the narrow caverns of Wall Street north to the World Financial Center on the Hudson, and to large parcels on Water Street next to the East River, reflects the demand for mega-structures that can be built on landfill rather than on the narrow urban street-grid of the early twentieth century.

Moss is entirely correct in looking to the financial district for evidence of the latest urban restructuring. In the post-World War Two period, different entities have shaped the growth and dynamics of the central business district. In the 1950s it was the department store that occupied the peak land value intersection. With urban renewal in the 1960s and 1970s the government was the

most powerful influence on central city dynamics. By the 1980s, the department store had moved to the suburban mall and government was less interventionist. Those who depend on information, face-to-face and electronic, took over as the driving force in the real estate market of the central business district. This group included corporate headquarters and the financial services industry.

Financial Services as Information Technology Users

The characteristics of activity in the banking and financial service industry qualify it as a high demand telecommunication user using Valentine's (1987) hierarchy of telecommunications users. High intensity users have a high density of employees in an open interior building space, need on-line, real-time access to data and voice systems, require absolute redundancy for systems and service, perform clerical functions and have a medium to high turnover of personnel.

Banks and financial service providers meet most, if not all, these criteria. Security and bond trading rooms, as well as processing centers put high densities of personnel in open areas. Banks need real-time access to account balances, interest rates, currency exchange rates, and other integral information. It is absolutely imperative that banks and other financial service providers have complete redundancy of telecommunications systems in case of a calamity such as the 1993 explosion at the World Trade Center. Much of banking involves clerical

operations. Regardless of the turnover rate of banking employees, the activities of the banking industry are such that it would be classified as a high-intensity telecommunications user in Valentine's scheme.

Indeed, "information is both the process and the product of financial services" (Dicken 1992:360). In the process of bringing savers and borrowers together banks must manipulate and communicate large amounts of information. Jussawalla and Dworak (1989) note the historical association between banking and communications. The first European newspaper was founded in the 16th century by the Ausburg banking family of Fuggers. Banker Nathan Rothschild used carrier pigeons to help his financial endeavors. The first telegraph link between New York and London in 1866 was immediately used to reduce market differences in the stock markets of the two cities. Financial institutions have been on the cutting edge in implementing new communications technologies.

The increased use of telecommunications technologies has had a deep effect on the nature of banking. Traditionally, banks could turn a profit by extending credit and collecting interest. However, lending no longer provides the margin of return that it once did, because telecommunications have made the market for capital much more competitive. Banks must turn toward noncredit and investment banking services which depend on information and telecommunications technologies (Regan 1989). Concurrently, corporations are demanding more

services from banks, such as instant on-line service and direct access from corporate headquarters to the bank (Regan 1989).

Regan (1989) also notes four trends in the credit system facilitated by information technology. First, information technology has allowed the globalization of all kinds of financial markets. Second, information technology has led to the integration of financial and capital markets, blurring the distinction between commercial and investment bankers (see also Jussawalla and Dworak, 1989). Third, information technology has spurred the movement from loans to securities, as seen by the development of the Eurobond market. The Eurodollar market would also be impossible without the current global telecommunications system because it involves trading currency instantly on a foreign market. Fourth, information technology has led to the elimination of intermediaries in financial transactions. Because these changes in the financial environment were brought about by the use of advanced telecommunication and information technology, no institution could survive in the market without the telecommunications infrastructure to provide the broad array of credit and non-credit services now required. Some of the new demands and services are summarized in the following list from Mey (1989):

New Demands
- lower operating costs
- more security of operations
- faster posting cycles
- more precise information on liquidity and exposure
- interest by-the-hour calculation

- liquidity planning
- value dated accounting

New Services
- automated clearing houses
- real-time posting
- more sophisticated telecommunications
- same-day clearing
- cheque truncation

As stated by Daniels, "there can be little doubt that the internationalization and expansion of services has been made possible (if not accelerated) by rapid advances in telecommunications." (Daniels in Brunn and Leinbach 1991:157). The internationalization of financial markets made possible by telecommunications has fundamentally changed the existing economic order (see also Langdale, and Hepworth, in Brunn and Leinbach 1991). Computerized trading systems and telecommunications allow 24-hour-a-day trading; a trader can watch the market from London to New York to Tokyo to Singapore and back again. This integration of markets contributes to making world cities into "a single, transterritorial marketplace" (Sassen 1991:326). It also reduces the effectiveness of national and international economic policies, as Jussawalla (1989:92) states:

> international financial market integration and the information links between markets have eliminated the effectiveness of past international structures such as the gold standard and Bretton Woods system and replaced them with an information standard, from which no one can resign and that makes policies and policy changes subject to instant judgement by traders who can react immediately to any changes.

Jussawalla's analysis of finance also supports the world city contention that the fortune of the world city depends as much or more on its ties to the international economy as on its own hinterland (Friedmann and Wolff 1982).

It is clear that financial services are dependent on the use of advanced information technologies. Given this dependence, this thesis explores the effect of implementing this technology on the internal structure of a world city district. New York is used as an example, concentrating on the Wall Street Financial District. It will be argued that the ability to incorporate information technology is a factor in reshaping the location of central city economic activities.

The technical aspects of information technology and the architectural considerations for their implementation will be discussed in Chapter Two and a theoretical pattern of altered land use will be developed. Chapter Three will introduce the case of New York and examine the changing office locations of several leading financial firms, using data gathered from telecommunications and computer experts within the corporations and from representatives of real estate, architecture and engineering companies. Chapter Four compares the expected and actual office location patterns and speculates on the future role of information technology in shaping the urban landscape.

Chapter 2

OFFICE BUILDING TECHNOLOGY FOR THE WORLD ECONOMY

Smart Buildings

Much of the literature about the use of information technology in office buildings concentrates on the so-called "intelligent" or "smart" building (Atkin 1988; Bernaden and Neubauer 1988; Cross 1987; Moskal 1985; Paznik 1987; Sequerth and DeFranks 1987; ULI 1985). Definitions of the smart or intelligent building vary from "a building capable of providing for and accommodating as much advanced technology as its tenants want to pay for" (ULI 1985) to "one which provides a productive and cost-effective environment through optimization of its basic elements--structure, systems, services, and management--and the interrelationships between them" to any building that is fully rented (Bernaden and Neubauer 1988:459). Still others place an emphasis on shared tenant services, where tenants buy their telecommunications and data services from the building landlord. This arrangement provides advanced services for small businesses that cannot afford the required capital outlay on their own. However, shared tenant services seem to be a passing real estate sales device (Ossorio 1993). Stitt

(1989:283) claims that: "From now on (1987) virtually all new buildings of substantial size will be designed as "intelligent"". For the sake of reference any building designed or retrofitted to accommodate modern information technology will be called a "smart" or "intelligent" building, with no implication of the existence of shared tenant services.

Smart Building Design

Davies (in Atkin 1988) identifies three powerful influences on the design of the modern office building: the growth of information technology and its infrastructural requirements, greater expectation and demand for increased quality of human environment, and demand for better building performance, providing a maximum economy of building operations, maintenance, growth and change. The responses to these demands can be divided into three categories: building automation, office automation, and telecommunications services (Atkin 1988).

Building Automation

Building automation refers to central control of fire, security and HVAC (Heat, Ventilation, and Air Conditioning) systems. Of special interest to the implementation of information technology is the need of the building system to respond to varying heat loads produced by electronic equipment. Other features are motion detecting lights that turn off when there is no activity, thus reducing

operating costs. Building automation systems may heat or cool unoccupied areas less at night. These features, as will be shown, are not a driving force in office location but the reduction in energy costs is an added benefit to occupying a smart building.

Office Automation

Office automation systems enhance communications and information use in the workplace. Electronic mail allows rapid and convenient intra-building communication. The use of Local Area Networks (LANs) of computers provide data communications, and sharing of software. Access to mainframe computing is necessary for storage, manipulation, and real-time access to information. As will be discussed later, specialized financial trading rooms are examples of intensive use of information technology for office automation.

Telecommunications Services

The ability to accommodate long distance telecommunications is another important feature of the intelligent building. Before the divestiture of AT&T the choice of long distance services was made by that monopoly. Since then, the choice and variety of services have increased dramatically, fueling the need for the building to accommodate growing quantities of telecommunications hardware. Financial institutions also need redundancy in telecommunications

service. Most institutions have their own private branch exchange (PBX) which allows them to reduce the number of outside lines, but increases space requirements in the building. Other features may include data transmission lines requiring a digital PBX and direct lines to other corporate sites. The design of a smart building takes these features into consideration.

Davies (in Atkin 1988) summarizes the trends in building design to accommodate information technology. The smart building must provide for:

- major data distribution networks integrated within the building fabric,
- communications input and output systems,
- ease of access to building data-ways without disrupting the work environment,
- growth in numbers of individual data processing and terminal points,
- increased power requirements for high terminal density areas,
- growth in density of power, telephone and data connection points,
- growth in thermal loads from equipment,
- technical support for data systems, including uninterrupted power supply, stable current generators, power smoothing equipment and battery rooms,
- growth of computing support personnel areas, and
- individualized, local climate control systems.

The two most significant considerations from an architectural standpoint are designing for cabling and wiring and for various pieces of computer and telecommunications hardware.

Transmission Media

Three kinds of wires are used for voice and data transmissions: twisted pair, coaxial and fiber optic. Twisted-pair wire was the original type used in telephonic communications and is still used for most local telephone and data

transmissions. Pairs of copper wire are twisted together in a regular geometric pattern. Cables can range from 2 to 200 pairs of wires. Twisted-pair cable is the cheapest transmission medium and is sturdy and versatile. However, twisted-pair cable offers a limited frequency of transmission and is subject to outside electrical interference. The speed of data transmission is also limited to 1200 bits per second.

Coaxial cable is most familiar in its application as the cable in cable TV. A central conductor is surrounded by insulation, an outer layer of woven copper mesh (for baseband applications) or aluminum (for broadband applications), and coated with vinyl. Coaxial cable is popular for use with LANs because it has larger capacity that twisted-pair combined with lower error rates. Broadband cable is used to transmit simultaneously on a number of frequency channels, capable of sending up to 50 color TV channels or thousands of low-speed data signals. A baseband coaxial cable can send digital signals much more quickly than broadband but only sends one signal at a time. Coaxial cable is the choice medium for LANs because of its flexibility, speed and cost. It is easily spliced and split, is significantly faster than twisted-pair cable, and is reasonably priced between twisted-pair and fiber optic cables.

Fiber optic cable transmits light instead of an electrical pulse. A central glass core is surrounded by a protective sheathing. Pulses of light from a Light Emitting Diode (LED) travel along the core, kept on path by refraction or

reflection. Pulses of different bandwidth can travel simultaneously, meaning that fiber optic cable has an immense capacity. Other advantages of fiber optics are insensitivity to electrical interference, smaller size and lighter weight, greater security, reliability, and long transmission ranges. They are not as suited to local applications because they are difficult to splice and couple. Other disadvantages are their lack of mechanical integrity, susceptibility to water damage, cost and unidirectionality. For these reasons, fiber optics have been used mostly for high-volume point-to-point communications, such as inter-city networks, CPU to CPU communications or as a building "backbone".

Architectural Considerations for Smart Buildings

Planning for a new smart building or to upgrade an existing building is a significant activity. It involves more than a matter of laying a few fiber optic cables. As will be evident later, these architectural considerations become so costly in the case of older buildings that it is frequently more efficient to move into a new space.

Building Entry

The first design aspect is that of building entry conduits. There must be cabling space for telephone and power wires to enter the building. For the sake of redundancy, provision should be made for two entries. The number of

telephone wires depends on the size of the building; one source estimates one per 2,000 square feet of floor space (Stern *et al.* 1985) but more lines are likely to be needed for buildings with specialized trading floors. Power entry conduits must also be designed to account for the increased power load of computer equipment (Cebulski 1993). Any new building will also plan for future expansions of the telecommunications system. While it would be possible to push a new entry conduit into the basement wall of an older building, it has the danger of reducing structural integrity. It would be much cheaper to add wires to existing entry conduits that had been designed with expansion in mind.

