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INFORMATION AND COMMUNICATIONS TECHNOLOGY FOR REAL ESTATE INVESTMENT MANAGEMENT

by

Henrikus J.J. Huijbregts

Bachelor of Science in Construction Management. University of Professional Education. Tilburg. 1994
Master of Science in Project Management and Real Estate Development. Delft University of Technology. 1997

Submitted in partial fulfillment
of the requirements for the degree of

Doctor of Design

at the Harvard Design School

June 2002

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ABSTRACT

Since the mid-1990s, information technology and Internet solutions have risen to address the inefficiencies in the real estate process—the process of the planning, design, construction, and operations—and consequently have also had an impact on one of real estate's subindustries, real estate investment management. Real estate investment management is the physical and financial management of real estate properties for investment purposes. This dissertation answers the question: how does information and communications technology impact the processes of real estate investment management, what is the value added to the real estate industry, and how should its participants prepare for the future industry ahead?

A comprehensive survey of real estate investment management firms and case studies of industry leaders was conducted to study the impact of technology on their process inefficiencies. The research found that the "value added" of information and communications technology included increases in productivity—largely that of the information intensive stages of portfolio management as one of the investment management subareas. This "added value" is channeled toward the development of additional products and services. Technology has changed information exchange between property managers, investment managers, and clients to an automated effort, freeing time for additional research, more interaction with the investment client, and more assets under management.

With the ongoing evolution of information and communications technologies, resulting in the ongoing integration of the different subareas of investment management (research, acquisitions and dispositions, and portfolio management), clients, and the many surrounding service providers (property managers and brokers), the real estate investment manager will continue to expand its offerings in order to increase competitive advantage. Shifts in time allocation and budgetary spending will allow for this reorganization of real estate investment management to occur.

June 2002

Thesis Committee: Professor Spiro N. Pollalis, Chair
Professor Richard B. Peiser
Professor Jeffrey Huang

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I would also extend my appreciation to Lynne Meyer-Gay for her never ending support and assistance, her gentle prodding in balancing work and research, and her remarkable editing talents.

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Most importantly I would like to thank those special people that made this opportunity a reality...my family. Thank you Mom and Dad, for walking this road with me, even when it seemed the twists and turns would have made others run for shelter. My warmest thank you goes to my wife Nada Aoudeh. Without her continuous support, love, and indulgence, this research would have never been completed—and I would have undoubtedly lost sight of the more important things in life.

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Chapter 1: INTRODUCTION

The *real estate industry* is the collective term for all subindustries, processes, and activities that deal with the creation and utilization of the built environment. The real estate industry encompasses the planning (including land acquisition), design, construction, and operations (including maintenance) of real estate. Within this industry, we identify the financial subindustry of real estate investment management, which carries out its functions mostly in the operations stage. Real estate investment management is the process of the operational and financial management of investment assets. Investment management is the process of guiding the acquisition, use, and disposal of assets to make the most of their service delivery potential and managing the related risks and costs over their entire life.[1] Approximately 90 real estate investment management firms currently conduct business in the United States, of which only 69 manage portfolios of $100 million or more.[2]

Like the earlier stages in the real estate process (from planning, through design to construction), we see numerous success stories within other industries (e.g., banking, airline ticketing, and financial services) that have turned information and communication technology (ICT) into a crucial asset to the firms' competitive advantage. Through a staged transitional process, we find the examples to successfully migrate their business models into more efficient, cost effective, and competitive companies. In the building industry, CAD and 3-dimensional graphic building representations, Geographic Information Systems (GIS), and technology-enhanced methods of communication and

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[1] Financial Management Division, Department of Treasury and Finance, Australia. Available on Internet: http://www.fmd.au, accessed July 2000.

[2] Centerprise.org, accessed January 2002.

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information exchange have already penetrated the information-intense and fragmented design and construction industry.

This dissertation focuses on the potential of information and communication technologies for real estate investment managers in the United States—an industry with more than U.S.$240 billion in real estate assets under management. In particular, this research studies the impact of technology on the communicative subprocesses of real estate investment management that includes research (including feasibility studies), acquisitions and dispositions, property management, and portfolio and asset management (for the recording and reporting of financial data). The first signs of change in the industry are studied and evaluated, in line with examples from other industries' success stories and from innovative examples from within the industry itself.

Chapter 2 provides a literature review, focusing on process, process inefficiencies, and opportunities of real estate investment management and the potential of information and communication technology as seen both in theory and in the study of other industries. At the same time, it will "paint the landscape" of today's real estate technology, focusing on trends and innovations. This review sets the stage for the concluding research question.

Chapter 3 explains the research methodology used to answer the research question. Three methods are used. First, a 20-company telephone survey of executive level professionals with leading U.S. real estate investment firms is conducted to obtain specifics on the industry, the current status of technology in the industry, and expectations of technology's future role. In-depth interviews with 20 more industry professionals within five investment management firms complement the telephone survey and provide additional qualitative and quantitative evidence for trends, assumptions and

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anticipations (Chapter 4). Case studies of two of the nation's largest investment managers were used to test and verify the findings of the survey and interviews and to provide in-depth information and analysis (Chapter 5).

Chapter 6 discusses the findings, focusing on the anticipated and perceived impact of information and communications technology on the main sub functions of real estate investment management: research, acquisitions and dispositions, property management, and in particular, portfolio and asset management. Just as real estate investment management is considered a conduit function between investment owners and investment properties, communication and information exchange is considered a pivotal activity and core process of the industry. This communication and information exchange is mainly the responsibility of portfolio and asset managers. All other functions are considered to facilitate this industry's core process. The impact of the technology is found in money and time allocations, quality and quantity of input and performance, standardization and legislative features, as well as client satisfaction. Chapter 7 reiterates the contributions made and provides suggestions for further study.

This dissertation makes significant contributions to the real estate investment industry by: (a) providing a landscape and overview of the current implementation of real estate technology, (b) providing an understanding of the capabilities of technology on the four main processes of real estate investment management, (c) providing a framework for understanding the pace of change, and (d) providing a framework to understand future developments of technology impacting the process of real estate investment management.

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Chapter 2: LITERATURE REVIEW

2.1 Introduction

This chapter introduces the focus of this dissertation: the factors of information and communications technology that impact the process of real estate investment management.

First, it outlines the research setting, that is, the real estate industry, its subprocesses, and, in particular, the position and characteristics of *real estate investment management* within the industry. Second, it provides a description of the unique landscape of *information and communications technology*, its impact factors, and a variety of success stories that can be used later as reference points. Third, this chapter introduces the concept of *real estate technology* and how information and communications technology (ICT) has an impact on the real estate industry and in particular on real estate investment management. Literature and introductory interviews with real estate professionals are consulted to provide the research framework, and out of this, the resulting research question and sub questions are discussed.

2.2 The Real Estate Industry

Among others, Crowston (2001) and Hamberg and Smit (1993) provide bodies of literature defining the real estate industry, its characteristics, and inefficiencies. Connor (2001) and DeMay (1998), as well as other resources from branch organizations and conversations with industry professionals, explain the industry of real estate investment management, its processes and inefficiencies. The industry challenges and opportunities

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are presented that call for innovative solutions—solutions that possibly can be found in the implementation of information and communications technology.

2.2.1 Introduction

The *real estate industry* is the collective term for all subindustries, processes, and activities that deal with the creation and utilization of the built environment. Bartuska and Young (1994) define the built environment as "the totality of all that humans have changed or rearranged within the natural environment." Academia and industry leaders commonly use the term "building industry," meaning the planning, land acquisition, design, and construction of real estate, and the term "real estate industry," meaning the utilization of real estate, to denote separate industries. In this study, however, the building industry is the first stage (until the delivery of the construction project) and merely a subset of the overall and all-encompassing real estate industry (Cacace, 2000).

Consequently, the real estate process encompasses all activities of planning, acquisition, design, construction, operations, and maintenance of real estate properties and the related and intertwined business activities, such as financing, marketing, and services (consulting, research, brokerage/leasing, and so forth) (Menheere, 1993).

Real estate investment management is the physical and financial management of real estate properties for investment purposes, combining and controlling a large variety of the different phases and activities of the overall real estate industry. Real estate investment management is also often referred to as "third-party investment advisory." This dissertation focuses on third-party investment managers that provide investment services (also referred to as "third-party investment advisors") to institutional investors. Approximately 90 third-party investment management firms currently conduct business

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in the United States, of which only 69 manage portfolios of U.S.$10 million or greater.[3] Section 2.2.4 will deal in detail with the definition and setting of real estate investment management.

2.2.2 Real Estate Quality—The Ultimate Achievement

The definition of quality[4] for real estate depends largely on whose perspective is being queried. From a corporate real estate owner's point of view, quality is defined as either the most efficient use of the real estate property for core operations, or the maximization of return on investment during the time of ownership (for investment owners). Equilibrium will be sought between income on the one hand, and expenditures on the other (Brueggeman and Fisher, 1997; Pollalis *et al.*, 1996).

Pollalis *et al.* (1996) show in a research study on the Build Operate Transfer method that the amount of revenue that can be generated in the operations stage is determined more by the market than by the physical quality of the product. This is exemplified in one case study of a public infrastructure project that consisted of construction of a toll road near a public road that charged no tolls. Market analysis failed to show the effect of the existing public road, resulting directly in lower-than–expected revenues on the new toll road, as the users were now presented with a choice to pay or not to pay for using the infrastructure.

The distribution of time expenditures and financial costs throughout the real estate life cycle depends on a variety of factors. A real estate property's typology (infrastructure, industrial, commercial, retail, residential, or telecommunications),

[3] Ibid.

[4] Quality is defined generally as a measure of excellence (*Webster's Tenth Collegiate Dictionary*). Excellence is subjective and can only be established by the definer.

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program, location, and so forth determine the money and time spent on the various process stages (Menheere, 1992).

The time expended in the planning stage ranges from 7% to 12% of the total real estate life cycle. This includes the activities of initiating renewal or disposing of existing properties. Approximately 10% of the life span of a piece of real estate is spent on design and construction. The division of total life-cycle cost takes similar shape: 5% to 35% for planning, 5% to 10% for design and construction combined, and 60% to 85% for operations (Hagan, 1998).

In addition to *time* and *money*, Twijnstra Gudde (1997) recognizes *organization*, *information*, and *quality* as important management control factors. Equilibrium among these factors allows for the required quality achievements that result in client satisfaction. For this dissertation, these management control factors are renamed and regrouped as: *cost expenditures*, *time allocation*, *communication and information exchange*, *value chain and organizational setting*, *quality and quantity*, *legal boundaries*, and the resulting *client satisfaction*—hereafter referred to as research factors. The impact of the implementation of redesigned processes and innovative technologies on any of these factors has to be fully understood in order to project the changes in work activities, organization, and value chain.

2.2.3 Industry Inefficiencies—The Challenge for Technology Innovation

Size, complexity, and fragmentation are the core causes of the inefficiencies occurring in the real estate life-cycle process.[5] The real estate industry deals with unique

[5] Corporate research for Edificium, Inc. and other U.S.-based extranet providers, 2000.

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project types and processes that vary from project to project. The speed and size of the global economy, competition, and international growth of industry competitors trap industry participants in process inefficiencies. While these factors force them to cling to what they know, at the same time, slim margins pressure industry participants to improve their business processes and models.[6] Change is costly and time consuming, however.

Inefficiency cost—also called process cost—is a tremendous and recognized burden on the total cost of the real estate life-cycle process, yet it is often ignored or disregarded (Hamberg and Smit, 1993). Inefficiency cost can be subdivided into three categories: (1) communication cost, (2) quality cost, and (3) agency cost. Communication cost is the cost related to the interaction between the various project participants. The inefficiencies lie in the unnecessary expenses of communication when alternative methods are available.

Van Nelle (1989) subdivides quality cost into three categories: (1) failure cost, (2) prevention cost, and (3) evaluation cost. Failure cost means expenditures made to rectify inefficiencies caused earlier in the process. Prevention cost means expenditures made to prevent failure from occurring. Evaluation cost means expenditures made to study and learn from mistakes. Huang (1997) identifies agency cost, meaning the expenditures made because of the differences in cultures, goals, work ethics, and principles of the different process participants. These costs are more likely to occur indirectly and are difficult to quantify. Figure 2.1 provides a graphic breakdown of the inefficiency costs for the real estate industry.

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[6] Interviews and discussions with Viktor Mirovic, of Indofin Ventures, and Prof. Ir. Frits Seijffert, of Delft University of Technology and Edificium, Inc., February and March 2001.

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Breakdown of Real Estate Inefficiency Cost

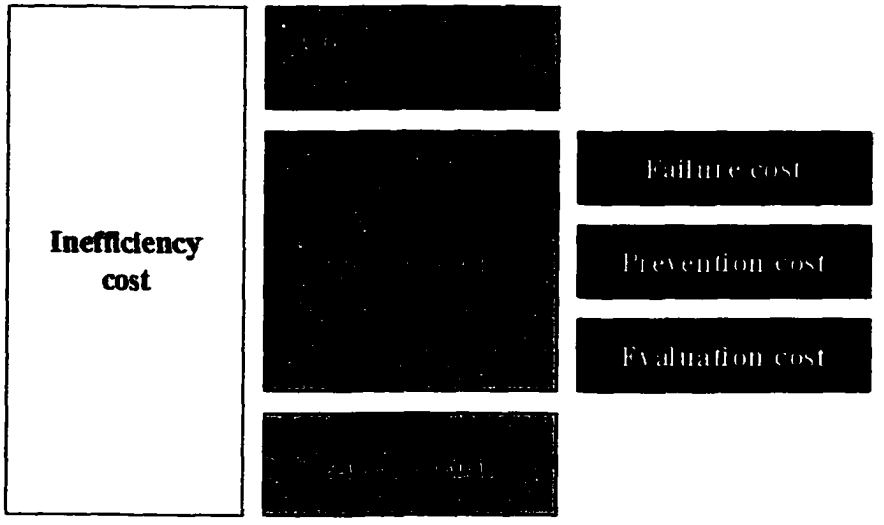

Figure 2.1: Breakdown of Real Estate Inefficiency Cost (after Van Nelle, 1989 and Huang, 1997)

Like other industries experiencing the pressures brought on by rapid change and growth in technologies and economies, the real estate industry is being forced to better understand its characteristics and problems that prevent traditionally practiced processes from improving efficiency and effectiveness. There is a need for innovative tools and process reengineering to better deal with inefficiencies and to facilitate the industry's growth in this new century.

Real estate is an information-intensive industry, emphasizing the role of information and underlying computing and communications technologies (Baen and Guttery, 1997; Tucillo, 1997). For most real estate firms and market intermediaries, their intermediary position in the transactions is therefore mostly at risk of being made redundant, as new technology replaces human interactions. If such new technologies appear that can supply this information more cheaply or conveniently, then agents and information intermediaries may be replaced (Crowston *et al.*, 2001).

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2.2.4 Real Estate Investment Management

Real estate investment management is the process of the operational and financial management of investment assets (Dept. Treasure and Finance, 2000). Asset management is the process of guiding the acquisition, use, and disposal of assets to make the most of their service delivery potential and to manage the related risks and costs over their entire life. The term "asset" in this study refers to tangible, non-current assets: real estate properties[7]. Figure 2.2 presents the setting of the real estate investment manager. It shows the relationship between internal (research, acquisition, portfolio and asset manager) and external participants (property manager, service providers, and investment client).

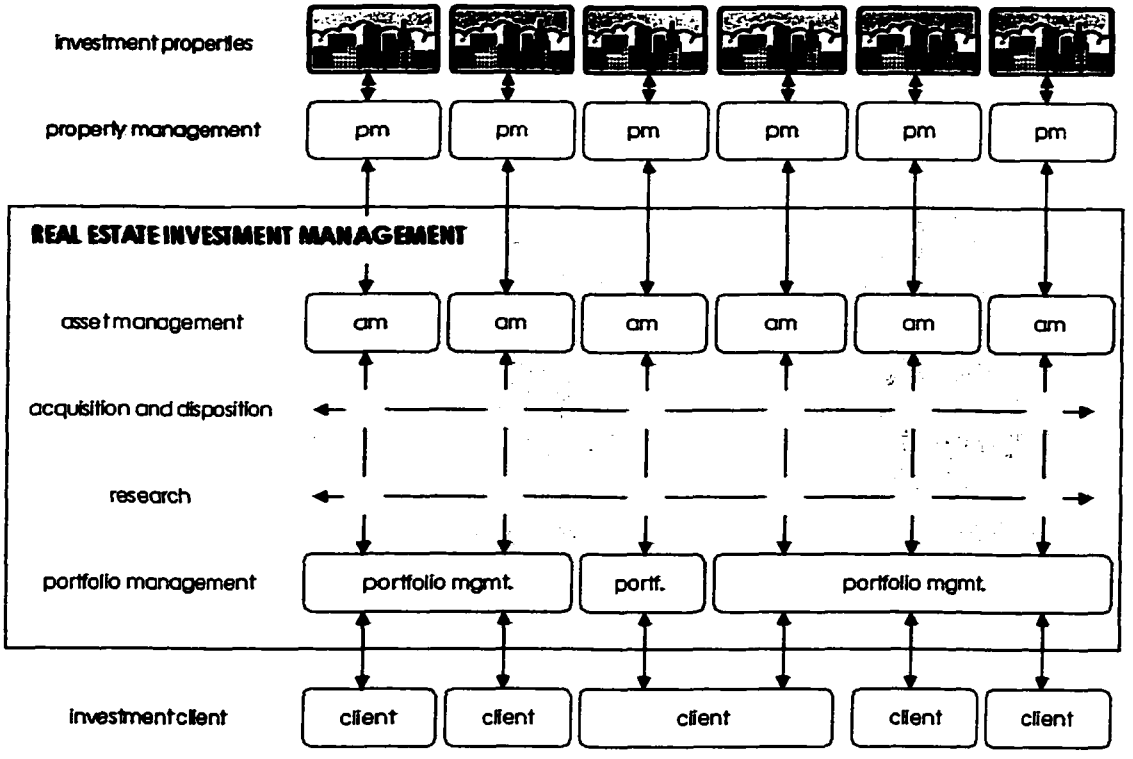

Figure 2.2: Typical Representation of the Industry Setting of Real Estate Investment Management

[7] Financial Management Division, Department of Treasury and Finance, Australia. Available on Internet: http://www.fmd.au, accessed July 2000.

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The process of real estate investment management can be subdivided into four major subprocesses: (1) research or feasibility studies, (2) acquisition and disposals, (3), property management or management in use, and (4) portfolio management or recording and reporting services. The process of real estate investment management commences with the understanding of the clients' needs.

Investment clients of the real estate investment manager are institutional investors, pension plans, health plans, and endowments.[8] Depending on the investor's sophistication, at an early stage, decisions will be made on the investment type and diversification of the portfolio. In addition to determining the minimum required investment return, the investment manager has to decide globally what type of investment needs to be made. Oftentimes, these decisions are made using the most intangible knowledge: experience (after Boulton *et al.*, 2000).

Armed with knowledge of investment areas, the real estate investment manager will conduct a variety of *feasibility studies* (also termed *research and due diligence*) that examine alternative investments and match those with the investment criteria. Feasibility studies include extensive market analysis with great emphasis on the success of any investment. Data sources (both internally prepared and those provided by third parties) provide the resources for analysis of market, investment types, property status, and environmental and legal issues.

An *economic appraisal* determines the maximum amount that can be invested to still guarantee the requested return on the investment. For this, the equilibrium between

[8] After reviewed corporate Web sites of all U.S. real estate investment management firms.

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income (from both operations and eventual sale) and expenses (from both acquisition/development and operations) is examined.

When a consensus is reached on the feasibility of a specific investment, a letter of intent is signed between purchaser and seller (in the case of an acquisition) or design development is commenced (in the case of a new development). A first security deposit often is made to guarantee the transaction. Only after all closing documents are mutually approved and all details of the investment property are disclosed will the parties move to close the transaction. Traditionally, the due diligence process until closing took months with the intensive assistance of buying and selling parties, as well as a range of consultants on legal, environmental, structural, and economic issues. However, due to the increased speed of the markets—driven by the markets in REITs (Real Estate Investment Trusts)[9] and CMBSs (Commercial Mortgage-Backed Securities),[10] closings now take place in weeks, while elements of research remained unchanged (DeMay, 1998). Both *acquisition and disposal* processes follow the many steps of feasibility studies, appraisals, and closing schedules.

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[9] A Real Estate Investment Trust (REIT) is a company that buys, develops, manages, and sells real estate assets. REITs allow participants to invest in a professionally managed portfolio of real estate properties. REITs qualify as pass-through entities, companies that distribute the majority of income cash flows to investors without taxation at the corporate level. As pass-through entities, whose main function is to pass profits on to investors, a REIT's business activity is generally restricted to generation of property rental income. Another advantage of REIT investment is its liquidity (ease of conversion of assets into cash), as compared to traditional private real estate ownership. One reason for the liquid nature of REIT investments is that its shares are primarily traded on major exchanges, making it easier to buy and sell REIT assets/shares than to buy and sell properties in private markets. Source: REIT 101, on Internet: http://www.reitnet.com/, accessed in November 2000.

[10] Commercial Mortgage-Backed Securities (CMBS). Mortgage securities (MBS) represent an ownership interest in mortgage loans, made by financial institutions (savings and loans, commercial banks, or mortgage companies) to finance the borrower's purchase of a home or other real estate. Mortgage securities are created when these loans are packaged or "pooled" by issuers or services for sale to investors. As the underlying mortgage loans are paid off by home or commercial real estate owners (MBS and CMBS, respectively), the investors receive payments of interest and principal. Large institutions typically make primary investments in mortgage securities when the securities are issued. Brokers in the secondary market may ultimately redistribute these securities. Source: Bond Market Association, *An Investor's Guide to Mortgage Securities* (New York, N.Y.: The Bond Market Association Publications, 1999).

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After acquisition of a property, the real estate investment manager remains responsible for the investment and eventual decision of disposal. Tasks such as marketing, leasing, maintenance, and *operational management* (also referred to as *property management*) are often outsourced to brokers and facility managers. Maintenance and occupation of the property are crucial to the anticipated returns. On behalf of the investment owner, the real estate investment manager sees to it that the property is managed and frequently reports back to the investment owner.

A recording and reporting process (*portfolio management*) is often in place: individual property managers provide information that is interpreted by asset managers. Data from various properties and reports, summaries, and essentials are consolidated by portfolio managers and reported to investment owners, who oftentimes are only interested in trends regarding their individual properties and the overall return on their investments. In addition to property-specific information (financials regarding income and expenses), asset managers constantly monitor the anticipated maintenance and property improvements as well as market indicators to optimally predict future of the facility in light of the required yields. Appendix A illustrates a comprehensive overview of the process of real estate investment management, including its subprocesses and subactivities, as currently practiced by the various U.S. investment management firms.

2.2.5 The Products of Real Estate Investment Management

Full-service real estate investment managers manage three different types of asset groupings: (1) direct investments, (2) high-return private equity investments, and (3)

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securities,[11] such as REITs and CMBSs.[12] The terms "core," "value added," and "opportunistic" are often used by the investment community to indicate different levels of risk and return. At one extreme, core investments are investments of lowest risk with lowest returns, while at the other extreme, opportunistic investments are both high risk and high return (Figure 2.3). Value-added investments are investments that harmonize moderate risk with moderate returns.

Real Estate Investment Categories

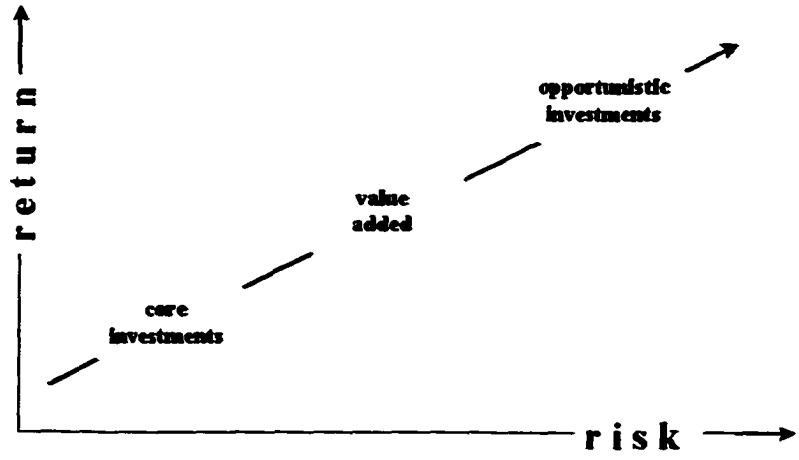

Figure 2.3: Three Investment Categories: Levels of Risk and Return

In *direct investments*, real estate investment clients invest directly in a property. The property is operated and maintained on their behalf, and the profits directly benefit them. *High-return private equity investments* involve a portfolio of selected real estate properties in which a group of investors and real estate owners invest. Instead of owning

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[11] Securitizing real estate means that mortgages in "pools" serve as assets that, in turn, are guaranteed for the sale of securities to investors. Source: William B. Breuggeman and Jeffrey D. Fisher, *Real Estate Finance and Investments*, 10th ed. (Burr Ridge, Ill.: McGraw-Hill, 1997). Mortgage-backed securities are sold to individual and institutional investors that desire to hold investments in real estate-backed assets, but do not wish to undertake the substantial management and administrative work associated with owning individual mortgages.

[12] Interview with Douglas Poutasse of AEW Capital Management LP, Boston, Mass., USA. Information also available on Internet: http://www.aew.com, accessed November 2000.

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the total share of one property, a limited number of shares in a larger grouping of real estate assets are owned by members of the investors group. Finally, in *securities investments* (capital management only), real estate capital is invested in securitized real estate portfolios. Examples are real estate investment trusts (REITs) and commercial mortgage-backed securities (CMBSs). More than 60% of investments are made in direct investments while 16% are invested in securities such as REITs and CMBS (McMahan, 1999). Figure 2.4 presents a graphic representation of the three types of investment instruments.

Real Estate Investment Instruments

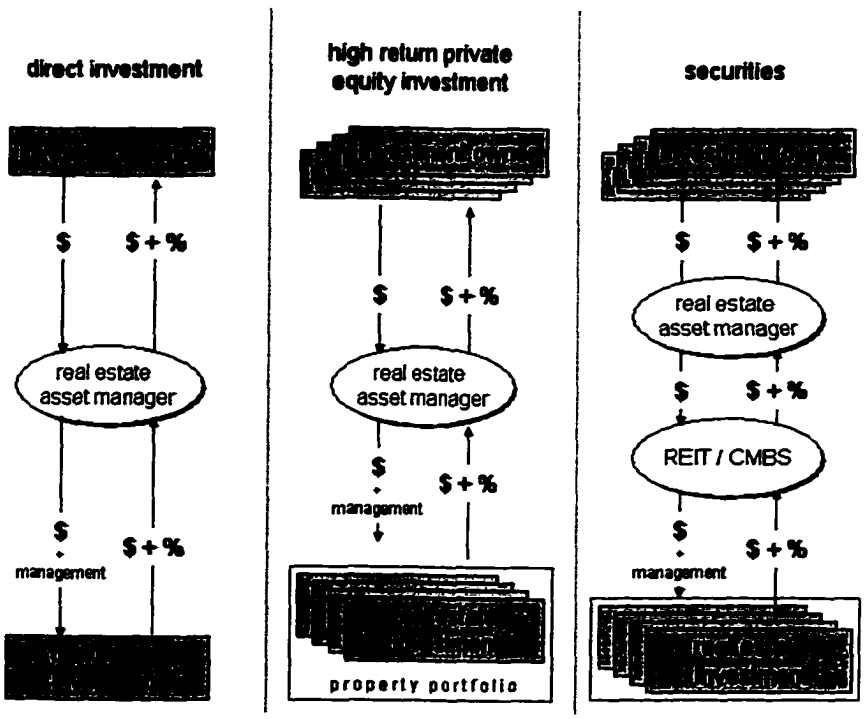

Figure 2.4: Investment Instruments: Direct Investments versus High-Return Private Equity Investments versus Securities Investments

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2.2.6 Forces and Signs of Change in the "Landscape" of Investment Management

Growth, integration, and deregulation of world financial markets, as well as changes in international politics and economic policies have resulted in increased global investment opportunities. For stocks and bonds—and at increasing levels, also for real estate investments, there is considerable evidence over 30 years that investing internationally offers diversification benefits, such as reduced portfolio risk and enhanced portfolio performance (Newel *et al.*, 1995).

Consequently, one expects the investment management community to react. Consolidation of advisory firms into more diversified entities and the creation of focused real estate operating companies offer two possible models for the future (Conner, 2001) (e.g., the acquisitions of: RREEF by the Deutsche Bank, Clarion by ING Real Estate, AEW by the French CDC, and Henderson Global Investors by the Australian AMP).

The resulting firms offer investors a broad array of investment products and strategies through national and global networks. The trend towards specialization is proven by the numerous proposals involving the restructuring of investment management firms into REOCs (real estate operating companies) and REITs (e.g., AMB and the Canadian Trizec Hahn). "The investment manager in the future is going to have to have something unique to offer. The REITs and real estate operating companies are such good vehicles for so many sponsors that there's going to have to be some twist in the story coming from managers. Otherwise, there just isn't enough capital, even with as much as there is flowing into real estate now, to keep them all in business," says John Imboden, director of real estate assets for the Ohio State Teachers' Retirement System (Conner, 2001).

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"Going forward, consolidation in the investment management field is inevitable and gradually, institutional investors will be left with four investment choices: (1) REITs, (2) opportunity funds, (3) niche or boutique shops, and (4) large investment managers offering a broad array of real estate products," says B. Abrams, portfolio manager at E.I. DuPont De Nemours & Co. (Conner, 2001).

Ultimately, the fundamental changes taking place in the industry should make the investment process more efficient and provide an opportunity for greater alignment of interests. Whether through consolidation, specialization or otherwise, investment managers must adapt to this changing environment to survive (Conner, 2001). The question then arises: what opportunities are available to the investment managers that can facilitate and accelerate such adaptation processes?

2.3 Information and Communications Technology

Thorp (1999), Sohal (2001) and others address the impact that ICT may have on traditional business processes and how organizations are likely to respond. Walker and Gerritsen (2000), Linderholm (2001), Huang (1997) and others provide valuable industry examples on how ICT facilitates the redefinition of an established industry. In specific, a detailed analysis by Wilhelm (2002) describes the effects of technology on the intermediary functions within the money market industries. Lessons can be learned and adapted to the developments of the real estate investment management subindustry. This section provides the tools to understand the opportunities and impact, which ICT may present.

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2.3.1 Introduction

Information and communications technology (ICT) provides the solutions to the transmission, storage, transformation, switching, and networking of digital information. Solutions can be (a) networking technologies, (b) computer system technologies, (c) broadband and wireless technologies, and (d) speech, image, and multimedia technologies. Daniels (1994) defines ICT as "the application of technology to business processes to gather data and create information that is valuable to managers." Despite the inconsistency in categorical definition of ICT, a growing consensus from academia argues that ICT should be defined broadly to encompass hardware, software, telecommunications (including voice, facsimile, and email), as well as the personnel and resources assigned to supporting such technologies (Sohal *et al.*, 2001).

With regard to information flow and management, ICT has already proven to lead to: (1) faster information exchange, (2) frequent information exchange, (3) enhanced information content, and (4) improved but simplified information flow (Vries, 1996). Consequently, ICT has been used to reduce cost by automating existing tasks and activities. However, as it has become more of a permanent fixture in organizations, there has been a shift in focus towards managing ICT in a way that assists organizations in achieving a competitive advantage. Now, the Internet and its technologies that combine several solutions in the ICT spectrum are beginning to have an impact on the real estate industry and its processes (MacKie-Mason, 1995).

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2.3.2 The Internet

The early versions of the Internet were developed in the 1960s and 1970s.[13] The user population has grown from about 13 million in 1994 to more than 300 million around the world by summer 2000 (Cerf, 2000). About half of Internet activity takes place in North America. However, ongoing research shows the acceleration of adaptation to the Internet in Europe and Asia.[14] Rapidly, the new technology is proving its beneficial impact on business processes, products, and services worldwide. Business-to-business transactions over the Internet (e-commerce) are projected to increase from U.S.$200 billion in 2000 to U.S.$1 trillion in 2003 (Walker and Gerritsen, 2000). By 2000, the technology sector had become the largest sector of U.S. gross domestic product, larger than housing, automobiles, or food. By 2006, technology is expected to employ 50% of all U.S. workers (McMahan, 2001).

Parallel to the rapid evolution of the Internet, the financial markets have responded correspondingly. In 1999 alone (up to April 2000), more than $45.7 billion in venture capital was raised for equity positions in Internet startups in the United States. During that year, 273 initial public offerings (IPOs) took place, 202 of which were technology companies (IPO Monitor, 2000).

2.3.3 Impact on Value Chain

ICT is often referred to as "transformational technology" (Crowston *et al.*, 2001), a technology that is capable of transferring or creating entire industries. Hammer (1990)

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[13] R. Zakon, "Hobbes' Internet Timeline v5.2," (2000). Available on Internet: http://www.zakon.org/robert/internet/timeline/, accessed March 2000.

[14] NUA Internet Consulting. Available on Internet: http://www.nua.ie, accessed Spring 2000.

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describes this as "using the power of modern information technology to radically redesign our business processes in order to achieve dramatic improvements in their performances." Reengineering will typically take place in five different stages in an evolutionary process (Venkatraman, 1991). Stage one involves the localized exploitation of ICT to improve the operational efficiency of various business activities and functions. The integration of internal ICT systems via a common technology platform and knowledge base by different departments and/or organizations are the second stage. Foo and Zhong (2001) note that the ICT-induced evolution so far has been concentrated mainly at stages one and two of Venkatraman's hierarchy. Stages three to five are further described as business process redesign, business network redesign, and business scope redefinition, respectively.