Near the building entry conduits provision must be made for PBX and maintenance rooms. A typical PBX room is 25 by 25 feet with another 17 by 17 feet to accommodate the power supply, back-up batteries, and air conditioning (Stern *et al.* 1985). Floors must be specially reinforced to withstand the weight of equipment.

In addition to the external power source, it is necessary to provide for an uninterruptible power supply (UPS). The UPS is designed to provide emergency electricity to the building in case of a municipal power blackout. Batteries provide power when power weakens or fails, until diesel generators can be brought on line (Cross 1987). Space for reinforced slabs for upwards of 4 diesel generators must be found, as well as space for fuel storage tanks. Smart building plans must also include space for backup water tanks for air conditioning.

Wiring Distribution

The wiring distribution system throughout the building can be divided into three sub-systems. Primary wiring involves the vertical distribution of cables through risers and ducts from the incoming supply points. Secondary wiring consists of the horizontal distribution of the system around a floor. Tertiary wiring is the way in which wires are connected from the floor, wall or ceiling to the appropriate equipment. The amount of structural design considerations required declines from primary through tertiary wiring. Obviously, it is more difficult to put in more risers and communications closets than to clean up workspace cabling.

Primary Wiring. Primary wiring is installed in risers and communications closets. Risers are vertical shafts house wires going between floors of a building. Increased telecommunications and power demands make their location, capacity and accessibility increasingly important. Riser design must take into account the bending radii of cables and space for distribution boards, junction boxes and patch panels. There is a trend towards distributing risers around the perimeter of the building to reduce the complexity of secondary wiring networks. Insufficient riser space poses a significant problems for upgrading older buildings because constructing new risers can upset the structural integrity of the floors. Communications closets contain increasing amounts of equipment and often require three times the standard required space (ULI 1985:13). They are installed

separately from power distribution risers and involve many of the same considerations.

Secondary Wiring. Secondary wiring needs can be met in a variety of ways: flat wiring under the carpet, suspended tray from the ceiling, wall-mounting, and raised floors (Stansall and Bedford 1985). The most flexible method is a raised floor of 8-12 inches in office areas to 12-24 inches in computer rooms. Raised flooring allows complete wiring flexibility, allowing areas to meet the changing organizational demands of a dynamic corporation. Other secondary wiring distribution systems are less flexible and costly to change. For example, an underfloor duct system only allows access at regular intervals. Poke-through wiring from the ceiling below requires new holes in the floor and disruption of two floors to modify.

The raised floor is one of the most restricting requirements for retrofitting an old building. The floor to floor height of a smart building ranges from 12 to 14 feet. Older buildings with shorter story heights are difficult to renovate for information technology precisely because of the lack of space for secondary wiring (Worthington in Atkin 1988).

Tertiary Wiring. Problems with tertiary wiring involve few architectural considerations but may seriously reduce the quality of the work

environment. Pre-computer era furniture and the proliferation of workplace hardware can combine to cause confusing, inaccessible, wiring systems. If a company has enough room to move functions while the wiring is organized and new furniture installed there should be no problem. But in the case of a dealing floor, activities cannot be so easily moved, exactly because of the telecommunications and data hardware. If for no other reason, the opportunity to upgrade specialized workplace facilities may push activities intensive in information technology out of older buildings.

Poorly managed tertiary wiring system can also compound other wiring problems. In the case of one diversified financial service firm, a Radio Shack power strip that had been bought by a dealer to use on the trading floor caused its building's underpowered electrical system to blow a fuse.

Computer Rooms

Special considerations must be made for computer rooms. Mainframe computers, typically IBM 3090s or IBM 9000s, midrange VAXs, tape-loaders, LAN servers, diagnostic equipment and support personnel must be housed. Mainframes operate within a plus or minus 10-degree temperature range and a 5% relative humidity range. Conventional air conditioning systems cannot maintain these standards so special provisions must be made (Cross 1987). Air conditioning

must work 24 hours a day, year round, even in the winter. The need for constant air conditioning reinforces the necessity of an uninterruptible power source.

Computer rooms need raised flooring of 2 feet to accommodate wiring and air conditioning. The floors must also supports weights of 100 pounds per square foot and up compared with 50 pounds per square foot for general purpose offices (ULI 1985:11; Alexander 1988:205). With the proliferation of LANs, rooms for computer servers is adding to the space requirements of the smart building.

Trading Floors

All of the largest banks and financial services companies operate trading floors, dealing on the debt, equity, commodities or money markets. The technological support of trading floors is of utmost importance. Architecturally, the trading floor requires a large open area, free of columns to allow eye contact and face-to-face interaction (Alexander 1988:203; Post 1988). Multiple trading floors accommodating over 1,000 dealers are common for the largest brokerage houses and banks. Each trader requires a video switch to condense several on-line market quotation systems to a single screen and multiple telephone lines. Telephone conversations must also be recorded for later review. The technical backup for a trading floor may require space the size again of the floor itself, plus existence of sufficient riser space and an underfloor distribution system.

Floor Size

The need for large floor plates stems from considerations for trading floors and business flexibility. Moss (1987) suggests that the preferable size for a trading floor is 30,000-40,000 square feet. This large, uninterrupted, horizontal area is necessary for groups of traders to work most efficiently together. On a typical floor the traders who are dealing directly with the market tend to be towards the middle and those dealing more with clients near the edges. Often the floor is built with tiers to improve visibility between the dealers. Groups of traders work together taking their orders verbally from a leader in their midst. "Lines of sight to the "heavy" traders in the pit--those with authority to buy and sell--are crucial to dealmaking" (Post 1988:26) Trading floors are also equipped with wire service displays on the walls so that dealers can react to any breaking news.

The other demand for large floor plates in modern buildings comes from the dynamic nature of business activity. Major banks and financial service providers have rapidly changing working groups with changing office needs. The preferred layout is a large, open, raised floor, with movable cubicles so that new ventures can easily and quickly create their own office areas.

The desire for large floor plates may be one of the strongest factors influencing the location of certain economic activities. Moss (1987:538) asserts that:

> Moreover, financial institutions that participate in global markets require elaborate trading rooms that are linked to the major exchanges around the world; such trading rooms occupy large floor areas, often in multi-level settings, that are not available in the narrow skyscraper or traditional office building.

The provision of large floor plates for specialized financial functions serves as a strong influence pushing upper level economic activities out of the core of older buildings built on the smaller grid at the heart of 19th century American cities.

Harborside: A Smart Building

Promotional literature for the 1989 Harborside Financial Center in Jersey City reenforces the importance of the smart building design considerations. Harborside advertises that its "floorload capacity of 125 to 250 lbs. per square foot easily accommodates both heavy computer equipment and U.P.S. back-up battery packs." It also states that "Harborside's 13'6" slab-to-slab heights allow for raised floors, underfloor cabling and complex above ceiling mechanical installations." The office center promotes its "two 13,200 volt primary service feeders," and "redundant fiber optic capabilities with access to the Teleport System, NJ Bell's light guide cable and AT&T's Fiber Optic Link providing for the most intricate, secure telephone systems." The competitive market for building services indicated by the Harborside advertising material makes it difficult for older buildings to escape obsolescence.

Building Obsolescence

There are many problem that lead to the obsolescence of old buildings (Stansall and Bedford 1985:267; Atkin, 1988; Cebulski 1993; Ossorio 1993). While individually these factors may not force a tenant to leave a building, the costs of solving these problems is weighed against the benefits moving to a new location (Cebulski 1993).

- Inadequate riser space, poorly located
- Inadequate space for bending radii of cables
- Poorly situated distribution boards and patch panels
- Inadequate story height for raised flooring
- Insufficient space in floor dusting for cable crossovers
- Inadequate separation of data, telecom, and power cables
- Inaccessible cable trays above ceilings
- Hidden cables running through partitions
- Poorly planned system of outlets at workplaces
- Trailing leads from outlets to equipment
- Trailing leads between equipment
- Underprovision of outlets for telecom, data, and power
- Disconnected or redundant cables left in risers and ducts
- Insufficient bay width for mainframe and PBX
- Underprovision of power
- Insufficient space for telecommunications entry
- Inability to compensate for localized computer heat loads
- Insufficient floor strength for mainframe computers
- Insufficient floor plate for specialized activities

Given this list of possible problems, one would expect that older buildings would diminish greatly in desirability for large information users and that they would find it more economical to move to a newer building than renovate their existing facility. As an official from a major New York construction firm observed, "It is a much more complex task to install new and integrated security, communications,

life safety, and environmental control systems in an existing building not designed for these systems than to include them in the design of a new structure" (Ravo 1992).

Construction Methods

Before making any predictions about the age at which are buildings are likely to be obsolete, a brief history of construction and site development is needed. Hayden (1998), of the prestigious New York architectural firm Swanke Hayden Connell, identified three forces leading to more flexible building design during the 1960s and 1970s: the size and shape of the projects, the shell and core method of marketing buildings, and the high inflation of the 1970s. Hayden claims that the very large structures of 1960s structures caused more planning for flexibility because the "large floor plates were being occupied by a single company that tended to be dynamic and required changes at a rate much more rapidly than their smaller predecessors" (Hayden 1988:192). Companies were looking for large floor areas that would be easy to reconfigure as their business needs changed.

The shell and core method of marketing was also developed. Before World War Two developers built and fitted commercial structures without a specific tenant. Increasingly, following World War Two, the interior design was assumed by the future tenant, leaving the developer to construct the shell and the tenant to install and outfit the core.

The separation of design functions was intensified by the high inflation of the 1970s. Because of high interest rates every effort was made to complete buildings in the shortest possible time. These economic conditions led to compartmentalized design, where the shell of the building was being built while the interior was still in the final design phase.

The result of these changes in the process of site development was that buildings were much more flexible. Renovating the core in a building that was built as a shell and core is easier than in one that was not. As a result, buildings built in the 1960s and 1970s may be able to accommodate technologies that were not even invented when they were built.

Smart Building Location

Unfortunately, the patterns of office location evolving as a result of incorporating information technology are not easily generalizable. The preexisting conditions in any given city rule out predicting one universal pattern. The general tendency will be for head office functions (and their smart buildings) to occupy larger plots of land away from the traditional core of their district, leaving the center, and its much older, smaller, and technologically inferior buildings to house secondary activities. The particular manifestation of this tendency will depend on the geography and history of the city involved. For the case of New York's Financial District Moss (1992) suggested calling it a "doughnut district".

Chapter 3

CASE STUDY: NEW YORK'S FINANCIAL DISTRICT

New York as a World City

To examine changes in the internal structure of the city resulting from the design requirements of information technology, New York was chosen as an example. While the definition of the world city is a subject of continued debate, there is no question that New York City is a world city. Friedmann (1986) identifies it as a first order world city and Sassen (1991) uses it in her comparative work on global cities. More recently, Friedmann (1993) includes New York with Tokyo and London as cities that serve as global financial articulations.

The economy of New York City in the 1980s has been dominated by growth in the information sector. (O'Neil and Moss 1991) Manufacturing as a share of the labor force has declined as high and low level services have grown. New York City has more headquarters of Fortune 500 corporations than any other American city and houses the largest stock market in the country.

If city hierarchies were determined by shares of telecommunication activity, New York City would exhibit dominance of primate city proportions.

The city produces more overseas telephone calls than any other entire country, save Germany (O'Neil and Moss 1991:29). New York City has a sophisticated telecommunications infrastructure, including several alternate telecommunications carriers (Moss 1986b). Before the telephone, New York's prominence as a financial center in the national urban hierarchy was already well established.

The Financial District

Early History

The European development of Manhattan Island started in the seventeenth century on its southern tip. Until the nineteenth century this area contained all the island's commercial and residential structures. The early central district centered around Broadway and Wall Streets and was an important site of national political and financial activity. The original Federal Hall at 26 Wall Street was the site of George Washington's inauguration and served as the nation's first capitol; later, New York's Subtreasury occupied the address. In 1812, City Hall was completed at the northern edge of the city.