Thorp (1999) and Morton (1999) each discuss a simplified yet all-encompassing evolutionary scale of the implementation of information technology and its continuing development through three discrete stages: (1) work automation—using information technology to automate clearly defined tasks, (2) information management—managing information and work processes through the implementation of information technology applications, and (3) business transformation—completely redesigning processes and business models.

Because of the size and complexity of most industries, it is difficult to study the impact of ICT on such entire industries (Dess and Beard, 1984). The mere existence of some information system is unlikely by itself to directly affect an organization or an industry. The nature of ICT with its constantly increasing rate of change has meant that businesses cannot compete based on technology alone (Sohal *et al.*, 2001). It is recognized that ICT alone does not deliver benefits (Ward *et al.*, 1996). Competitive

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advantage comes not only from sophisticated ICT, but also from the skilled management of information technology assets, both tangible and intangible. Karake (1995) states that the success of ICT implementation and thus the anticipated impact on a company's performance is crucially dependent on (a) ownership structure, (b) composition of the board, (c) managerial compensation, (d) age of the chief executives, (e) organizational tenure, (f) experience of the chief executive, and (g) power of the chief executive (Karake, 1995).

Crowston and his colleagues (2001) find that the use of ICT is enacted by individuals who, through their actions, change the conduct of their work in response to the availability of computing and communication technologies. Individual levels of use of ICT may be associated in turn with changes within the organizations. These effects manifest themselves, in part, as changes in organization processes, where organization processes are the identification and chronological order of tasks to accomplish intended outcomes, and in changes to organizational and industry structures and value chains (Crowston, 2000; Orlikowski and Robey, 1991).

Pollalis (1997, pp. 28-29) stresses this further: "The effective use of [ICT] for improving the coordination of the processes and for automating distinct tasks in order to reduce process inefficiencies will inevitably lead to restructuring the organization of the process itself." Pollalis further notes that "ICT has brought not only a technological revolution but a revolution in the structure of organizations by making traditional organizational structures obsolete."

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2.3.4 The Efficiency Battle: Success Stories

Examples of how ICT use can lead to changes in individual work and changes to both organization and industry structures can be found in the airline travel industry (Lewis *et al.*, 1998). The World Wide Web (hereinafter referred to as the Web) and electronic ticketing enable airlines to provide schedule information and to sell tickets directly to the public, bypassing travel agents. Airline ticket processing costs at a travel agent's office are approximately $8 per transaction, but only $1 per transaction over the Internet (Walker and Gerritsen, 2000).

Other examples of organizations that are trying to harness ICT are cited by Goldhar and Lei (1995), who found that organizations in the manufacturing sector are integrating new technology with innovative and more flexible organization designs in order to create an all-encompassing ICT resource for competitive advantage. Walker and Gerritsen (2000) show success stories in that banking cost per transaction has decreased from $1.07 at a branch office to approximately $0.01 via the Internet.[15] Dell Computer Corporation saves over $150,000 per year on postage alone to communicate with their online customers, a function that is already 11% of their total business.

Huang (1997) describes other examples where companies have undergone these developments successfully in the past, for example, Proctor & Gamble, Wal-Mart, Caterpillar, and Otis-Line. Each uses online ordering systems to link supplier and buyer, allowing a nearly seamless supply chain management. These systems allow them to eliminate a number of intermediaries and consequently to speed up processes and cut miscommunications by virtue of fewer parties involved in the communication structures.

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[15] Statistics of U.S. Department of Commerce, 1998.

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Boeing and Chrysler improved their performance (e.g., in design, cost and revenues, acquisition, inventory) through direct linkage of their major subcontractors and vendors to their own computer-aided-design (CAD) systems, resulting in cuts in time-consuming stages and unnecessary intermediaries. McKinsey—one of the largest international consulting companies—built an intranet database in which employees capture their experience and knowledge to share with other employees worldwide. The financial markets are successfully transforming their "service" and "relationship" business to a convergence of digital, tangible, and intangible products and service to better service the needs of the professional and demanding investment community (Wilhelm, 2001, 2002).

Vice chairman and CIO of Charles Schwab says that every single product and service Schwab offers is touched by technology. "On the very busiest day at our Web site ... we had just under 100,000 simultaneous sessions, which means that we had 100,000 of our customers interacting with us at the same time. All you have to think about is what it would cost to build enough call centers to have 100,000 employees be able to handle 100,000 phone calls at any point in time, and you can see the value that technology adds," she says.[16]

Consequently, research shows that more than 52% (200 respondents) of ICT and business executives claim to perceive a significant impact of technology on business revenue and 34% see a moderate impact (Linderholm, 2001). Linderholm also recognizes that a majority (60%) of his respondents find the impact of technology on their business revenues growing, with only 1% of respondents experiencing a decline in revenues. On average, ICT and business acknowledged a staggering 20% increase in net revenue.

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[16] Quoted in Linderholm, O., "Making the Case for IT", *Infoworld Magazine* (May 14, 2001).

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2.3.5 Challenges and Opportunities

The strategic opportunities of ICT bring with them similar risks and challenges. On the one hand, "the traditional, hierarchical organization is in deep trouble. . . . The reason is that the old organization is poorly equipped to respond to new business needs" (Tapscott and Caston, 1993). On the other hand, ICT has the capability, when implemented effectively, to meet the needs of modern business, provided it is partnered with the right leadership (Sohal *et al.*, 2001).

Such changes and challenges make the real estate industry fear the elimination of real estate agents (and other intermediary functionaries) from transactions or at least they will be forced to accept a reduced portion of the proceeds. Agents and other intermediary functionaries are concerned about their future roles in the face of the changes propelled by ICT use (Buxmann and Gebauer, 1998), which would be consistent with predictions of disintermediation that have been made in other industries (Benjamin and Wigand, 1995). However, in most settings, there are also strong organizations and industry forces shaping how work is done (Abbott, 1995).

2.4 ICT and Real Estate: Real Estate Technology

This final section presents bodies of literature by Roulac (1996), Miller (1995), and others, focusing on the convergence of virtual and digital developments and the physical real estate. An extensive forthcoming report by Huijbregts and McMahan (2002)—based on earlier research by Huijbregts and the Harvard Design School—provides the landscape of real estate technology and discusses the presence and impact of a wide variety of technology solutions that impact the industry's processes and real estate

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products. This section explains the concept of real estate technology for the industry as a whole, while presenting an opening for further study and discussion on how these developments will impact the processes of real estate investment management.

2.4.1 Introduction

Advances in ICT have introduced both a new paradigm of how society relates to place and space and also a new model of society's relationship to real estate (Roulac, 1996). Developments in ICT transform society's relationship to and involvement in economic and social activity, and therefore the real estate processes, systems, procedures, and relationships that characterize the real estate that supports society's space-using economic and social activity. In this new "pattern of space and place, tangible real estate is increasingly replaced by considerations of virtual space, and evolving processes and new business models" (Roulac, 1996).

2.4.2 Technology's Impact on Physical Real Estate

A most profound, transformational and far-reaching impact of ICT on real estate is the change in how people interact with space and place (Roulac, 1995). The implications embrace changing the content and nature of work, the production and consumption of services and products delivered in these spaces, as well as the types and place of interactions between co-workers, suppliers, and customers. As an example, we see how the teaching function has dramatically altered through distance learning, leading toward the demise of traditional lectures and the lecture hall (Cannon, 1997).

Companies such as Amazon.com, Cable & Wireless, and Webvan recognize that certain real estate assets are critical to the reliable fulfillment required to sustain a

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company's good idea or first-mover advantage, and thus to the success of their business. Amazon.com, for example, continues to expand its distribution facilities nearby fulfillment and transportation companies such as UPS and FedEx in order to better and faster serve its dispersed customers. Consequently, the company is currently seeking direct control over its real estate assets. But, as spokespersons for Amazon have stated, outsourcing may be the next logical step once the company can outsource without weakening its existing competitive advantage (PWC, 1999).

In addition, there is a blending and redefining of the basic function of property. For example, with the advent of home computers, the Internet, and at-home offices, more and more the distinction between the space in which one lives and the space in which one works is becoming blurred, blended, and integrated (Bakaler, 1995).

2.4.3 Impact on Real Estate Business Processes

The functions concerning how real estate information is employed have expanded from calculations (the simple automated calculations of expected investment returns) to data storage to analysis to decision-making to communications (Roulac, 1995) and to total process redesign. Miller (1995) notes,

> the economic gains from technology will come from the enhanced ability to communicate, eliminating tasks redundancies, and modeling work processes through virtual reality and expert systems to achieve integration involving the network linking of all internal information resources as well as the organization of the knowledge and expertise that exists throughout the firm so that all of the organization's resources can be applied to serve clients effectively.

ICT is fundamental to designing investment products, restructuring specialized financing arrangements, monitoring and managing investment portfolios, reporting

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financial performance, and servicing and communicating to large number of investors, as also can be seen in the financial markets (Barret, 2001; Coffin, 2000). As a consequence of ICT evolution, the universe of real estate investment possibilities has been expanded to become more like common stock (Roulac, 1995).

In 1995, a study by E &Y Kenneth Leventhal Real Estate showed the prime ICT needs and challenges to be the extracting of information to support decision-making and the communicating of such information in a clear, timely, efficient, and usable format (Ernst & Young, 1995). Access to information allows a relatively new organization to compete very effectively. Miller (1995) notes that, "in a high-tech, 'high touch' marketplace, those with competitive advantage will combine both instantly accessible critical information and knowledge of a customer's past experience with the firm with ready access to market information, including tenant composition, lease terms, comparable sales, etc."

The various players in the real estate industry are expected to experience great impact of the new Internet technologies on traditional real estate business processes. Emerging technologies will drastically affect the roles and value proposition of the various participants in the complex and fragmented real estate value chain. Embracing these technologies in the near future will be important for all industry players in order to secure a market position. Redesign of core business processes is vital in order for traditional real estate firms to compete with the fast-evolving online real estate process and service providers. Through the deployment of Internet technologies, unrestrained by traditional processes and customs, the new electronic real estate industry will be able to provide less expensive yet more competitive and efficient services and products to

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industry clients for the subareas of brokerage, financing, communication, procurement, and service (Huijbregts and McMahan, 2002).

Brokerage constitutes the activities of brokers or agents who buy and sell real estate for their corporate and residential clients. Online multiple listing services (MLS) for both for-lease and for-sale properties offer to potential clientele up-to-date and comprehensive information provided by a wide range of brokers and property owners. Clients are no longer limited to dealing with one broker or service. Information services on the Internet, such as LoopNet, PropertyFirst,[17] and Comro,[18] offer freely accessible market and research data, allowing clients to make faster and more informed decisions on their real estate portfolios.

Capital and financial processes have become within reach through online mortgage and loan issuers (e.g., Mortgage.com,[19] RedBricks, and LoopLender), debt and equity matchers (e.g., C-lender, C-loans, and Oinke), and market and research information services (e.g., Transamerica Intellitech, RealComm, and Property.Com). Development projects and properties seeking financing can be displayed and promoted online. Due diligence and transactions can be executed more efficiently and in a timely matter over the Internet.

Internet service providers enable the real estate players for a specific group of properties to *communicate* and collaborate (e.g., Buzzsaw, Bricsnet, FacilityPro).[20] Through communications, portal, and hub services on the Internet, construction and

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[17] In April 2001, Loopnet and PropertyFirst merged.

[18] Comro.com ceased to exist in December 2000.

[19] Mortgage.com, a public company registered on the New York Stock Exchange, filed for bankruptcy in Fall 2000. ABN Amro Bank in the Netherlands purchased its domain name for more than U.S.$2 million.

[20] Ernst & Young Kenneth Leventhal Real Estate Group (1999), "*E-Wakening: The New Technology Play in Real Estate,*" Real Estate E-Commerce Report, 1999.

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property management involving many players becomes faster, easier, and more effective. Through services that combine e-commerce, communications services, and information management (such as BuildNet and the Realm), the principal or client representative may further control and optimize the process and/or information flow.

Real estate *procurement* sites enable commerce in real estate products and services. This type of commerce is already available for the construction industry (e.g., E-bricks, Build Point, Home-Depot) and for property management (e.g., office.com, Opus360, and PurchasePro). Where product and service providers initially built their own Web-enabled procurement sites, now, increasingly, many product and service providers are appearing on consolidated Web sites or portals. Through one source, real estate professionals have access to multiple providers of products and services and can even initiate transactions.

The *service* applications fulfill or improve the core real estate processes. Examples include information portals to improve data collection for research, due diligence, and market comparisons (e.g., PikeNet, RealtyIQ, ReLocate Online, and Loopnet). Technologies such as virtual reality, three-dimensional modeling, video conferencing, and so forth are services offered that enable Internet users within the industry to improve communications, collaboration, and marketing.

Fundamentally, ICT solutions for core real estate processes enable the automation of individual activities. At the beginning of the computer era, specific technology applications were offered for specific tasks (e.g., AutoCAD or MicroStation for design and construction drawings, Primavera or MS Project for scheduling, and IBIS or Timberline for construction budgeting). These "islands of automation," as they have been called, have melded together on full-service sites that provide a wide range of automated activities to fit a wide range of needs (Porter in Pollalis, 1997). The technology trends

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experienced in other industries have spun off a new era in real estate. After the mid-1990s, the potential of the Internet penetrated the traditional building and real estate industry. By virtue of the trends in real estate technology, new real estate companies are forming and existing firms are being restructured.

Consequently, hubs (comprehensive sites offering *solutions for management* of processes, knowledge, and resources) consolidate the automated processes and create "one-stop shopping" for real estate professionals, allowing them to execute their business in a more proficient and integrated matter. Only a few hub business models are operating on the Internet at this time (e.g., Bricsnet, Autodesk, and the Realm); however, rapid development in this area is expected.

2.4.4 Competitive Advantage

In a study on the changes to organization and industry structures in the residential real estate industry, Crowston and his colleagues (2001) find that real estate agents in their intermediary role have lost some of the domination originally created by their own control over the information resources. Simultaneously, the agents are restructuring their roles by their own actions. One action is to refocus their business on service by (a) concentrating on their social networks, and (b) consulting on the real estate process and transactions.

Real estate professionals and especially the traditional intermediaries draw on large informal social networks to provide value-adding services. These informal social networks have many qualities, but the most useful of which is their weak ties; that is, the networks are composed of people who have only limited connections to one another and those connections are used only rarely (e.g., buyers and sellers). Often the larger the

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agents' network of weak ties, the better service they are able to provide. A limited network of strong ties (consisting mainly of lawyers and title companies) is also helpful in to provide buyers and sellers with guidance in preparing the closing transactions (Granovetter, 1973; Hansen, 1999).

Crowston and his colleagues (2001) find a strong impact on the information dissemination component of the real estate agents' core business, while finding little impact on the components of process support or the development of the intermediary's social network—both important characteristics of the real estate agent's service business. Consequently, agents who have large social networks composed of many weak ties and/or who have deep knowledge of the closing process may be able to adapt more easily to their reduced role as an information intermediary.

As a result of these new forces, intermediaries may be forced to unbundle previously packaged services, pricing individual services separately in response to customer demand for some but not all of their services. Similar unbundling has been seen over the last few years in other industries (e.g., travel agents, brokers, financial services), in which various forms of disintermediation (enabled by increased use of ICT) are observable (Wigand *et al.*, 1997).

2.4.5 The Landscape of Real Estate Technology: A Categorization

Stock analysts more frequently focus their attention on the changes and opportunities within this largest industry in the world. Most activities contributing to the development of trends in the real estate industry are on the transactional side. These activities include property purchase, financing, and rental (Scott, 2000). Purveyors of Internet technologies for real estate have developed various categories to describe their activities. JP Morgan,

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for example, categorizes its activities as brokerage, financial, incubators, portals, retail related, and telecom (Schalop, 2000), while InRealty divides the landscape into primary transactional activities and secondary supportive activities (Scott, 2000). Transactional activities include virtual tour enablers, home listings, home loans, residential rentals, investment property listings, commercial loans, and commercial rentals. Secondary supportive activities include home remodels, home selling/buying, inspection and closing services, employment, research and due diligence, news, equity investing.

As a background study[21] for this research, to better understand the evolution and activity of real estate technology and to identify the issues and trends prevalent in this fast-changing industry, 518 real estate technology companies were studied (Huijbregts and McMahan, 2002).[22] The companies were grouped in two categories according to whether their activities were real (space and physical), or virtual (process and service).

Real estate technology companies provide services that are both real (tangible) and virtual (intangible). These include: (a) space, e.g., newly designed warehouses, co-locations, and telecom innovations; (b) physical, e.g., adjustments in real estate through roof top[23] and riser management[24]; (c) processes, e.g., facilitators for real estate processes such as multiple listing services, procurement, finance, etc.; and (d) services, e.g., new innovative business models that provide service for existing and new real estate processes. Real estate technology companies that were studied either focus on certain

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[21] The listing provides a snapshot, last updated in Fall 2001 before the events of September 11, 2001. The "landscape" has continued to change during the following recession. Due to the turbulent stock markets and business environment, the listing may contain real estate technology companies that have ceased to exist or lack real estate technology companies that were not familiar at the time of the research.

[22] In collaboration with Agnus Ng of the Harvard Center for Design Informatics as part of the "Owner's IT" research project in 2001.

[23] Roof top management is the use of high-rise rooftops to install telecom applications equipment, such as dishes and antennas.

[24] Riser management is the refurbishment of existing real estate properties through the installation of new wiring and technology.

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processes within the industry or follow existing business models of real estate firms and service providers.

Of the 518 companies studied, 39 companies fall in the "physical" and "space" categories, many focusing on telecommunications activities. Of the remaining 468 firms, 70 companies have ceased to exist in their original form, 28 of which were bought or have merged. Of the 399 left over, 243 companies can be categorized as "process" providers and 156 as "service" providers.

Table 2.1 shows the subdivision of the examined companies, into a "process" category (with focus on brokerage, financing, collaboration, document exchange, procurement, etc.) and a "services" category. The table shows the total number of companies, set against the number of firms still in business per the summer of 2001.

Approximately half of the companies studied specialize in services for the building industry (design and construction) and the other half specialize in services for the facilities management industry (financing and operations). More than half of the applications and services for facilities management focus on the residential building market (mortgage and moving services), and a slight minority focus on the commercial markets alone.

Most companies examined were still privately held; therefore detailed financial information was not available. Thirty-seven real estate technology firms have gone public since the study concluded, and a few of those have even been taken off the stock markets again, for a total of 42 companies that have ceased operations in the last two years. Forty-three percent of the companies operate as independent entities (in 8.8% of cases, the parental structure is unknown). The remaining majority are part of other organizations of the following types: *larger conglomerations* (e.g., McGraw Hill's construction.com and

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e-Builder; and CMD's Cyberplaces and BuildingTeam.com); *existing real estate firms* (e.g., Simon Property's ClixnMortar, YourSherpa.com, and Merchant Wired; AMB's Phatpipe; and Prudentials BridgerFunding), and *large software houses* (e.g., Bentley's Viecom, GetTogetherNow.com, and ProjectWise; Microsoft's Homeadvisor; and Homestore's Realtor.com, Homebid, Homefair, and Springstreet.com).

Landscape				
Space	**16**	100%	**16**	100%
Telecom	16		16	
Physical	**23**	100%	**22**	96%
Infrastructure	19		19	
Riser management	2		1	
Rooftop mgmt.	2		2	
Process	**299**	100%	**252**	84%
Brokerage	12		10	
Collaboration	61		49	
Document Exchange	10		7	
Financing	57		51	
Marketplace	70		53	
Multiple Listing Services	46		43	
Property Management	43		39	
Service	**180**	100%	**158**	88%
Architecturals	13		11	
Community	3		3	
Construction services	23		22	
Education	4		2	
Human Resources	11		10	
Information Portal	64		54	
Market Research	22		20	
Product information	8		8	
Service (other)	8		7	
User Services	24		21	
Grant Total	**518**	100%	**448**	86%

Table 2.1: 518 'dotcom' analysis—Real Estate Technology Landscape.

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Most online business models for real estate technology have their roots in the residential subprocesses that appeared on the Internet in the mid-1990s. Tested business models were rapidly adapted by the commercial real estate sector. The leading example of this dynamic were the multiple listing services (MLSs) that have been around since the inception of the Internet for local and regional listing by small real estate brokerage firms. Later, with the Internet boom of 1997 and 1998, the commercial real estate sector collectively embraced the added value of MLSs and expanded their use to a larger national scale (e.g., Loopnet, Comro, Propertyfirst).

Twelve percent of all firms in the study provide online listing services that can be populated and used for marketing by more brokerage service companies. As a result, all real estate brokers and investment managers with an online presence—as uncomplicated as a Web site with a few simple charts and lists—have listed their investment properties for sale or lease (Huijbregts and McMahan, 2002).

2.4.6 Technology Opportunities for the Real Estate Investment Manager

Various software and Internet applications have been developed and deployed to facilitate the process of investment management. More than 214 out of the 399 available software and Internet application solutions focusing on real estate processes and services can be applied as well to the real estate investment management industry. As investment management is an information-intensive industry, we notice that most of the information exchange and resource applications are used or well known by the investment managers. Brokerage and financial services provided through the online medium are close to all consulted by the investment managers but less so used and relied on in real life.

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Table 2.2 summarizes the dot-coms[25] (in business per the summer of 2001), targeting the industry of real estate investment management in relationship to the companies that are still operating within the areas of "process" and "services."

[illegible] companies (April 2001)

Landscape	[illegible]		[illegible]		[illegible]	
Space	16	100%	16	100%		
Telecom	16		16			
Physical	23	100%	22	96%		
Infrastructure	19		19			
Riser management	2		1			
Rooftop mgmt.	2		2			
Process	299	100%	252	84%	**141**	**56%**
Brokerage	12		10		10	
Collaboration	61		49		3	
Document Exchange	10		7		3	
Financing	57		51		42	
Marketplace	70		53		11	
Multiple Listing Services	46		43		42	
Property Management	43		39		30	
Service	180	100%	158	88%	**72**	**46%**
Architecturals	13		11		3	
Community	3		3			
Construction services	23		22			
Education	4		2			
Human Resources	11		10		6	
Information Portal	64		54		36	
Market Research	22		20		20	
Product information	8		8			
Service (other)	8		7		1	
User Services	24		21		6	
Grant Total	518	100%	448	86%	**213**	**48%**

Table 2.2: Real Estate Technology targeting the Real Estate Investment Management industry.

[25] A dot-com is defined as a company that markets its products or services on-line via a World Wide Web site. *Webster's 10th Collegiate Dictionary*. Available on the Internet: http://www.m-w.com, accessed March 2001.

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The companies represented in the table include the following types of ICT solutions for different stages of the real estate investment management process: (a) research or feasibility studies, (b) acquisitions and disposals, (c) property management or management in use, and (d) portfolio management or recording and reporting, as first identified by Huijbregts and McMahan (2002) in collaboration with Harvard's Center for Design Informatics.

For *feasibility studies,* ICT has made market research widely available to investors and investment managers alike. Detailed data can be found on demographics, economics, politics, neighboring facilities, and other factors influencing decisions in the investment management process. As mentioned earlier, the user of this information should keep in mind that the quality and validity of the data is only as good as how and by whom it was developed and entered in the first place. Some examples of Web sites that provide relevant real estate information[26] are: Freedomgraphics.com and Anysite.com (demographics); Comps.com and Domania.com (property information); Nareit and Inrealty.com (real estate securities); and Inman.com, InternetREview.com, and Naidirect.com (real estate information).

Furthermore, the rapid developments in and availability of Geographic Information Systems (GIS) software provide users with the facility to improve real estate and market analysis (Rodriguez *et al.*, 1995). GIS software automates spatial processes and is ideal for examining spatial components of real estate and its surroundings (e.g., information about census tracts, census block groups, towns, counties, states, and other areas). This information helps to define market areas and attract market data.

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[26] The examples stem from the dot-com analysis as finalized April 2001. Because of the volatile nature of the Internet environment, these companies may no longer exist in the form listed, for they may have disbanded, consolidated, or moved into new and/or additional markets.

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A wide variety of Web sites (30 identified out of the 518 studied real estate technology companies, exclusive of the many more local and less public initiatives), organized mostly by geographic location, allow access to information on property appraisals and comparables. The services are locally oriented, provide detailed market data, and are managed and maintained by online appraisers. Examples of online applications that facilitate the process of economic appraisal are: Propsci.com and homegain.com (appraisals); Bloomberg, Bondspace.com, and Commercial-source.com (research); CoStarComps.com and Loopnet.com (comparable real estate information). Third-party advisors access this information to provide profound investment decisions and scenarios. Obviously, this readily available information is also accessible to the investment owners themselves. However, it is the investment manager's analyses, judgments and management services that provide the value added to the basic information. Software tools such as Yardi, Argus, and MRI for Windows provide the functionality to budget income and expenses in order to analyze the findings and research.[27]

Feasibility studies and economic appraisals lead to the *acquisition or disposal* of existing or development of new real estate. Development of new real estate is more likely to be outsourced to real estate developers, project managers, or construction managers. Financial and progress updates substantiate to the real estate investment manager that the property will be delivered on time and within budget to ensure timely occupation (and thus, income) and a balanced equilibrium between development cost and future earnings (Huijbregts and McMahan, 2002).

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[27] After http://www.yardisystems.com, http://www.mri.com, and www.realm.com, accessed February 2002.

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For such activities, design and construction management tools are being used: collaborating through project extranets (Citadon, Buzzsaw, BricsNet); scheduling (Primavera); budgeting (Timberline); design (Bentley, AutoCAD); and permitting (NetClerk). Full integration, and thus improved reporting, is being pursued in this sector of the real estate industry (Huijbregts and McMahan, 2002).

For the acquisition or disposal of real estate, investment managers call for help from brokers (when not available in-house) to structure the financial deal that will lead to the final real estate transaction. As part of the due diligence, market research, and economic appraisals—all necessary before selecting the property to be acquired, real estate investment managers have access to a large number of multiple listing services that allow a quick overview of available properties by geographical location and typology (residential, commercial, retail, industrial, infrastructure, or telecom and communications).

Despite the enormous paper- and contract-intensity of the acquisition process and therefore opportunity for profit, few to no technology resources have targeted this significant part of the investment manager's tasks and responsibilities because of the danger of legal exposure. Lack of trust in security, the questionable validity of digital signatures, and the need for constant customization prevents the industry from fully embracing technology to further organize the acquisition process. Standardization, or, more likely, the lack of it, plays an important role in the slow acceptance of technology to facilitate these processes. Starting with the leasing side of real estate, standardization will eventually find its way into the legal processes and will soon provide integrated solutions for contract and version management (as it already somewhat exists in the form of online

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document management), negotiations management, due diligence integration, payments, and closings (Huijbregts and McMahan, 2002).

The real estate investment manager carries the responsibility for operations (*management and maintenance*) of the investment property. Various tools enable the property or facilities manager (often an outsourced provider but sometimes the asset manager itself) to communicate with tenants and to procure vendors and suppliers. Examples include: Consource.com (community management); OurBuilding.com (Web services for commercial real estate); DesignerOffice.com, Staples.com, SiteStuff.com, EquityOffice.com, and PowerBuyer.com (furniture, office equipment, etc.). Management information systems are available for efficient management of installations, business, and building processes. Examples include: RentPayment.com, GoProjex.com, CTI Limited, OpenAir, and Opus360.

On the hardware side, new technologies have been developed to better serve the end-user of the facility. For real estate, we find innovative marketing applications such as multimedia kiosks in shopping malls (BigFatWow, Centerlinq, and GoldenScreens); infrastructure for merchants (Merchant Wired); and multimedia screens in elevators (Captivate.com). Simultaneously, technology provides new solutions to drastically improve the real estate concepts that enhance the end-user's productivity. In this new economy, the property manager will do anything possible to facilitate and thus attract more tenants for the property in order to keep the revenues up and as high as possible.

Brokerage and marketing enables the property manager to occupy the facility with tenants. Virtual and 3-dimensional tools serve this purpose: bamboo.com, CycloVision, and Kaidan, as well as the multiple listing services already described (Loopnet, eRealty,

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LookingForSpace.com, and Owners.com); viva.com (tenant matching); and FastFrog (for links to retail and shopping centers).

Among one of the most time-consuming activities for investment managers is the *recording* of a property's financial and technical data and *reporting* the essentials to the investment owner. The investment owner needs to be updated on the financial progress and status of its investment. A large variety of software applications have been available for recording and reporting, led by market leaders Yardi and MRI for Windows.

Reporting applications register the financial activities of the property, keeping track of income and expenses during the operations stage of the asset. Occupancy (in number of units) multiplied by rent (the unit price) equals income. Reporting functionalities include current financial status and projections, keeping the future expected occupancy and pricing in mind. The reports inform the investor of actual and anticipated return on investment, to determine whether they match the required yield determined during the feasibility studies.

Property information often comes from the property and facilities managers who are responsible for the day-to-day operations of the asset. Financial data is transmitted to the investment manager, who collects the various data for the various investments within a specific portfolio. As described, this reporting often still occurs in paper format. Increasingly, investment managers provide their own extranet resources for such data collection. Similar technologies are momentarily more readily available. The Realm (Realpulse.com), Capstone, Facilities Information Systems, and PropertyFirst all provide a certain level of software functionality for recording and reporting.

The same situation obtains for reporting to the investment owner. Still, the majority deploys "hardcopy" monthly, quarterly, and yearly reports. The same technologies as

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mentioned above are deployed. However, none of these methods truly allows for seamless reporting from facility to owner. In addition, the "conventional" recording and reporting applications are now being Web enabled to provide the familiar and tested services online.

One important aspect of the process of investment management is the actual *marketing and acquisition of clients*. Technology seems not to be used for this company-crucial activity, however—and has not yet reached a stage of severely raising competitive advantage. With the increasing adaptation and more innovative evolution of real estate technology, however, this is expected to change. Once again, it is clear the importance of personal relationships (networks) (Hansen, 1999) and company officers' reputations for the success of real estate investment management firms. Although this aspect is important to, but not part of, the investment manager's core business, this dissertation will not further elaborate on the internal marketing and acquisitions processes, just as it does not focus on administrative and office management tasks.

2.5 Research Question

So far, this chapter has painted the landscape of real estate technology and its efforts to positively impact the established processes of the real estate industry and, in particular, those of real estate investment management. Numerous online solutions are available to facilitate increased efficiency for the inept processes of real estate and investment management, including: research and feasibility studies (among which the so-important economic appraisals), acquisition and disposal processes, property management (or management in use), and the time-consuming reporting and recording functionalities

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(portfolio management). The wide variety of solutions, though, seems to create more "islands of automation" rather than providing the necessary improvements to make ICT fully functional and efficient for the industry. It seems up to the intellectual professionals to deploy a selection of such tools and solutions in such a manner that a great benefit can be achieved.

Keeping in mind this framework of problems of ICT facing the real estate investment manager, the question arises: if and how can real estate technology positively facilitate the process redesign of real estate investment management, while increasing productivity and lowering operational costs? Concurrent with this is the question of how current ICT developments are impacting the work environment (value chain) of the investment manager. Consequent subquestions can be identified, each within one of the four subprocesses of real estate investment management: research, acquisitions, property management, and portfolio management:

I. *Research:* How does real estate technology affect the cost and time expenditure for the real estate investment manager's research activities? What is its impact on the input and output quality and quantity?

II. *Acquisitions:* How does real estate technology affect the cost and time expenditure for the real estate investment manager's acquisitions and dispositions processes? Is the transaction cycle time impacted by technology innovation?

III. *Property Management (operations and management):* How does real estate technology affect the cost and time expenditure for the real estate investment manager's property management activities, if performed in-house or outsourced? Does technology create a higher real estate quality that, in its turn, can lead to higher performance and higher returns on investment?

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IV. *Portfolio Management (recording and reporting):* How does real estate technology affect cost and time expenditures for the real estate investment manager's portfolio management activities? Does technology reduce the need for manpower within the investment management firm by eliminating redundant and repetitive manual information exchange? How does technology's enhancement of communication affect the level of satisfaction of the real estate investment manager's clients?

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Chapter 3: RESEARCH METHODOLOGY

3.1 Introduction

This dissertation studies the value proposition of information and communications technology (ICT) on the processes of real estate investment management. Impact of ICT will be measured in regards to money and time expenditures, quality and quantity, information exchange, organization and value chain, and eventual client satisfaction. Three different research methods are utilized for data collection and analysis.

First, a 20-company telephone survey set the framework for the research and provided important background information. In addition, in-depth interviews with 20 industry professionals—representing the different subareas for five leading U.S. investment management firms—were conducted to obtain more detailed information on the qualitative and quantitative value proposition of ICT on the processes of real estate investment management. Lastly, case studies of two innovative U.S. investment management firms provided in-depth information on the practical deployment of ICT for the processes of real estate asset management, gathering further evidence to back the findings of the telephone survey and interviews. The findings are presented in Chapters 4, and 5

3.1.1 Measuring ICT Performance

Research suggests that although firms acknowledge the importance of ICT investment to enhance performance, they do not have a satisfactory way of assessing the relationship (Weill and Olson, 1989). Powel and Dent-Micallef (1997) developed a resource-based theoretical framework to study the impact of ICT in an attempt to address

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the lack of empirical studies of the relationship between ICT and competitive advantage. Their research, which concentrated on the retail industry, revealed that "information technology alone has not produced sustainable performance advantages in the retail industry, but that some firms have gained advantages by using information technology to leverage intangible, complementary human and business resources such as flexible culture, strategic planning-ICT integration, and supplier relationships".

Similarly, a study of 108 small and medium-sized manufacturing firms found that ICT usage is positively related to organizational performance (Raymond, *et al.*, 1993). The research findings indicated that structural issues and ICT management is an important indicator of success. These two were among the few rigorous research studies of ICT; because the field is new, existing literature relies heavily on case studies, anecdotes, and consultant frameworks, with little solid empirical research in the arena of information technology (Sohal *et al.*, 2001).

3.2 Survey and Interviews

3.2.1 Introduction

The telephone survey is based on a structured questionnaire, in itself based on preliminary interviews and practical training working experience with a Boston real estate investment company, AEW Capital Management. The survey addresses the relationships between the "processes" and their "inefficiencies," level of implementation of real estate technology, and the elements of "process control" (time, money, information, quality, and organization). A consequent reorganization of the study factors are (a) communication and information exchange, (b) time spending and productivity, (c)

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cost expenditures, (d) client satisfaction, (e) quality and quantity, (f) professional relationships and the value chain, and (g) legal conditions.

3.2.2 Research Population

Ninety real estate investment management firms operate in the United States, of which only 69 manage portfolios of U.S. $100 million or greater.[28] The twenty largest investment managers have invested more than 78.6% of the total market concentration, and the five largest firms in 42.6%. The top ten includes TIAA-CREF, JP Morgan Investment Management, Lend Lease Real Estate, Principal Capital, RREEF, Prudential Real Estate Investments, UBS Asset Management, Heitman Financial, Clarion Partners, and AEW Capital Management.

A multi-stage cluster sampling method was used to determine the eventual research sample drawn from this 90-firm population. A first selection was made from the member listings of foremost branch organizations and associations for real estate investment managers in the United States. The organizations included: (1) Institute of Real Estate Management (IREM), (2) International Development Research Council (IDRC), (3) National Associations of Real Estate Investment Managers (NAREIM), (4) National Council of Real Estate Fiduciaries (NCREIF0, (5) Pension Real Estate Association (PREA), and (6) Urban Land Institute (ULI). From these, 30 real estate investment managers were selected and approached to participate in the telephone survey. The survey focused on subscribing the top 20% of the investment managers in the study because of the scope of their portfolio under management, the size and requirements of

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[28] Centerprise.org, accessed January 2002.

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their investment clients, and their adaptation to and investments in information technologies. Twenty out of the 30 firm approached cooperated with the telephone survey (a response rate of 67%, totaling 22% of total research population).

In addition to others who preferred to remain anonymous, survey and interview participants were Douglas Poutasse, Alison Husid, Christopher Meyer, Glenn Burdick, Daniel Bradley, Ed Cassidy, Grant Monahon, Shawn Mahony, and Joseph Azrack of AEW Capital Management; Michael Young and John Shields of RREEF; Graig Camp and Eric Lezak of American Realty Advisors; Kevin Scherer of SSR Realty Advisors; Wayne Pryor and John Roberts of AMB Property Corporation; Douglas Pearce, James Martha, Edward Pierzak, and J. P. Rachmaninoff of Henderson Global Investors; Thomas McCarthy of Heitman Financial LLC; Brian Webb, Tom Farrell, Dan Leary, Bill Harrison, and Ron Urdanick of UBS Realty Investors; William Shen of Legg Mason Real Estate; Marc Roberts of Invesco Realty Advisors; Phil Robler of State Teachers Retirement System of Ohio; John McMahan and Espen Thoegersen of Centerprise; and Randal Bessolo of Transwestern Investment Company.

3.2.3 Execution

Prior to the telephone survey, the survey participants were selected, approached, and invited to participate. The survey was made available to all participants prior to the telephone interview to assist in the preparation (see Appendix B). The telephone survey was carried out with the assistance of Marc Numann (Delft University of Technology), and executed within a two-week period. Each interview took 30 to 50 minutes. The answers to the survey—including additional comments—have been entered into an Excel spreadsheet in order to tally the results. The telephone survey was developed in

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cooperation with Harvard's Center of Design Informatics and Marc Numann, with input from Douglas Poutasse (Chief Investment Strategist at AEW Capital Management), Graig Camp (Chief Administration Officer at American Realty Advisors), and Prof. Richard Peiser (Harvard Design School).

The first three telephone surveys were used as pilot interviews to develop feedback to further enhance the survey questions. No significant changes were suggested or required as a result of the pilot survey process; therefore those interviews were included in the research sample for data collection and analysis.

3.2.4 Survey Design

The telephone survey consisted of 49 questions (see Appendix B). A combination of closed and open format question types was used. Open format questions were used to examine the "general feelings" of participants on the matter and to study the respondents' opinions and actions. The open questions dealt with (a) listing the tools and functionalities used in the real estate investment management process, (b) listing the process and inefficiency issues that are or are not addressed by technology, and (c) obtaining percentages or assumptions of increasing or decreasing trends.

In the closed (or "forced-choice") questions, a number of alternative answers were provided from which the respondents could select one or more. The closed format questions were used to quantify results and to avoid generating as many different answers as there were different respondents. The predefined answers or answer ranges were selected as a result of the preliminary interviews, background studies, and discussions with AEW Capital Management.

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This survey mainly deployed two question types: (1) *Likert-style formats* and (2) *checklist questions*. In the *Likert-style* questions, participants were asked to indicate how strongly they "agree" or "disagree" with the question statement. Since this concerns an abstract scale, to avoid false accuracy, the telephone survey incorporated a "yes/no" or "increase/same/decrease" scale to eliminate *soft* factors such as feelings, hunches, and guesses.

Checklist questions listed items that are to be selected by the respondents. These questions narrowed down options but were all encompassing and unambiguous. The questions were used to find out (1) what media types were used by the companies for data exchange, and (2) what technology services were provided to real estate end-users. A variation on this question type, the *ranking format*, was also used. Here, a list of alternative answers was provided and participants were asked to rank their importance.

Where possible, the questions were quantified by asking the participant the estimated percentage of the perceived increase or decrease. If the participant preferred to refrain from answering or doubted about their accuracy in responding, the answers were marked as "n/a" (not applicable) to avoid suggesting false conclusions.

The order of the questions follows the chronology of the process of real estate asset management (facilities management, acquisitions and disposals, recording and reporting, and management use). Each question focuses on one of the research factors: (a) communication and information exchange, (b) time allocation and productivity, (c) cost expenditures, (d) client satisfaction, (e) quality and quantity, (f) the value chain, and (g) legal conditions. Appendix C organizes the questions from the telephone survey in relation to the specific industry subprocesses and to the focus research factor.

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3.2.5 Limiting Conditions of the Survey

The first limiting condition on the research study, and also the reason for choosing closed format questions, was the novelty of using real estate technology for the processes of real estate investment management. Innovative tools and applications (e.g., online real estate transactions and online access to information for clients) have only been deployed since 1999 and have not necessarily provided the most accurate and up-to-date information on value (measured in both time and money) or return on technology investment. One question in the telephone survey, therefore, was if the company had attempted to measure the actual internal value proposition and returns on its technology investments.

Secondly, real estate investment management is a collection of subprocesses (tasks and activities) and specialties (such as market research, acquisition and disposal, and property management). Often, different players on the investment management team perform these subprocesses. The survey addresses only those officers who oversee or manage the process as a whole. Some respondents might not have been fully aware of all subprocesses, all technologies used, and the value created by using these technologies. Where possible, multiple officers of the studied companies were approached.

Lastly, because of the complexity of the processes, often respondents did not clearly recognize or understand where and how time and money expenditures are made. In order to quantify the value proposition of technology, therefore, the survey expresses only the increases and decreases in time and money allocation, organization, quality, and information in ranges and percentages compared with conditions prior to the implementation of technology. The percentages mentioned should be understood from

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the perspective of the size of the asset under management, the sophistication of the investment owners, the level of technology implementation, and the range of services provided by the investment managers.

3.2.6 Interviews

To further quantify the value of ICT and to provide additional and in-depth information to the survey results, 20 professionals of five additional U.S. investment management firms were designated subjects for further study. Status reports were prepared to assess the current level of ICT implementation for the different firms. The firms were selected through their relationship with AEW Capital Management, RREEF, Harvard Design School, and Centerprise.

In order to adequately cover the various subareas of investment management, research participants were company officials, representing research and feasibility studies, acquisitions and dispositions, operations, and recording and reporting through the portfolio manager. In addition, the input of the company's technology officers was required to develop an overall understanding of the technology strategy.

3.2.7 Execution

Face-to-face interviews were scheduled with the various officers of the research subject firms. Each subarea was discussed individually, with participants answering questions on changes in budgets and headcount over a five-year period, changes in quality and quantity of performance over the same period, and providing a graphical indication of the current level of ICT implementation for the specific subarea. An overall estimate of changes in budget and headcount for the subarea as a whole was provided,

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where applicable and available. The interviews have resulted in mini-case studies that capture the results (Appendix D)

3.2.8 Limiting Conditions of Interviews

The complementing mini-case studies have been prepared during a period when the national economy has stalled. In the year 2001, the process of data collection has been affected somewhat by an increasingly negative perception of real estate technology in U.S. investment management firms. Interpretation of the various research elements, therefore, must take into consideration the changes in the economic setting at the time of the study.

In most cases, hard data was not available on the various questions about conditions in 1996 or about other history. Often, answers to questions were the participants' *best guess*, but in all cases, information obtained from the interviews has been verified with at least one other source within the firm in order to assure the validity of the data.

3.3 Case Studies on Real Estate Technology

To further research the outcome of the telephone survey and interviews, two leading investment management firms were selected to participate in detailed case studies. The case studies were designed to elaborate on findings from the survey or to better understand the practical implementation of technology in the investment management sector. The case study subjects were RREEF and AEW Capital Management. Together, they operate and manage more than U.S.$25 billion in real estate investments. Out of all the survey participants, AEW and RREEF also have proven to be forward-thinkers and

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innovators in the field of technology implementation to enhance the efficiencies of their core processes. It is important to understand that neither firm represents the status quo within the industry as a whole—but they clearly set the pace for the rest to follow.

The case study method is a qualitative and inductive research method that can deliver information and insight on a project, a company, a building, or on the design process itself, or on how a designer faced and solved specific problems.[29] In a case study, the background, development, current conditions, and (environmental) interactions of one or more individuals, businesses, or institutions is observed, recorded, and analyzed for stages of patterns in relation to internal and external influences.[30]

The case studies follow a similar format, focusing on the same research factors as were studied in the telephone survey. First, a company portrayal and a descriptive analysis of the typical process of real estate asset management were ascertained as background for the case study. Then, a chronological overview was created that follows the timeline of technology implementation and acceptation (development) in each firm. Third, the status of real estate technology within the respective firm is described and opinions about the future were collected (current conditions). Last, inhibitors were studied to understand the framework in which technology is deployed. Throughout the case study, the research factors described above were constantly taken into account—to provide additional comparative data for the analysis of findings and preparation of conclusions.

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[29] Spiro N. Pollalis, Harvard Design School Presentation on Case Study Methods, Fall 1996.
[30] http://www.languages.ait.ac.th/el2meth.htm, accessed on February 21, 2002.

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Chapter 4: SURVEY AND INTERVIEWS

4.1 Introduction

Technology has had and is still having an impact on process control factors such as money, time, organization, quality, and information, and "soft" factors such as satisfaction, repeat customers, legal issues—all elements that have been observed in the various subprocesses of real estate investment management. This chapter presents the findings of the telephone survey and the interviews of 20 industry professionals representing five leading investment management firms. Results are reported relative to the factors of (a) communications and information exchange, (b), productivity and time allocation, (c) cost expenditures, (d) client satisfaction, (e) quality and quantity, (f) relationships and changes in the value chain, and (g) legal factors—taking both "soft" and "hard" study factors into account. With the inclusion of the findings of the case studies, results will be discussed in Chapter 7.

Out of all the incentives for embracing real estate technology, all survey respondents ranked the reduction of *cost* as of highest importance—together with increasing operational efficiencies. Improving the *quality* of services and consequently increasing *client satisfaction* ranked second and third in importance, respectively. Working faster or more *time*-effectively ranked only fourth, while reducing the employee *headcount* was never a consideration.

Reducing operational efficiencies was found to be most important in the interviews of 20 industry professionals representing five leading investment management firms. Productivity increases were reported from 50% to 200%, where more assets under management were controlled with an equal number of employees.

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Eighteen percent of survey respondents claimed to implement technology purely for competitive reasons, while another 18% claimed technology to be a critical part of their internal operations: "Without technology, we simply cannot run our 1,000-headcount corporation," said Michael Young of RREEF—the fifth largest third-party advisory firm in the United States.[31]. The remaining 64% of survey respondents more or less admitted to "jumping on the bandwagon," inspired by the promise of the new economy.

All 20 professionals interviewed from the five additional investment firms indicated that the investments in information and communications technology were made to facilitate internal working processes—and only indirectly influenced services to their investment clients and, therefore, client satisfaction. None of them claimed to embrace technology merely because their competitors were doing so. Three out of five firms have conducted intensive research on the status of competitor firms and third-party property managers to benchmark their services and improve their own strategic choices.

All respondents were receptive to the implementation of technology and the impact it has or should have on their business processes. Only 17% of respondents claimed to have analyzed the return on their investment in technology. Among those who have, claims were made of returns ranging from 50% to 300% on their initial ICT investments. The general and accepted consensus among the others was an assumption of positive returns on investment, without any supporting evidence.

The technology implementation of the five leading U.S. investment management firms whose professionals were interviewed focused on the development of data

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[31] Center for Real Estate Enterprise Management (Centerprise), after, on the Internet, http://www.centerprise.org/pages/top20.html, accessed October 2001. Centerprise is a non-profit, public-interest corporation that serves as a collaborative, integrative "clearinghouse of ideas" for the real estate industry, cutting across academic disciplines, industry sectors, functional business areas, and private/public interests.

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warehouses. A data warehouse is a centralized database that holds important property and portfolio information extracted from existing accounting and management software applications. It is typically a subject database that allows users to tap into a company's vast store of operational data to track and respond to business trends and facilitates forecasting and planning efforts. Implementing a data warehouse enables firms to "slice and dice" the information as they require and to present it via online intranet and extranet resources. All firms use electronic PDF file formats to share financial reporting with investment clients. Providing online and dynamic access to real-time portfolio financial information to the customer is on the agenda of each company for the upcoming years. They all agree, however, that their investment clients have no identified need for such detailed, real-time, online information.

4.2 Communications and Information Exchange

The most common and broadly acknowledged inefficiency within the investment management industry was reported by the various process participants to be communications and information exchange. Seventy-five percent of the respondents addressed process inefficiency as the number one problem for which new solutions have been or will be implemented.

In a few cases, the communications referred to involved internal business processes, such as time tracking, expense reports, and accounting processes; but mostly communications referred to the firm's relationship with (1) service providers, such as brokers, consultants, and analysts; (2) property managers; and (3) clients (or investment owners). Communications and information exchange with property managers was reported to be the most cumbersome and inefficient of all.

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All but one respondent have implemented or are in the process of implementing communications and data transfer systems to improve communications with property managers and clients. The firms offering in-house property management services have already implemented far-reaching, streamlined information management systems, connecting the "property" through its portfolio managers to investment clients. It is in these firms that reporting frequency has increased from once per month to daily and even real-time. For 90% of firms of the survey respondents that outsource property management, Web-enabled systems such as Yardi and MRI for Windows have been implemented to manage information flow of property data.

All survey respondents experienced a modest to drastic decrease in the amount of data duplication and time expended reentering received property data into their general ledger systems. The result has been more up-to-date information that is often directly linked into reporting applications that are used for developing (quarterly) reports. Historically, information from the property manager traveled through many hands and information systems before it was represented in quarterly reports and shipped to the client. Today, the information is transferred from the general ledger systems into spreadsheets and desktop publishing applications presented as financials and summaries to the client via hardcopy reports.

Sixty-three percent of the survey respondents already use online knowledge and information systems to retrieve property data from property managers. Half of the survey respondents have finished such technology implementation within the last 18 months. If no online systems are available, property information is still sent by mail in hardcopy (with a copy sent by email to expedite processes). In more than three-quarters of the online cases, however, hardcopies are still provided to asset and portfolio managers. Only

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two respondents out of 20 have taken the bold step of completely eliminating paper exchange between property and asset managers.

Only 27% of the survey respondents automatically link the information into an online information system for communications with their clients. All asset and portfolio managers, though, still rely fully on hardcopy reporting to their clients and investment owners. The online systems are merely an additional service and resource. Even when such online systems are available, quarterly reports in hardcopy are still preferred by all clients, according to all research respondents. The best-case result was that the number of hardcopy reports diminished from two reports per quarter to only one report.

Communications and information exchange with service providers (e.g., brokers, appraisers, consultants) still occurs mostly through hardcopy and increasingly through email. Due to the binding and legal character of the information, hardcopy is preferred. More on the legal aspects and resulting limiting conditions of technology adaptation shall be discussed later in this chapter. For legal reasons in particular, less than half of the survey respondents one way or another keep track of the information exchange using automated information systems. Less than 8% claim to truly manage the knowledge (both internally generated and that provided by third-party service providers) using intranets or internal knowledge management systems.

Activities such as market research, analysis, appraisals, marketing (for leasing), and acquisitions all benefit from evolving communications methods. Email is the primary medium for communications during these subprocesses. More than 80% of communications is exchanged by email. All survey and interview respondents use Internet resources for online research sources, multiple listing services, extranets, but none of them rely exclusively on these new resources. In all cases, information is

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exchanged using hardcopy (both mail and email) and mostly between partners in established relationships.

Less than 40% of survey respondents consult Internet sources for investment opportunities. Only one respondent actually claimed to find such opportunities, but this also was a rare event for them. Twenty-five percent of respondents frequently consult multiple listing services to look for real estate properties for sale. None of them actually base their investment decisions on any of the information provided by these Internet sources.

Less than half of survey respondents (46%) analyze their potential investments by comparing them with other properties whose information was accessed on local listing services. Only 9% actually use this information in the appraisal process, while the majority still relies on the services of brokers and appraisers (service providers). There was no information as to whether the service providers use similar online services or consult their own databases.

Forty-five percent of the real estate investment managers claimed to use—or to know that their property manager uses—multiple listing services to market their properties. Only 9% of survey respondents actually use the multiple listing services themselves. All respondents, however, provide a private listing of their own acquisitions and disposable properties on their Web sites. Most of the time, real estate investment managers rely on the services of brokers and service providers to market investment properties. In the next few years, however, due to the consolidation of online brokerages and listing services, it is expected that investment managers will move to promoting their properties on the more public and national operating listing services. Figure 4.1 presents some of the findings discussed above.

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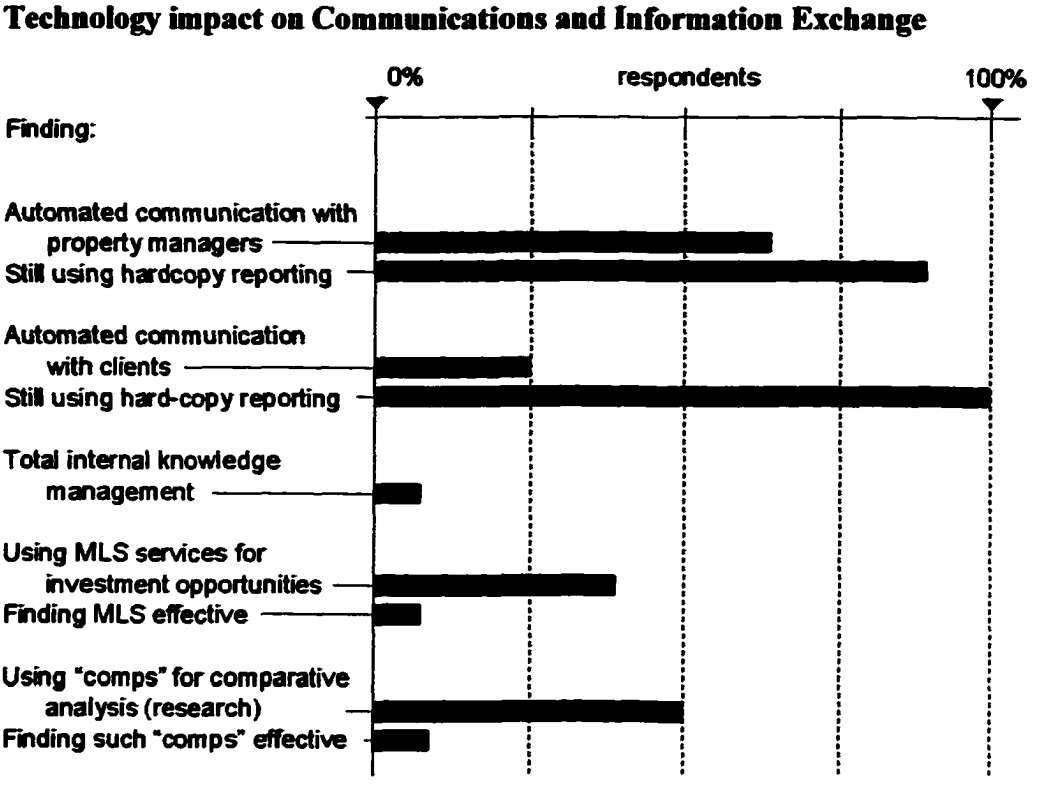

Figure 4.1: Summary Survey Findings on the Impact of Technology on Communications and Information Exchange

4.3 Productivity and Time Allocation

Saving time is rated to be a relatively minor reason to implement information technologies. Modest savings in time are experienced—and any savings are often consumed in more detailed study and analysis. One respondent even noticed an increase of time expenditure due to "using technology." Others claim to save time, however minimal and relatively insignificant, through the general deployment of information technology that automates cumbersome manual tasks.

The most significant savings in time are experienced in internal business processes (in cases where real estate investment managers have optimally linked the information flow between property managers and asset managers) for companies with established and

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tested technologies. Since hardcopy is still the most used medium for information exchange, processes are hardly performed in a speedier manner—and their speed is often limited to the speed generated by using email.

Technology has not had any impact on the frequency of reporting from investment managers to clients. Quarterly reports are still prepared and sent out in hardcopy. An impact was noticeable, however, in cases where property management information is retrieved through online information systems. Through the linkage of property managers and asset managers by virtue of online or dial-up-accessible general ledger systems, reporting frequency has increased from monthly to daily, or even to real-time.

4.4 Cost Expenditures

Improving efficiencies, and meanwhile lowering operational costs, ranks high in importance as a reason for real estate investment managers to embrace real estate technology. Because of the technology-driven era—during which 46% of respondents are currently in the process of implementing or upgrading their systems, while the others have already upgraded theirs, budgets for technology are higher than ever before.

With an increase of between 10% and 30% in technology investments for 2001 compared to the previous year, respondents have invested or are investing heavily in the upgrade and/or implementation of streamlined information systems. Twenty-seven percent of respondents have just finished an implementation and do not expect more investments for technology in 2001, whereas another 27% expect a decrease following the high investments in previous years. All interview respondents with the five firms expect to finish their strategic implementations before the spring of 2003.

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Only 10% of survey respondents perform full-scale market analysis and research in-house, while 90% outsource some of the research activities to third-party consultants and analyze the data in-house. Technology has not impacted the organization of this research. Because the vast majority of the investment managers do not rely for their analysis on free online research data and only use paid services, the cost of market research generally has remained unchanged or has fallen only slightly.

Economic appraisals are also often outsourced to trusted local partners such as brokers and appraisers. Despite the fact that more affordable technology sources are available, only 18% of respondents have experienced a decrease in cost. The majority (82%) has not noticed a difference in price, other than the regular inflations.

Except for the costly initial design, layout, and implementation of the new technologies for improved communications between property managers and clients, 60% of survey respondents experienced a slight to significant decrease of cost, mainly in recording expenses. In cases where the recording function is completely automated through online information systems, cost of information gathering and reentering data has fallen sharply.

Because in all cases clients are still informed through quarterly reports in hardcopy, little to no cost savings have been experienced for reporting. It is even said that because it has become easier to analyze and present information (partially due to technology), clients require more information and thus the cost of reporting is rising. Figure 4.2 depicts the responses of the telephone survey respondents to the costs of implementing real estate technology.

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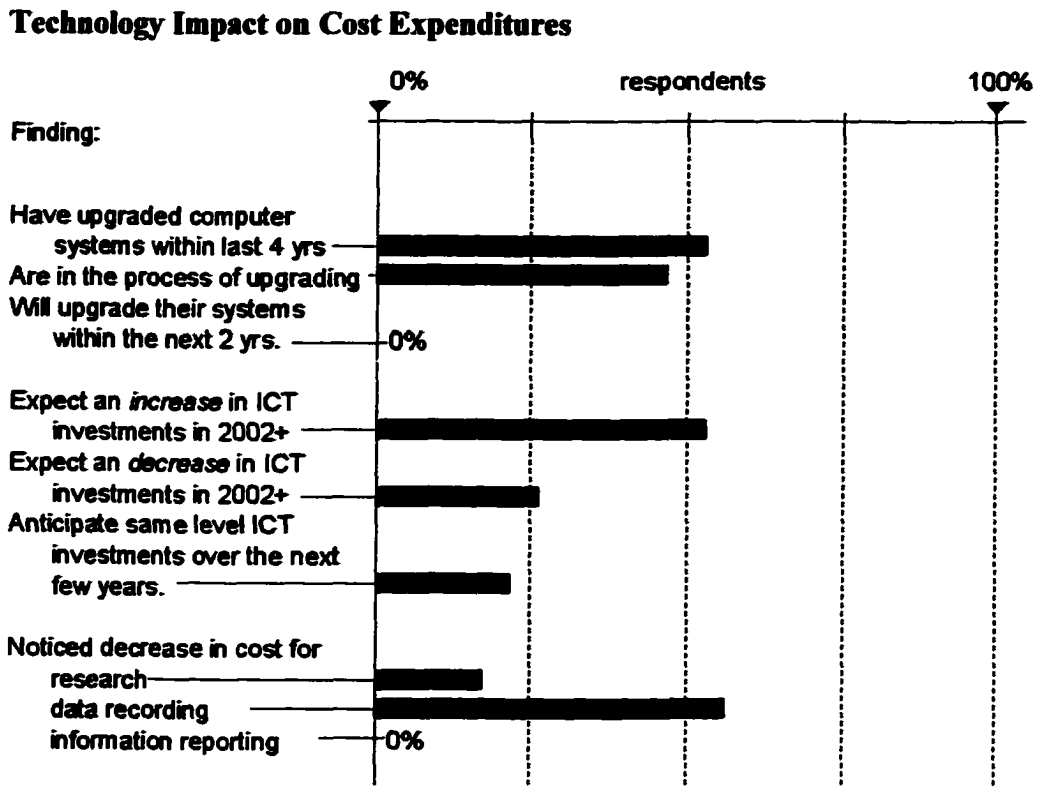

Figure 4.2: Summary Survey Findings on the Impact of Technology on Cost Expenditures

4.5 Client Satisfaction

All survey respondents agree, client satisfaction is determined solely by a positive and prosperous return on investments. Service and quality of reporting are of secondary importance to the owner. However, 55% of respondents experienced an increase in client satisfaction that is not tied to return on investment after the implementation of more advanced technologies.

In the cases where real estate investment managers are equipped with online information systems to inform the clients of the performance of their properties, hardcopy reports are still required and sent to clients. Figure 4.3 shows the limited correlations between the investment manager's efforts to provide technology solutions to its clients and the resulting impact on client satisfaction and trust relations. Interestingly, as figure

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4.3a shows, there is a much faster *reduction* in client satisfaction when online solutions are taken away from the clients' package of privileges and services, as opposed to a much slower *increase* in client satisfaction when new solutions and online functionalities are added.

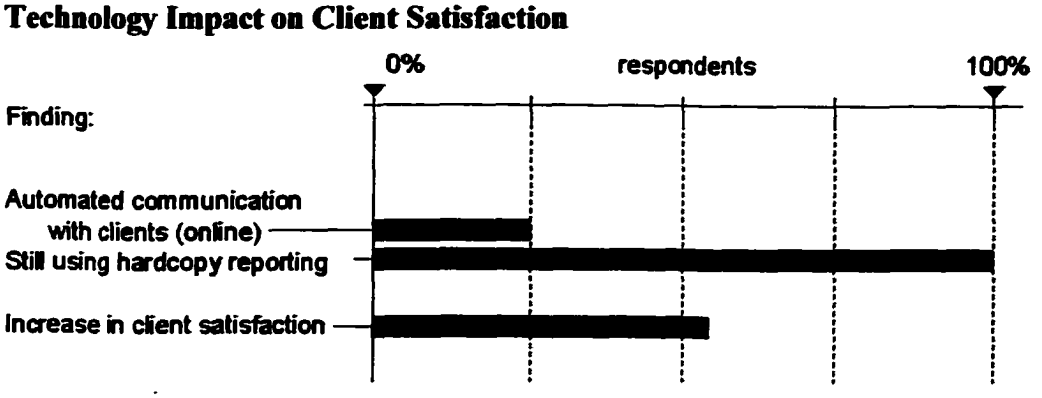

Figure 4.3: Summary Survey Findings on the Impact of Technology on Client Satisfaction.

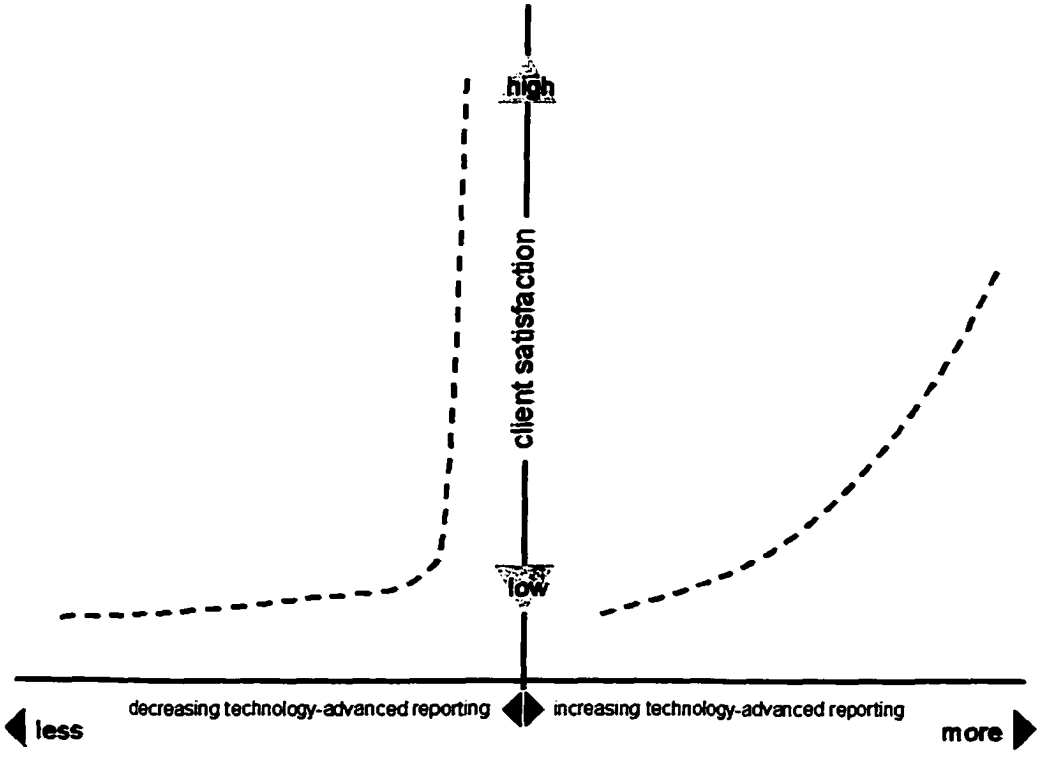

Figure 4.3a: The relationship of customer satisfaction with increasing or decreasing technology advanced reporting instruments.

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4.6 Quality and Quantity

The Internet and its applications have made a wide range of information and research sources available. Information sources that previously only could be accessed through local providers or brokers now are available online in all gradations and at low cost. Thirty-six information portals and 20 market research sites[32] provide data on markets, properties, and the industry—all to benefit the core business of asset and portfolio management.

More than half of survey respondents frequently access online information sources to support their decision-making and business processes. None of them, however, base any of their decisions on the data freely and readily available from these sources. Established business relationships with brokers, consultants and other paid-for resources still provide the necessary and required quality information.

Despite the fact that none of the survey respondents base their decisions solely on online information sources, they have opinions about the quality of the sources. Forty-five percent of respondents do not find improved quality of data from online market data providers, and some even feel the quality has suffered from the booming growth in online resources, where quantity matters more than quality. Fifty-five percent of survey respondents, however, believe the quality of available market research has increased. The assumption is that this opinion is based on the increased quantity of data and thus there is more selection and choices of data and data sources.

For recording and reporting functions, the quantity of information exchanged has increased, according to 64% of survey respondents. Investment managers request more

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[32] From the 518 dot-com company analysis as presented in the literature review.

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information from third-party service providers in order to improve their research and analysis. Through online information systems, now property managers can provide the information needed for property performance studies. Quantity has not really increased for this matter, since all surveyed investment managers already enforced standardization for information collection from their property managers.

Figure 4.4 depicts the findings on the qualitative and quantitative changes in communications and information exchange. For now, investment managers still rely on their relationships with service providers that may or may not deploy technology.