During the nineteenth century expansion continued northward, so that by 1880 all but the northern end of Manhattan was developed. However, the downtown area still contained the commercial district. At the turn of the twentieth century all but three buildings of New York's commercial real estate stock was Downtown (Real Estate Board of New York 1985). The Midtown commercial

Figure 3.1 Downtown Manhattan. Base Map digitized from *Map of Lower Manhattan*, Hagstrom 1989.

districts around Grand Central Station, Times Square and the Rockefeller Center grew rapidly through the early twentieth century but the Downtown area centered on Wall Street continued to add to its commercial real estate.

Downtown continued its importance as a financial center even as other commercial activities moved north to Midtown. The New York Stock Exchange, American Stock Exchange and the other commodity exchanges maintained operations Downtown, justifying its name as the Financial District. Wall Street, the location of the New York Stock Exchange, became synonymous with financial markets.

Wall Street, 1960

In 1960, the identification of Wall Street as the heart of American financial activity was a reasonably correct geographic assumption. The location of buildings comprising the Financial district were on or near Wall Street. A map of existing commercial office buildings that were built before 1960 shows a concentration along Wall Street and Broadway (Figure 3.2). The insurance district around Maiden Lane is also visible, as are other offices stretching up Broadway.

A comparison of the present distribution of office buildings in the Financial District with those built before 1960 provides the basis for an indication of the effects of information technology on office location. In 1960, the use of information technology in banking was in its developmental stages.

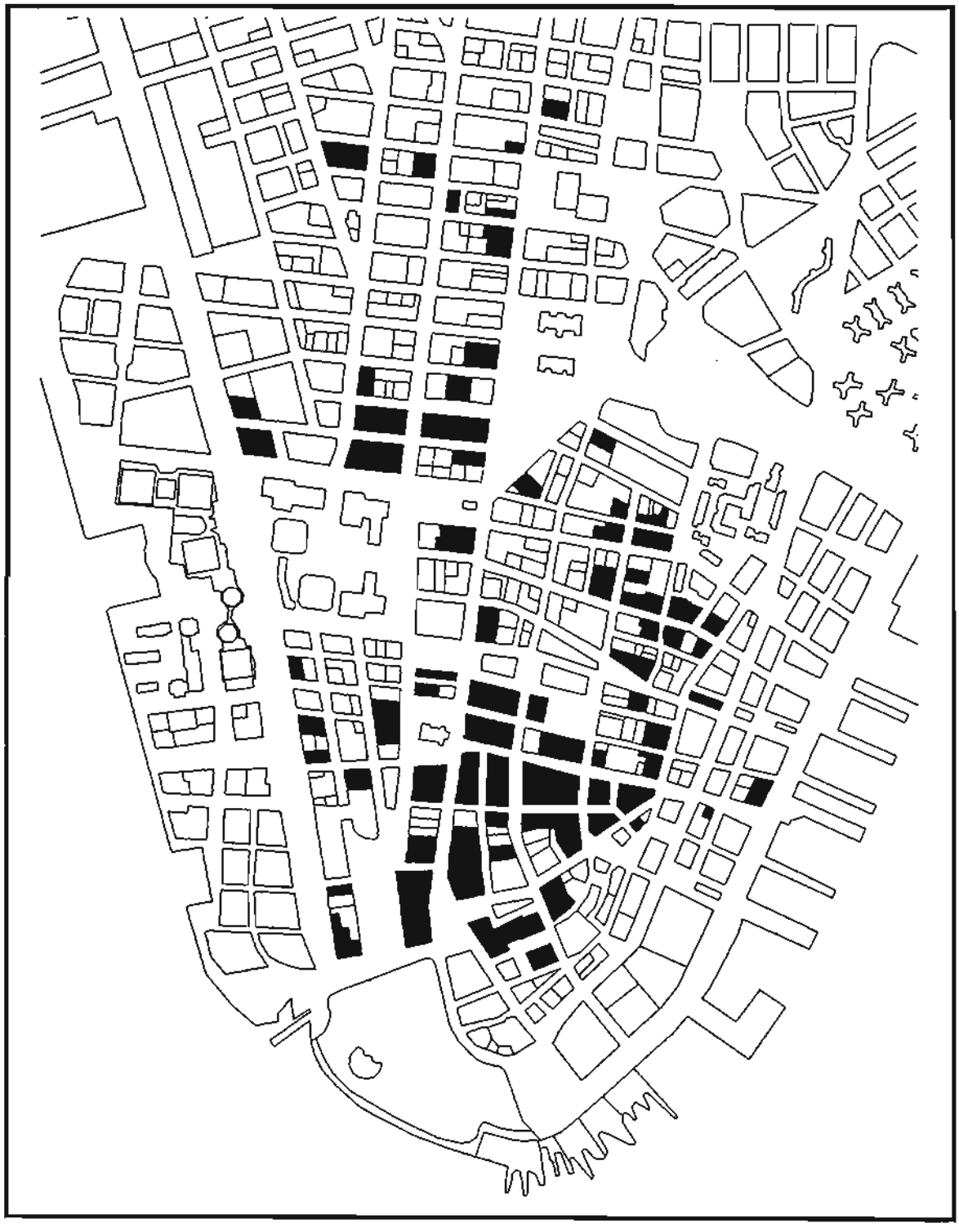

Figure 3.2 Remaining Major Office Buildings Constructed Before 1960 (*Office Buildings* 1992; Real Estate Board of New York 1985)

Supercomputers were still rather bulky, and personal computer and local area network technologies had not reached the market. Financial traders were not as dependent on telecommunications for access to overseas exchanges because the Eurobond and Eurodollar markets were in their infancy and banks could still make a profit domestically on large corporate loans. Those buildings constructed before 1960 were not designed to support the infrastructural requirements of information technology and most could not be easily retrofitted at a later date.

New Office Buildings, 1960-1969

Construction of downtown office buildings during the 1960s showed the beginnings of a changing pattern of office location. The buildings were not necessarily designed or located with information technology in mind but they proved to be easily retrofitted (See Chapter 2). Figure 3.3 shows the location of office buildings that were completed between 1960 and 1969.

The pattern of 1960s new construction gives hints of the changes to come. Five buildings were constructed along Water Street, taking advantage of undeveloped land on the periphery of the district to build with large floor sizes. Of these buildings--One State Street Plaza, Four New York Plaza, 95 Wall Street, 110 Wall Street, 111 Wall Street and 80 Pine Street--three have floor areas over 40,000 square feet.

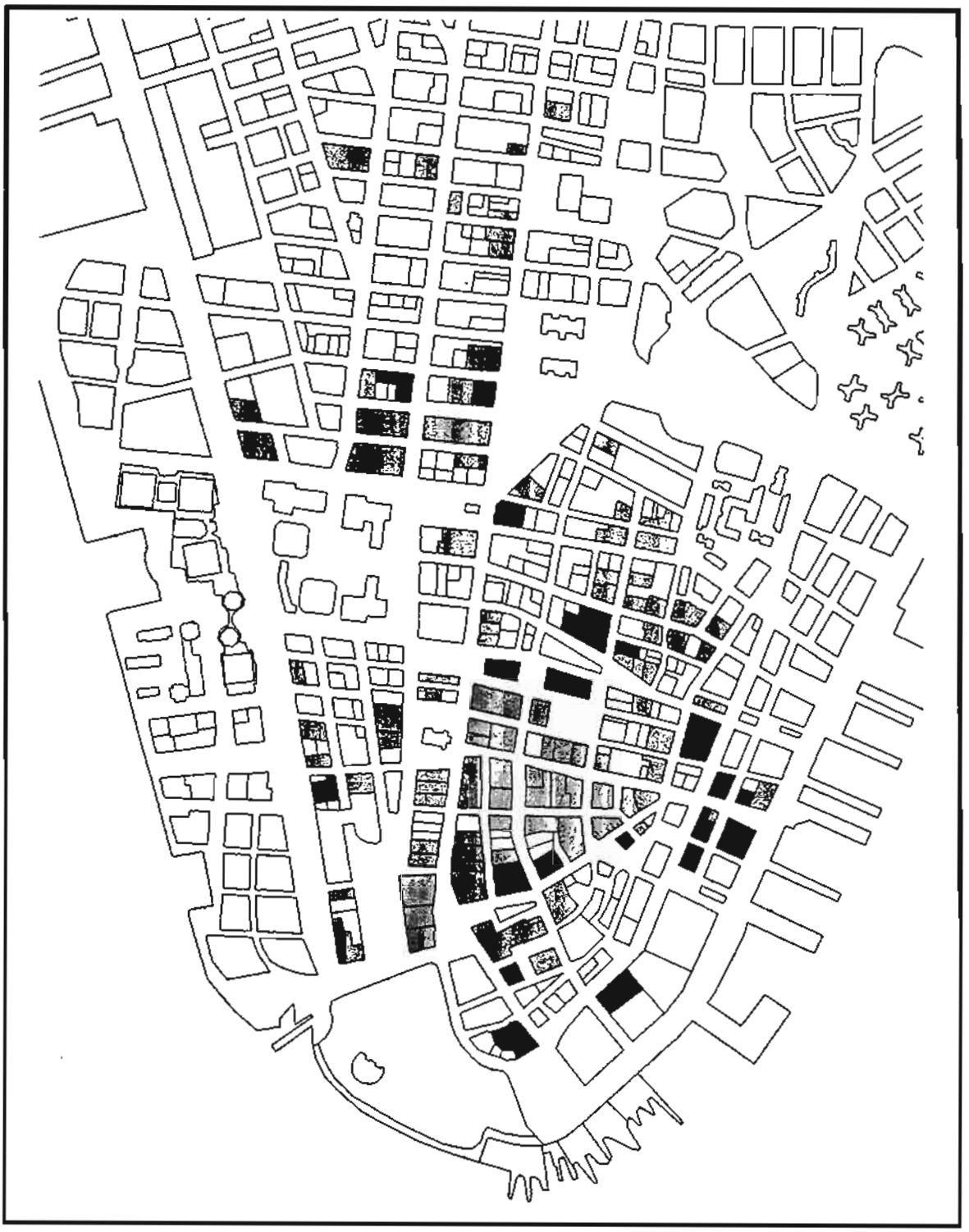

Figure 3.3 New Competitive Office Buildings, 1960-1969. Pre-1960 buildings shown in grey. (*Office Buildings* 1992; Real Estate Board of New York 1985)

The other relevant constructions are One Chase Manhattan, the Marine Midland Building at 140 Broadway and the Home Insurance Building at 59 Maiden Lane. These buildings seem to have been the first of the large office complexes to fill in north of Wall Street. The preexisting office buildings north of Wall Street had been of a smaller scale.

New Office Buildings, 1970-1979

The pattern of new office construction in the 1970s shown in Figure 3.4 dramatically illustrates the development of the periphery of the Financial district. Buildings filled in the entire length of Water Street and were occupied by such tenants as Chase Manhattan, American Express and Chemical Bank. To the North of Wall Street the World Trade Center, One Liberty Plaza and Bankers Trust Plaza were built, attracting firms like Merrill Lynch, Bankers Trust and housing the Commodities Exchange Center.

It would be incorrect to attribute the location of these new buildings only to the architectural considerations of information technology. The tendency in the 1970s was toward larger buildings, as much for office flexibility and prestige as for computer networks and trading rooms. However, the effects of information technology cannot be ignored. International markets were becoming more important as the Bretton Woods international financial system broke down and computerized market quotation systems were becoming the norm.

Figure 3.4 New Competitive Office Buildings, 1970-1979. Office buildings built 1960-1969 shown in grey. (*Office Buildings* 1992; Real Estate Board of New York 1985)

New Office Buildings, 1980-1990

As can be seen in Figure 3.5, new office construction in the 1980s was mostly along the Water Street and extended to the north of the World Trade Center. Buildings like 17 State Street, 3 New York Plaza, 85 Broad Street, 7 Hanover Square, Financial Square, and 75 Wall Street filled in the area along Water Street, completing a strip of newer buildings from State Street in the south past Maiden Lane to the north. The new building at 60 Wall Street was also indicative of the tendency away from the traditional center of the Financial District, as will be discussed later.