Technology Impact on Quality and Quantity of Information and Performance

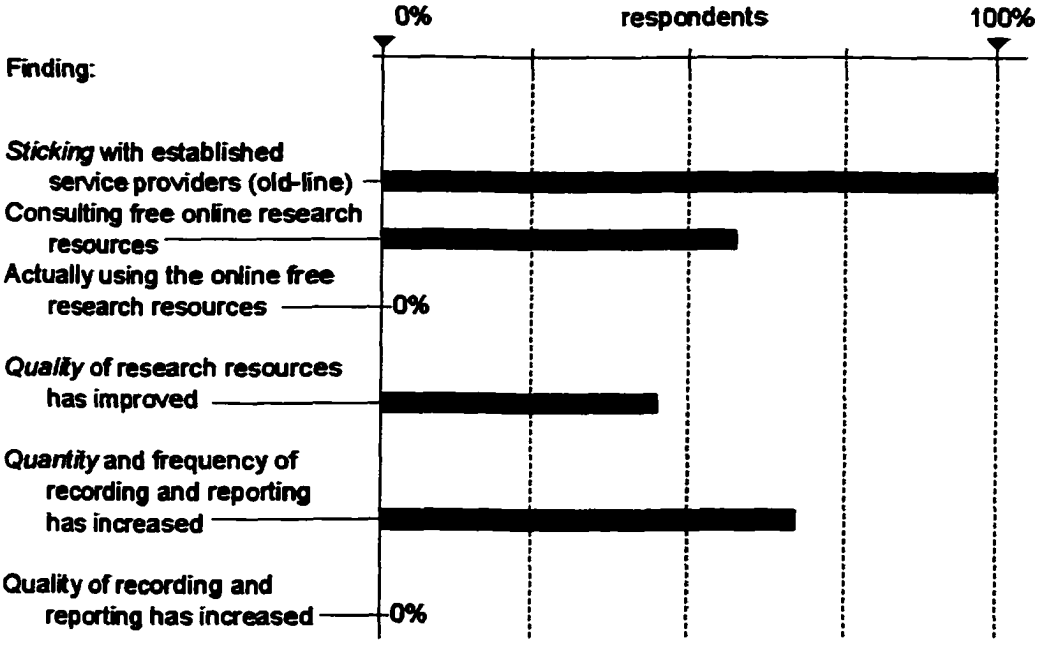

Figure 4.4: Summary Survey Findings on the Impact of Technology on the Quality and Quantity of Information and Performance

Sixty percent of the survey respondents agree that owners tend to request more information regarding their portfolios because of the availability of additional tools and software applications. Online information systems have been developed and implemented to further enhance the provision of information to clients. None of the survey and

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interview respondents found an impact on the quality of information exchanged with the investment client because of technology advances.

4.7 Legal Factors

More than 50 contracts and documents are drafted for the real estate acquisitions process, with each document eventually containing at least two sets of authorizing signatures. All respondents find the negotiation process to be dependent on "face-to-face meetings and conciliation sessions." Documents have contractual and legal value and are required by all respondents in hardcopy. For the data exchange, all respondents use email to distribute such legal documents.

Each real estate transaction exceeds U.S.$10 million in purchase price for all respondents. The complexities of such transactions are generally not yet trusted to the "digital highway," otherwise known as the Internet. Only one respondent claimed to experiment with digital signatures but has not fully implemented this.

4.8 Summary Findings

The findings of the telephone survey and interviews show that the pre-assumed but generally untested positive impact of real estate technology on the processes of investment management have led all respondents into the information era through heavy investment in new management systems to streamline and integrate the cumbersome information flows. This chapter discussed respondents' opinions and experiences on technology's impact on (1) communications and information exchange, (2) productivity

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and time allocation, (3) cost expenditures, (4) client satisfaction, (5) quality and quantity, and (6) legal factors.

In an example followed by all investment managers, industry leaders have tended to elevate tedious and cumbersome processes that can be easily automated to the electronic highway. This is not necessarily done to gain immediate cost benefits or timesavings, but rather to support the processes of an evolving industry using newer and more innovative methods. Because of this, the most drastic improvements are occurring in the exchange of information between the various players around the investment manager. Mind you, exchange of information is one of the most important and time-consuming jobs of the real estate investment managers.

Furthermore, client satisfaction initially does not seem to be affected by the use of the Internet and other high-technology solutions. However, the interviews and experiences from similar industries that have previously experienced these evolutionary changes show a change in client-population and demand. All respondents acknowledged that the investments made today in technology might not produce immediate savings in time and money, but will contribute to a longer-term benefit of facilitating them in the reengineering of their role and position within the industry.

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Chapter 5: CASE STUDIES: RREEF AND AEW CAPITAL MANAGEMENT

5.1 Introduction

This chapter presents two independent and self-supporting case studies of the implementation of real estate technology within leading U.S. investment management firms. The first case study deals with the technology efforts of San Francisco-based RREEF and its impact on the organization and its processes. The second case study discusses real estate technology implementation within Boston-based AEW Capital Management LP. Section 5.4 recapitulates the findings of both case studies in one comprehensive paragraph.

5.2 RREEF, Real Estate Investment Managers[33]

In the last 26 years, RREEF has positioned itself as a leading full-service real estate investment advisory firm in the United States. With more than 1,100 employees and 515 properties under management, and valued at over U.S.$16 billion, RREEF deploys innovative processes and tools to improve its services and enhance returns to clients. From the early stages in its corporate development, RREEF has embraced software and technological applications to reduce process inefficiencies, to lower overhead costs, and more importantly, to increase client satisfaction. RREEF was consequently one of the first real estate investment management firms in the United States to embrace the Internet and its applications in its communications to clients about investment properties and

[33] Information for this case study is partially abstracted from RREEF's corporate Website, brochures, white papers, and interviews with Michael Young and John Shields; additional information provided in part by John Shields, Vice President of Client Relations at RREEF.

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funds. "In order for us to run a 1,100-employee company, we have used technology as soon as it was available," says Michael Young, RREEF's Chief Technology Officer, but he adds, "To our clients, though, it is yet a slow sell."

After a quarter-century of business and only four years after its first professional application of the Internet in the real estate investment management industry, RREEF has embarked on the so-called *iRREEF* initiative that will integrate the various third-party and proprietary information systems and Web enable the interface, first for internal use, then later for communications with its clients by providing dynamic content on their investment portfolios. To date, RREEF has fully implemented email communications with its clients and shares digital "hardcopies" via Internet or email. The slow rollout of this virtual communications initiative has begun to accelerate as "more than 20% of our investment clients are moving to electronic information exchange only," according to one company officer. The "first complaints were received when RREEF's Internet presence was down due to technology problems," indicating a growing use of and reliance on RREEF's online offerings. Despite slow acceptance by its clients, RREEF is a strong believer in the further utilization of real estate technology to support not only its clients but also—perhaps more importantly—its internal organization. This case study takes a closer look at the RREEF organization and its investment processes, the identified needs within the firm for which technology is a solution, and the implications for its operations.

5.2.1 Introduction

In the early 1970s, Claude Rosenberg, founder of a San Francisco investment firm, thought real estate investments to be the future for pension funds. Lacking knowledge of real estate, Rosenberg brought together three local real estate professionals to make his

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vision a reality. With Paul Sack (a Northern California apartment developer), Sandy Hogland and Jack Bogart (former Coldwell Banker associates and later founders of the real estate consulting and development firm Hogland & Bogart), and later also with Dick Bertrero (one of Coldwell Banker's top marketing executives), Rosenberg founded the Rosenberg Real Estate Equity Funds (RREEF) in 1975. These five men founded RREEF on a philosophy of teamwork and an entrepreneurial spirit that still guides the firm. Their goal was to give institutional investors access to the same hands-on real estate decision-making that private owners had enjoyed and been successful with for a long time. The vehicle they invented to implement this strategy was the closed-end real estate commingled fund,[34] that is, a large real estate investment pool for multiple investors, bundled within one accessible investment fund, having a predefined disposition date.

In 1975, RREEF started its first fund, the West Fund, focusing exclusively on West Coast investments in small properties. Only four years later, RREEF closed two more funds and opened a branch office in Chicago to better serve national dispersed clients and investment properties. Through its success and interest in the East Coast, RREEF opened its third office in New York in 1982. In 1987, RREEF started its first separate account—an investment pool of U.S.$200 million in real estate for one corporate pension plan as the sole investor. In the period between 1988 and 1991, RREEF experienced some organizational restructuring and its slowest year ever—with only U.S.$87 million in new investments in 1991. Layoffs followed, forcing RREEF to re-invent its organization. As a result, RREEF Research was formed to provide an increased range of complementing products and services and to better facilitate the advisory services. After this year,

[34] After John Shields, "*RREEF's History*," a RREEF white paper (March 2002).

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RREEF picked up again and a path of constant growth and recognition was entered. In 1993, RREEF followed the inception of real estate securities[35] through active investments in this new investment instrument, to be followed by another successful "flagship" core fund, the RREEF America II. In 1998, the Dutch financial institution Rodamco bought RREEF, only to be sold again in 2002 to the Deutsche Bank for U.S.$440 million.

Now, in 2002, RREEF has U.S.$16.2 billion in real estate assets under management, totaling 165 million square feet, spread over 515 properties in 50 U.S. metro areas and financed by 196 investment clients. With offices in San Francisco, New York, and Chicago, RREEF employs 1,127 employees of whom 75% are actively involved in the daily management of its real estate investment properties. RREEF provides its investment services to endowments/foundations (2%), corporate pension funds (26%), public pension funds (64%), and Taft-Hartley and foreign investors (8%).

5.2.2 The RREEF Organization

RREEF's Client Relations team (13 professionals) maintains the communicative contact with its investment clients. The portfolio managers (32 professionals) collaborate closely with research, acquisition, development, and property management functions in the firm to make the best investment strategies, decisions, and valuations for the investment portfolios. RREEF counts 15 research associates that provide up-to-date market information on 50 U.S. metropolitan areas and 230 submarkets, as well as various top-down and bottom-up analyses, to facilitate the work and decisions of RREEF's associates. As one of RREEF's core competences, RREEF employs 331 professionals in

[35] The first true U.S. private REIT was started in 1994.

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property and facilities management. Staff operations (46 professionals), such as finance and accounting, complete the departments that support its fully integrated real estate advisory services.

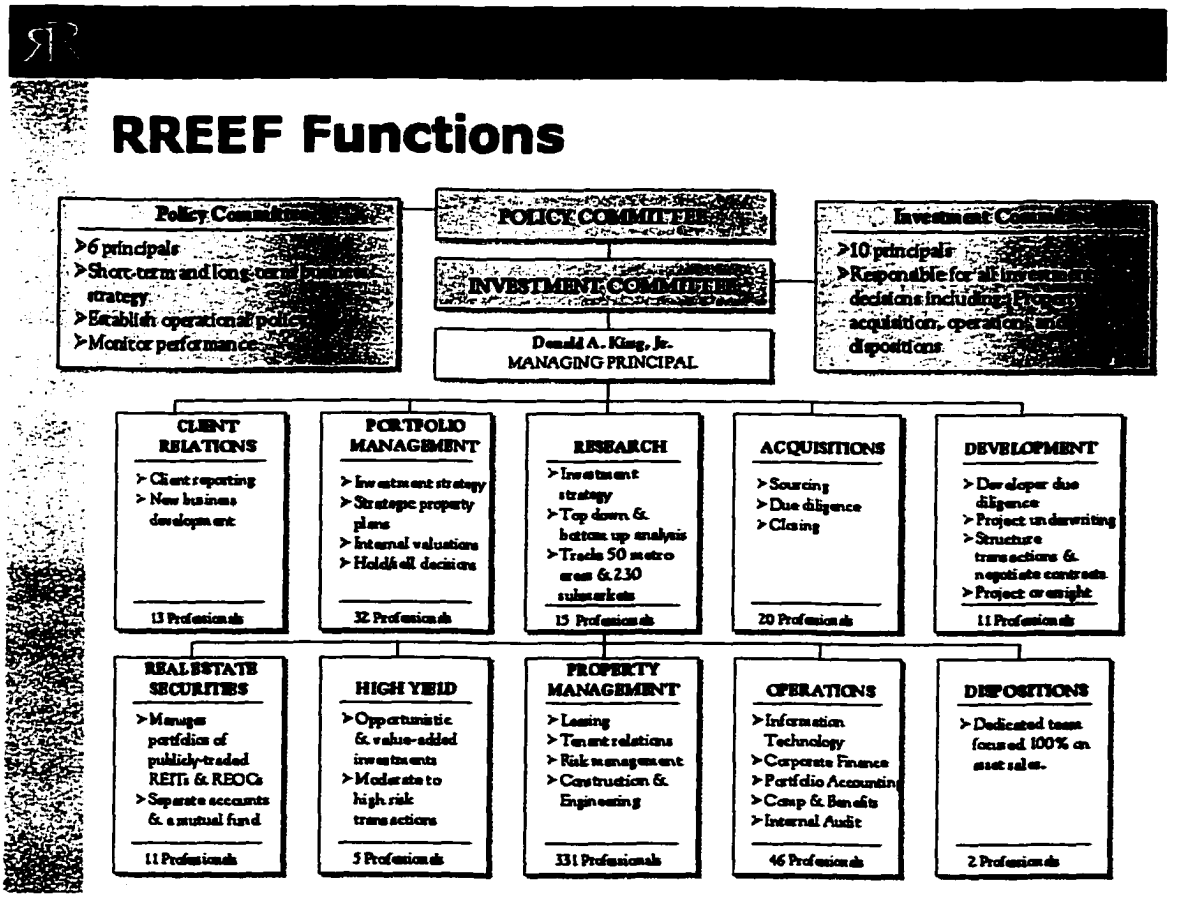

Figure 5.1: RREEF Functional Diagram (Source: RREEF, 2002)

A team of 11 professionals forms the Real Estate Securities department that manages portfolios of publicly-trade REITs and REOCs (real estate operating companies) as well as RREEF's separate accounts and mutual fund. RREEF's High Yield department (5 professionals) manages the opportunistic and value-added investments, as well as the moderate- to high-risk transactions. Each department at RREEF is led by one of the firm's principals. RREEF's Investment Committee is responsible for investment decisions. The Policy Committee (6 principals) establishes the short-term and long-term

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business strategies, operational policies, and monitors the firms' performance. The total RREEF team is driven to provide "superior real estate investment performance," through "careful and ongoing research into real estate markets," "direct control and active management of real estate," and "investments in high quality, completed and leased properties, in major metropolitan areas"—channeled in three categories of real estate investment instruments:

- Separate accounts: direct investments in privately held real estate (71%)
- Commingled funds: core, value-added, and opportunistic investments (13%)
- Real estate securities: publicly traded real estate securities (14%)

RREEF has 38 clients[36] and U.S.$11.5 billion in real estate assets under management in *separate accounts*,[37] providing 71% of RREEF's operation. These investments are acquired, managed, and sold for distinct institutional investors. With separate accounts, risks and returns all come to the one institution that is providing the capital for this investment.

RREEF identifies three levels of *commingled funds*, all varying in risk and returns. In these funds, RREEF brings together a selected group of investors to jointly invest in a pool of real estate investment properties. RREEF's core commingled funds are the RREEF America I and II Funds. These funds hold approximately 11% of their assets under management (U.S.$1.9 billion). U.S.$503 million is held in RREEF's value-added and opportunistic funds (2% of the total AUM). The value-added and opportunistic funds are to enhance portfolio performances by finding higher-risk/higher-return investments. The average internal rates of return (IRR) for the value-added and opportunistic funds are

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[36] Number of clients might also be included in other investment instruments, as discussed later.
[37] As of December 31, 2001. Courtesy of RREEF, 2002

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19.7% and 26.6%, respectively.[38] Within this latter group, RREEF also employs a 9-professional development group that sources and analyzes the development fundamentals of potential sites throughout the United States.

Finally, RREEF invests in publicly traded *real estate securities* to maximize returns to clients. A select number of REITs with strong cash-flow growth potential and the capacity for sustained dividend increases are targets for investment. RREEF manages U.S.$2.2 billion in these publicly traded securities on behalf of 40 separate account clients and a mutual fund.

5.2.3 The Investment Management Process

Figure 5.2 graphically illustrates the steps of the investment management process, starting with *building a relationship*. Each client has a group of professionals who make up its RREEF team. Team leaders are the client relations and portfolio management representatives. Key individuals from the research, acquisitions, dispositions, and property management departments are also assigned to the investment client's account.

Together with the investment client, the RREEF team shapes the client's objectives and *formalizes the investment strategy*—depending on investment allocations, risk, and amount of capital. This "living" document may continue to develop or change over time, subject to changes in the investment climate, markets, available capital, and other investment requirements. The investment strategy forms the framework guidelines to investment decisions, acquisitions and disposals.

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[38] Average IRRs for 29 completed and liquidated investments. The IRR range for 18 value-added investments is 7.7% to 38.5%, and IRR range for 11 opportunistic investments is 5.1% to 45.1%.

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The RREEF Investment Process

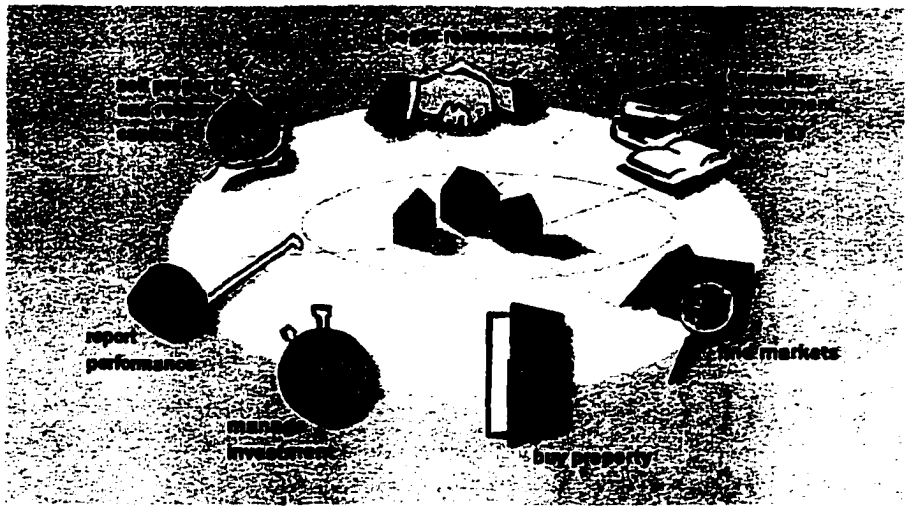

Figure 5.2: RREEF Process (Source: RREEF. available at www.rreef.com, accessed December 2001)

Through RREEF's research department, supported by proprietary market databases and forecasting models, nationwide links to the industry, professional and government data sources, and current market intelligence from RREEF field personnel in over 100 offices around the U.S, RREEF *identifies and targets investment markets.* An in-house top-down analysis (from national market to property level) allows RREEF to focus on properties that meet the investors' requirements. RREEF continues to focus on existing, substantially leased properties in select major metropolitan areas. RREEF Research tracks economic conditions and forecasts real estate market performance in every major metropolitan area and in specific submarkets where RREEF has its properties. The markets are reevaluated at least every six months to address weaknesses and to identify opportunities.

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Once a property is found, the *acquisition process* starts with signing a letter of intent and negotiating the terms and conditions of the various purchase contracts and exhibits.[39] RREEF's relationships with brokers, owners, and developers allow RREEF to source transactions not formally on the market and to access a great number of quality properties. RREEF's acquisition portfolio (1998–2001)[40] comprises 10% apartments (U.S.$961 million in 34 Assets Under Management—AUM), 17% office buildings (U.S.$1,5 billion in 52 AUM), 12% retail buildings (U.S.$1 billion in 21 AUM), 54% industrial buildings (U.S.$5.1 billion in 98 AUM), and 7% other investments.

RREEF is one of the few advisory firms that performs most activities in-house (including property management). The majority of its competitors choose to outsource activities such as property and facilities management, as well as parts of research and analyses, due to the anticipated level of specialization. RREEF, however, believes in direct and active hands-on real estate management through equity ownership and in-house portfolio and *property management*. RREEF has developed a national property management organization staffed by 331 real estate professionals, comprising 115 offices in major metropolitan areas. With this team, RREEF serves 513 properties under management, totaling approximately 165 million square feet with more than 10,000 commercial tenants.

Asset management at RREEF is a coordinated effort between the portfolio management and property management groups. Through this strong relationship, RREEF has the ability to provide timely *financial and performance measurement reporting*, tailored to the client's needs. RREEF has a fully integrated automated information

[39] Tracy L. DeMay, "Real Estate Due Diligence and the Closing Processes," *Real Estate Review* 28(3) (Fall 1998), 45–52. DeMay is Vice President of Acquisitions and Director of Closing, RREEF Funds.
[40] As of December 31, 2001.

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system, giving portfolio managers online access to all aspects of its clients' portfolios, and in real-time populated by the property managers. RREEF's computer network enables the firm to funnel financial information quickly and efficiently from the property, through asset management accounting, and ultimately (via client accounting) to its clients. A proprietary feature of this system is the Investor Reporting System, which tracks the financial activity of clients' accounts and calculates the performance of their investments. From the inception of the relationship, the Investor Reporting System maintains a history of contributions, distributions, and income from real estate operations, management fees, and appreciations.

RREEF's accounting services are separated into two distinct groups to provide internal control over the integrity of financial information that flows from property level to the client. Asset management accounting is decentralized at the property level. This focuses responsibility for the quality of financial information at each property management office. Client accounting includes fund consolidations of property level financial information, fund financial statement preparation, tax compliance reporting, RREEF's quarterly internal audit program, cash management, and client distributions. By separating the responsibility for input of accounting information at the property level from preparation of client financial reports at the corporate level, RREEF provides a system of checks and balances. Final statements, fact sheets, and financials always go through the hands of the client relations or portfolio management department on to the investment client. The personal relationship between these parties is considered one of RREEF's competitive advantages.

In RREEF's constant effort to achieve the highest performance on an investment portfolio, throughout the period of ownership and complying with higher-level

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investment strategies, RREEF's professionals evaluate each investment on its future contribution to the client's investment goals. If they decide that selling a property (return capital) will benefit the portfolio, RREEF will eliminate the property from the investment portfolio from the investment property. The client and RREEF's investment committee ultimately decide together on the *disposition of the real estate.* Since 1998, RREEF has sold nearly 270 properties to return approximately U.S.$5.3 billion in sale proceeds to its clients, averaging 10% above the properties' appraised values. RREEF's dedicated disposition team (2 professionals) expedites sales processes and allows portfolio managers to continue to focus on the properties that will be retained.

5.2.4 Real Estate Technology @ RREEF: The iRREEF Initiative

Not only because of the client's wishes and demands, but also to "enable growth and manage the information flow among more than 1,100 people,"[41] RREEF has often deployed the latest available technologies. It was one of the first real estate advisory firms to embrace the Internet for internal and external communications. Technology has never been the "competitive advantage" but was simply used to facilitate RREEF's complex and evolving business processes and rapid growth since 1991. Inefficient and cumbersome information flow and communications processes have forced RREEF to explore alternative scenarios for its information management. Initial investments were made early on in software applications to streamline data collection, storage, and distribution, primarily for property management and accounting purposes.

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[41] Interview with Michael Young, as part of the initial research telephone survey in May 2001. RREEF was one of a research sample of 20 firms, including a large group of the top 20 American advisory firms as well as a selection of the smaller industry representatives.

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With Michael Young's varied business background, the now-chief technology officer started twelve years ago as a quantitative analyst within RREEF's research group. With his extensive knowledge of the organization and its processes, and with his pragmatic and constructive ideas and insights on what technology could do for RREEF (for example, he once said, "technology, when it removes tedious and repetitive tasks, provides the ability to work on value-added opportunities and processes"), Young became the firm's chief technology officer in early 2001. Since then, Young and his team get full support from RREEF's policy committee, which—under leadership of the firms' managing principal Donald King—drives the technology initiatives to enhance the firm's operations. To operate freely and without obstruction, Young knew to create an autonomous technology team that would report, not through the company's corporate finance group, as it did before, but directly to the board of directors. Now, "we can better anticipate change without having finance or accounting needs limit our ability to serve other operating groups in the company," he says.

The technology group counts 27 employees and is divided into three groups: application development, for maintaining existing applications and creating new ones; operations and support, for both hardware and software assistance; and business services, for the more strategic outline of corporate technology decisions.

With an ear to the problems and inefficiencies in RREEF's current business processes, RREEF embarked on a project called *iRREEF* that triggers improvements in the company's business processes through technology implementation. With more than 20% of the project implemented and a goal of full operation by the end of 2002, *iRREEF* is well on its way to positively affect RREEF's information management and work processes. The *iRREEF* project entails the integration of the various information systems

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through a proprietary data warehouse and overlying interface design. *iRREEF* is an internal and role-driven system that allows each and every individual to access authorized information. Initially, the project will facilitate internal communications within the organization, but later it will be opened up to RREEF's investment clients: "If it works for us, it also works for our clients." *iRREEF* is not meant to "shrink departments, but clearly is a way for us to free up time for other things, and to raise the bar to our competitors," Young says.

5.2.5 RREEF Entering the Electronic Highway

In 1997, RREEF opened its first public Web site, promoting its own organization but still denying any dynamic content to its customers. Soon after, RREEF started publishing online custom hardcopy reports in PDF format for its customers' use. With email still the most used and virtual method of communication, RREEF found the Web presence to be at very least a helpful extension to its marketing arm. Meanwhile, RREEF deployed its usual information system to facilitate the various departments autonomously.

With time frames, fee structures, investment volumes, and the acceleration frequencies of real estate transactions becoming increasingly complicated, RREEF realized the need to increase information flow transparency and consequently to further embrace technology in order to integrate the various processes and information systems. One example that triggered RREEF's digital initiatives was its growing multiple databases holding contact information of the more than 24,000 tenants of its investments properties. Many of these entries turned out to be duplicates, only entered and written differently. More than 100 employees had the authority to provide and manage the data entries, thereby increasing the chaos in the system. A new centralized data system,

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accompanied by new rules and privileges (now only lease coordinators can make changes to the databases) has reduced errors, the occurrence of multiple data entries, and even the need for training people. Consequently, the *iRREEF* project goes beyond technology implementation alone, focusing also on personnel and process factors.

5.2.6 ICT for the Property Manager

RREEF has two accounting systems in place, the asset management accounting system that keeps track of property data, and the client accounting system for analysis and preparation of client reports. For management and verification purposes, the systems are kept separate. *iRREEF* will eventually provide a central data warehouse that allows communication between the different existing and established accounting and information management software applications, each serving a specific area within the RREEF organization.

Ninety percent of RREEF's technology infrastructures are based on standard software. The customization of those software applications will be built into *iRREEF's* new interface. Currently, RREEF does not have to constantly customize expensive and existing software applications when requirements change over time. The *iRREEF* interface application is being developed in-house.

Through RREEF's integrated information systems, its portfolio managers save time in the reentering of data and verifying accuracy and completeness. Instead of using these savings to reduce the portfolio team, RREEF has used this efficiency to "manage more assets with the same number of bodies." The average dollar amount of assets under management per employee has increased from U.S.$9 million per employee to more than U.S.$14 million per employee.

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One of the new systems in place is RREEF's investor reporting system. This Web-based system provides an internal analysis tool with triggers to both portfolio and property managers. "When the actual financials exceed the predetermined budgets, the property manager is automatically prompted to explain this difference," Young explains. Each portfolio manager now can provide the appropriate explanations to its investment clients. The trigger can be set per property or per investment client, depending on the level of required detail. RREEF has been able to standardize and facilitate these information processes to a great extent, merely because the firm performs most activities, including property management, in-house. It was therefore relatively easy to implement such a comprehensive information system throughout the organization. During the implementation period, RREEF put a lot of effort into educating and training all its portfolio managers over only a few weeks' time.

5.2.7 ICT for Acquisitions and Dispositions

"Mechanisms to 'own' real estate won't go much faster—with or without technology. Environmental analysis, for example, will only increase and co-determine the speed of transactions," Michael Young states in order to indicate the relatively minor impact of technology on RREEF's acquisition departments. The increased transparency caused by technology, however, will facilitate the efficiency in the transactional processes by providing instant access to property and market information.

5.2.8 ICT for Communications with the Investment Client

Currently, some investment clients get their financial statements and summaries emailed in PDF file format. Soon, in addition, RREEF expects to provide online real-time

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access, following in the footsteps of the development of *iRREEF* for the internal organization. To date, "20% of our clients want online access to their information," says John Shields, referring to simply PDF information exchange, "but this number is growing fast." John Shields is vice president of client relations and in that function, he is responsible for RREEF's Web presence.

Despite all these developments and customer requests, RREEF will "not ask its clients to look up their information themselves via an online interface," Shields says, emphasizing the importance of the personal client relationship—an asset that RREEF recognizes as one of their core competencies.

Although some of the reporting products are somewhat standardized (e.g., RREEF's flash report, which is a quarterly summary page on each client's investments or portfolio), RREEF's incentive is to supply whatever the customer prefers. Thus, for each investment client, RREEF spends a lot of time customizing the quarterly and annual reports. Upon finishing the *iRREEF* project (regardless of whether the information is made available online to the investment client), both Young and Shields expect great improvements to rapidly and in real-time provide the requested customization.

5.2.9 Organizational Changes

Over the last ten years, RREEF grew the assets under management 356% (from U.S.$4.5 billion to U.S.$16.2 billion), while the firm's employee headcount increased only 224% (from 503 to 1129). Figure 5.3 shows the growth projections of the assets under management (AUM) and the number of employees. The headcount includes RREEF's workforce dedicated to property and facilities management (accounting for approximately 75% of its employees).

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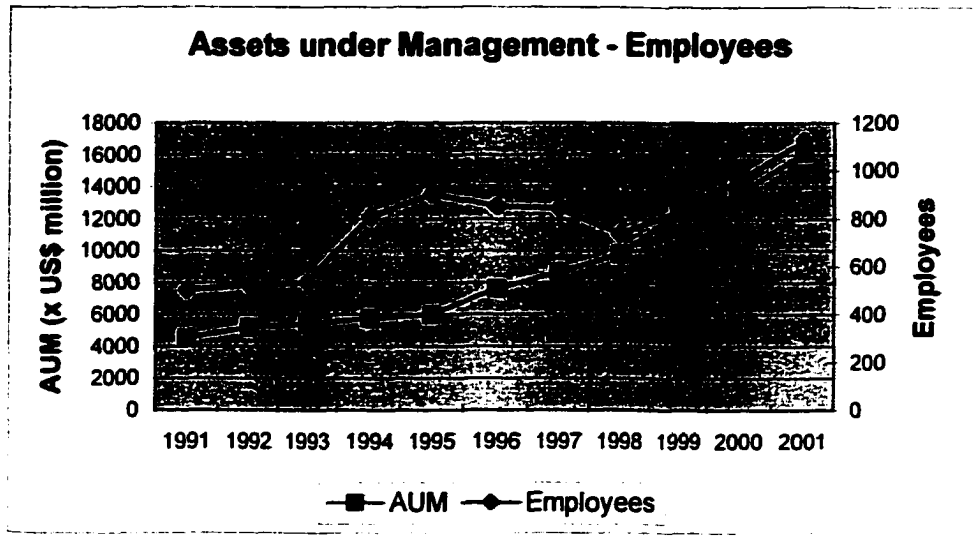

Figure 5.3: Growth Projections of RREEF's Assets under Management and Employee Headcount

Figure 5.4 shows an increase in productivity, as we assume the ratio U.S.$ AUM managed per employee. As the majority of U.S. real estate investment managers choose to outsource the property management function, this productivity ratio is not a proper benchmark for the investment management industry.

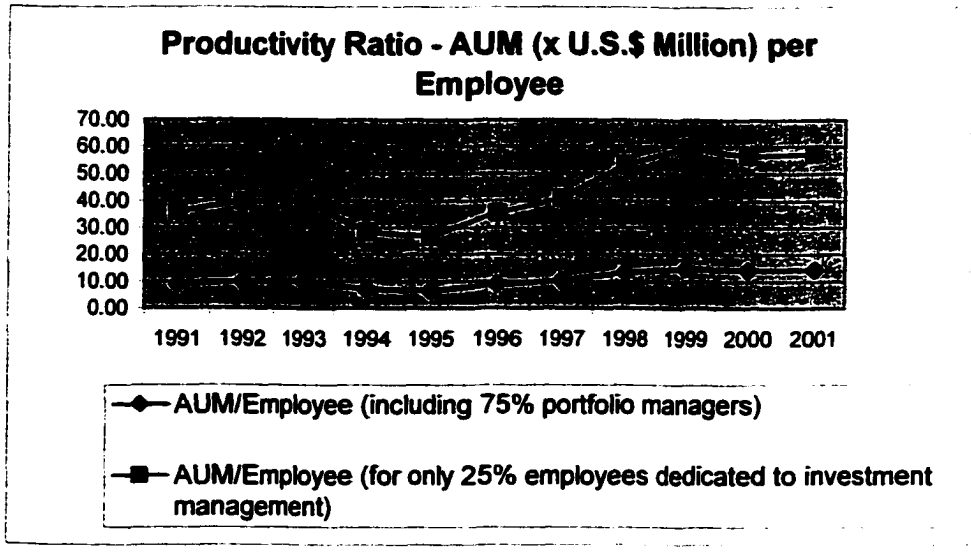

Figure 5.4: Average Productivity Ratio: Total Assets under Management Divided by the Number of Employees (with and without 75% property managers)

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On average, RREEF employs 75% of its employees in property and facilities management functions. The figure therefore shows both the ratio of RREEF's total headcount and AUM (including the 75% property managers), as well as the ratio for RREEF's dedicated investment management team and AUM (only 25% of the firm's employees). The question now arises, how has technology contributed to this increase in productivity for the RREEF organization? In order to facilitate the firm's rapid growth, something had to be done, and both Young and Shields believe technology has proven to be an excellent tool that allows RREEF to channel and organize less productive processes and business inefficiencies.

5.2.10 Conclusion

RREEF has completed approximately 20% of the implementation of *iRREEF*, an initiative to integrate various data sources through a three-tiered data warehouse and a Web-enabled universal interface that will allow RREEF employees to access and manipulate data on the spot and as they find appropriate. By the end of 2002, RREEF expects to have the new online interface ready, interacting with the various underlying existing and standard software applications. Soon thereafter, RREEF expects to grant its investment clients access to secured areas of financial information pertinent to their specific investments and portfolios. Meanwhile, these efficiency leaps do not lead to a reduction in headcount or to tremendous cost savings. Despite this, and with the assistance of future projections, approximately 5% of RREEF's annual revenue is spent on ICT innovation. The gained efficiencies, however, do have a significant impact on the time allocation of RREEF's employees, who now have time to focus on work "that otherwise simply would not have been done" or on the management of more assets and

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investments, facilitating company growth with a much smaller change in full-time employment. Given these developments, RREEF can rightly be considered one of the U.S. real estate investment firms taking charge in innovative implementations of ICT for process and efficiency improvements.

5.3 AEW Capital Management LP

Founded in 1981, AEW Capital Management, L.P. (AEW) is a real estate investment advisory firm, providing investment management and related services to institutional investors and other owners of commercial properties and portfolios. Grounded in research and experienced in the complexities of the real estate and capital markets, AEW offers innovative solutions to the needs of its investment clients while adding value to their investment portfolios. With more than U.S.$6.9 billion in capital under management (net asset value), which is invested in more than U.S.$11 billion in property and securities (gross property value), AEW is the tenth largest real estate investment advisory firm in the United States,[42] serving many of the nation's leading public and private retirement programs, university endowments, foundations, and Taft-Hartley plans, as well as international and private investors.[43]

Early in 1998, President and CEO Joseph Azrack—then located on the 25th floor of Boston's State Street Building, overlooking Logan Airport and the downtown area—saw the tremendous prospect of technology for AEW's business processes as well as interesting investment opportunities in real estate focused digital enterprises. A task force

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[42] Ranking 2000/2001 by Center for Real Estate Enterprise Management, available on Internet, http://www.centerprise.org/pages/ top20.html#Advisors, accessed November 2001.

[43] Information for this case study is partially abstracted from AEW's corporate Web site and brochures, available on Internet, http://www.aew.com, accessed October 2001.

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was started, headed by AEW's Chief Knowledge Officer Douglas Poutasse, to explore trends and opportunities in real estate technology that would improve the processes, services, and investments of AEW's flourishing business. Only two years later, with the depression of the capital markets and the failure of many dotcom enterprises, the enthusiasm for real estate technology diminished, reaching a realistic level of implementation and operation. Today, still holding a strong, long-term belief in technology, AEW provides most important investment information to its clients using the World Wide Web, while temporarily limiting its investment activities in the dubious world of dotcom initiatives.

5.3.1 Introduction

In 1981, founders Aldrich, Eastman, and Waltch created AEW Capital Management L.P. (AEW). Nvest, one of America's largest capital management firms, bought the firm in 1996, though AEW continued to operate unconstrained and autonomously. After more than 20 years, "AEW now provides leading and innovative investment services to the U.S. institutional market place, primarily focusing on pension funds, endowments, and other institutional clients," said Grant Monahon, chief operating officer at AEW.

Focusing on innovation, AEW was one of the first U.S. real estate advisors that applied "corporate debentures to support real estate company growth," said Azrack.[44] Less than ten years later, AEW was involved in the creation of the first upREIT, called Taubman Centers, Inc., "since two of our clients at the time held interests in a 15-property Taubman portfolio." In 1993, AEW handled the first portfolio securitization for

[44] In an interview with Michelle Napoli, *Commercial Property News*, March 16, 2001.

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a pension fund lender, where more than U.S.$200 million worth of a whole loans portfolio was securitized.

AEW often invests in or with "strategic partners." Since 1981, AEW has invested over U.S.$5 billion with such partners as Taubman Realty Group, Westcor Realty Limited Partnership, and CenterAmerica Property Trust (for investments in retail properties); La Quinta Inns, Inc., Wyndham Hotel Company, and Dolce International (for investments in hotel properties); Gerald D. Hines, The Koll Company, The Voit Companies, Gale and Wentworth (for investments in office facilities); Essex Property Trust, The Related Companies, and Trammell Crow Residential (for investments in apartment buildings and other residential complexes); Trammell Crow Company, Overton Moore, South Bay Development, and Hewson Companies (for investments in industrial buildings); and, for more specialized investments, with Allright Parking, Inc. (parking facilities), Sunrise Assisted Living (senior housing), and Alexandria Real Estate Equities, Inc. (specialized research and development).

Throughout its period of vast growth in the United States, AEW had an increasing need for global expansion to meet the international needs of some of its clients and to expand its market further for competitive reasons. After some independent international investments in Europe that were managed from AEW's Boston headquarters, AEW found an international partner in DTZ Holding (DTZ) in 1999. DTZ is one of Europe's largest real estate brokerage and service firms, focusing mainly on property management, brokerage, appraisals, and other services rather than on investment management as mastered by AEW. Consequently, in 1999, Curzon Global Partners (Curzon) was created. Curzon gives clients of both AEW and DTZ access to international real estate investment strategies and opportunities, as well as to the real estate, research, and capital markets

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expertise necessary to capitalize on these opportunities. Curzon also serves as investment manager for AEW's first international real estate investment fund, Curzon Capital Partners.

AEW pursued international expansion only after it had established a solid set of public market capabilities in the United States—an effort that began in the mid-1990s, after AEW's executives recognized the increasing importance the public market would play in commercial real estate. In 2000 alone, AEW's securities group invested U.S.$290 million of client capital, U.S.$200 million of which was invested in REIT[45] stock portfolios. In the early- to mid-1990s, AEW also traded actively in CMBS and other types of debt investments. "When the CMBS market was emerging, spreads were wide and there were few participants. AEW was a significant player, and at one point, had more than U.S.$1 billion of these notes under management," said Azrack. Since the market has become much larger and more efficient, less opportunity was left for AEW to add true value to the investment-grade securities pension funds in which it historically invested.

Today, AEW is part of the French banking institution Caisse des Dépôts, which has been branded CDC ISIX, with its headquarter in Paris. Consequently, AEW "is operating as a global organization with offices and resources located in both the United States and Europe," said Grant Monahon.

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[45] REIT – Real Estate Investment Trust: A REIT is a company that buys, develops, manages and sells real estate assets. REITs allow participants to invest in a professionally managed portfolio of real estate properties. REITs qualify as pass-through entities, companies that distribute the majority of income cash flows to investors without taxation at the corporate level. As pass-through entities, whose main function is to pass profits on to investors, a REIT's business activity is generally restricted to generation of property rental income. Another advantage of REIT investment is its liquidity (ease of liquidation of assets into cash), as compared to traditional private real estate ownership. One reason for the liquid nature of REIT investments is that shares are primarily traded on major exchanges, making it easier to buy and sell REIT assets/shares than to buy and sell properties in private markets. Source: REIT 101, available on Internet, http://www.reitnet.com/, accessed November 2000.

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5.3.2 Organization and Services

AEW is headed by a group of key professionals, each focusing on a specific aspect of the investment process. These processes are represented in departments, including client services, research, direct investment, real estate investment, real estate securities, high-return private equity, international, advisory services of federal agencies, general counsel, and media contacts. Portfolio managers in these departments are responsible for the investment portfolio of specific investment clients and report directly to the executives of the firm. While a portfolio might hold a large number of investments, asset managers oversee the individual investments and report to the respective portfolio manager. In their responsibilities, they are supported by a large group of associates. Figure 5.5 illustrates the graphic representation of the AEW organization.

The AEW Organization

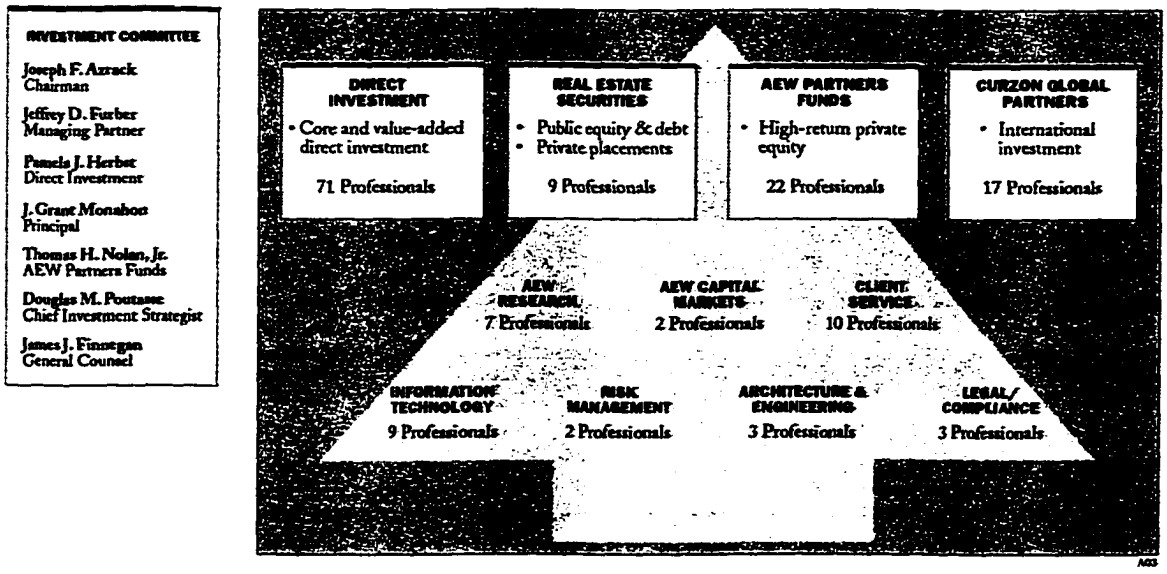

Figure 5.5: Organization diagram AEW 2001 (Source: AEW Capital Management LP).

Like other leading real estate advisory firms, AEW offers a range of investment services designed to match client capital with real estate market opportunity, including

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direct investment in real estate assets and portfolios; high-return private equity real estate partnerships; real estate equity and debt securities; and international investment.

AEW's Direct Investment Group focuses on (1) the development and execution of value-added investment strategies guided by in-depth research and executed to achieve specific client objectives, (2) the active management of existing assets and portfolios, including those originated by AEW and those transferred to their management, and (3) the analysis or repositioning of property portfolios, through selective new investment or the recapitalization or disposition of existing assets. AEW's direct investments deal with particular investments for particular investors. Through its strong and personal relationships with its clients, AEW is trusted with investors' capital to invest in large, stand-alone real estate portfolios.

Second, AEW strongly focuses on high-return private equity investments, or so-called co-mingled investments. With a higher risk but diverse portfolio, AEW offers investment funds that can be invested in by a larger group of investment clients. In 1988, AEW formed its first real estate fund, AEW Partners L.P., fully dedicated to real estate investments. Today, AEW has sponsored four such funds having an aggregate net equity capitalization of over U.S.$2 billion.

The securitization[46] of real estate has provided AEW a third but prominent investment vehicle. AEW specializes in public equity securities and CMBSs,[47] and, in

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[46] Liquidification of real estate is the process whereby a fundraiser transfers ownership of real estate or a claim secured by real estate to a provider of capital, using the cash flow created by the real estate as a source of credit in order to raise funds. Securitization takes the process of liquidification even further by using securities to raise funds. Depending on the type of asset, real estate securitization can be classified as either debt-type (corporate bond type, such as CMBS) or equity-type (investment type, such as REITs). In real estate securitization, a real estate operator (the fund raiser) converts the ownership or profit rights from real estate properties into negotiable securities through a conduit and sells them to investors. For investors, the securities are similar to ordinary stocks or bonds and are purchased with the objective of acquiring dividend or interest income and capital gains. The conduit takes the form of a special-purpose investment

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addition, creates its own funds containing security investments only. AEW has offered its investors equity securities portfolios since 1995, with more than U.S.$1.3 billion currently invested. AEW has installed various investment vehicles to allow its investors access to a wide range of security products, including: (a) separate account portfolios (a diversified or concentrated portfolio of securities for an individual client); (b) AEW Real Estate Securities Value Fund (a diversified portfolio of publicly traded equity securities by REITs and other real estate operating entities); (c) AEW Real Estate Securities Long/Short Fund (concentrated long and short positions in selected securities); and (d) CDC Nvest AEW Real Estate Fund (publicly offered mutual fund similar to AEW's value fund—but now jointly with its owner[48]).

AEW Targeted Securities Funds provides an exclusive portfolio of private placement investments in REITs and other real estate companies. These closed-end funds make equity private placements in promising public REITs and real estate operating companies, as well as in private companies in anticipation of an initial public offering or a contractual capital event that will provide liquidity. Since 1998, AEW's clients have committed more than U.S.$345 million to the AEW Targeted Securities Funds.

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company or group and is tax exempt under current laws. Interest and principal are repaid to investors, similar to other securities.

[47] CMBS – Commercial Mortgage-backed Securities: Mortgage securities represent an ownership interest in mortgage loans made by financial institutions (savings and loans, commercial banks, or mortgage companies) to finance the borrower's purchase of a home or other real estate. Mortgage securities are created when these loans are packaged, or "pooled," by issuers or services for sale to investors. As the underlying mortgage loans are paid off by home or commercial real estate owners (MBS and CMBS, respectively), the investors receive payments of interest and principal. Large institutions typically make primary investments in mortgage securities when the securities are issued. Brokers in the secondary market may ultimately redistribute these securities. Source: The Bond Market Association, *An Investor's Guide to Mortgage Securities*, New York, NY, 1999.

[48] In 2001, the French-originated CDC IXIS Asset Management acquired Nvest, owner of AEW, becoming one of the world's 25 largest investment managers with a total capital representation of U.S.$286 billion (as of June 30, 2001). See info on CDC IXIS at http://www.cdcixis.com/uk/index.html.

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In AEW's securities offerings, AEW originates and manages commercial mortgage whole loan portfolios. AEW was one of the first real estate advisors to create such commercial mortgage-backed securities, including in some instances, securities backed by AEW-originated loans.

Last, through Curzon Global Partners—AEW's London-based investment manager, AEW offers its fourth investment vehicle in its diverse range of investment solutions. Curzon is an exclusive business alliance between DTZ and AEW, focusing on international strategies and investment opportunities with Curzon Partners as its first investment fund.

In addition to advisory services to private institutional investors (retirement programs, university endowments, foundations, Taft-Hartley plans, and international and private investors), AEW focuses strongly on services to governmental, non-profit and educational entities through its National Advisory Services Group. Among AEW's largest public and non-profit clients are the U.S. General Services Administration, the U.S. Department of Housing and Urban Development, and the Federal Deposit Insurance Corporation. AEW provides these entities with portfolio advisory services, asset and program management services, transactional services, and training.

5.3.3 Real Estate Investment Processes

With a staff of 190, located in Boston (corporate headquarters), Los Angeles, Washington, and London, AEW focuses on the mainstream core activities of real estate advisory and management. Many of the subprocesses, such as brokerage and property management, are subcontracted to trusted national or local leading vendors and consultants. "Brokerage is outsourced because good brokers are generally more effective

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locally, and AEW maintains many different relationships in order to access potential new deals in the [national and global] marketplace," said Grant Monahon. "Property management is also best handled locally and not at a national level. As a fiduciary, AEW believes its clients are better served by a broad marketplace of specialist property managers."

Throughout the real estate investment process, research continues to play a prominent role to the success of AEW's operations. AEW research employs eight associates and is actively involved in many national branch organizations and research initiatives. AEW research is composed of urban economics researchers rather than real estate researchers, who monitor and study the anticipated changes in the factors that affect occupancy and rents. Focusing on the five major property types (office, retail, industrial, apartment, and hotels) in the 55 largest metropolitan markets, AEW research provides valuable information to clients and their internal investment processes: (a) strategy development, (b) targeting of investment markets, (c) underwriting of investment opportunities, (d) development of marketing and leasing strategies, and (e) transaction (hold/sell) analysis.

The following paragraphs will discuss the real estate investment process in more detail. In essence, "AEW advises its investment clients on broad issues as to *where* to invest (public or private), *how* to invest (debt or equity), and *what* to invest in (properties, companies or entrepreneurs)."

In collaboration with the investment client, AEW's portfolio manager identifies the client's investment objective for the anticipated investment opportunities. Each client has its own investment objective, that is, its required return on investment. AEW identifies three levels of return objectives: core, core plus, and opportunistic, each increasing in

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comfort level of return. Simultaneously, the role of real estate in the client's portfolio will be discussed and decided, setting the scope of potential investments. Real estate most often takes a minor position in a total investment portfolio. "Real estate averages 5% to 10% of the total investment portfolios of most institutional investors," explains Grant Monahon.

After determining the client's investment objective, AEW prepares an investment plan, to stipulate the course of action that will lead to meeting these objectives and obtaining the required return on investment. Although investment plans are not fixed and unchangeable, they have great impact on the future operational stance of AEW toward the specific client, so much so that many of AEW's departments are involved in setting up this plan of action.

With the client's investment plan in place, AEW's portfolio and asset managers are ready to search for investments that meet the set requirements. Through extensive market research that is conducted in-house by AEW Research, and various additional resources, AEW narrows down investment types, sizes, and locations. Through AEW's own listings or third-party brokers and agents, available investment properties are considered.

To narrow down specific available investment properties, demographics and property settings are studied to assess future risks and opportunities; current and future cash flows are examined and projected. In addition, existing leases and tenant credit histories are looked into to assess the certainty of future cash flows. The physical quality of the property is appraised, and factors such as liquidity, replacement cost, and exit strategies are contemplated. Only after close evaluation of these factors and discussion of the quality reports with investors does AEW move to purchase the property.

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As soon as the investment client approves the investment, the acquisition process commences. AEW will underwrite the investment by structuring a financial deal that transfers the title of the property or investment to AEW and its clients . The underwriting process can take as long as six weeks and entails the intensive involvement of various outside participants, including the seller of the property, his attorneys, and consultants. In addition to the final negotiation of the price and placing a down payment in an escrow account for securing the anticipated sale, parties have to agree on numerous other factors before a deal can be closed. Through the intermediary of attorneys, contracts are prepared for mutual approval.

In addition to the allocation of client's equity to purchase the property, often, and for plain economic reasons, debt is drawn from banks, AEW itself, or other financial institutions. AEW's professionals will find the best equilibrium between debt and equity investment that will provide for the highest combined return on investment and return on equity. It is in these stages that AEW and the investment client can verify all sources and information about projections, market, tenants, contracts, etc., to avoid unexpected financial deficits after transfer of the property's title.

Once the property is owned by AEW's client, constant care and attention needs to be given to maximum occupancy, optimum balance between the cost of operations and maintenance and the incoming cash flow from the tenants, and the meticulous recording of events and financials and the reporting of results to the AEW's investment client. AEW does not perform facilities and property management in-house, but outsources such activities to recognized management firms, such as Trammell Crow, Insignia, and CB Richard Ellis. These contractors provide hands-on management of the facility and have direct contact with its tenants. The property managers, under the guidance and budget

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restrictions determined by AEW, perform maintenance and operations. Property and facilities managers report to AEW's asset managers, who oversee the financial status and development of the investment property. This is why AEW is constantly involved in the development of marketing and leasing strategies to ensure the highest possible cash flow and consequent returns.

Monthly property updates (maintenance activities, rent rolls, tenant improvements, etc.) are provided to AEW's asset managers for constant oversight of the financial development of the investment. At AEW, data on real estate investments are collected and consolidated along with that of other investments within the portfolio to provide accurate feedback to the investment owner. Voluminous reports are prepared at the end of each quarter with property specific and portfolio financials. Because of the "relationship" nature of this industry, a great deal of time is expended in perfecting and optimizing the reporting—with the help of marketing department and graphic designers.

In an effort to provide the best diversification of the investment portfolio in order to optimize periodic returns on the client's equity within the preset boundaries of the investment plan, AEW's portfolio and asset managers continually update and reevaluate the research on markets, demographics, property, and leasing. This research allows asset managers to determine when the optimal selling point for the property has been reached, allowing for speedy and grounded decisions to be made. The investment will be put to market in order to free up the client's capital for new investments to increase the portfolio yield. Thus, AEW Research remains a constant factor throughout the operation of AEW's investment process to provide the best possible analysis for making adequate and fast decisions to optimize return on the investments of its clients. Figure 5.6 provides for a conceptual overview of AEW's investment process.

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The AEW Investment Process

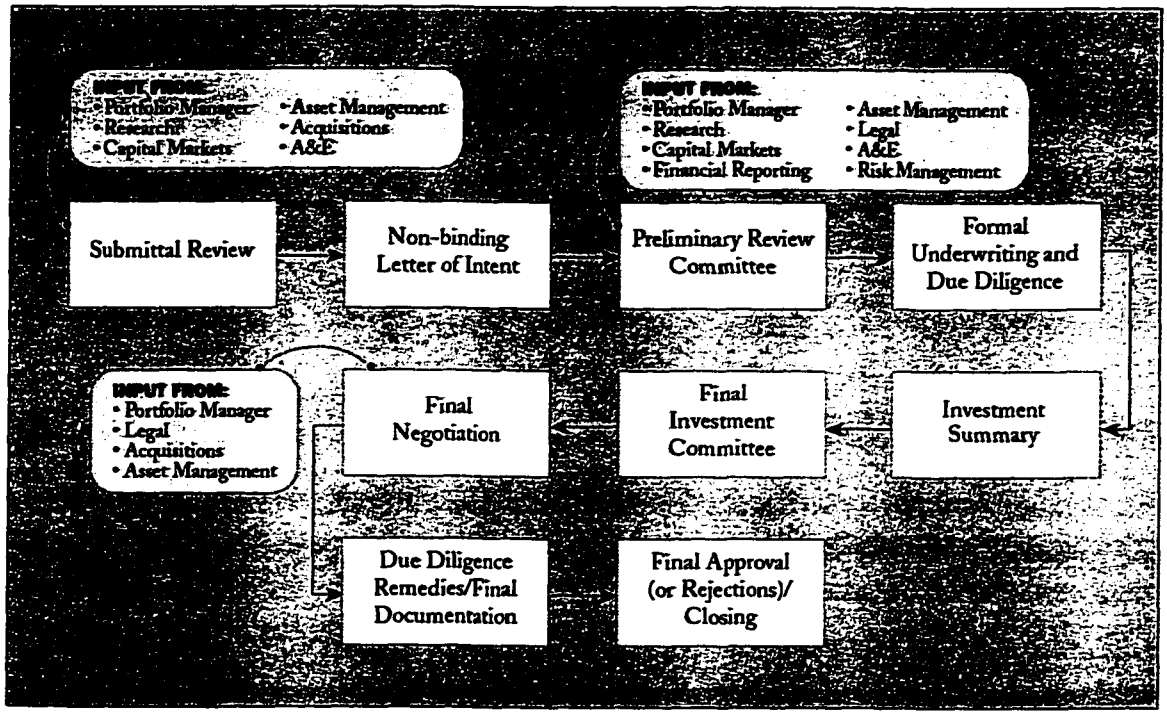

Figure 5.6: AEW real estate investment processes (courtesy AEW Capital Management, 2002)

5.3.4 Inefficiencies in the Investment Process

In an interview with AEW's leading professionals representing the various departments of the firm,[49] a wide variety of process inefficiencies were discussed. Real estate asset management or advisory services fully rely on strong relationships with the investment owner. Personal contact is highly valued within the AEW organization and communication with its clients must be of the highest quality. It is providing this level of customer service that causes some clearly identifiable inefficiencies. Monthly reporting from the bottom up within the firm, and quarterly reporting to investment clients, is

[49] Douglas Poutasse (Chief Investment Strategist, AEW Research), Alison Husid, Glenn Burdick, Daniel Bradley, and Christopher Meyer in an interview with Rick Huijbregts and Monica Tovar of the Harvard Center for Design Informatics (CDI), in preparation for a CDI research study on the impact of technology on the real estate owner, March 19, 2001.

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unnecessarily time consuming due to a lack of standardization and the level of customization required for each client.[50] Add to this the breadth of different kinds of products to be reported on and it is not surprising to learn that the majority of associates at the firm are devoted to this task.[51]

In the earlier stages of the investment process, in the micro market research phase, significant inefficiencies are realized when the building and neighborhood is visited either by AEW personnel or at least by trusted local partners.[52] Due to a decentralized information system, most of AEW's intangible assets (knowledge of the business held by AEW's associates) are kept within the departments or even at the mercy of one individual. Because most aspects of its advisory services rely on the personal expertise and experience of AEW's associates, knowledge sharing is difficult and hence inefficient.

An additional inefficiency is located in AEW's archives. Because of its traditional, paper-intensive reporting and contracting methods, AEW has built a 4,000-square-foot space with thousands of piled boxes in which all reports and documents are held for seven years after an investment has been terminated.

5.3.5 Introduction to Technology

From AEW's inception in the early 1980s, software applications for property management and cost control, such as Yardi and Argus, were implemented. Despite the many tools available on the market, surprisingly, AEW's most used tools for a long time were the plain vanilla applications of Microsoft Office and some additional desktop publishing suites. Microsoft Excel spreadsheets have proven to be a very helpful tool for

50 According to Allison Husid.
51 According to Glenn Burdick.
52 According to Christopher Meyer.

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property assessments, feasibility and financial analysis, and the recording of property performances. Decentralized information systems have dominated AEW's computer systems. Most asset and portfolio managers seem to maintain their own customer-relationship management software, such as Microsoft Outlook and ACT. It is with the help of AEW's technology department that the firm is continuously looking to implement new technologies that will improve internal processes and, potentially, investment results, and to slowly move toward a more integrated information system throughout the company.

It was in late 1998 that Joseph Azrack made the bold statement, "By the end of 1999, we need to have all our clients' financial information available online." AEW's managing director of research, Douglas Poutasse, was put in charge of this operation and became the company's chief knowledge officer. Together with Shawn Mahoney, chief technology officer, and his team supporting the effort, most of the planned technology endeavors would be realized. A framework for thought and action was developed that would lead to first prototypes of online access of financial data for investment owners.

Soon, however, it became clear that only a few clients were sincerely interested in and more than just curious about these developments. Simultaneously, one of AEW's largest clients was pushing independently to streamline information flow between its own legacy systems and the asset managers at its advisory firms, an initiative that eventually led to a customized link between AEW's and the client's general ledger systems for fast and accurate information exchange.[53]

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[53] Explained by Janet Donavon, one of AEW's business analysts.

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The lack of enthusiastic clients did not prevent AEW from pursuing the initiative to enable online access to portfolio information. It was AEW's executives' strong belief and Mahoney's energetic devotion to the notion that online communication between facilities managers and AEW, on the one hand, and AEW and investment clients, on the other, was inevitable that moved the project forward. Mahoney quickly managed to create a prototype for AEW's own intranet—another initiative that quickly gained popularity within the firm as operational information was made available throughout the company and its far-located offices. Mahoney strongly believed that "it was easier just to build something ourselves that we could hook into our own legacy systems throughout the organization than to shop the dotcom markets for expensive and rather useless applications." By the fall of 1999, the first financial information was customized and made available online for some actual portfolios, but using dummy clients. By early 2000, the intranet was increasingly used, an extranet "opened for business," and centralized applications had replaced scattered, decentralized ones.

5.3.6 Real Estate Technology at AEW Capital Management

Jonathan Martin, vice president of AEW's direct investments group, identified three major areas of attention for the firm's technology implementations. The first deals with the communication between portfolio manager, client services, and the investment clients. For this, AEW has developed an extranet service, whereby using a secured login, each client can, in real-time, review its quarterly portfolio and investment information, and access historic reporting and a wide variety of proprietary research in electronic PDF file formats. The service first went online in 1999 to be tested and was made available to clients in early 2000. An intuitive "drill down" method was used that allows the customer

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to view an overall portfolio summary and then each portfolio item in increasing detail. The data is downloaded from AEW's Yardi system and secured every quarter (REITs are secured every month). It was found that updating such information more than once each quarter was unnecessary, because the client does not need high frequencies. As AEW's clients still require hardcopy reporting, all quarterly reports are available online. In the near future, AEW will expand the dissemination of information to its clients via the Web. The extranet will also hold legal documents, and investor presentations. "It will be a great library for our customers, it will be a great benefit for our internal organization to have this information centrally organized and available," said Martin. The extranet development is primarily internally driven. "Clients do not push us for these developments, but are sincerely pleasantly surprised" when the online efforts are made available to the investor community.

In addition to the hardcopy reporting and the extranet services, AEW has developed technology components for approximately 10% of its clients to integrate with their information systems. It is the clients who want the most detailed investment information that is asking for digital access and integration.

The second focus is the communication between property managers (an outsourced service) and the internal asset managers. Through standardized Excel templates, AEW requests detailed information from all its property managers. "We don't want to enforce our systems upon them, as they all have their own; we don't want to deal with training and support, and our Excel solutions have proven to be a very efficient and cost-effective for us, " said Martin and Janet Donovan. Each property manager manually, or through a self-made technology component, uploads the Excel spreadsheet that is sent monthly to AEW's asset managers. The accountants automatically upload the information into Yardi,

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where it is used for any evaluations, assessments, and further processing. A possible future development identified by Donavan and Martin is the implementation of Yardi Voyager for Web-enabled access to AEW's general ledger system. This will allow the property managers to provide property financials even more directly.

Third, AEW deploys mainly the Yardi system to handle all property, investment, and portfolio information within the company. The implementation of the Yardi system has been a long process, as it did not provide the answers to all of AEW's information-handling problems. According to Martin, "Things Yardi does not do for us, we build around it ourselves." as AEW will continue to do as the requirements and needs of the company evolve.

Other technology advances have been implemented or adapted by AEW to further facilitate the integration of the fragmented information systems. One example is AEW's new client relationship management system, Sales Logics. This advanced system keeps track of the firm's client database and is accessible to only a limited group of professionals within the firm. Another successful implementation is AEW's XMS expense management system. The management and reimbursement of expenses are monitored, providing more clarity to AEW's associates, human resource department, and accounting. A Citrix virtual workplace environment has also been installed to provide a number of associates with distant access to AEW's information systems. Applications such as email, Yardi, and some operational tools can now be accessed using a secure private connection between the associate's residence or laptop and AEW's technology infrastructure. Finally, Janet Donovan explained yet another efficiency tool that has been embraced by the firm. PropertyFirst, after its merger with Loopnet, is frequently deployed for listing properties for sale and finding new acquisitions. "A great advantage

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of this system is that we can outsource the maintenance of the technology, while exposing our disposable properties to a much larger audience," Donovan stated. However, AEW still relies heavily on the brokerage community for its sales and acquisitions activities.

5.3.7 Supporting Departments: Research and Acquisitions

Parallel to AEW's core processes (the information and communication stream from the property managers through asset and portfolio managers to the investment clients), AEW has an active research and acquisitions team. The latter is organized by department and mostly exists in the form of a conglomeration of professionals throughout the firm focusing on relevant areas—including associates from research, asset and portfolio management. The acquisitions process has only somewhat benefited from AEW's technology efforts. Whatever time and efficiency savings are gained are achieved through the intensive use of email and other communication tools to expedite processes. Due diligence still requires significant face-to-face and physical time allocation. Through a proposed new reporting system, with an improved data warehouse and Dyna as its backbone, the acquisitions team will have access to more internal comparables and benchmarks, providing more information for better-educated acquisitions decisions.

AEW Research is a very technology-equipped department. The research group (and client services) is a driving force behind providing the content on the company's intranet. All research is made available to and easily accessible to the internal organization, and via the extranet, to the investment clients. AEW excels in market research focusing on 55 metropolitan markets. AEW Research's market reports are a pride to the organization and are prepared almost fully automatically. Third-party data is downloaded in predefined

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templates that are updated periodically. Market reports are available to the internal organization from the company's intranet and to the client by mail and the extranet.

5.3.8 Continuation of Technology Advances and Productivity Improvements

As AEW continues to grow, the need for more efficient solutions that facilitate the business processes and more productive operations will remain. Donavan and Martin identify a few areas that will be the focus of ongoing improvement. First, AEW's extranet will continue to provide more and more information to the investor community. Although initially will this be done using electronic PDF file formats, slowly more dynamic access to the portfolio information will be available. Second, a Dyna reporting module will allow instant analysis to the large amount of data within AEW's information systems. This application will allow the company to review and benchmark existing investments and portfolios. Third, the firm's intranet endeavors will be further extended to provide more access to a wider variety of resources. The plan is to grow the intranet into a true internal knowledge management platform that will facilitate the company's operation. Last, an ongoing effort will be made to update, fix, and improve upon the existing information systems.

Over the last few years, AEW has invested significant time and money in its technology advances. In addition to efficiency improvements due to such innovation, AEW has experienced several mergers and expansions, which have led to an increase in the firm's employee productivity. Figure 5.7 shows the rate of change rate over the last five years for AEW's assets under management and headcount. AEW has managed to constantly increase its investment portfolio while slowly reducing its headcount by simply "not replacing any employees that have left over the years."