The four buildings of the World Financial Center are significant for their attraction of major tenants even farther away from Wall Street. Dow Jones, Merrill Lynch and American Express all moved to the new complex to the west of The World Trade Center. Three new buildings were added north of the World Trade Center as well, including The Bank of New York's headquarters at 101 Barclay Street.

There are several smaller structures built in the old core of the district, but they are mostly filling in old spaces, for example 45 Broadway and 1 Exchange Plaza. These buildings are technologically advanced but will not attract the major financial players because they are too small. Both buildings have maximum floor sizes less that 30,00 square feet.

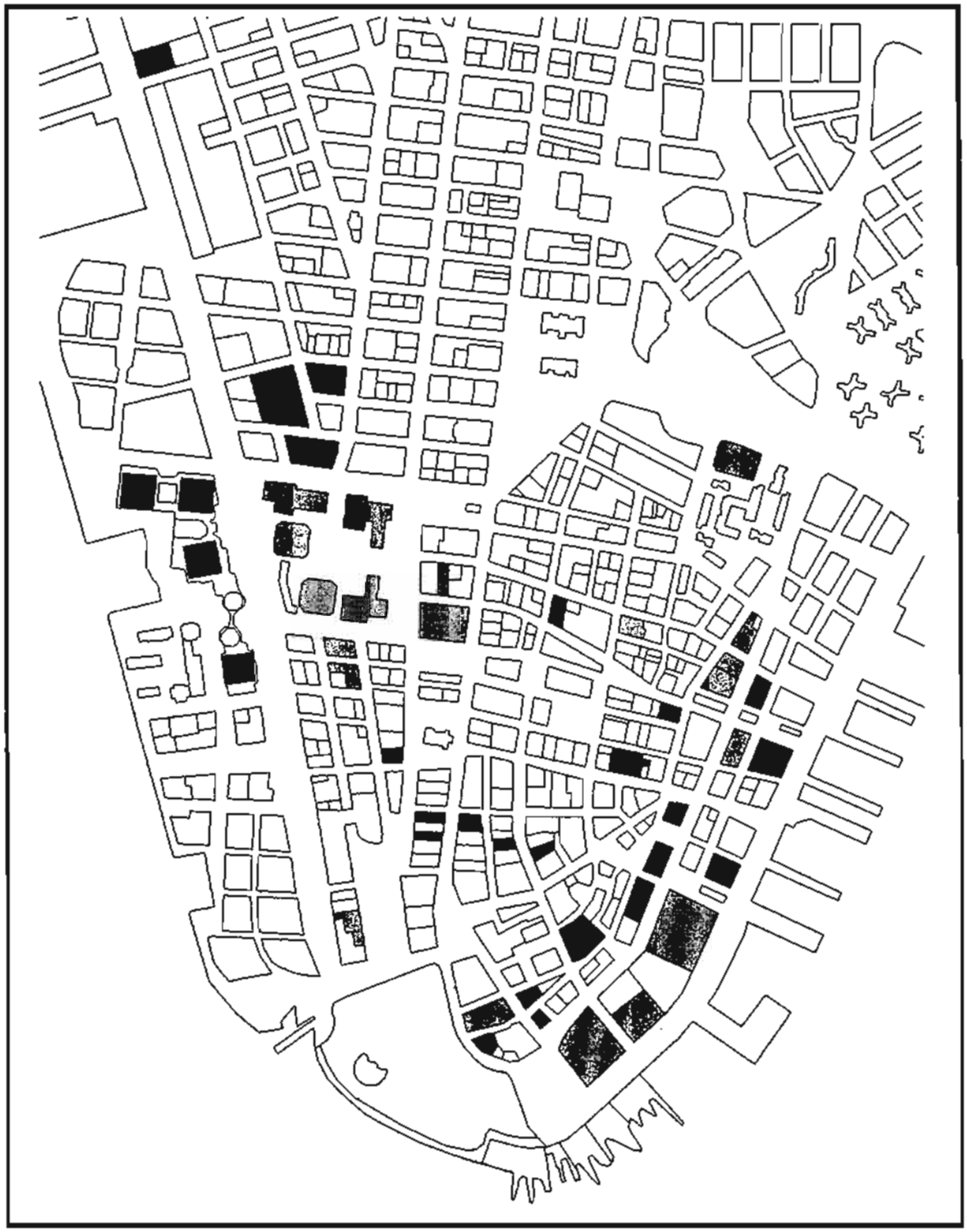

Figure 3.5 New Competitive Office Buildings, 1980-1990. Office buildings built 1970-1979 shown in grey. (*Office Buildings* 1992; Real Estate Board of New York 1985)

Figure 3.6 Competitive Office Buildings with Floors Larger than 30,000 Square Feet, 1960-1990. (*Office Buildings* 1992; Real Estate Board of New York 1985)

The Doughnut District

Figure 3.6 shows all of the office buildings built in the Financial District since 1960 with floor sizes over 30,000 square feet. This cut-off is based on a more conservative estimate of the floor size needed for the operation of major financial institutions than Moss's 40,000 square feet (Moss 1987; Moss and Dunau 1987). The pattern of building construction has ringed the traditional Wall Street core from Water Street around to the World Trade Center. Ignoring the fact that there is only new residential (instead of commercial) construction to the southwest, it is convenient to think of the new buildings forming the shape of a doughnut (Moss 1992), with the New York Stock Exchange at its core. In the remainder of this chapter, using real estate data and specific examples, it will be seen what activities moved into the new buildings and what role information technology played in their decisions to do so.

The Real Estate Market

Cushman and Wakefield, one of New York's largest real estate firms, reports vacancy rates for primary and secondary office space. Primary space is defined as "Buildings that are well-located, professionally maintained, attract high-quality tenants, and command upper-tier rental rates. Structures are modern or have been modernized to compete successfully with new buildings" (Cushman and Wakefield 1992). Secondary space lacks any one of the characteristics of primary

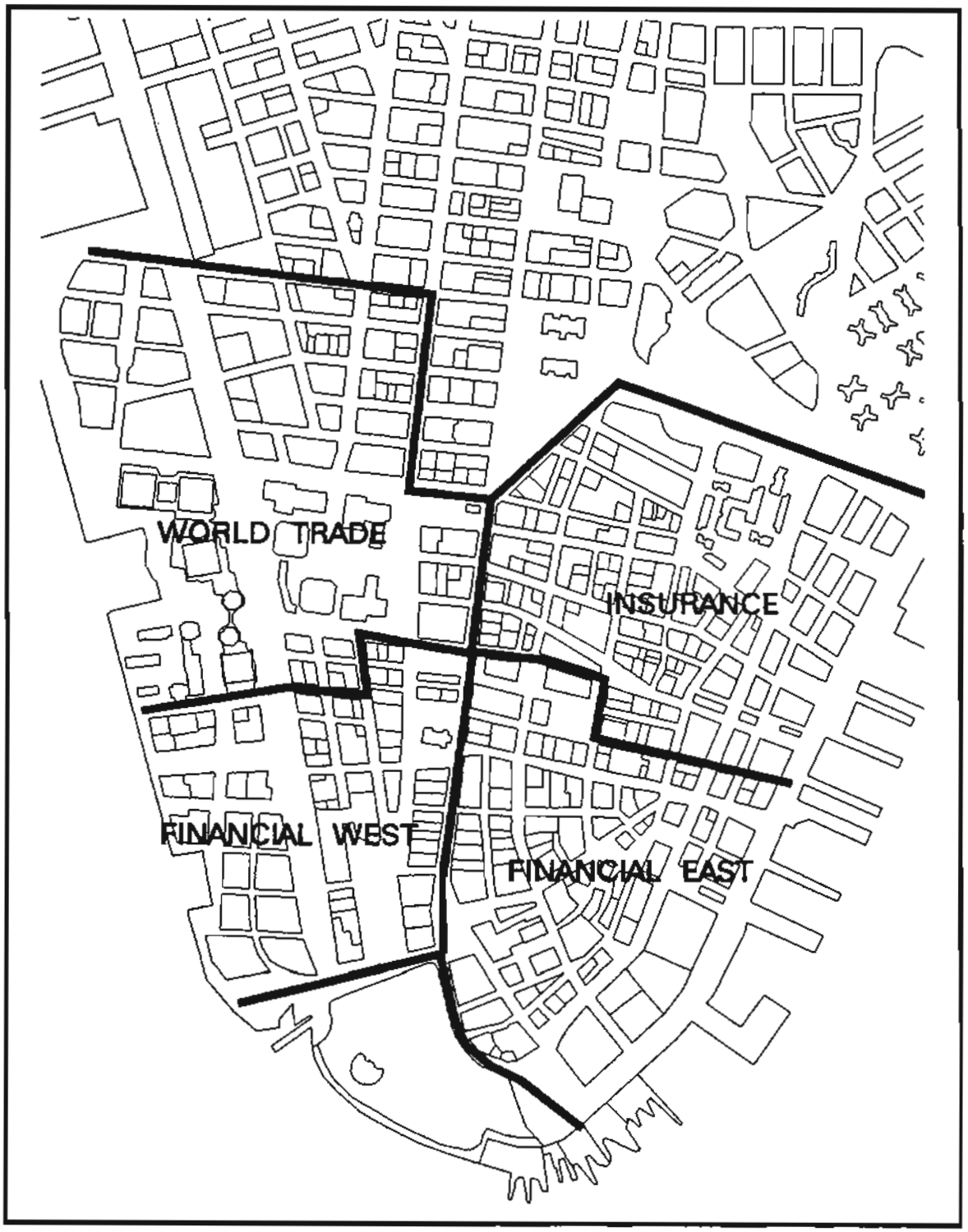

Figure 3.7 Downtown Real Estate Districts (Cushman and Wakefield 1992)

space. The primary/secondary distinction is largely subjective (Ossorio 1993) but does include technological considerations. Any building that can compete in "modernity" with new buildings must be able to support the same information technology infrastructure. Another real estate analyst identifies "Class-A space" that "should out perform space in older, technologically or physically inefficient buildings." (Belmonte 1992) Again, no standards are set but the implication of building "smartness" is apparent.

The Cushman and Wakefield market study gives data on four relevant Downtown districts: Financial East, Financial West, Insurance, and World Trade (See Figure 3.7). The data for these districts, shown in Table 3.1, give some insight into the downtown office market.

Vacancy rates for secondary space are significantly higher than for primary space. While technological factors are not explicitly considered, these figures suggest the basis for such a relationship. Assuming that primary office space is technologically advanced, the ratio of primary to secondary office space gives an indication of the technological desirability of districts as a whole. The World Trade District, with a 13:1 primary to secondary ratio, is by far the newest, and by implication, most adapted to information technologies.

The Financial West District shows its age with a 1:9 primary to secondary office space ratio. Financial West had only four new "competitive" office buildings from 1960-1990 (*Office Buildings* 1992). The majority of office

Table 3.1 1991 Downtown Manhattan District Activity (Cushman and Wakefield 1992)

District	Total Inventory (sq. ft.)	Available Space (sq. ft.)	Overall Vacancy Rate
Financial East			
Primary	33,628,061	8,027,549	23.9%
Secondary	7,892,313	2,932,648	37.2%
Ratio	4.3:1	2.7:1	
Overall	*41,520,374*	*10,960,197*	*26.4%*
Financial West			
Primary	829,196	140,490	16.9%
Secondary	7,412,695	2,052,142	27.7%
Ratio	1:8.9	1:14.6	
Overall	*8,241.891*	*2,192,632*	*26.6%*
World Trade			
Primary	25,891,390	3,124,744	12.1%
Secondary	1,933,387	451,969	23.4%
Ratio	13.3:1	6.9:1	
Overall	*27,824,777*	*3,576,713*	*12.9%*
Insurance			
Primary	12,878,168	1,685,547	13.1%
Secondary	5,251,763	1,184,309	22.6%
Ratio	2.5:1	1.4:1	
Overall	*18,129,931*	*2,896,856*	*15.8%*
Downtown			
Primary	73,226,815	12,978,360	17.7%
Secondary	22,490,158	6,621,068	29.4%
Ratio	3.3:1	2.0:1	
Overall	*95,716,973*	*19,594,428*	*20.4%*

stock in Financial West is along Broadway. These buildings, and those on the east side of the street in Financial East were built in late 1800s and early 1900s. Along with the first three blocks of Wall Street they comprised the central financial district of the early twentieth century. Considering the age of Financial West and the difficulties of modernizing the buildings, the small amount of primary space now available is understandable.