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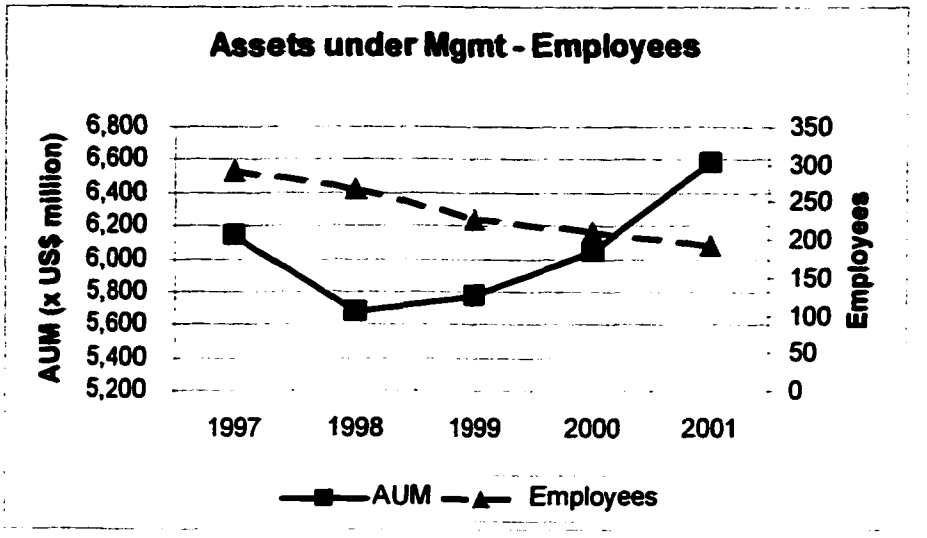

Figure 5.7: Growth Projections of AEW's Assets under Management and Employee Headcount

Although improved and evolving business processes, and the effect of mergers and acquisitions, are the main causes for the productivity changes, AEW's professionals do attribute part of the growth to the implementation of information technology solutions. Smarter tools and applications, and a more efficient means of communication, are great facilitators of the firm's business processes.

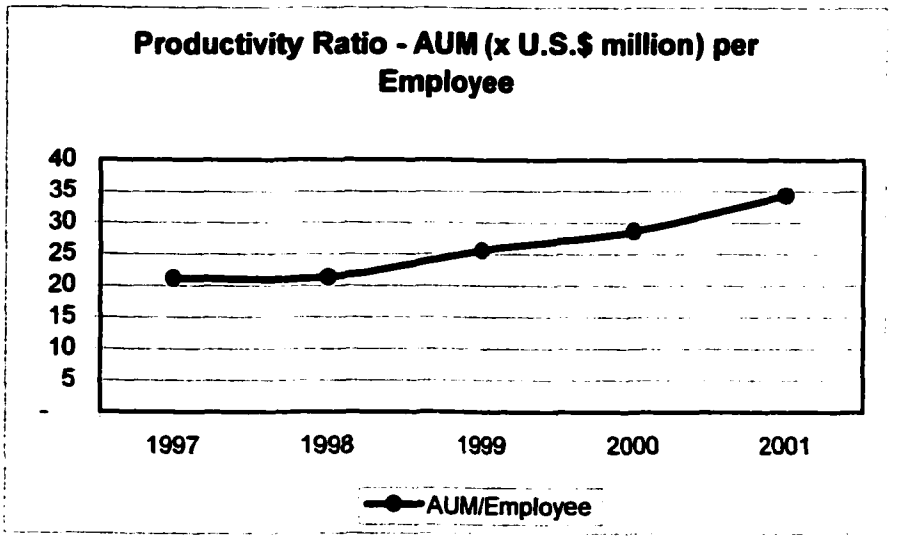

Figure 5.8: Average Productivity Ratio: Total Assets under Management per Number of Employees

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The whole range of influence factors result in a steady growth of the employee productivity ratio—one that has grown nearly 40% from U.S.$21 million AUM per employee in 1997 to U.S.$34 million AUM per employee in 2001. With AEW's ongoing effort to improve on its information systems, a further productivity increase is expected. Figure 5.8 shows the growth of the average productivity ratio.

5.3.9 Conclusion

At a slow pace, AEW's investment clients are embracing its online efforts. The greatest impact of all these technological improvements on AEW's operations is that "we have to be more on our toes; owners are now more alert and know of facts and trends sooner and easier themselves," stated Husid. Still, though, "our clients only want to own a mall and still don't want to run and manage it," Meyer added, "and thus still rely on our judgments and expertise." In addition, it is only a small percentage of AEW's clients that use the Internet frequently and intensively, other than for email communications. The vast majority still prefers paper reporting to online information, or at least require both for archiving and legal purposes.

After several years of significant investments and efforts by AEW's internal technology group as well as by a wide variety of outside consultants, AEW has reached a point where "the infrastructure is in place, and all is well developed." In early 2002, the firm intentionally scaled down its investments in technology. A technology team of only five—one from operations support, one from management, one database administrator, and two technology-equipped business analysts (opposed to a total team of 14 only three years ago)—drives the ongoing management and improvements of AEW's new management information systems. AEW strives to further enhance the information

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systems to better support the internal business processes where the company's professionals can manage and absorb more data, and consequently "provide better, faster, and cheaper services."

5.4 Summary Findings

AEW and RREEF represent more than U.S.$25 billion in U.S. real estate assets under management, ranking them in the top 10 real estate investment management firms. AEW employs just fewer than 200 while RREEF employs 1,100 personnel, finding the distinction in the fact that RREEF performs in-house property management taking more than 75% of the workforce. Both firms started operations when investments in real estate were being considered valid alternative investment instruments for long-term value—late 70s, early 80s. Now, both AEW and RREEF are wholly owned subsidiaries of European capital investment managers, CDC-ISIX and the Deutsche Bank respectively, making them part of the largest capital managers in the world. For CDC-ISIX and the Deutsche Bank, the U.S. real estate investment firms were logical expansions into the U.S. markets specializing in real estate investments. Vice versa, the European firms provided a much-needed wider range of products and services, to better serve the growing needs of the established—and global—investment clients.

With slight differences in process, investment strategies, target markets, and approach, AEW and RREEF have both embraced technology from the early stages in an effort to continue the optimization of their internal business processes. With the availability of the Internet, on-going developments have resulted in the leading character of both firms in regards to far-reaching implementation of technology solutions.

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Based on established general ledger software applications, AEW and RREEF have greatly automated the information flow between property level and investment clients. Where AEW works with their various third-party property managers in an attempt to streamline this equation of the information exchange, RREEF has taken it further as they perform property management in-house. For many years, RREEF already has fully integrated the information systems for the property managers and asset and portfolio managers. On the client side, both firms present PDF-format financial reports and provide archiving features via secured websites. AEW takes it one step further already, where an early version data warehouse allows for relative instant online reporting. AEW's customers have online access to their portfolio and property financial information. RREEF's Internet initiative—iRREEF—follows similar developments. Soon, RREEF expects to provide more online and dynamic information to their investment customers. Exclusive of the very few investment clients who request more technology advanced reporting, both AEW and RREEF professionals do not see a trend where there is a clearly identified need for such online, real-time, and dynamic reporting.

On both firms the technology advances have made secondary, but significant impact. However, it has not drastically lowered cost or increased times to delivery. It was efficiency improvements in the business processes that have led to improvements in productivity. This productivity resulted for both firms in the management of more real estate assets per employee. Since 1996, for RREEF the efficiency improvements have led to an increasing dollar value of assets under management per employee from approximately U.S.$40 million to $60 million (150%; excluding property and facilities managers), and AEW has experienced an increase from approximately U.S.$20 million to $35 million (175%) per employee. Differences in the total value of the assets under

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management per employee, and differences in productivity increases depend on many more factors than ICT alone. Economic developments, merger and acquisitions, business strategies, types and classification of investment instruments, and the real estate typology and quality focus (as where residential investments require more management than commercial investments), all have impact on organizational, efficiency, and productivity changes. In both cases, the investment firms have not translated these efficiency and productivity improvements into lay-offs of personnel, but re-allocated its resources to alternative products and services (e.g. research) and to the management of more investments with the same company headcount.

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Chapter 6: DISCUSSION

This chapter discusses both the anticipated and perceived impact of real estate technology on the role of real estate investment management as revealed by the results of the survey, interviews, and case studies. The discussion of the results is introduced first by setting its framework and by addressing industry reasons for and sensitivity to change and adoption of ICT. Then, the impact of technology on the various sub-processes of real estate investment management will be discussed in detail. Lastly, the effect of ICT on the role and value chain of the real estate investment manager is discussed, as well as the evolving need for greater efficiency and the development of strategies for turning future technology advances into assets to the industry in order to facilitate such efficiencies. Table 6.1 presents an overview of the results and discussion.

6.1 Introduction

Like other businesses affected by emerging Internet technologies, such as the financial markets and online airline ticketing, real estate investment managers are re-evaluating their propositions within the value chain of the real estate industry. The propositions are ones of service, advice, analysis, evaluation, and reporting to and on behalf of the real estate owner. "We are the conduit running between investment owner and investment properties. Everything else we do is just to facilitate this intermediary role," said one experienced chief technology officer.[54] The main functionalities of the real

[54] In an effort to respect the research respondents' privacy and professional ethics, this chapter will only cite anonymously. Where possible, the respondent's function is included along with a reference to the method of data collection (survey, case study, or status report).

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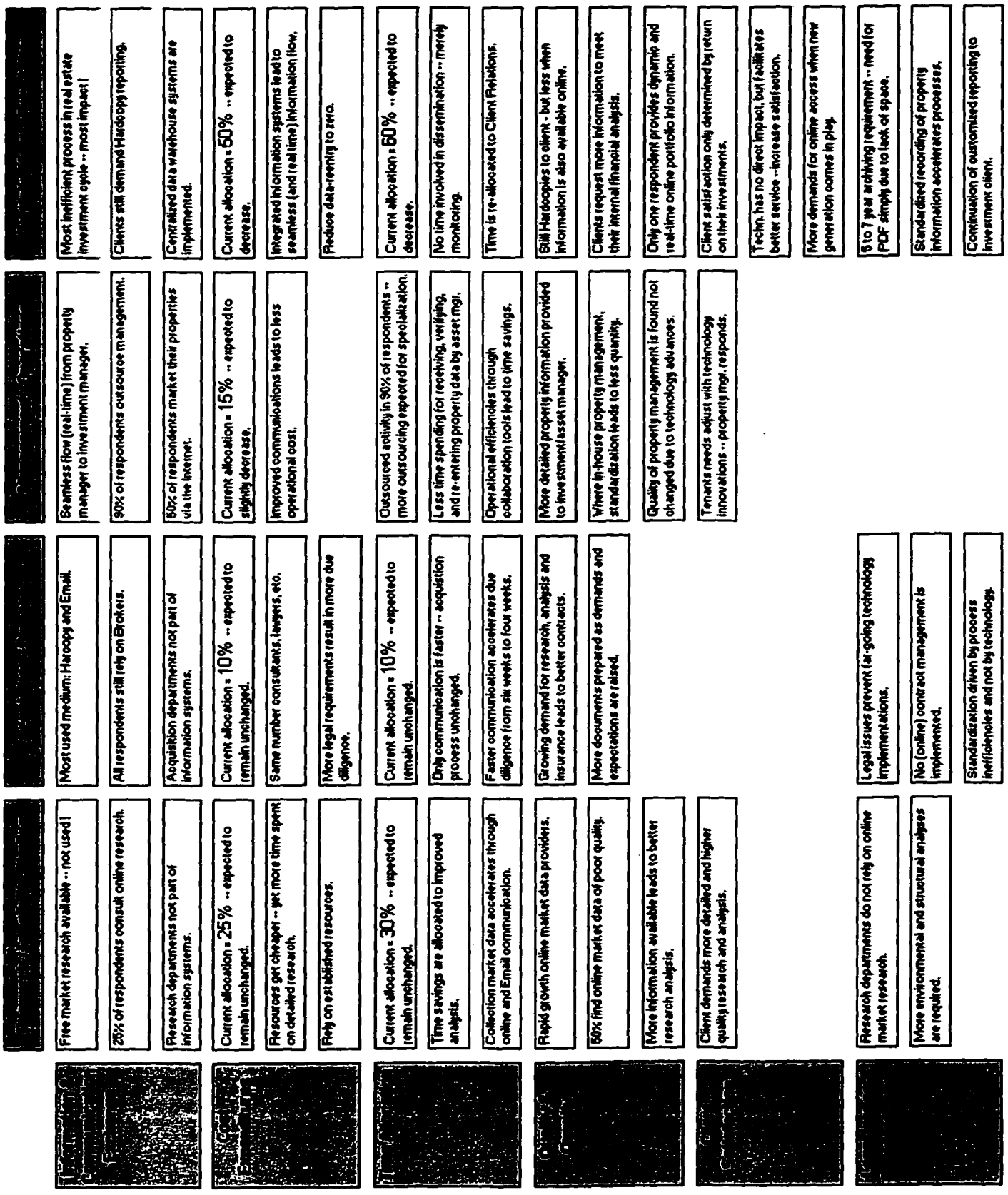

Free market research available -- not used!	Most used medium: Hardcopy and Email.	Seamless flow (real-time) from property manager to investment manager.	Most inefficient process in real estate investment cycle -- most impact!
25% of respondents consult online research.	All respondents still rely on Brokers.	90% of respondents outsource management.	Clients still demand Hardcopy reporting.
Research departments not part of information systems.	Acquisition departments not part of information systems.	50% of respondents market their properties via the Internet.	Centralized data warehouse systems are implemented.
Current allocation = 25% -- expected to remain unchanged.	Current allocation = 10% -- expected to remain unchanged.	Current allocation = 15% -- expected to slightly decrease.	Current allocation = 50% -- expected to decrease.
Resources get cheaper -- get more time spent on detailed research.	Same number consultants, lawyers, etc.	Improved communications leads to less operational cost.	Integrated information systems lead to seamless (and real time) information flow.
Rely on established resources.	More legal requirements result in more due diligence.		Reduce data-reentry to zero.
Current allocation = 30% -- expected to remain unchanged.	Current allocation = 10% -- expected to remain unchanged.	Outsourced activity in 90% of respondents -- more outsourcing expected for specialization.	Current allocation = 60% -- expected to decrease.
Time savings are allocated to improved analysis.	Only communication is faster -- acquisition process unchanged.	Less time spending for reworking, verifying, and re-entering property data by asset mgr.	No time involved in dissemination -- merely monitoring.
Collection market data accelerates through online and Email communication.	Faster communication accelerates due diligence from six weeks to four weeks.	Operational efficiencies through collaboration tools lead to time savings.	Time is re-allocated to Client Relations.
Rapid growth online market data providers.	Growing demand for research, analysis and insurance leads to better contracts.	More detailed property information provided to investment/asset manager.	Still Hardcopies to client - but less when information is also available online.
50% find online market data of poor quality.	More documents prepared as demands and expectations are raised.	Where in-house property management, standardization leads to less quantity.	Clients request more information to meet their internal financial analysis.
More information available leads to better research analysis.		Quality of property management is found not changed due to technology advances.	Only one respondent provides dynamic and real-time online portfolio information.
Client demands more detailed and higher quality research and analysis.		Tenants needs adjust with technology innovations -- property mgr. responds.	Client satisfaction only determined by return on their investments.
			Techn. has no direct impact, but facilitates better service --increase satisfaction.
			More demands for online access when new generation comes in play.
Research departments do not rely on online market research.	Legal issues prevent far-going technology implementations.		5 to 7 year archiving requirement -- need for PDF simply due to lack of space.
More environmental and structural analyses are required.	No (online) contract management is implemented.		Standardized recording of property information accelerates processes.
	Standardization driven by process inefficiencies and not by technology.		Continuation of customized reporting to investment client.

Table 6.1: Overview Results and Discussion

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estate investment manager, which these activities serve, are research, acquisitions and dispositions, portfolio and asset management, and (if not outsourced) property management.

As a growing majority of such functions and activities can be automated and facilitated by real estate technologies, the real estate investment manager may experience noticeable shifts in its workspace and its resulting power position in the real estate industry value chain. Despite these encroachments on the real estate investment manager's traditional role, a great lack of concern regarding the supposedly insecure future of the investment manager prevails throughout the industry[55].

6.1.1 The Context for Change

Real estate investment management may be undergoing redefinition as the implementation of information and communications technology impacts the value chain of the real estate industry. The degree of impact of information and communications technology depends upon three factors:

1. The willingness of the industry[56] to adapt its traditional processes,
2. The acceptance of new technologies and methods by the industry to further facilitate these reengineered processes, and
3. The cultural openness to all this change by industry participants and, more importantly, by the ultimate industry end-user, the real estate investment client.

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[55] "Information technology is not going to make investment managers obsolete", say many real estate investment management professionals.

56 The real estate industry as a whole, but in particular the real estate investment management industry.

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Although these factors are a serious concern now, they will cease to be a force with the passage of time as the new generation of technology-savvy professionals rise in the real estate investment management industry. Yet, for the time being, it is these factors that still prevent the industry from a total self-cannibalization and process redesign.

The real estate investment sector seems flooded by opinions on what the impact of technology could be on the core business processes. Attitudes toward technology, or toward change in general, are mostly determined by the respondent's position in the firm. Executives and technology officers see great potential and a great future for technology[57]. Operational professionals, however, seem more restrained in their praise and prognostications[58]. For them, this is "yet another development that we have to face while doing our regular work." Despite differences in opinion and anticipation, all agree, "clients don't seem to care how we use technology, as long as their returns continue to increase, which is a market effect and, in most cases, totally unrelated to how efficient we work internally."

Since the early 1960s, technology has had a great and ongoing impact on real estate planning, design, and construction (the building industry)[59]. The impact of technology on information exchange, visual representation, and planning has made the building industry

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[57] "It is a struggle to get industry professionals to consider the many possibilities, thereby making it difficult to introduce and implement new technology tools, products, and services in the real estate industry", one technology officer says, and "If I could start my firm again, I would need only half the number of people," a chief executive adds.

[58] "The software industry has done a great job telling the real estate industry what they want [in an effort to penetrate a virgin technology market]", and "I look forward to the day when the I.T. professionals really make something that we can all benefit from." Another added, "... and something that works the way they promise."

[59] "Computer-aided drafting has changed the nature of producing construction drawings by lowering the cost of producing those drawings and, more importantly, by providing a partial automation that facilitates repetitive design," (Pollalis, 1997)

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more efficient, but, like the real estate investment management industry, this has not happened overnight for this 'traditional and conservative industry.'

For the processes of investment management, despite some disbelief and hesitancy, information technology "has had, and is having an enormous impact on the industry," according to John McMahan[60]. "Because of the way we conduct business and develop financial models and investment instruments, the methods of communication, and the availability of information via the World Wide Web, have great impact on the industry's professionals and the development of the investment business."

6.2 Impact of ICT on Investment Management Subprocesses

This section discusses the impact of information and communications technology on the four subprocesses of real estate investment management: research, acquisitions and dispositions, portfolio management, and property management.

6.2.1 Research (Feasibility Studies)

One of the first chronological tasks of the investment manager is to prepare research for analysis. The research department's responsibilities include serving the following:

- The client services and the marketing departments, "with any type of research analysis the client wants to see," such as marketplace reports, quarterly U.S. or regional economic outlooks, presentations, assistance for requests for proposals, and other ongoing product developments;

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[60] In an informal interview with John McMahan and Espen Thoegersen at Centerprise, San Francisco, Calif., March 4, 2002. John McMahan is owner of the McMahan Group and director at Centerprise—Center for Real Estate Enterprise.

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- The acquisitions and dispositions team, with economic studies on markets and property types with established commentary for investment decisions;
- The portfolio managers, with ongoing analyses of property returns, benchmarking, and operational predictions; value debt reporting; target market analysis; and advanced financial modeling, using both in-house and third-party research data.

As investment management revolves around communications with and service to the investment clients, the companies' research departments are often seen as facilitating services[61]. A small number of the respondents perform full-scale market analysis and research in-house. The others outsource some to most of the data collection activity to third-party consultants and then analyze the data in-house. Technology is not found to drastically impact the organization of this research. In all the respondents' cases, research departments work rather autonomously from the other departments in regard to data collection. Only two research respondents have an automated information exchange between researchers and portfolio managers, asset managers, and acquisitions managers[62]. Currently, most companies are linking the researchers' databases into the company's centralized information management system. By doing so, they allow researchers to have instant access to portfolio data that will help with benchmarking and property research.

6.2.1.1 Impact on Quality and Quantity

The quality and quantity of research input is a frequent topic of discussion among respondents and is most impacted by new technology solutions. Information sources that

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[61] "We do almost everything and anything that our clients ask for. This is part of our extended service and helps to keep good relationships with our clients", one research director says.

[62] "I found our research department too independent and there was no cross fertilization between the different knowledge sources", one technology officer says.

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previously could be accessed only through local providers or brokers are now available in all kinds of value gradations online and at low cost. Less than half of respondents do not find an improved quality of information from online market data providers, and some even feel the quality has suffered from the booming growth in online sources, where quantity matters over quality. One respondent said that with the abundance of poor-quality market data available on the Internet, checking the source for reliability and accountability is crucial. But a growing small majority believes the quality of available market research has increased. One case study respondent said that the quality of data is improving simply because it now comes from third-party sources, rather than as before, from the broker, whose information may often be biased.

A complementing benefit to the increase in the quality and quantity of data is a change in human culture. "People are more willing to provide you with data," said one research director, explaining that there is a growing transparency in the industry and an openness of his cohort research departments at competing companies.

6.2.1.2 Productivity

In terms of the actual analytical analysis of research data, none of the respondents experienced a change in time allocation or cost expenditures for that activity. Most impact is achieved in the collection of data, as it is more readily available[63]. On the question of whether this has led to significant timesavings, the answer is somewhat diffuse. Direct timesavings are achieved and could lead to "savings of up to one day or one week on certain research projects." However, the savings that are achieved are often

[63] "Through sources such as the online LexisNexis [for news and company information] and Bloomberg [for real-time financial market information], we are now able to rapidly pull together literature research and provide our portfolio managers and client relations department with up-to-date research that they can take to our investment clients," said one research director.

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reallocated to developing a more critical assessment of the research data, because its source is less familiar and therefore less reliable than before, or just to improve the product. Time savings are often allocated to providing the constantly growing quantity of research "as clients and internal organizations become more demanding." This perception coincides with a belief that real estate investment managers ought to expand their services and products to provide for an increased competitive advantage over their competition as their more communicative and information exchange processes are being automated. These new demands cancel out any serious efforts at time saving.

In terms of research department budgets for third-party data, none of the respondents found changes due to technology advances. In almost all cases, the costs have remained unchanged over the past few years.

6.2.1.3 Conclusion on technology Impact on Research (Feasibility Studies)

Approximately one-third of investment managers' operational budgets are spent on research. The cost of data seems not to change; however, more data is being distributed by the online research sources. Due to technology, time is saved through efficient data collection, but also spent in more detailed analysis and data assessment. Any cost change is thereby eliminated.

research	developing trends	
cost expenditures today's allocation: **25%**	Budgets remain unchanged – efficiency allows researcher to produce more work and retrieve more data.	▼ Indirect reduction: because now researcher gets more data for its money via online resources.
time allocation today's allocation: **30%**	▲ Spend more time doing additional research and improved assessment of online data sources.	▼ Reduction in time because information is more readily available.

Table 6.2: Technology Impact on Research Activities by Real Estate Investment Managers

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Twenty-five percent of the companies' budgets are dedicated to research activities and appear not to change. Monies are just reallocated to other activities whenever efficiencies are achieved. Despite the lack of transformation, an increase in quality and quantity is achieved with similar budgets and headcount, which accounts for an important improvement in efficiency.

6.2.2 Acquisitions and Dispositions

Similar to research departments, acquisitions and dispositions departments are often considered somewhat independent functions within an investment management organization. The acquisitions and dispositions group, often a relatively small team, facilitates the activities of the portfolio manager by providing a diverse and active portfolio. The acquisitions process follows a series of steps that eventually lead to the purchase of a property:

The first phase of the acquisitions process is called 'acquisitions sourcing', where the department narrows down its acquisitions opportunities and focuses on one investment property. This activity is often done by or in collaboration with the firm's research department, which has data on markets and property types. The outside brokerage community may also be involved. Initial screening and underwriting leading to the signing of a letter of intent secures the first right of refusal on a property. At this stage, the groundwork for a possible deal is executed. The formal due diligence follows. This activity involves investigating the details of the potential investment, such as examination of its operations and management and verification of the material facts. The functions of due diligence have many similarities to the functions of the firm's research department: however, where the research department focuses more on the macro-economic aspects of

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the property, the due diligence process addresses its micro-economic aspects. Throughout the respondents' companies, we perceived a mixed task allocation of the due diligence process to both the research team and the acquisitions and dispositions department.

6.2.2.1 The role of the Brokerage Community

It is in the first stage of the acquisitions and dispositions process that the acquisitions team members experience the most impact of technology advances. Investment managers and their acquisitions teams historically depend on relationships with a select, trusted, and local brokerage community. In turn, real estate brokers are increasingly technology driven and at the head of the curve of technology innovation in the real estate industry, as they have been listing their residential properties for sale online since the mid-1990s[64].

All acquisitions respondents agreed that the appearance of multiple listing services has benefited them ("and even more so the real estate brokers") in finding potential investment opportunities. This has made acquisitions sourcing "more efficient, and more pro-active than re-active," as properties present themselves even before the need for an acquisition is identified. In addition to the readily available market data from the brokerage community, independent—and less "self-serving"—sources allow for the "dissemination of market information," which has helped the credibility and accuracy of the acquisitions sourcing activity.

6.2.2.2. Information Dissemination

As for the functional operation of the remaining three levels of the acquisitions manager's activities, all respondents sadly agreed that technology advances have created

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[64] One acquisitions director says: "we receive more than 95% of our acquisitions by email or online link directly from our broker or the broker community", and "I receive more than a dozen emails every week from the brokers around us with investment opportunities for sale," adds another.

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no significant changes. "Mechanisms to own real estate won't go much faster—with or without technology. Environmental analysis, for example, will only increase and codetermine the speed of transactions," said one chief technology officer, indicating the minimal impact of technology on the functional process of real estate acquisitions. Where technology does have a significant impact is in the communications between the many acquisition participants[65]. Information is exchanged between brokerage community, analysts, third-party appraisers, lawyers, property managers, building owners, and others in an effort to verify and negotiate the purchase documents. On average, a minimum of fifty documents pass through this value chain, and all run through a variety of iterations and conciliation sessions. In all cases, acquisitions teams rely on email as the communications medium.

On the question whether the accelerated information exchange resulted in cost or time efficiencies, surprisingly, none of the representatives of acquisitions and dispositions departments could agree. However, all respondents did agree that they do more detailed due diligence with the same number of people, and some even stated that they are able to do more deals. The availability of the technology creates the expectation of more detailed analyses and especially more in-depth environmental studies, leading to more time spent on the same number of transactions.

6.2.2.3 Productivity

At a rapid pace, the implementation of information and communications technology is causing an increase in information transparency. One research director stated that

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[65] "Though it has not affected the way we do things, it clearly has had an impact on the speed of the process as we cut out all the regular mail and Federal Express transmissions," one acquisitions associate said. "We can rapidly exchange and review any proposed changes, and this has accelerated the process," added an acquisitions team leader.

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people are more willing to provide data, indicating the growing openness of his cohort research departments at competitive organizations. This increased transparency facilitates the efficiency of the transactional processes by providing instant access to property and market information. In addition, the multiple listing services offered by brokerages allow for broader access to property information for the acquisitions-sourcing process.

Meanwhile, improved communications with the large group of internal and outside consultants and service providers has improved the ongoing revision processes of the purchase contracts, as well as due diligence processes. However, as discussed earlier, the acquisitions community does not expect any changes in the way real estate is bought and sold[66]. According to the respondents, maximum speed is achieved with the innovative underwriting tools and financing models.

Internal productivity will increase when the new integrated information management systems for portfolio and asset managers are opened up to the supporting departments, such as the acquisitions group. "There is never enough information on properties," an acquisitions team leader said, emphasizing the continuing need for additional market data, research, and historic information. In almost all cases, acquisitions and dispositions departments act as sovereign organizations, and a lack of information exchange between the current and existing real estate portfolios is perceived between asset and portfolio managers, on the one hand, and researchers and acquisitions teams, on the other.

One case exemplifies this. In one company, "the dispositions group has no direct access to all property information" when a dispositions process is started, said its

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[66] "For the due diligence of the properties, we still have to go out there and physically inspect the property and surroundings [using internal manpower or by outsourcing to trusted local correspondents]," and "we will continue to review each and every lease contract and to study each and every tenant," as part of the lease and business analysis

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technology officer, signaling the importance of a implementing a truly integrated information system. For this reason, the unlimited access to historical property data is found to be important by the acquisition teams[67].

6.2.2.4 Standardization and Legal Limitations

Most real estate transactions handled by real estate investment managers exceed U.S.$10 million in purchase price. With such high stakes and with the high complexity of such transactions, generally these transactions are not yet trusted to the digital highway. Only one survey respondent claims to have experimented with digital signatures but has not fully implemented this. However, all acquisitions group respondents anticipate a change in attitude toward the matter of digital signatures in the future, and expect the legal status of digital communications to be adjusted.

There is an evident relationship among the standardization of documents, the negotiation process, the legal aspect of the documents, and the level of technology adaptation. Simply restated, the time-consuming and legally important processes of the acquisitions and dispositions stages are increasingly—where possible—standardized to save time and money. Technology has proven to be an ideal facilitator for the standardized character of the newly reengineered processes. Standardization is most observed in the legal processes within the residential real estate markets. This is because the scope and size of the transactions in these markets are generally smaller and there are often similar transactions for relatively high numbers of units. Commercial, retail, and industrial transactions, however, require a great deal of customization because of their

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[67] "For cross checks and benchmarking of new investment opportunities," said one acquisition associate.

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individual character and size. The intense collaboration with attorneys and consultants do not make the drive for standardization any easier.

Because of the scale of responsibilities and risks involved, participating parties still anticipate outsourcing to trusted and skilled organizations, such as brokers, legal firms, and financial analysts. As a result, it is not always clear who the initiator should be for technological innovation. Because it is not yet clear who benefits and who loses in the deployment of information and communications technology resources and functionalities in the real estate investment management process, the move to put it all in the hands of technology has yet to gain industry acceptance.

Further, due to the implementation of information and communications technology, now more research and accuracy is required for environmental and engineering surveys. Tolerance for mistakes has decreased. Consequently, the quantity and iterations of legal documents for due diligence and acquisitions processes have increased as well as the time spent on such processes.

6.2.2.5 Conclusion on technology Impact on Acquisitions and Dispositions

On average, 10% of an investment manager's operational budget is spent on the acquisitions process (assuming that the research department takes on part of the research and due diligence expenses), and 10% of its time is allocated hereto. Shifts are expected in productivity and efficiency with the implementation of information and communications technology, as technology notably facilitates communications processes, while at the same time more and more in-depth due diligence analyses will be required. Further development of standardization is expected to facilitate the wide variety of studies and contractual processes. As further standardization seems unrelated to

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technology, but is merely facilitated by technology, only slight and insignificant efficiency improvements are expected in acquisitions and dispositions processes due to technology advances. Legal limitations continue to impede advances in technology that enhance the underwriting and negotiation stages.

acquisition	developing trends	
cost expenditures today's allocation: 10%	▲ More money is spent on expensive additional analyses (e.g. physical and environmental).	▼ Indirect reduction, because more transparency, more availability, and better communication.
time allocation today's allocation: 10%	▲ Spend more time doing additional due diligence and covering more contractual issues (e.g. environmental).	▼ Reduction of time because of improved communication lines with service providers.

Table 6.3: Technology Impact of Current Cost and Time Allocations for Acquisition and Disposition Activities by the Real Estate Investment Manager

6.2.3 Portfolio and Asset Management

Portfolio and asset management are the subprocess of real estate investment management most impacted by technology advances. It is the communicative processes that take a central position in the portfolio manager's operation, and these processes have been and continue to be heavily affected by the information technology evolution. Figure 6.1 illustrates the traditional process of portfolio management as it generally had been performed until the mid-1990s:

(1) The property manager updated its' own information system on a daily basis. Once per month, printouts were produced on each property, including all information as required by the investment manager's asset manager.

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(2) The printouts were received by the asset manager and manually imported into the investment manager's information system. Here, the data was verified and organized using third-party research and analysis applications.

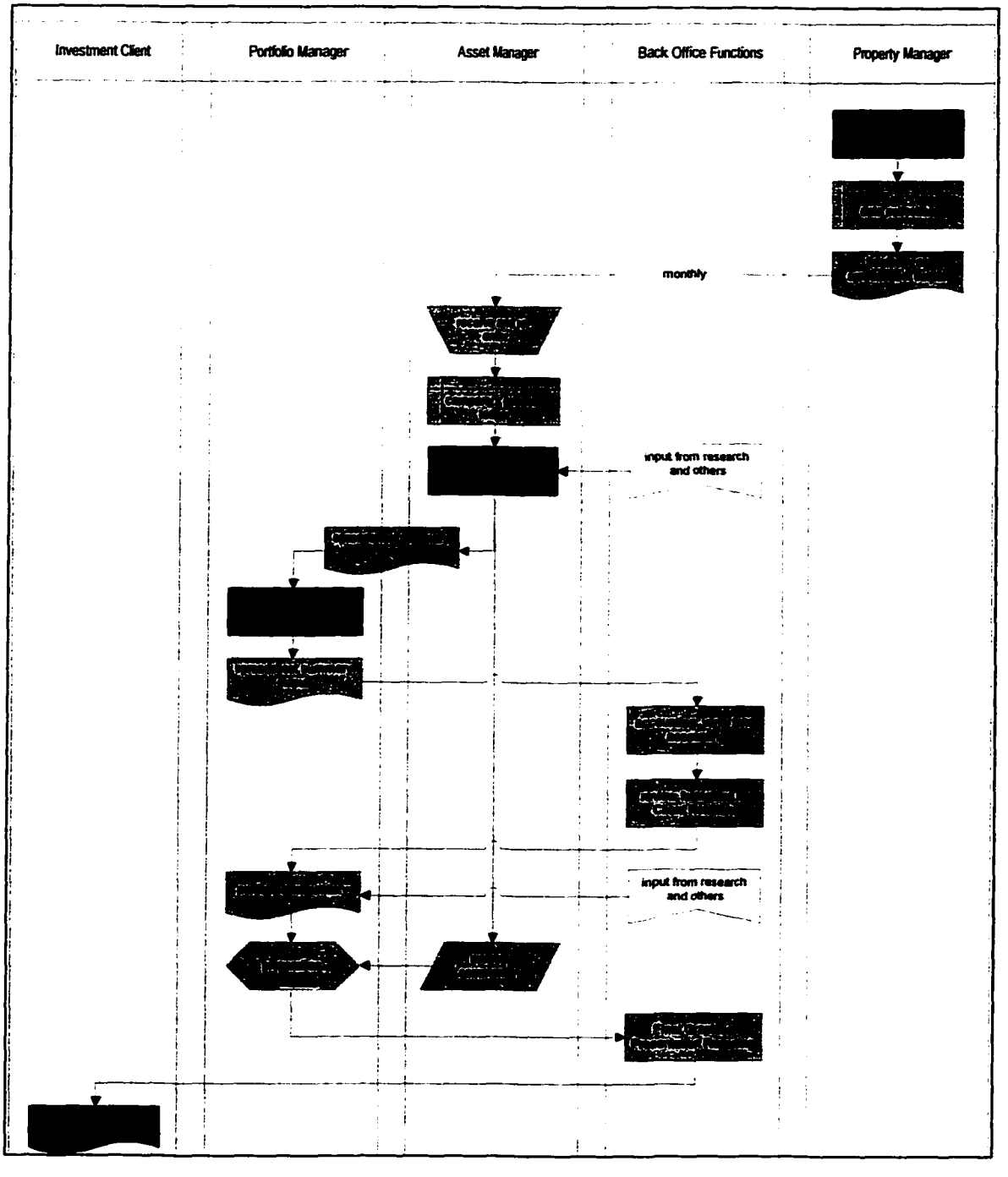

Figure 6.1: 1985–1995: The Asset and Portfolio Management Process and Information Flows from Property Level to Investment Client

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(3) Financial summaries were sent frequently to the portfolio manager, which had an overall authorizing function and consolidated the property information with that of other properties.

(4) Internal accounting departments verified and validated the property and portfolio information before creating a first draft of the investment client's portfolio report.

(5) For final checks and additional commentary, the portfolio manager proofed the (usually quarterly) report and sent it to the client relations department or to the internal department that dealt with presentations and graphic design.

(6) The client relations' manager or portfolio manager saw to it that the investment client received the report in a timely manner with appropriate commentary and introductions.

In this process, data changed hands seven times before it was presented to the investment client. A process similar to this had been in operation in all respondents companies until the mid-1990s. After earlier technology advances (from carbon copies and typewriters to desktop computers, electronic publishing, and spreadsheets), the first wave of change came in the mid-1990s, when existing information systems were linked together in an effort to streamline the information flow. Property managers were asked to adopt the same information systems as the investment manager in order to create a seamless exchange of information via modem dial-up connections. Internally, professionals working with the asset manager were granted direct access to these information systems to avoid internal duplications.

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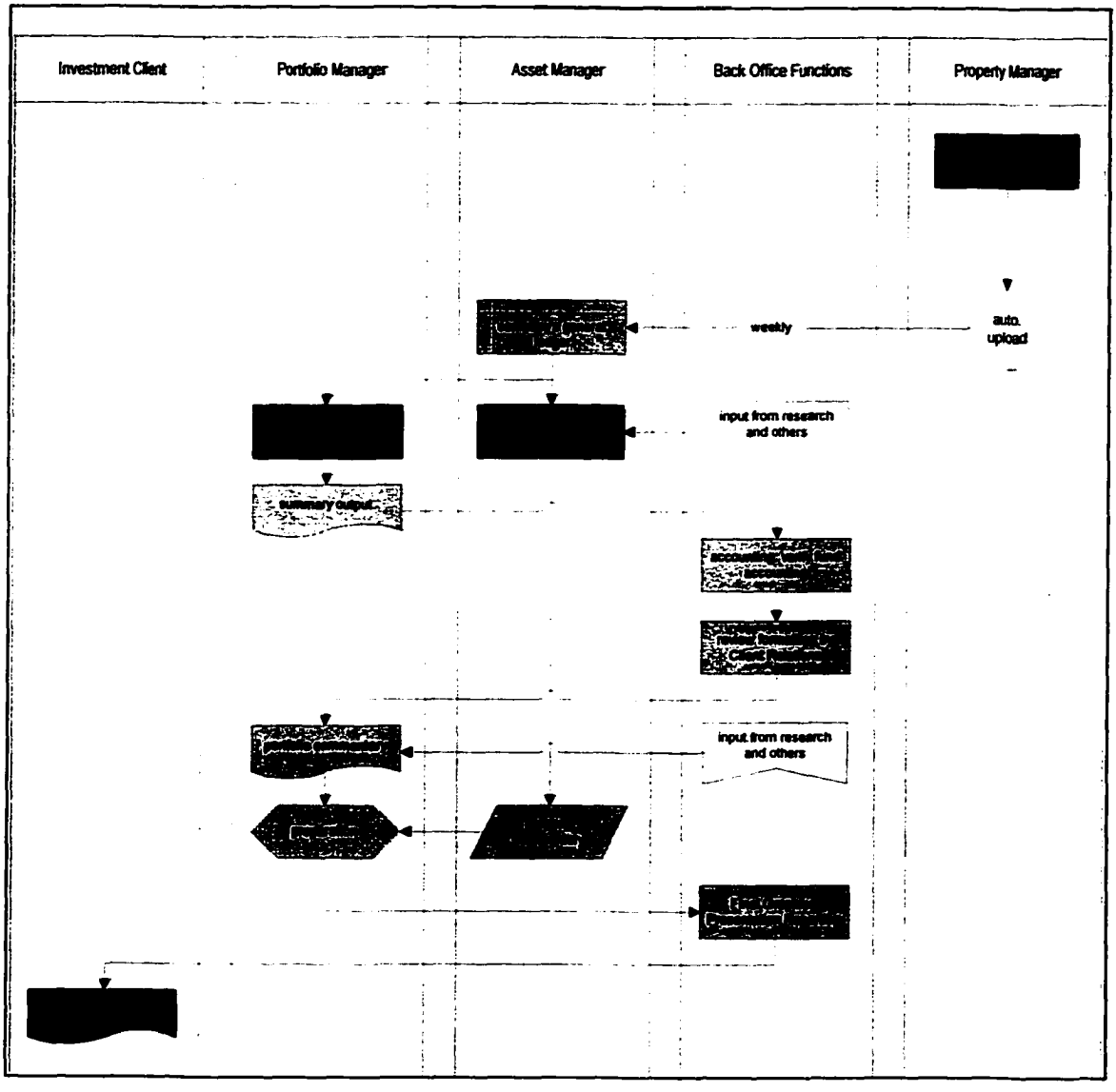

Figure 6.2: 1995–2001:The Second Wave of Innovation, Where Information Systems Are Integrated and Data Flow Is Automated

However, the research and accounting functions, as well as the final reporting and presentation of periodical reports, were still performed outside the newly implemented information systems. With the second wave of change, triggered by the modem dial-up connection, the investment manager achieved significant efficiency, as the property manager's data did not have to be reentered. Problems still occurred, ranging from discrepancies in beginning and ending balances to technical issues when modem

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connections were insecure or unstable. Each transaction had to be verified and supported by a team of asset managers and technology staff. Today, this remains the most used data exchange system between property managers and asset managers. Figure 6.2 illustrates the modified information systems—in the form of the first centralized information systems—that facilitate the on-going developments in portfolio and asset management.

The third evolutionary step has been the implementation of even more elaborate information systems to manage and organize property data throughout the company, including access to the internal property-critical departments (excluding research, and acquisitions and dispositions). Now, via a Web-based application, property managers update property financial data daily. The centralized information system holds all accounting information (rent rolls, operations, and occupancy) and property information (tenants and vendors).

Figure 6.3 illustrates the redesigned information flow between the property management and investment management firms commonly found in the industry today. Asset managers, portfolio managers, accounting, and client relations have direct and real-time access to property data. Commentary can be added instantaneously and a variety of checks and consolidations can be performed automatically[68].

[68] "Via a Web-enabled interface, we can access all the property data that is in the data warehouse [referring to a newly developed database that holds all critical property data], and slice and dice it as our work and clients require," one portfolio manager stated.

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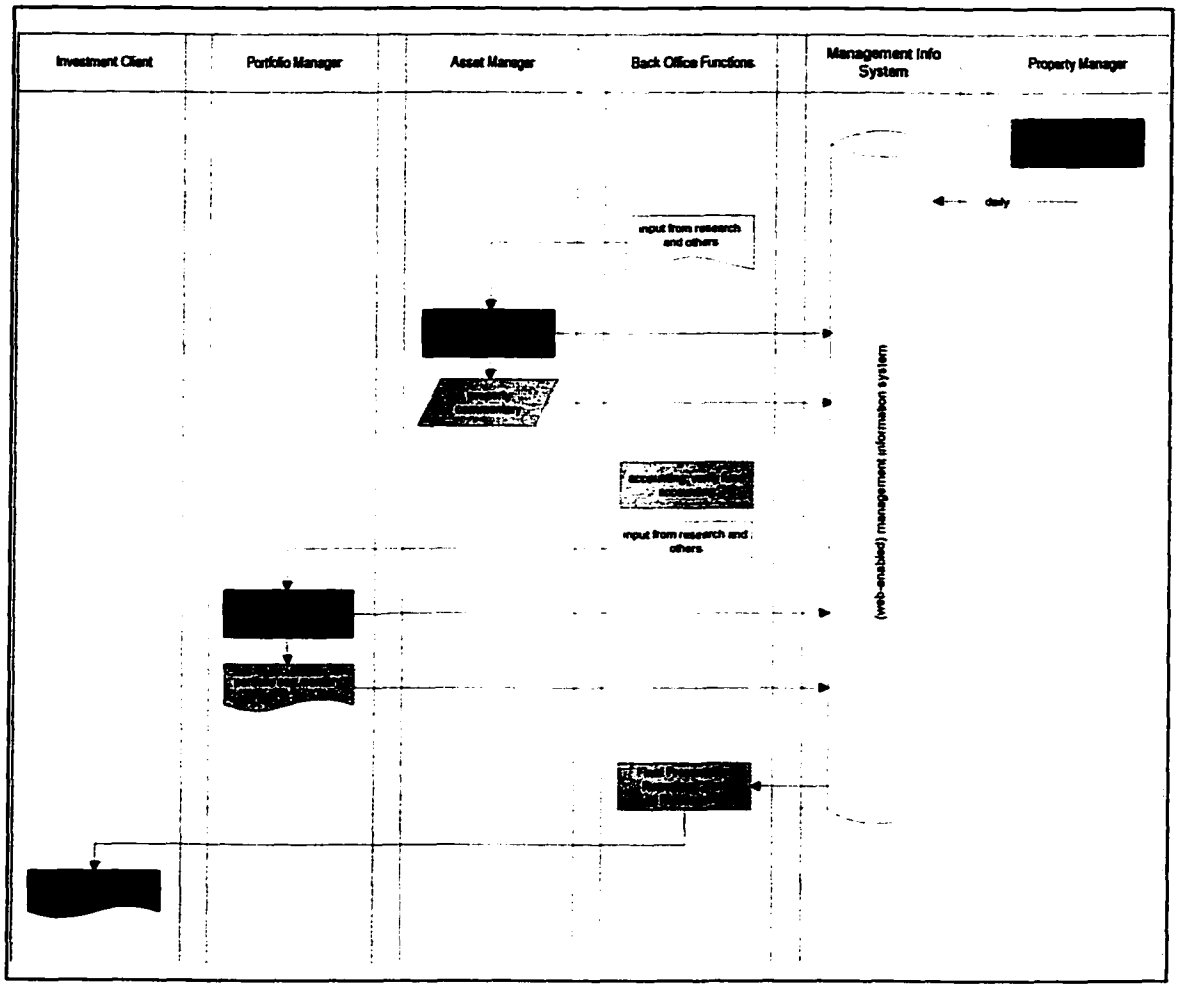

Figure 6.3: 2001–2005: The Integration of Information Systems into One Centralized Information Management System Accessed by Internal and Third Parties

6.2.3.1 Communication with the Investment Client

Again, the final step in the workflow is still to provide the investment client with portfolio financials in the form of a hardcopy or PDF-format (quarterly) report. This coincides with the industry's belief that the success of its business depends on close contact between the investment management firm and its customer, and this will not

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change[69]. Also, despite the technological advances, clients have not demanded online availability of financial information. The legal obligation to keep a history of one's portfolios, and the level of discomfort with the reliability of technology has prevented investment clients from embracing the Internet wholeheartedly.

According to some respondents, one explanation for the investment clients' lack of interest in accessing their information online is that the majority are middle-aged and not as likely to be used to these new technologies. This is expected to change as younger and more innovation-oriented executives rise to strategic positions and as younger people become real estate investors[70].

Additionally, in essence, the investment owners require only one thing: "the highest possible yield on their return, as agreed upon in the investment strategies definition phase" with investment managers. Despite this, and the investment managers' desire to limit online access for their investment clients in order to maintain the valued personal relationship, the next most logical evolutionary step for all respondents is customizable online access to portfolio information for the investor community. There are several reasons for investment managers to eventually (and sooner rather than later) open up their information systems to investment clients:

1. To provide access to databases by international clients—Three out of seven of the case study subjects have international investors. For the investors to access the portfolio managers at a convenient time might be complicated due to differences in international time zones. Providing online access allows an

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[69] One client relation's manager said his firm will never "ask clients to look up their information themselves via an online interface," as they attempt to "come in front of [their] clients" to personally provide whatever meets their needs.

[70] "I can see the difference of adoption [of technology] between 30-year old and 50-year-old colleagues," said one asset manager of the generation gap.

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internationally dispersed clientele to access and review their portfolio instantly and possibly deploy online communications.

2. To serve a larger group of clients at the same time with a smaller group of portfolio and asset managers[71].
3. To serve the next generation of technology-informed investment managers and clients—With the rise of a new generation of investment managers, and, more importantly, the new investor community, the demand for online access and technology-driven solutions will continue to grow.

Another logical area that technology development is expected to address is the need for further integration of investment managers' information systems. To date, all but three of the respondents still have separate systems in place to manage data received from the acquisitions and dispositions and research departments. A "cross check and benchmarking" effect can be achieved if all departments have access to historical and actual portfolio data. In turn, portfolio and asset managers will be able to increase their productivity and reduce time-consuming inefficiencies by limiting internal communications between the various departments if information is integrated and available. For all technology professionals questioned, both of these are logical next steps. The more conservative attitude typical of investment professionals, added to disappointing experiences with past technology implementation processes, make the latter group more wary.

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[71] Charles Schwab's chief information officer stated, "On the very busiest day at our Web site . . . we had just under 100,000 simultaneous sessions, which means that we had 100,000 of our customers interacting with us at the same time. All you have to think about is what it would cost to build enough call centers to have 100,000 employees be able to handle 100,000 phone calls at any point in time, and you can see the value that technology adds."— Answering a large number of questions by online clients can be avoided by implementing dynamic discussion boards and offering a frequent-asked-questions (FAQ) feature on the Web site.

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6.2.3.2 Conclusion on Technology Impact for Portfolio and Asset Management

Despite an aversion to technology adoption expressed by several of the participating professionals, it is the portfolio and asset management subareas of real estate investment management company that experience the greatest impact of technology advances. On average, portfolio management consumes more than half of the investment manager's time and approximately half of its annual budget. Both recording and reporting functions are important as they function to expose the firm to clients and the outside investor community. It is expected that increasingly significant timesavings will be gained when centralized data systems are installed. Time spent on data collection and reentry has already been minimized to nearly zero in most respondents' cases.

Half of the questioned firms have not experienced an impact on efficiency of technology implementation as of yet. Of the ones that have, responses vary. One portfolio manager complained that his firm does not make any more money due to technology implementation, rather just spends more time on the extra work required when yet another system is introduced. For the firms that claim an improvement in efficiency, this timesaving is not used to lower employee headcount; rather it allows asset and portfolio managers "to do what we otherwise did not have the time to do before." A heightened level of analysis and consultancy is expected to result from these efficiency gains, as well as improved levels of employee productivity. In some cases, productivity increased 200%, as the technology implementation allowed double the number of assets to be managed using the same number of professionals.

After an initial increase to cover hard and soft costs, costs are expected to go down due to gained efficiencies. As efficiency and productivity rise in this important area of the industry, real estate investment managers will begin to acknowledge that their 'cutting

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edge' and 'competitive advantage' is shifting from client relations and portfolio management to other functions, such as research, property management, and new investment instruments.

portfolio mgmt	developing trends	
cost expenditures today's allocation: 50%	▲ Initial increase due to expensive implementation of ICT systems that affect the organization.	▼ Less spending due to streamlined information flow – reduction in transfer and re-entry cost.
time allocation today's allocation: 60%	▲ A slight increase is expected due to more in-depth analysis and client services.	▼ Significant decrease as information flow and reporting functions are reduced (to zero).

Table 6.4: Technology Impact of Current Cost and Time Allocations for Portfolio and Asset Management Activities by the Real Estate Investment Manager

6.2.4 Property Management

Functionally, property management can be subdivided into two parts.

1. Daily management of the investment property, including leasing, maintenance, and operations; and
2. Financial reporting of the investment property's activities, such as leasing, occupancy, and communications with asset managers.

The vast majority of the U.S. investment managers have chosen to outsource these activities[72]. Only a few survey respondents perform property management in-house. Historically, all respondents' companies had a stake in property management companies. Two of the companies still own a minority share in a partner firm that performs property

[72] "By outsourcing this activity, we can promptly respond to our properties' needs with local and experienced property management firms, without having to have a physical presence in each region where we have investments", one executive officer says.

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and facilities management services—in both cases, focusing on residential facilities. Of the case studies, only RREEF performs the full-range of property management services in-house, employing more than two-thirds of its professionals in this department. RREEF believes in direct, active, and hands-on real estate management through equity ownership and in-house portfolio and property management. There seems no right or wrong answer as to whether to outsource property management or perform it in-house. For each respondent, doing one or the other merely adds to their competitive edge as it fulfills their own strategic approach and visions.

6.2.4.1 Communications with Property Managers

The investment manager (through its portfolio and asset managers) develops and maintains a strong relationship with the manager of its investment properties. In cases where property management is outsourced, the research study revealed three evolutionary steps of data collection and exchange in the last ten years.

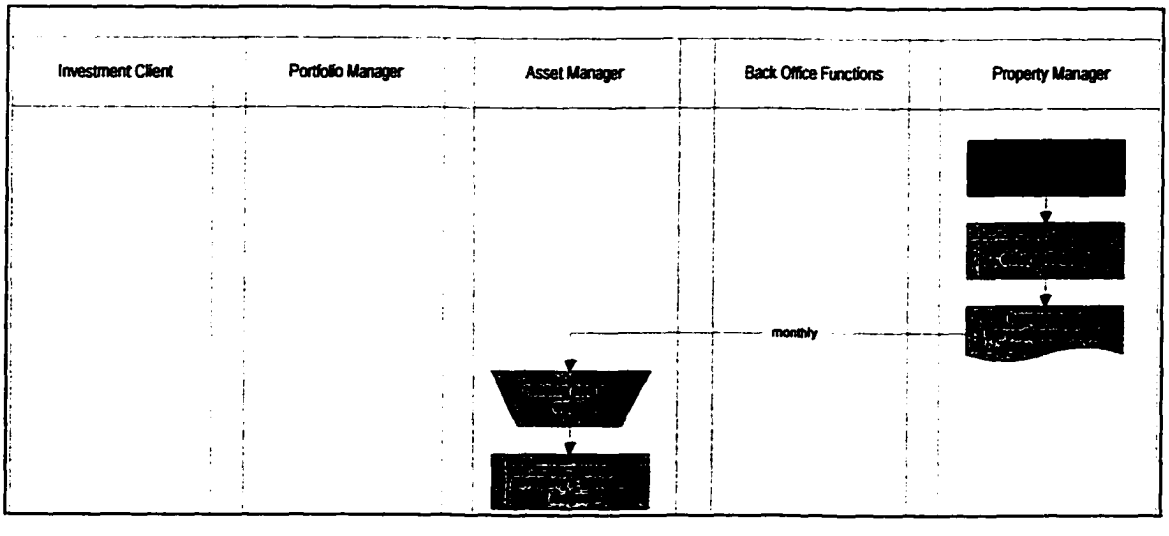

Figure 6.4: 1985-1995: Section Workflow Diagram: Information Flow from Property Managers to Asset Manager by Sending Hardcopies or Spreadsheets on Floppy Diskettes

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Up to the mid-1990s, information was often exchanged monthly through hardcopy or on data storage media (diskettes, etc.). Asset managers had to reenter received information in their own information systems. See Figure 6.4.

From the mid-1990s to the present, most property managers use the same applications as investment managers (see Figure 6.5). Thus, using a modem connection, data can be automatically uploaded into the investment manager's software system. Asset managers still have to verify the accuracy of the retrieved data. They often spend a great deal of time in both technical and financial problem solving, for example, when "beginning balances and ending balances didn't match," said a technology officer, describing the problems incurred in the introduction of his company's next evolutionary step toward a more integrated information management.

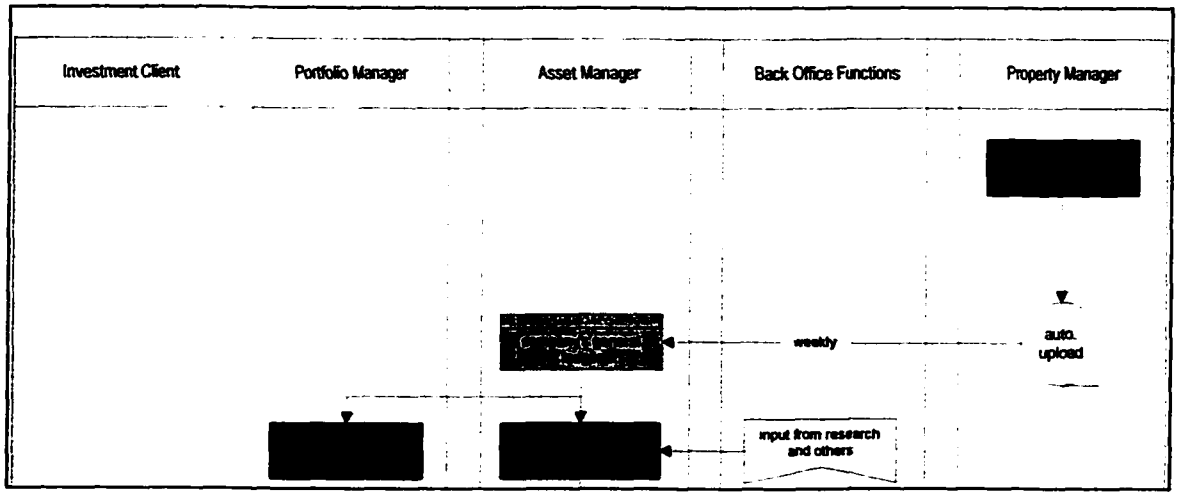

Figure 6.5: 1995–Present: Section Workflow Diagram: Information Flow from Property Managers to Asset Manager via Dial-Up and Modem into Asset Manager's Information System

Only now, firms are in the process of installing seamless information systems where the property manager uses a Web-enabled version of Yardi or MRI to move updated property information directly into the investment manager's system. Expected

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timesavings are great, as the information dissemination becomes a real-time and seamless effort[73]. Consequently, property data will be updated and available for analysis at higher frequencies (or real-time), without the intermediary data reentry once required of the asset manager. As these changes play out, the role of the asset manager will change, from one of information "forwarder and analyst" to "supervisor and analyst." Now, for 75% of survey respondents, however, information is still reentered and reorganized by the asset manager after it is received in hard copy or in spreadsheet file formats. For the others, information is directly received into the company's general ledger systems (via the Internet or dial-up modem) (see Figure 6.6).

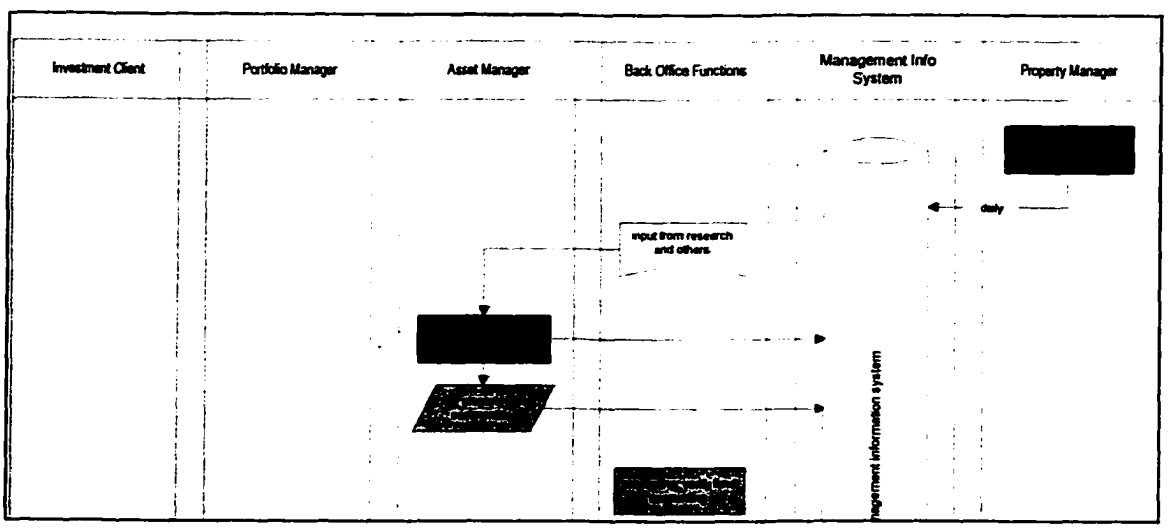

Figure 6.6: 2000–Present: Section Workflow Diagram: Information Flow from Property Managers to Asset Manager into Centralized Information Management System (Starting To Happen)

[73] "We expect to reduce our time to zero, when it comes to assisting in the data collection from the property level," one asset manager said. "We will save at least twelve hours per week, minimizing technical troubleshooting and verifications, when our property managers can directly populate our information systems," added a technology officer.

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6.2.4.2 Conclusion on Technology Impact for Property Management

In conclusion, the research respondents spend little time on actual property management, as opposed to companies that perform property management in-house. Such a hands-on activity can easily consume 80% of an investment manager's time. When property management is outsourced, however, investment managers still oversee and contribute to the services of the third-party property managers as part of their overall service to their investment client. Budgets for outsourced property management can total up to 15% of annual operations, which is calculated as 3% to 5% of the annual gross income of the property.[74] Technology advances within third-party property management companies have not yet led to price improvements for the investment manager.

6.2.5 The Technology Implementation

The implementation of all new technologies for the subprocesses and throughout the various subareas and departments is an important factor that cannot be ignored. Depending on their backgrounds, respondents had different opinions about whether technology implementations have been successful. All technology officers claim to devote full attention to the optimal implementation of technology and the associated training of its users[75] Mixed feedback was received from the operational staff members, who were concerned about the lack of attention to the soft costs (the cost of implementation and training) and the human factors involved in such an implementation.

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[74] The percentage depends on the real estate type (e.g., residential versus commercial), location, and service level.

[75] "The implementation of new technologies had the effect of getting our investment professionals to think about their application, and to generate even more ideas" one technology director says.

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The hidden costs of implementation, including additional people, space (for servers and computers), and time (for training) was believed to be greatly underestimated.

Consequently, it should be understood that the success of technology implementation depends on the acceptance of the people who have to work with it—and the appropriate and consequent redesign of procedures and processes. Through all of this, people have to adjust their attitudes, including their resistance to change, and step forward to willingly facilitate these changes in the organization. Although time is of the essence in a successful implementation, some believe it will take a generation for people to fully understand and accept technology as a facilitating instrument in a redesigned core business (Welsh, 1999).

6.3 The Redefinition of Real Estate Investment Management

6.3.1 The Real Estate Investment Management Value Chain

Despite the potential inefficiencies experienced, corporate and investment real estate owners prefer to outsource the risks and responsibilities involved[76] for specific reasons:

- They have no resources to analyze, invest in, and manage their own properties;
- They lack knowledge of acquisitions and dispositions processes;
- They only want a positive and prosperous return on their investment without the worries of management; or

[76] "Our institutional clients are pension funds and money investors; they do not know a lot about the real estate business, other than that real estate provides them with a sound investment alternative. Most real estate investors want to invest their money and receive an acceptable return from their property; they do not want to manage it," stated an asset manager

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- They want "total-package-deliverers" to relieve them from their non-core-business-related real estate activities.

Consequently, real estate investment managers build a trust relationship with their clients and represent them in the research, acquisitions, and management of the properties within the investment portfolio. In this relationship between investment managers and investment owner limited changes are anticipated in the future, separate from the usual desire for more service and detail.

The study also shows that the relationships among investment (and in particular asset—) managers, property managers, and service providers are moderately affected by the implementation of technology—but that these effects hold the greatest promise. For starters, the study showed that technology better facilitated the communications and relationships that were already established. None of the respondents has replaced any services from brokers, consultants, and appraisals as a result of deploying technology solutions, nor have they taken those responsibilities and tasks back in-house. It is expected, however, that these relationships will be built upon to further enhance the products and services provided by the investment managers.

6.3.2 The Efficiency Challenge

It is somewhat surprising to see that the majority of the research respondents initially invest in technology to save cost and time, yet no significant savings have been reported other than the incidental (but significant) productivity enhancements. One reason for this is that no serious attempts have been made to measure the overall return on the technology investments. Why has this not been done since those savings were supposedly so important? One explanation is that, on the level of strategic decision-making within an

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organization (and perhaps not on the operational level that was the subject of this research, where the professionals who were surveyed may not have been aware of the overall benefits and strategic importance of technology implementation), it is clearly understood that the steep investments in technology (in most cases, increasing from 10% to 30% over the last three years) are not an effort to achieve short-term profits, but rather one to gain long-term benefits. It may be believed that these benefits will better serve the investment client and contribute to the reorganization of the processes of asset management—shifting away from information dissemination to in-depth and detailed analysis and the provision of complementing products and services.

Some recognized efficiency improvements due to technology advances are:

- The due diligence stages of the acquisitions process have been reduced from an average of 60 days to three to four weeks,[77] mostly due to standardization and stringent time agreements between service providers, brokers, and asset managers, but facilitated by technology.
- When AMB Property Management set its goal to report to the stock exchange in GE -1 (meaning one day faster than General Electric's reporting cycle to the stock exchange), information and communications technology helped the firm to achieve this goal and reduced the reporting time to GE +14.
- UBS Realty's acquisitions team has gained efficiency improvements through process redesign and technology implementation, which has led to an increase to four or five deals per year per person as opposed to the former three deals per year per person.

[77] DeMay, Real Estate Due Diligence and Closing Process.

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- The automated information flow between third-party property managers and in-house asset managers has saved one investment firm more than 12 hours per week in troubleshooting, support, and verification processes.

6.3.3 The Continuation of the Technology Evolution

When some companies (in other industries) lost their grip on information ownership, they responded by beginning to purchase and integrate products and services from outside their company to provide an upgraded level of service and added value to their clients. Charles Schwab, for example, moved to take advantage of the entire customer-wealth life cycle by adding investment advisory offerings, purchasing U.S. Trust & Co. (an old-line private client bank), and acquiring CyberCorp, a technology/day-trading firm. Similarly, E*Trade expanded its offerings by acquiring Telebank, an established online retail bank, and has repositioned itself as E*Trade Bank Holding Company, a federally chartered company offering FDIC-insured products in addition to brokerage services (Wilhelm, 2002).

Though less obvious, the real estate investment manager is facing similar challenges to increase its value added proposition. Providing property management in-house to better serve tenants and improve the company image and thereby the rentability of the facility is one possible—yet also arguable—step in that direction. Investment managers will more likely direct their focus on the services of their vendors and service providers in order to integrate those more with their current offerings—or else develop new investment instruments to increase diversity. AEW, for example, was bought by the French-originated Caisse de Depot (now CDC-ISIX), and the Deutsche Bank bought RREEF; both now becoming global players, thereby adding investment opportunities

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abroad and linking to other financial management services. Mergers, alliances, and takeovers allow real estate investment managers to scale their range of offerings to the investment client and, even more, to provide the one-stop-shopping vehicle needed in this changing market environment. In addition to these organizational and other processes changes, the industry is rapidly adopting real estate technology to further facilitate the growing industry.

Figure 6.7 shows a time-line with major industry events and the evolutionary steps of technology implementation, leading to areas and pockets of innovation. Real estate investment management, as we know it today, has only been around since the mid-1970s. Financial models and investment instruments were rapidly developed to facilitate the growing interest of the institutional markets in real estate as an alternative investment. From this beginning, typewriters and carbon paper were used to produce lengthy contracts and financial analyses. The first calculators in the early 1980s "eased the financial discounted cash flow analyses, reducing its production and modification time from days to minutes," said one senior asset manager.