In sum, information about the real estate market of downtown Manhattan supports the assertion that older buildings are becoming obsolete (Secondary space) and office activity is moving to newer or renovated buildings (Primary space). Districts with larger shares of primary space have lower overall vacancy rates (World Trade), those with less primary space have higher vacancy rates (Financial West).

Case Examples

Investigation Methodology

As previously stated in Chapter 1, the banking and financial services industry is highly dependent on advanced information technologies. Because the roles of commercial banks and diversified financial service providers are purported to be converging (Regan 1989), both groups were chosen for investigation. Fortune 500 commercial banks and diversified financial service providers were ranked by total assets for 1982-1991. The seven corporations that were among the

ten highest-ranked through the 1980s were selected for study. These firms were Citicorp, American Express, Chemical Banking Corporation, J. P. Morgan, Chase Manhattan Corporation, Merrill Lynch, and Bankers Trust New York Corporation.

The choice of the highest asset firms was made to ensure that firms had been selected which 1) were required to manage large amounts of information, 2) have an imperative to be competitive in international markets, and 3) were likely to be influential tenants in the financial district. There was no intention of making an exhaustive survey, or selecting a statistically significant sample. Rather, firms were chosen because of the assumptions that could be made about their technological and economic needs.

Various telecommunications, computer experts, and facilities managers in all of the sample financial institutions were contacted. Some were interviewed and provided access to the facilities discussed. Some institutions were unable to cooperate because of restrictions made by their corporate communications departments. While this thesis does not include any explicitly classified material, most institutions contacted were hesitant about discussing specific technologies and facilities. Their reluctance underlines the assertion that advanced information technologies are essential for competitiveness in the market.[1]

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[1] To protect sources who may otherwise have refused to grant interviews, names will not be used and quotes will not be given in conjunction with examples. The facts and quotes can be confirmed in the author's field notes. In addition to information gathered from financial institutions, representatives of real estate, architectural, and engineering firms were also interviewed. They are referenced as personal communication.

Headquarters and Trading Floors

An effort was made to develop an inventory of the location of activities within each of the firms studied. Of particular interest are the location of executive headquarters and trading floors. In theory, the headquarters and trading centers are activities which will not be moved out of the central business district and so must meet their telecommunication needs within the bounds of the district. Castells lists the reasons that head offices will remain in central business districts as: 1) face-to-face communication and dealmaking, 2) social milieu, 3) prestige, 4) assets invested in district and 5) ancillary business services (Castells 1989:150). However, two of the case examples show counter evidence to the idea that headquarters and trading floors will stay in the financial district. Citicorp has its headquarters in Long Island City and is moving its trading floor to Midtown and Chemical Bank has its headquarters and trading floors in Midtown.

Considering the location of Citicorp and Chemical Bank's headquarters it is appropriate to note that they are New York's two largest commercial banks, and not financial service providers. While the division of credit services and non-credit services between commercial banks and diversified financial service providers is growing smaller (Regan 1989), institutions may be influenced by their previous role. Commercial banks like Citibank, Chemical Bank (and Manufacturer's Hanover, which Chemical merged with) traditionally had contacts with the large corporations which had headquarters in the Midtown business

district. Therefore, their location in Midtown could exploit face-to-face communication with their largest clients. Even though their headquarters were not on Wall Street, both banks maintained a presence in the financial district.

Because this study is concerned with the changing geography of a district, consideration is not limited to headquarters and trading floors. Any major financial operation (securities processing, back office, or data center) that has been kept in the financial district is of interest, because all of these activities have information technology requirements that could influence their location.

Citicorp

Citicorp's headquarters have not been in the financial district, but Midtown at 399 Park Avenue. The headquarters is currently moving to a new site in Long Island City. In addition to the headquarters, Citicorp has, and is keeping, Citicorp Center, next to 399 Park Avenue.

In the financial district (See Figure 3.8), Citicorp owns and occupies 111 Wall Street, which is used as a data center. Citicorp's trading floors are on the top floors of 55 Water Street, but are currently being moved to Citicorp Center. The movement of Citicorp's trading floors out of the financial district to Midtown brings into question the choice of considering commercial banks and diversified financial service providers together. Commercial banks trade on international money markets, while diversified service providers deal with equity.

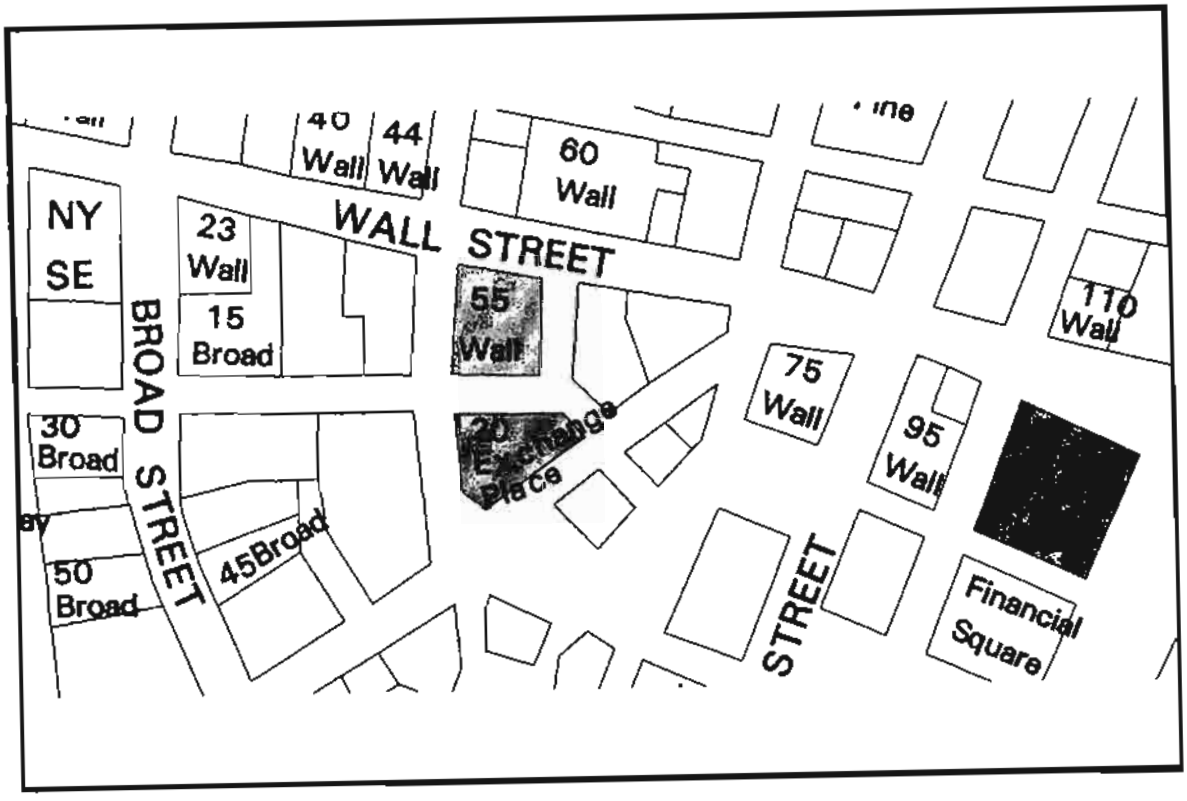

Figure 3.8 Citicorp Downtown Office Locations

Because the money markets are non-stop, news is old in five minutes, whereas an after-work tip for a stock on the New York Stock Exchange is still good the next morning. Therefore, dealers in equity would have much more to gain by proximity to the financial district, and dealers on the money markets would see less benefit in such a location.

The move of Citicorp trading floors can also be seen as a matter of corporate cost-cutting. Citicorp was renting the space at 55 Water Street, but owns

Citicorp Center, making it a much cheaper. The new trading floor is being built in a cafeteria left underused by the movement of activities to Long Island City. The new floor will house only 5% more personnel and represents an "evolutionary" step in technology.

Citicorp's downtown facilities are on the Water Street periphery of the district, and seem to have moved away from the traditional center of the district. In the early 1980s Citicorp sold the buildings at 55 Wall Street and 20 Exchange Place (immediately south of 55 Wall Street). If Citibank had wanted the prestige, elegance and classical grandeur of a central location, 55 Wall was the ideal location. The structure was built in 1842 and has an impressive columned facade, and a beautifully decorated rotunda. It is in the heart of the old financial district, one block from the New York Stock Exchange. Twenty Exchange Place is the landmark Wall Street Tower, built in 1931. Citibank left these locations for an international style building separated from the East River by an elevated highway. However, neither building could have accommodated the data center that was installed at 111 Wall Street.

American Express

In 1986, American Express moved its headquarters from 50 Broadway to the newly constructed American Express Tower at 3 World Financial Center (See Figure 3.9). The move represented a large increase in available space and a

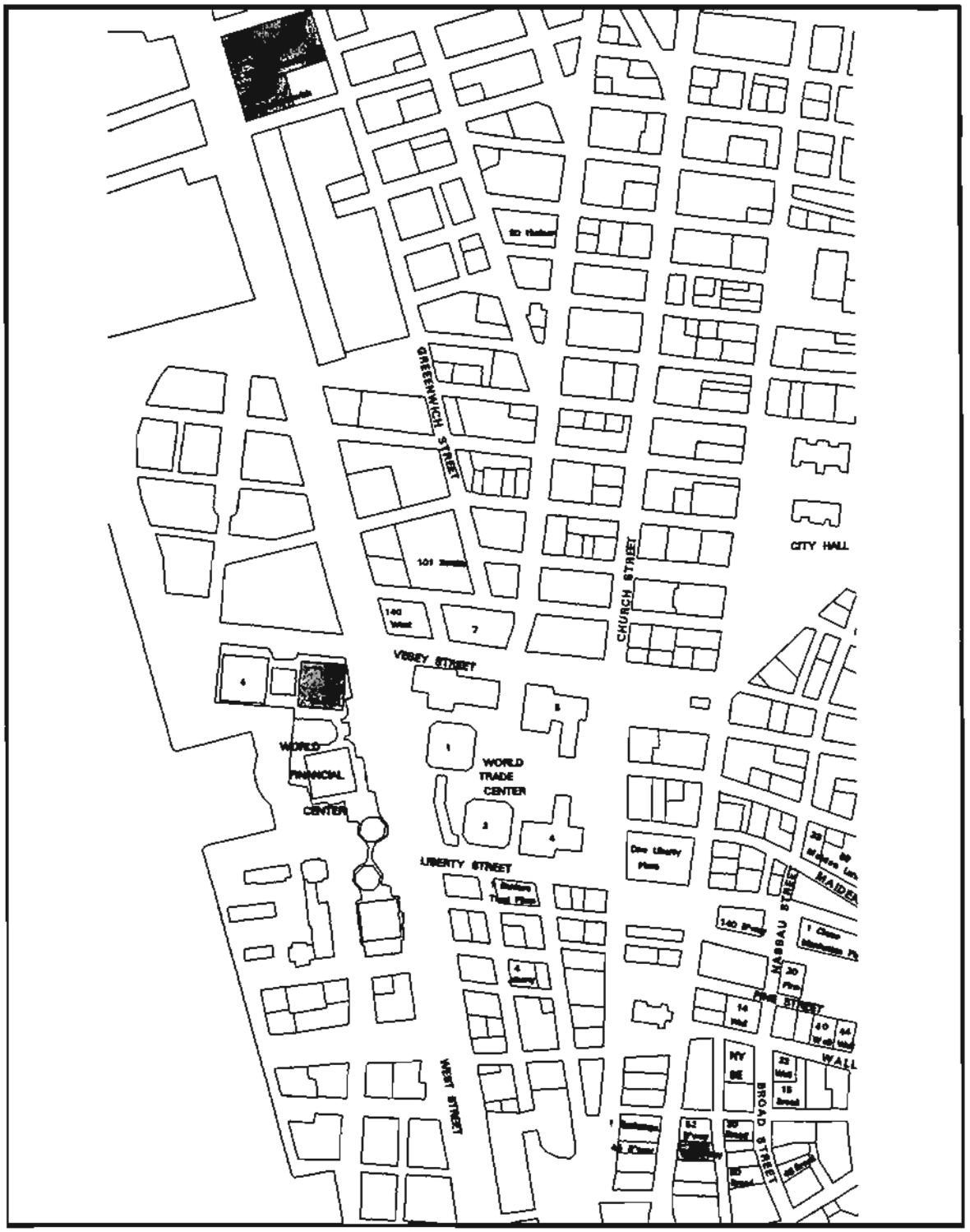

Figure 3.9 American Express Downtown Office Locations

great leap in technological ability. In the late 1980s, Shearson Lehman Brothers, American Express' investment division, built an office building and a data processing center at 388 and 390 Greenwich Street, eight blocks north of the World Financial Center in TriBeCa.

The office at 388 Greenwich is strictly a back office location. There were rumors of moving trading floors to 390 Greenwich because of its technological superiority to the American Express Tower, but the dealers themselves refused to move so far away from the financial district. The distance of the move would be the same as from 50 Broadway to The World Financial Center. This story reenforces the need of companies to meet their technological requirements within the psychological boundaries of the financial district. The American Express traders would have better facilities at 390 Greenwich but thought they would be out of the Wall Street loop.

Chemical Banking Corporation

The Chemical Banking Corporation represents the merger of the old Chemical Bank and the Manufacturers Hanover Bank. The consolidation of the two banks, both previously among top ten richest U.S. banks by assets, involved a major shake-up of office space.

The headquarters and trading floors of the new bank are Midtown at 270 Park Avenue, the old Manufacturers Hanover headquarters. The old Chemical

Bank headquarters and trading floors across the street at 277 Park is being vacated. Manufacturers Hanover's trading floors had been at 44 Wall Street until the 1980s when they were moved uptown.

The new Chemical Bank is keeping the property at 4 New York Plaza to house technical support staff for its mid-range data center at 55 Water Street (See Figure 3.10). Four New York Plaza was built in 1968 and had been used by Manufacturers Hanover as a mid- and high-range data processing center. It was easily upgraded through the 1980s because of its design as an operations center. It has large floor plates (36-37,000 square feet), large risers on both ends of the building and could accommodate multiple points of entry for both power and telecommunications. The structure next door at 55 Water has even more to offer.

Fifty-five Water Street was built in 1973 and is a mega-structure. Floor plates range from 58,000 to 128,000 square feet. The old Chemical Bank had mid- and high-range data centers at 55 Water, as well as other back office functions. The high range data processing center for the new bank was moved to Wilmington, Delaware but the mid-range center for global securities processing remains.

The new bank is keeping facilities at 95 Wall Street, 140 East 45th Street, 52 Broadway and 450 West 33rd Street as back office locations. The 52 Broadway location is right in the middle of the traditional Wall Street district and is being used for the bank's internal audit division.

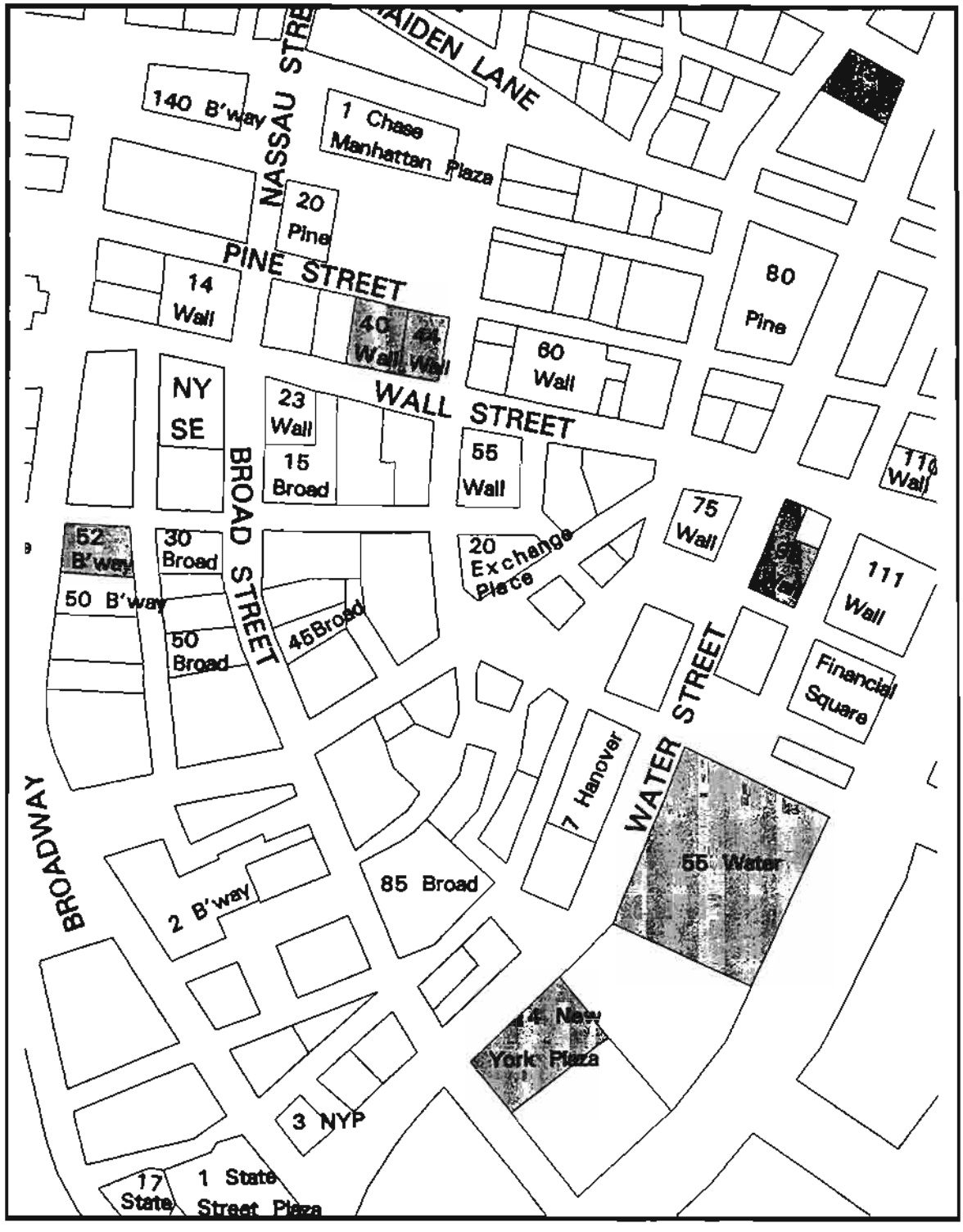

Figure 3.10 Chemical Bank Downtown Office Locations

The new Chemical is releasing office space at 130 John Street and 40 Wall Street. The building at 130 John Street used to house the Manufacturers Hanover data center that was moved to Wilmington, DE. While 130 John Street is a relatively new building (1971) it had been affected by power outages in the past. The desire to be in an owner occupied building for security reasons also influenced this move. Forty Wall Street was built in 1929, less than a block from the Stock Exchange, but Chemical Bank decide to leave its offices there in favor of locations in newer buildings farther away from the exchange.

J.P. Morgan

J.P. Morgan is one of the oldest and most well-known financial service providers on Wall Street. J.P. Morgan is literally on Wall Street. The Morgan Guaranty Trust Building at 23 Wall Street occupies the space directly across Broad Street from the Stock Exchange (See Figure 3.11). Built in 1904, 23 Wall was later connected at all floors with the 1914 construction at 15 Broad Street. The two buildings served as headquarters for J.P. Morgan until 1988 when it moved to a new building at 60 Wall Street. The physical distance of the move was a block and a half, but the technological distance was light years.

The ability of the 23 Wall/15 Broad complex to accommodate advanced telecommunications and computer systems was reaching a limit. While entirely renovating the building would have been possible, it would not have been

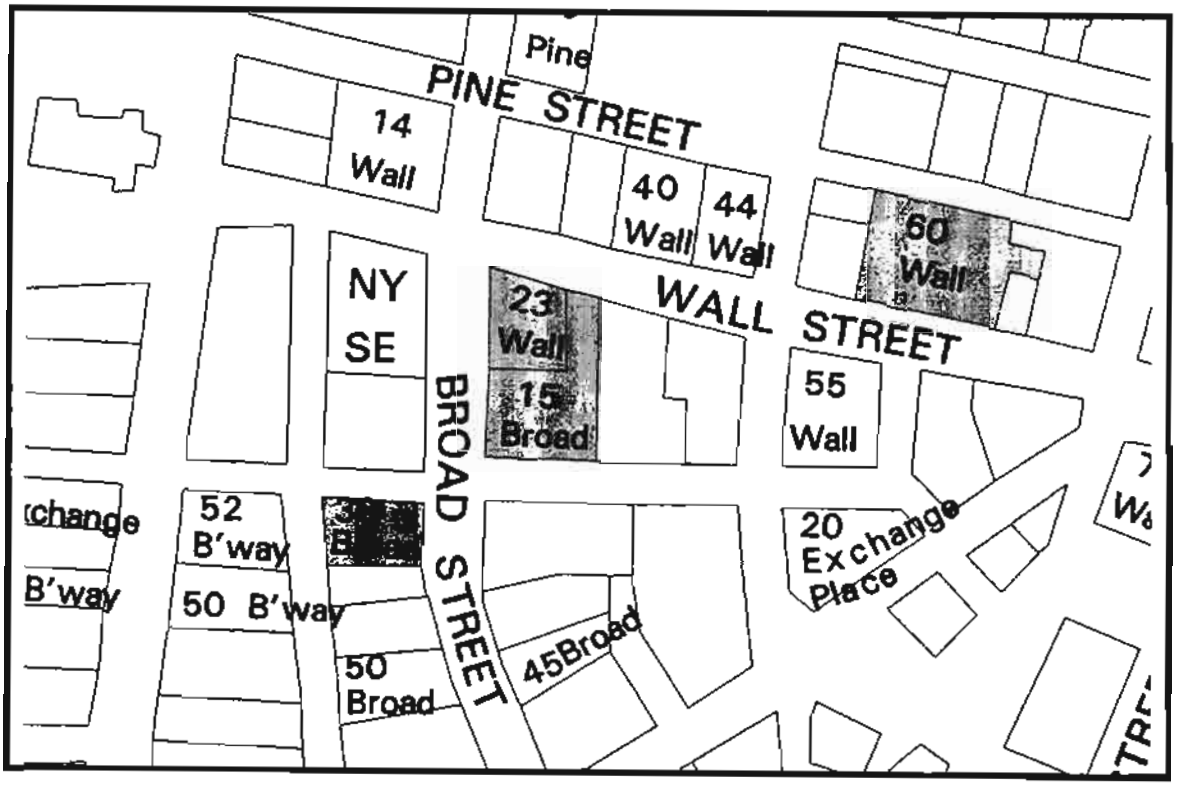

Figure 3.11 J.P. Morgan Downtown Office Locations

economically practical. Morgan's activities had filled the building to capacity. Communications wiring was installed in coat (not communications) closets. The power load of the trading floor was too great for the building. Eye contact on the trading floor was low due to the confusion of cables, pillars and terminals stacked on desks. The trading data support center was also bursting at the seams. Adaptability to new business was low because of the lack of space. Any sort of

significant modification entailed cutting holes in walls, sacrificing speed of transition and structural integrity.

The new headquarters at 60 Wall Street is a banker's paradise in comparison. The site was acquired from Park Tower Realty, which had already designed the building to be constructed there. J.P. Morgan took over the building project in 1985 and redesigned its interior to meet their specifications. Telecommunications and computing were primary considerations in the design. One floor of the original design was omitted and the space used to increase the ceiling heights of all the other floors (Goldberger 1990.) At the time that it was built, 60 Wall had the largest installation of fiber optic cable in the world. The main structure is built around a central core, which houses elevator, telecommunications, data and power risers. All user floors are raised a foot and data center floors are raised 18 inches. The distribution of the 2,500 miles of wiring is so extensive that one can virtually "plug-and-play" anywhere in the building. The trading floors are not under the 50 story tower of 60 Wall, but out over the "Public Space" that J.P. Morgan maintains. By avoiding the core of the building the three trading floors can offer large unobstructed areas. There are several data support floors housing video switches, and mid- and high-range computer support for the activities of dealers and the bank as a whole. Links are constantly maintained with the Federal Reserve Board and currency clearing

houses. Large areas are also devoted to the servers for local area networks. The new building also has video-conferencing capability.

Information technology was just one factor prompting J.P. Morgan to move. The company needed to be more efficient and jettison some of its New York City real estate. The move to 60 Wall Street allowed J.P. Morgan to consolidate its activities, leaving office space at 20 Pine Street, 150 William Street and 40 Wall Street. Low rent led the company to keep technical support and software development offices at 30 Broad Street. The 23 Wall Street/15 Broad Street complex now houses the human resources and auditing divisions and some technical support services. Data centers are maintained at 60 Wall Street and Newark, Delaware.

Chase Manhattan Corporation

Chase Manhattan declined to answer any questions in relation to this study. Information from their 10K reports to the Securities Exchange Commission and the directory *Office Buildings* do allow some conjecture on the real estate decisions of this bank. The executive office of the company is at 1 Chase Manhattan Plaza, between Pine, Cedar, Nassau and William Streets (See Figure 3.12). The headquarters, built in 1963 with floor plates between 31,000 and 33,000 square feet, is currently being renovated to attract more tenants (Garbarine 1991). The bank recently assumed the lease for 20 Pine Street and renamed it 2

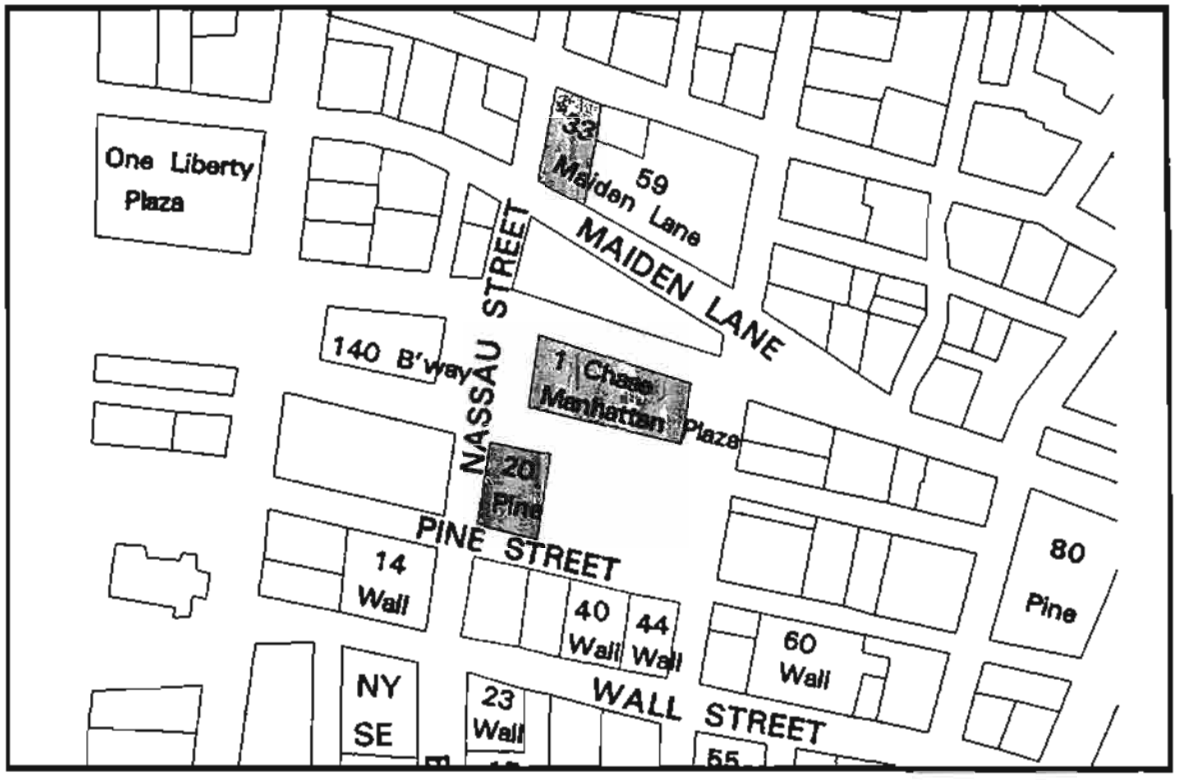

Figure 3.12 Chase Manhattan Downtown Office Locations

Chase Manhattan Plaza. The building was built in 1928 and has small floor plates, but allowed the bank to consolidate personnel from several downtown Manhattan locations. At the same time, Chase Manhattan released its property at 1 New York Plaza, a 1970 construction of massive proportions (40,000-60,000 square foot floor plates), and acquired 13 floors of space at 33 Maiden Lane one block north of Chase Manhattan Plaza. It is a 1984 construction with 20,000-21,000 square foot floor plates. Most recently, Chase Manhattan has constructed a new building in

Brooklyn, called Chase Metro Tech, to house the 1 New York Plaza support functions.

The role of information technology in these moves is neither explicit nor obvious. The Metro Tech project certainly is designed to take advantage of advanced telecommunications and computer technologies, but it is a back office. The acquisition of space at 33 Maiden Lane may be partly to fulfill information technology needs but without information about the activities located there, that assertion cannot be supported. One Chase Manhattan Plaza itself contributed to the movement of the financial activity northward. Together with the Marine Midland Building at 140 Broadway, creates a link between the back side of Wall Street (Pine Street) and the southern end of the World Trade Center complex.

Merrill Lynch

Merrill Lynch achieved great success in the 1980s as a growing diversified financial services provider. It's headquarters were at One Liberty Plaza until 1986 when they moved to their current headquarters at Four World Financial Center. Merrill Lynch occupies two of the four World Financial center buildings, as it houses support staff at Two World Financial Center (See Figure 3.13). The move from One Liberty Plaza to the World Financial Center is more complex than might appear because of the corporate relationship between Merrill Lynch and its landlord, Olympia and York. Olympia and York managed both properties and may

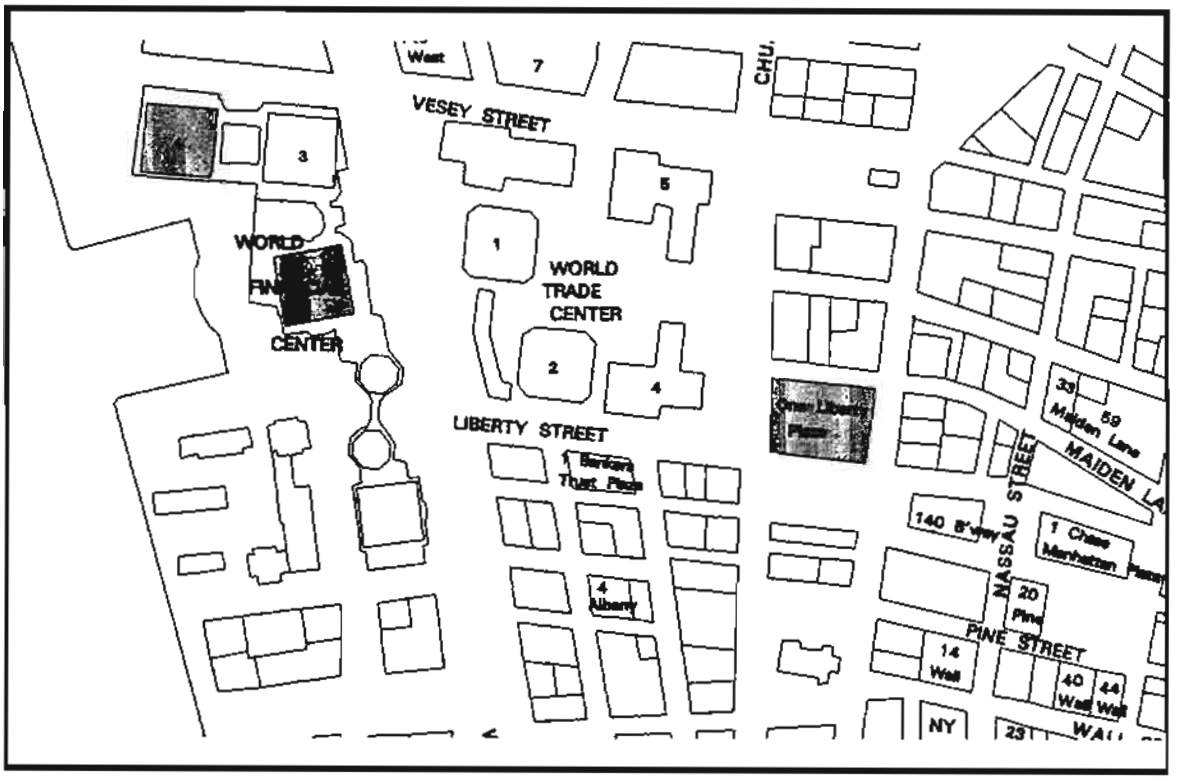

Figure 3.13 Merrill Lynch Downtown Office Locations

have put pressure on Merrill Lynch to move into their new building. Confounding factors aside, the move offered several advantages with respect to information technology.

Like J.P. Morgan's move to 60 Wall Street, Merrill Lynch redesigned the interior of Four World Financial Center. Merrill Lynch created three double height trading floors; added emergency generators with a three-day fuel supply; added rooms of batteries to insure an uninterrupted power supply and strengthened

areas of flooring to 250 psi to withstand the weight of equipment and cabling. One floor was devoted to telecommunications support for the trading areas and a two other floors used to support in-house telecommunications. A nine-pack cable was hardwired from the support floors to each dealer position, one for each market data service and one for a keyboard. Cabling alone accounted for 20% of the cost of the construction budget. Power supply to the building was upgraded to support the equipment on the trading floors, which consume 12 to 20 watts per square foot, plus 2 watts per square foot for lighting. By comparison, an normal office consumes 2 watts per square foot. Additional chillers to cool the trading floors were installed on the roof (Post 1988).

Merrill Lynch moved out of its only Financial West building at the start of 1993. It had occupied nine floors of the 1958 building at Two Broadway. The back office operations were moved across the river to 101 Hudson Street in Jersey City. The building was built in 1992 and is visible across the river from the head offices at the World Financial Center. It is only 3.5 minutes from the World Trade Center by the PATH train and part of a series of new Jersey City office buildings. However, it is still a back office, and likely to remain as such.

Similarly, Merrill Lynch has a data processing center at 570 Washington Street, north of the financial district in an old truck terminal. That Merrill Lynch was able to outfit a truck terminal with enough telecommunications capability to support a data center confirms that the size of a building is more

important than whether it was built as a technologically advanced building. This illustrates the importance of floor size for other companies that choose to keep data centers in the financial district. Merrill Lynch also maintains a data center at the Teleport on Staten Island.

Bankers Trust New York Corporation

Bankers Trust has its headquarters since 1974 at One Bankers Trust Plaza, directly across Liberty street from the World Trade Center. They also occupy seven stories of 14 Wall Street which are used for back office processing. Other offices are uptown at 280 Park Avenue and 1775 Broadway. The only change in occupancy during the 1980s was a move out of 4 Albany Street, directly south of 1 Banker's Trust Plaza. The inference from this behavior is that Banker's Trust could support its technological needs within the shell of One Bankers Trust Plaza.

Major Corporate Decisions

Evidence from real estate data and the case examples seems to show that front office activities, including trading floors, are moving from older buildings into newer ones. Information technology is one of many considerations that contribute to the decision to change location. It is difficult to distinguish the differential effects of prestige, space, location, and institutional relationships on

any specific decision. However, the reasons for moving given by executives interviewed from the banks used as case examples do suggest that the implementation of new information technology is an important factor. Information technology was called "a major influence" in moving to a new site and "right up there" in a list of important factors.

Each of the seven businessmen interviewed emphasized that the choice to move to a new location was an economic one. The benefits of a new location would outweigh the costs of remaining. Significantly, many of the costs of old sites and benefits of new sites are related to information technology.

Three executives mentioned that the act of moving allowed their corporation to consolidate and expand or otherwise restructure different parts of their operations. One part that was universally expanded was the trading operations. Changing facilities allowed firms to both upgrade the technology used in trading operations and to reconfigure their organization. The nature of trading floors is such that they cannot be shut down for a week to renovate. Unless setting up temporary space at great expense is adopted, movement to a new facility is virtually the only way to drastically upgrade trading floor technology.

The responses of those interviewed cited trading floors as a motivation for seeking new facilities. The old trading floors were "too cramped and noisy", and had "wires all over the place", with "terminals stacked on top of desks" and "bad eye contact". Universally respondents agreed that they could not have

provided their traders with the same technological support at their previous location without exorbitant expense.

As much as information technology seems to be an important factor in the movement to new facilities, there are unrelated confounding issues. A firm may be more likely to lease a building if it already has a corporate relationship with the developer, such as is the case with Merrill Lynch and Olympia and York. A firm may want to move out of properties that it does not own or fully occupy for security reasons. The prestige of occupying a new building may be more important than the technology that comes with it. The need for consolidated space may outweigh any other factors. However, information technology cannot be ignored as a factor in spurring relocation, or in the location of new facilities, because even if other factors are the ultimate determinants, requirements of information technology place major limitations on acceptable choices.

Chapter 4

THE CHANGING WORLD CITY GEOGRAPHY

Consequences of Information Technology

While the case examples concentrate on the district-level geographic actions of financial corporations, the data gathered give evidence to the predictions about corporate structure made in the literature about the world city, telecommunications and the information city. Corporate restructuring allowed by moving a headquarters was used to consolidate operations and decentralize any functions that did not need to be in the central business district--precisely the concentration of power predicted by Friedmann and Wolff in 1982.

For example, J.P. Morgan decentralized its global computing center from New York to Delaware. The merger of Manufacturers Hanover and Chemical Bank resulted in all mainframe computing being decentralized. In 1992, Merrill Lynch moved its back offices out of the financial district to Jersey City. The decentralization of back office activities reinforces the importance of the head office and its incorporation of information technology as "a hub of strategic

management, financial control, and communications functions" (Aksoy and Marshall 1992:157).

The review of the historical pattern of building construction reveals an outward spiral of new offices built since 1960. When post-1960 buildings that are too small to accommodate the needs of major financial firms are excluded, the pattern of buildings forms a ring around the traditional Wall Street core.

Data from the real estate market show that buildings that are "modern", or those renovated to compete with modern buildings, universally have lower vacancy rates. Downtown real estate districts with the most new buildings are attracting more tenants, compared with higher vacancy rates in the older Downtown districts.

The case examples establish that the tenants of the newer "smart" buildings include major global financial institutions with large information processing needs. Furthermore, the need for more modern information infrastructure was given as an important impetus for relocation to a newer, "smarter" building.

The Lobby Factor

Additional factors reinforce the locational instability of major businesses. It makes sense that a global financial firm would want to have its

offices in a good-looking, new office building for reasons of prestige, as well as for the needs of changing technology.

Pacelle (1992) describes the situation at 40 Wall Street, one block from the intersection of Wall and Broad streets, which he calls "the center of the financial world". Built in 1929, the building is now 80% vacant. Occupants of the building complain of the lack of security, erratic elevators and general lack of upkeep. Other old buildings are made less attractive by asbestos and awkward floor layouts (Garbarine 1992).

The coveted Class A office space label depends on many subjective factors (Ossorio 1993). Technology is considered, but a clean lobby with the prerequisite shiny marble and brass and a concierge desk goes a long way towards a Class A rating. Simply because of aging, newer buildings will have cleaner, smarter lobbies and thereby offer greater appeal to any business concerned with its image. To this end, owners renovate lobbies and other cosmetic features to attract tenants.

Chase Manhattan is currently renovating One Chase Manhattan Plaza, concentrating on its lobby, the exterior, elevators, removing asbestos, and upgrading heating and cooling systems (Garbarine 1991). A facilities director for Chase Manhattan said,

> We wanted to keep our building in a class A category, and in order to do that we realized that we had look at the lobby and renovate it, not only for our tenants, but for us. There is no question that

> having a lobby that is current and attractive is an enhancement to the tenants that are there as well as any prospective tenants (Ravo 1992).

While an attractive lobby and other cosmetic aspects of a newer building may make it more attractive, renovating a lobby will not necessarily help an old building to attract new tenants or retain old ones. According to a senior vice president at Tishman construction, the firm that installed Merrill Lynch's trading floors, "Renovated exteriors and lobbies get prospective tenants in the door, but today's sophisticated users are delving below the surface for the technology their businesses increasingly require" (Ravo 1992). Pacelle is dubious about the fate of older buildings because "their ceiling heights, antiquated electrical and cooling systems, and relatively small floor sizes make them unsuitable for the technology-intensive operations of today's financial services firms" (Pacelle 1992). Other authors echo this sentiment (Garbarine 1992; Pinder 1993). Because the older building cannot attract tenants by providing the same cosmetic amenities as a new building, it is logical that the infrastructure, not the lobby, makes newer buildings more attractive.

All is not lost for the old building, but the exception proves the rule of obsolescence. An example of old architecture incorporating new technology is given in a feature article on the buildings at 140 West Street, 60 Hudson Street, and 32 Avenue of the Americas (Dunlap 1991). All of the structures were designed in the Art Deco style by Voorhees, Gmelin, and Walker in the 1920s.

The building at 60 Hudson was built for Western Union Telegraph as a communications center. The 140 West Street building was designed as the headquarters for New York Telephone and the Avenue of the Americas building was built for AT&T. All three buildings are still used in their roles as telecommunication centers.

It is the atypical design of these "communications landmarks" that allows their continued use. When originally constructed, they had large floor plates--60 Hudson has floors of up to 57,000 square feet and 140 West up to 49,000 square feet (*Office Buildings* 1992). They were designed with cabling in mind, and therefore have more than adequate interfloor riser space and building entry points. The size of switching equipment that the buildings were designed for was five times larger than analogous modern equipment, leaving space for expansion today. Given the size and design, investing in more superficial aspects of these buildings has allowed them to remain as fully occupied class A buildings and protecting their occupants from the sort of recent moves that were necessary in the financial industry.

Why the Doughnut has a Hole

If newer buildings are so much more attractive and older ones are becoming obsolete, one could ask why old buildings are not torn down in the core and replaced by smart buildings. At least three factors discourage this condition.

First is a simple matter of space. The plot sizes near the intersection of Wall Street and Broadway do not allow for large floor plates and it would be difficult to acquire adjacent plots to merge. Second, many older buildings have not yet been fully amortized. They must still be used until their investment costs have been recouped. Finally, some buildings must be preserved for their historic significance.

The combination of historic significance and unrealized investment costs leaves many older buildings as white elephants in the core of the Wall Street district. As Pacelle (1992) reports in his article, "Skyline Turning Hollow Near Wall Street", 40 Wall Street is 80% vacant, 44 Wall Street is 50% vacant, 45 Wall Street is 90% vacant and 60 Broad Street has over 1 million square feet vacant.

J.P. Morgan faced the problem of the obsolescence of a historic building. The 23 Wall/15 Broad Street complex had been a landmark on Wall Street since 1904, and is intimately associated with corporate image. Morgan decided to move its headquarters and trading floors to 60 Wall Street but kept some of its less information intensive back office operations at the 23 Wall/15 Broad complex. The result is that one of Wall Street's most prestigious properties, directly across Broad Street from the New York Stock Exchange, is a back office.

Old buildings in the core are not left entirely empty as the term "doughnut" would imply. While there are examples of buildings with very high vacancy rates, other buildings in the core are being used for secondary office

space, for other purposes that one would expect to fill in behind a moving central business district. Further research would be required to elaborate on the changing uses of office buildings that are obsolete for use in the cutting edge of business.

The Wall Street Paradox

J.P. Morgan's back office may be indicative of a decreased psychological importance of the center in general. The development of a circle of buildings surrounding a central district is quite unlike the movement of districts traditionally seen in American cities, and it has different implications. For example, during the era of the late 19th-early 20th century when department stores formed the focus of downtown districts, the core moved linearly. By contrast, the changing geography of New York's financial district is one of outward dispersion. While the World Trade and World Financial Centers form a mini-financial district, they are quite separate and quite distant from other financial activities on Water Street and the outer eastern end of Wall Street. The clustering that is characteristic of a specialized district is not being maintained. The original clustering of the financial core was prompted by the need for proximity to exchange information and make paper transfers, producing a mystique of psychological propinquity that outlasted its physical need. This clustering is no longer maintained. If corporations realize that two locations that are considered to be in the same district may actually be as far apart as One New York Plaza and One World Financial

Center, the remaining mystique of the district as a cohesive unit may be dispelled. The creates a paradox: businesses which are prompted to move by technology which could release it entirely from a focus on Downtown nevertheless choose to remain on its periphery. Yet, the very move to a periphery stands to weaken the Downtown as a psychologically cohesive geographical district.

Terrorists versus Power Lunches

The centripetal forces of the central financial district are susceptible to erosion by other concerns, particularly security. With the 1993 terrorist bombing of the World Trade Center, occupants of the Downtown district must realize their vulnerability to attack. The response is that of increased security, further creating what Friedmann and Wolff (1982) called "the citadel". New buildings are protected by surveillance cameras and private security guards. Enclosed private space connects the World Trade and World Financial Centers, and no one without an appointment gets by the front desk in any major headquarters or office building--even then only with a temporary security clearance.

The cost of security must take its toll. An article in *The Economist*, prompted by the 1993 IRA bombing of London's financial district, comments that London's traditional advantages as a financial center--"light regulation, lots of established firms, liquidity"--are diminishing as other centers develop. Furthermore,

> In the future, the main reason for financial firms to band together may be that lunching brings them vital insights. But if the conviviality of eateries will loom larger in deciding where to locate, the admittedly tiny risk of getting blown up will count for something, too. (*The Economist* 1993)

The question still remains whether the appeal of power-lunching and face-to-face dealmaking will prevail over the threat of terrorist attack.

More Doughnuts?

While the case of New York City gives ample evidence to suggest a reformulated internal geography, questions remain about the geographic universality and predictive strength of the model presented. Will all world cities be affected like New York, forming new rings of buildings on the periphery of their financial districts in response to building obsolescence in the old core? Given rapid innovation, how long will the current information technology be relevant as a force for geographic location?

Identifying the Global and Local

It is unlikely that other cities will develop the same patterns of office construction and use as those seen in New York. The location of the Financial District on the tip of an island places unique constraints on patterns of development. However, the importance of information technology to office location in New York's development is generalizable to other cities that

accommodate global financial activity. Studies of London and Tokyo (the other two cities articulating the global economy in Friedmann's (1993) schema), should reveal a relocation of office activity as a result of technological needs. Indeed the creation of London's Docklands may signal such a move.

As cities compete to be articulators of global and regional financial activities, their geographies will be affected by the effort to accommodate more information technology. Some authors suggest that the implementation of information technologies can be used to stimulate economic development (Moss 1985; 1991; Rushton 1985). Singapore's investment in information technology has firmed its position as a center of multinational economic articulation and created an infrastructure of smart buildings.

While the geographic patterns created by the forces of information technology may differ from place to place, they are expressions of global forces. The global force is the need to be technologically connected to global financial markets. Despite the differing and interesting local historiographies of world cities, their patterns of office location will shown the expression of this global phenomenon mediated by local conditions.

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