With the introduction of the personal computer at each workstation and the implementation of spreadsheets and word processing, processes changed dramatically for investment professionals. Islands of automation (Pollalis, 1996) were now created, providing solutions for individual tasks. In the mid-1990s, paper-based information exchange with property managers and investment clients was replaced by dial-up modem connections and email—rapidly and frequently transmitting spreadsheets and data sources. Only in 2000 were integrated information systems implemented to streamline the information flow through the hands of the portfolio and asset managers.

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The Real Estate Technology Timeline

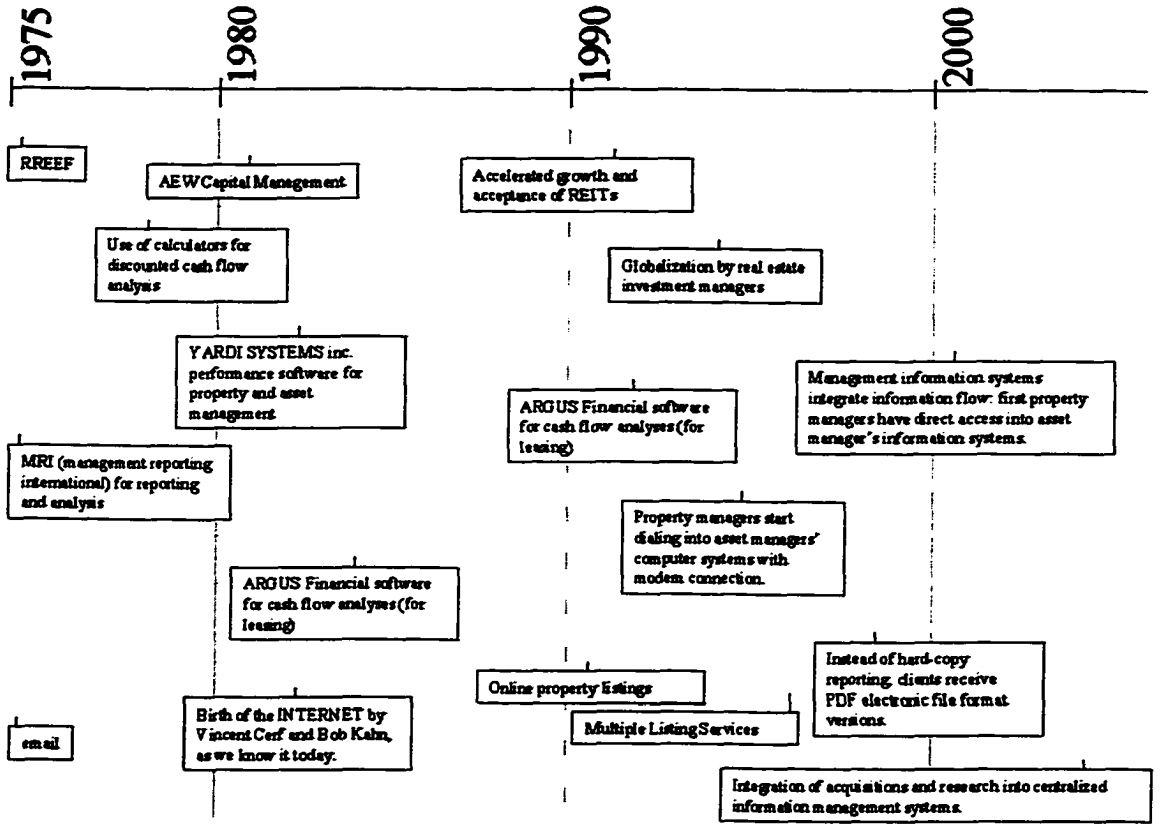

Figure 6.7: Timeline of Technology Implementation in the Real Estate Investment Management Industry

With ongoing developments and implementation, valuation and performance tools are being incorporated in such information systems, providing a seamless tool for all players in the real estate investment process. Information both accessed and developed by the research department and the acquisitions and dispositions department will also be further integrated, providing the internal organization with the opportunity to improve cross-referencing and benchmarking activities and to increase the leverage of the company's own knowledge capital.

Following the example of the financial markets, it is expected that real estate investment managers will become further specialized, providing more services and

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products through partnerships and stronger alliances. And so, we expect a possible shift in the investment manager's operations:

- toward the integration of services from third-party service providers to form knowledge and analysis portals,
- to improve the provision of flexible and innovative real estate by increasing services to tenants and users,
- and to provide new investment instruments to better fulfill clients' needs.

All these trends suggest a redefined role of the real estate investment manager as the "care-taker" of the investment client. Just as in the financial markets, the *winning* investment managers in the new, digitally created real estate investment industry space will be like a hub, surrounded by investment clients, adding more and more products and services and offerings as the needs of the clients change (Wilhelm, 1999).

6.3.3.1 Adopting new Technologies

In order for the investment manager to free up money and time for the ongoing evolutionary developments, technology is increasingly utilized throughout the subprocesses of real estate investment management. Appendix E shows again the various tasks of real estate investment management, but now indicating their current level of technology implementation according to research respondents. The technology referred to here consists of high technology using the Internet or centralized data sources and does not include the use, for example, of spreadsheets and word processing. The appendix illustrates the areas where technology has been more widely accepted and the areas where full penetration has yet to occur. We see that research departments are still disconnected from the centralized databases—that is, the organizations' new information systems.

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Most data is extracted from third-party resources and, in the majority of cases, it still involves the transmission of existing sources via email or Internet.

Another area that appears hardly affected by technology implementation is the acquisitions function due to legal constraints and the fact acquisitions managers must view properties before purchase. In this area, email has evolved as the primary means of communication among the many participants.

The area of portfolio management, and in particular, its communications with property managers, has seen a significant impact. All communications activities have been eliminated or fully facilitated by new technologies, often based around a centralized information system. From the portfolio to the investment client, we still see paper and digital copies of the existing financial reports.

6.4 Conclusion

This chapter has discussed the anticipated value, perceived value, and emerging opportunities of real estate technology for the dissemination of information, for the stages of real estate acquisitions, for the investment manager's research activities, and the role of its portfolio and asset managers. It has also dealt with the consequent shifts and prospects for the investment manager in the value chain of the real estate industry, and the need for a shift in emphasis in the real estate investment industry as historically important and visible activities become increasingly automated.

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Chapter 7: CONCLUSION

7.1 Introduction

After the continuing implementation and acceptance of real estate technology solutions since the late 1990s, some signs indicate that the Internet and its applications truly provide tools that increase efficiency and thus lower costs for the industry of real estate investment management. With the Internet acting as an intermediary in collaborations, certain processes have been shown to execute faster. Consequently, real estate companies report efficiency improvements, which result in savings in time and cost that can now be reallocated to induce more productivity and higher performance.

For the subareas of research and acquisitions, technology improvement in communications will have an especially positive benefit for their processes. The large number of new online data sources will allow for a better and faster analysis and due diligence, while more time can be spent on the verification of acquired research data. Consequently, progressive time expenditure on the subareas is not expected to drastically change. The efficiency gained through changes in communications and data collection will have its due impact on the cost of the subareas. Services and products of third-party providers are yet to decrease in cost, as for them as well; technology will improve process efficiencies and consequently lower their time and money expenditures to create and provide such products and services.

In summary, information and communications technology is proving to be the future of the real estate investment management industry. With increasing speed, the industry embraces the many opportunities the new technology provides. Already-existing e-

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business models have been revised and improved, complementary models have been consolidated, and new models have been born.

7.2 The Value of Technology for the Real Estate Investment Manager

The greatest impact of technology in the real estate investment management industry is taking place in the communications and information exchange processes with property managers. Savings in time and cost exceed expectations—but *only* if fully integrated online information systems are installed. Despite some consensus among U.S. investment managers on the need for cost reductions and efficiency improvements, we find actual movement in that direction rather disappointing. Informational resources do not come free or at reduced cost; furthermore, free services are not even used or trusted by investment managers. Real estate technology for market research and analysis is still used mostly as an extra source of information and does not replace any previous research methods. Clients do not use online reporting functionalities, although they are highly appreciated by some. Hardcopy reports, disseminated by ground surface mail or email, remain the main means of communicating with clients. Enabled by technology, more information is requested and required for better analysis and research.

Savings in time are modest. The greatest effects can be achieved in any new technologies by completely removing any need to reenter data from hardcopies into general ledger software applications. Traditional applications such as Yardi and Argus have developed their online solutions and enabled such required efficiencies. The time saved has not resulted in a reduction of employee headcount, however. The hours gained through these productivity improvements are used for more research and analysis, and for increasing company growth by increasing the number of projects and the ratio of clients

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per employee. The general consensus among the investment managers interviewed is that the increasing availability of information through real estate technology has so far resulted in a quality decrease, rather than an increase. New providers seem more interested in the technology and quantity of data, than in providing high quality data. The further evolution of technology is expected to elevate the good from the bad, and significant and already alleged improvements are anticipated. In the meantime, it appears that the true added value of investment managers still lies in their interpretation and analysis of information, and not in ensuring the ample availability of information and information sources.

Legal constraints still prevent the industry from far-reaching standardization and further implementation of technology. Functions that represent high risk and responsibility remain outsourced to third parties and service providers. Clients still specifically outsource the management of their capital investments in real estate due to its complexity, the amount of time required to manage their own assets, and the secondary status of these activities in relation to their core business functions.

The study researched the largest and most innovative real estate investment management firms in the United States, which seem to be embracing information and communications technology. Looking at the larger and most innovative real estate investment management firms and realizing that the smaller firms are yet to follow, one can draw the following conclusion about technology trends in real estate investment management industry. The future will bring the integration of property management information systems with general ledger systems. Reporting tools will enable seamless information flow, collection, and representation from property level through portfolio

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level to investment client. Additional products and services will be considered to provide a broader range of offerings to investment clients.

7.3 Integration of Islands of Automation

Just as in other industries, technology for real estate investment managers is evolving from a construct of "islands of automation" (Pollalis, 1996) to one of threads of integration within a process web. A wide variety of tools and applications facilitate the execution of tasks and communications. Ongoing integration of tasks and subprocesses, combined with a seamless inclusion of market and research data, will enable real estate investment managers to further enhance their process efficiencies.

Significantly improved processes, research, and communications—as well as increased services to users and tenants—will eventually lead to better marketable real estate properties and thus to higher returns for the investor. While technology already holds the capabilities and opportunities for process improvements, its value still needs to be proven in the context of the strong, established relationships among the process participants. Since advanced technology was introduced only in the late 1990s, a few more years will be required to further establish its benefits and value proposition for the processes of real estate investment management.

7.4 The Evolution of Real Estate Investment Management

Like other industries that have experienced the impact of the Internet and its applications, the real estate investment management industry needs to redefine its role and position within the overall real estate industry. With acknowledged trends where the

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tasks involved in disseminating information are becoming a commodity and more fully automated, and where investment clients demand to receive a broader range of products and services to help them further outsource their investment responsibilities, the real estate investment manager must look beyond its established and trusted job description. Integration of additional and complementing products and services (e.g., new investment instruments, international focus, improved tenant-service, brokerage, marketing, and modified financing models) will allow the real estate investment manager to reposition itself in the web of educated investors, vendors, service providers, tenants, and property managers to maintain or once again take control of the complicated and risky investment business.

Consequently, further study is recommended to quantify the value of information technology for the real estate investment manager as technology becomes more widely adopted and as the picture becomes clearer on changes and problems experienced in applying ICT to real estate investment management products and services.

This study has focused on the processes of real estate investment management—as part of the overall real estate process. Further study is recommended on the impact of technology on the operational activities of property management—where the property manager communicates with tenants, owners, and the vendor and maintenance communities. In this dissertation, a general overview and analysis of the "landscape" of real estate technology for the industry as a whole has been sketched. It is recommended to continue the analysis of real estate technology's evolving landscape—to better facilitate strategies and choices of real estate investment managers and industry professionals in their quest to improve efficiencies with technology solutions.

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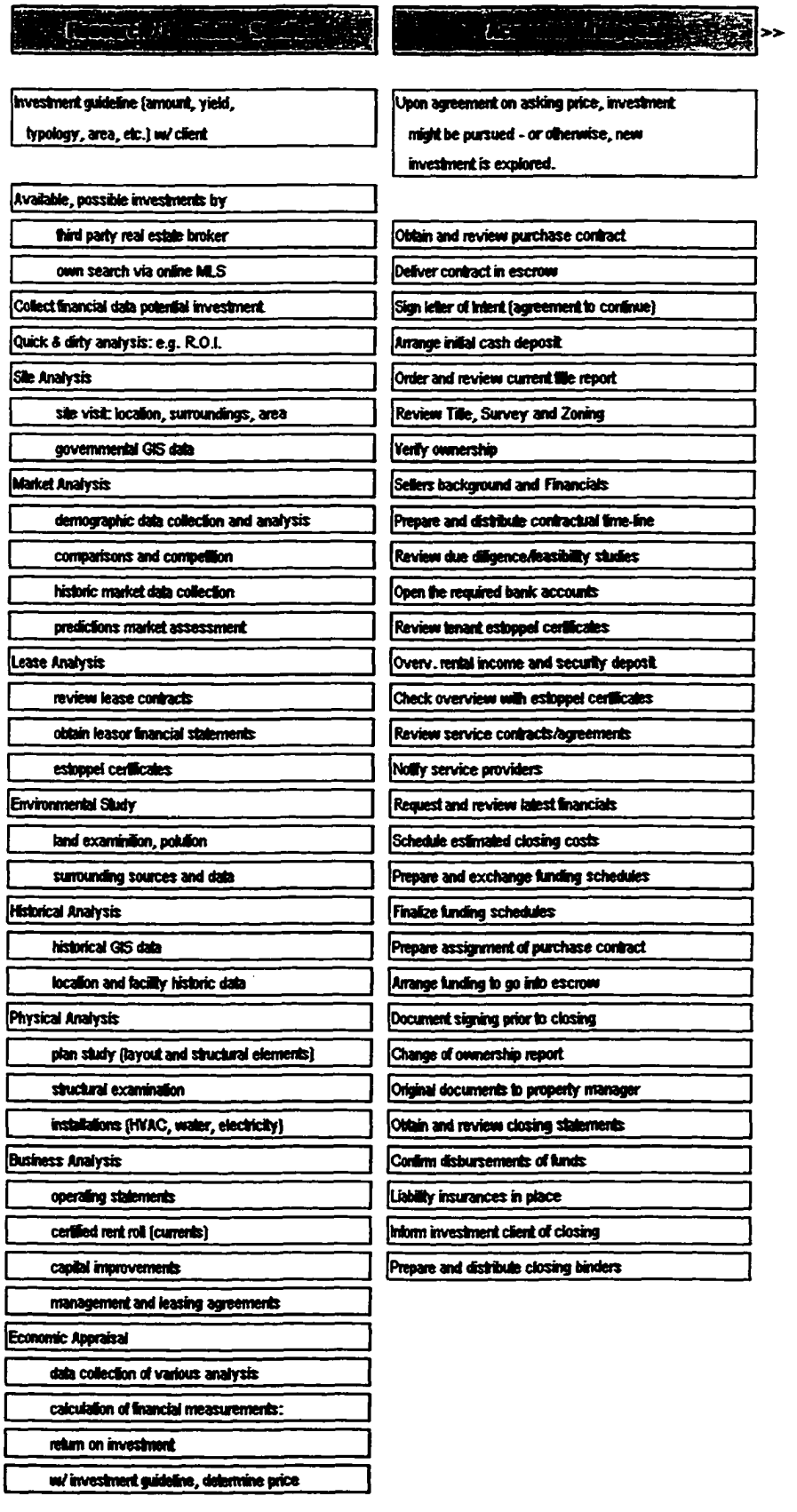
APPENDIX A:

The Process of Real Estate Investment Management



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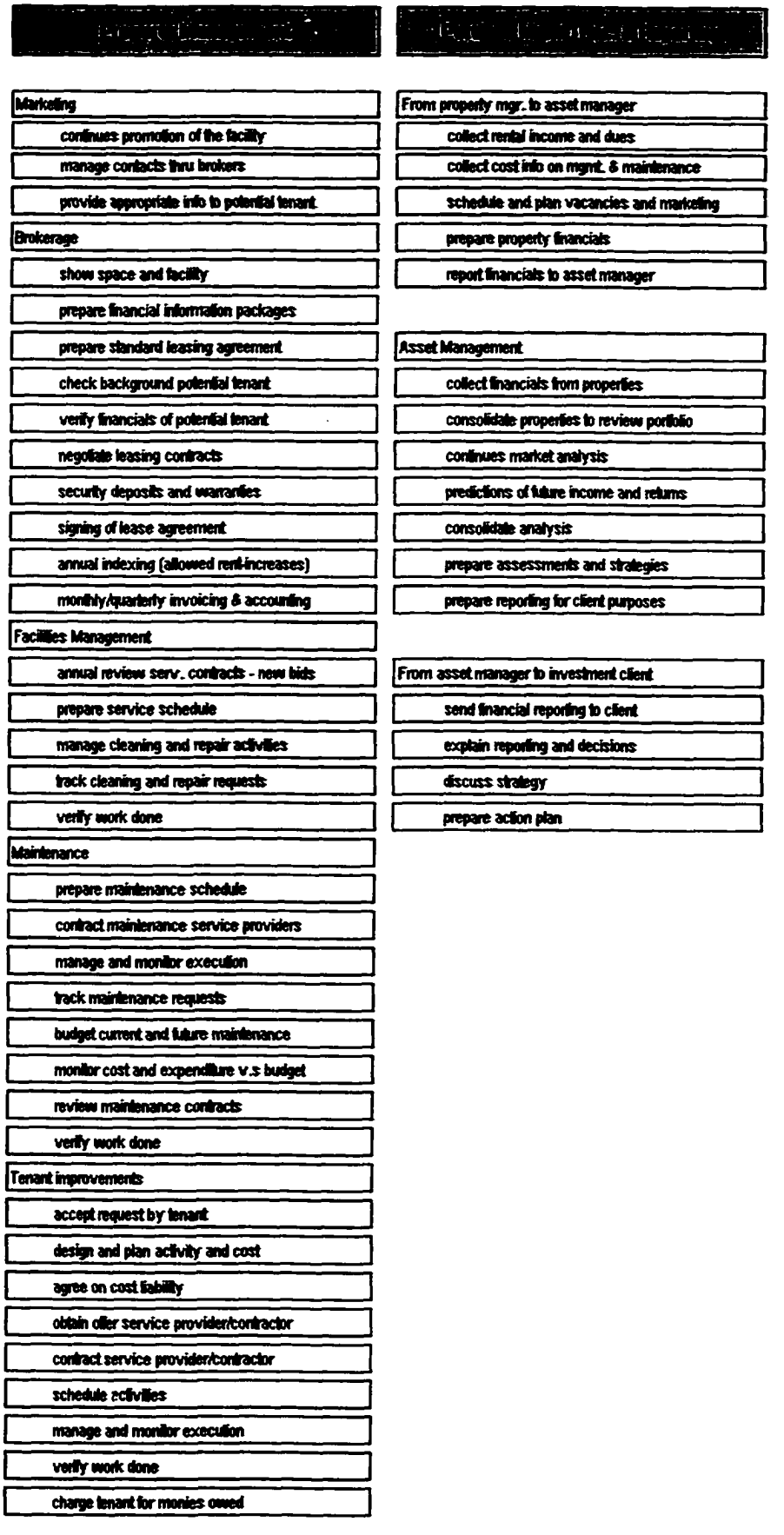

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APPENDIX B:

Survey Questions

Telephone Survey: Real Estate Technology - an Owner's appraoch				
Date:		**Time:**		
Company				
Name:				
Function/Title:				
Participation:	a.	Investment Owner		
		1	Institutional Real Estate owner (incl. Pension fund, endowment)	
		2	Real Estate Developer	
		X	Merchant Builder (sale after development)	
		Y	Investment Builder (income property)	
		3	Real Estate Asset Manager (third party advisory firm)	
	b.	Corporate Real Estate Owner		
	c.	Other:		
Real Estate Typology:			% of portfolio / activity	
	i.	Residential		
	ii.	Commercial		
	iii.	Retail		
	iv.	Industrial		
	v.	Infrastructure		
	vi	Telecom and Communications		
			100%	
US$ real estate under management				

Questions are organized by process:
Feasibility Study - Appraisal - Acquisition - Reporting - Operations Management

and by process control parameters:
Time, Money, Information, Organization, and Quality

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GENERAL											
1	Has your firm conducted general analysis on the value proposition of digital technology for your business processes?					yes / no					
2	Who makes strategic decisions in regard to the deployment of digital technology?										
3	Rank the reasons for you to embrace digital technology:	*Cost Savings*	1	2	3	4	5				
		Time Savings	1	2	3	4	5				
		Reduction HR	1	2	3	4	5				
	tick off when used:	*Improving efficiencies* / *Quality improvements*	1	2	3	4	5				
		Client Satisfaction	1	2	3	4	5				
4	Is technology going to be a requirement for your service providers?					yes / no					
5	Have you deployed "electronic signatures" for official documents (other than fax)?					yes / no					%
6	IF NOT: Why do you not used "electronic signatures"?										
7	What is the increase/decrease of investments in technology in 2001 compared to previous years?					increase / same / decrease					%
8	What is the most prominent process inefficiency (asset management) in your daily working activities?										
FEASIBILITY STUDY											
										quantify the answer with a % of the total	
	Market Research Where to Invest										V
9	Do you use digital technologies to find investment opportunities that match your investment criteria?					yes / no					%
10	What are your top three resources for digital market information?	1									
		2									
		3									
	Site Selection										
11	Do you find potential investment properties online via Multiple Listings Services?					yes / no					%
12	IF YES: do you mainly base your decisions on information provided by MLS?					yes / no					%
13	Does digital technology influence the way you work with brokers?					more / less / different					
	Local Market Analysis										
14	Is there an increase/decrease in time spent for market analysis using digital resources?					increase / same / decrease					%
15	Is there an increase/decrease in cost expenditure for market analysis, using digital resources?					increase / same / decrease					
16	What digital resources do you use for local market research?										
17	Is there an increase/decrease in the quality of market data, using online resources?					increase / same / decrease					%
	Economic Appraisal (property)										
18	Do you find useful comparble properties, using digital resources?					yes / no					
19	What digital resources do you use for this research?										
20	Is there a increase/decrease in time spent for appraisals, using digital resources?					increase / same / decrease					%
21	Is there a increase/decrease in cost expenditure for appraisals, using digital resources?					increase / same / decrease					%
22	Is there a increase/decrease in accuracy/quality of financials analysis?					increase / same / decrease					%
ACQUISITION AND DISPOSAL											
	Acquisition										
23	How many documents/contracts are typically processed for an acquisition?									docs/ contracts	
24	Is technology facilitating the standardization of acquisition documents?					yes / no					
25	Has the number of transactional documents increased or decreased?					increase / decrease					%
26	Has the time spent on the acquisition process increased / decreased?					increase / decrease					%
	Disposition										
27	Have you found equity and debt resources through digital sources?					yes / no					%
28	IF YES: What is the most used financial online service for this?										
29	Did time consumption for brokerage increase/decrease using online communications?					increase / same / decrease					%
RECORDING & REPORTING											
	From service providers (brokers, appraisers, consultants, etc) to Asset Managers										
30	Which medium do you use for the exchange of documents with service providers such as brokers, consultants, etc)?					hard-copy via mail / fax					%
						via email					%
						accessible via online info.system					%
31	Do you keep track of the knowledge exchange in a corporate knowledge network?					yes / no					%
	From property to Asset Manager										
32	Which medium do you use for the exchange of property financial information?					hard-copy via mail / fax					%
						via email					%
						accessible via online info.system					%
33	Is there a change in frequency of re-entering your property mgrs. information?					increase / decrease					%
34	Have you increased standardization to facilitate integration of portfolio information?					yes / no					%
35	Traditionally, what IT tools did you use for measuring your property's performance? What do you use now?										
36	What is the average reporting frequency from your property manager?	*every*	1	2	3	4	5			*weeks / months*	
37	Has the time spent on the recording function increased/decreased?					increase / decrease					%
38	Has the cost expenditure for the recording function increased/decreased?					increase / decrease					%
	From Asset Manager to Owner / Investor										
39	Which medium do you use for the exchange of portfolio information?					hard-copy via mail / fax					%
						via email					%
						accessible via online info.system					%
40	What is the average reporting frequency to your client (investor)?	*every*	1	2	3	4	5			*weeks / months*	
41	Traditionally, what IT tools did you use to prepare financial reports? What do you use now?										
42	Has the time spent on the reporting function increased/decreased?					increase / decrease					%
43	Has the cost expenditure for the reporting function increased/decreased?					increase / decrease					%
44	Has the quantity/frequency of reporting increased/decreased using digital resources?					increase / decrease					%
45	Has client satisfaction changed, using new technologies for reporting?					yes / no					
PROPERTY MANAGEMENT											
46	Do you outsource the function of property manager?					yes / no					
47	IF NO: Is the marketing for leasing / occupation facilitated by digital technologies?					yes / no					%
48	Which digital solutions do you provide for the benefit of tenants/users?					yes / no					%

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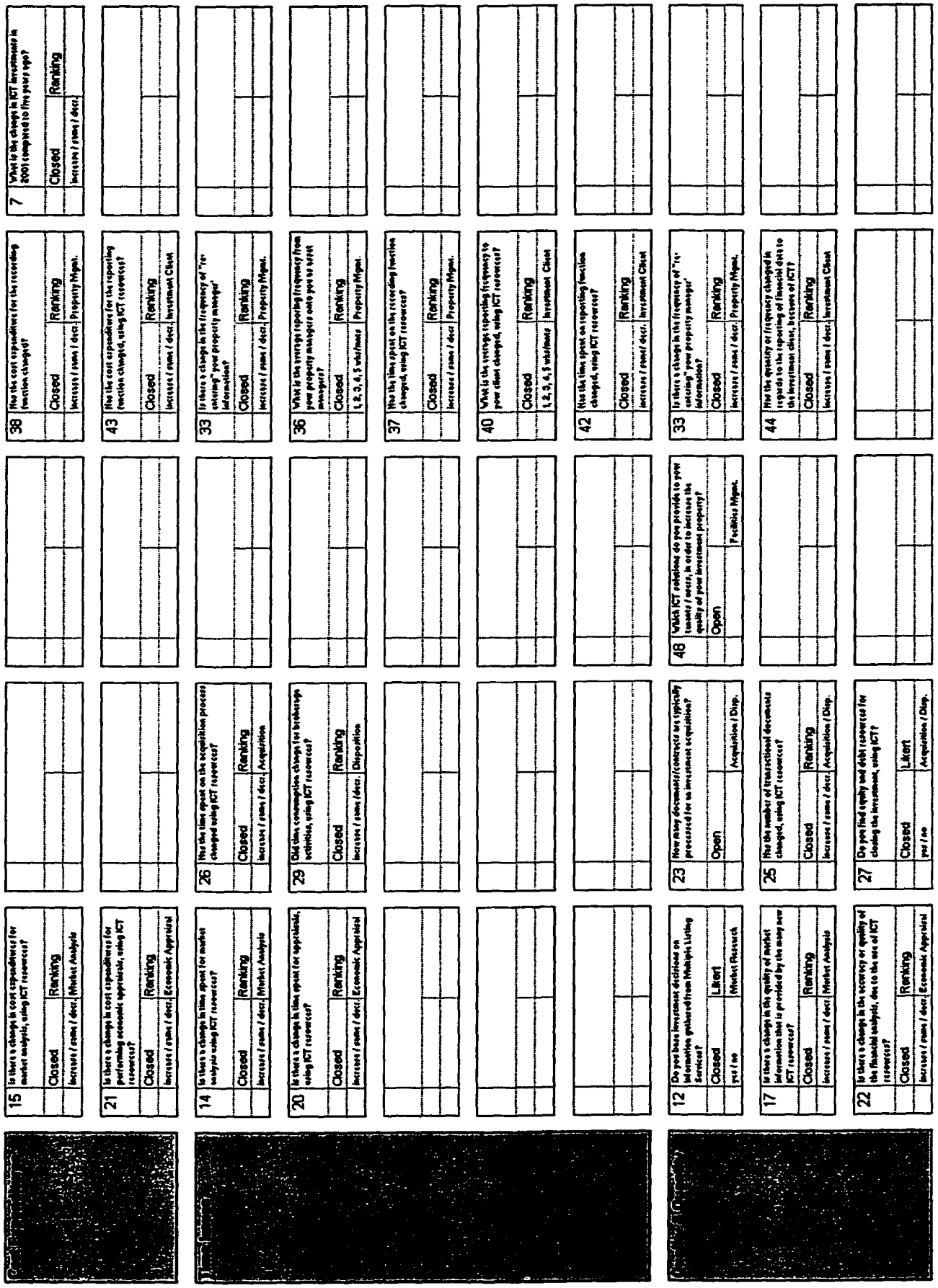
PENDIX C:

vey Design



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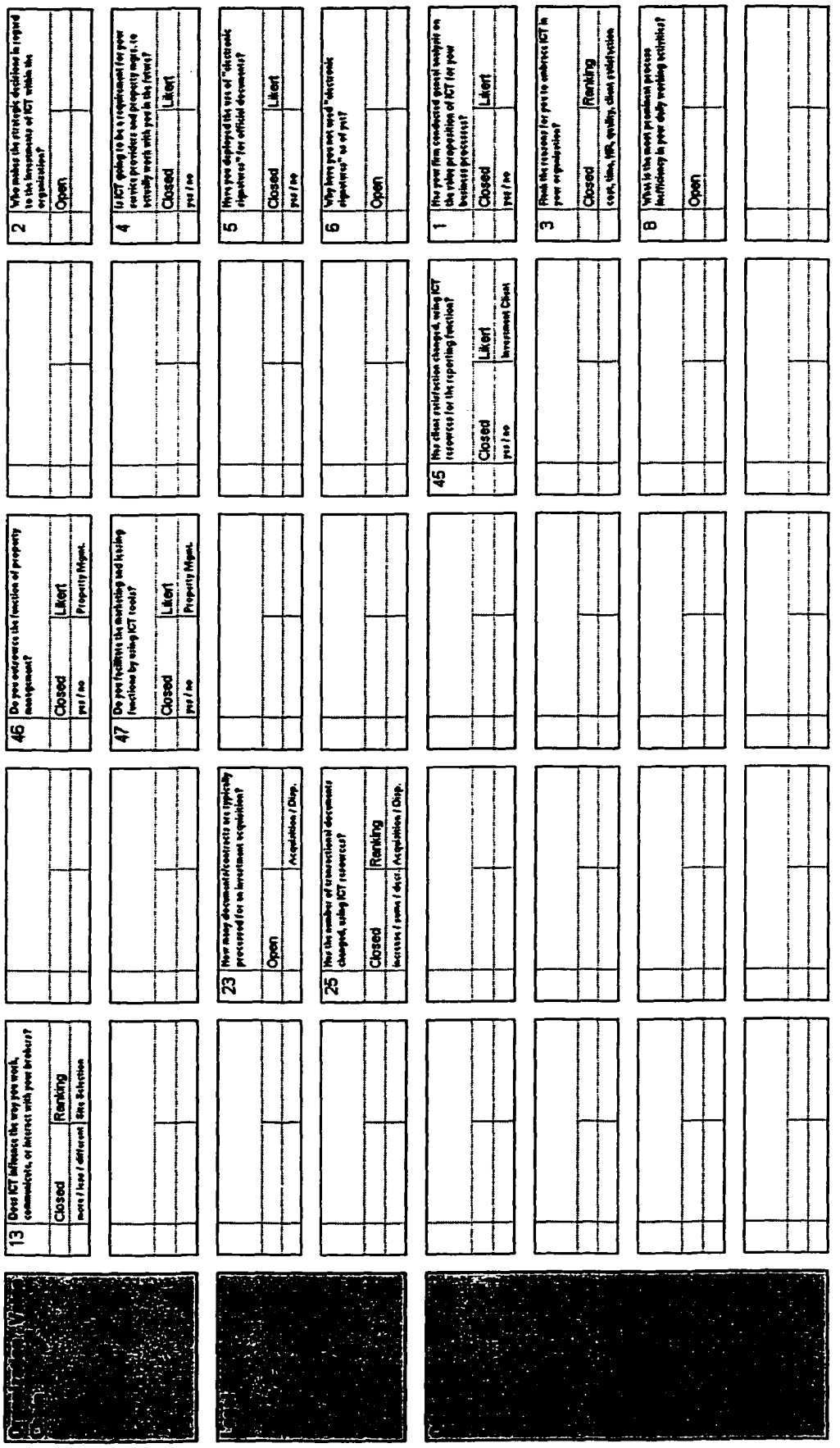

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APPENDIX D:

Summary Case Studies of Interviews with 20 Professionals

1 Introduction

This appendix presents status reports on five leading U.S. investment management firms. A total of U.S.$39 billion is represented (15% of the total U.S. assets under management with real estate investment firms[78]) by these five companies. The case studies are based on a variety of interviews with the company's technology officers and representatives of the research, acquisitions and dispositions, property management, and portfolio management departments. The status reports provide additional information on the level of implementation of technology for mainstream real estate investment management firms. The status report findings complement earlier study results and provide further evidence as discussed in Chapter 7 of this dissertation.

2 Company A

With nearly U.S.$5 billion assets under management, Company A[79] ranks among the twenty largest real estate investment managers in the United States. The firm provides its investment clients with a variety of options for their real estate allocations. Company A's core investment vehicles provide a Core Separate Account (managing individual separate accounts of U.S.$100 million or more) and its Open-End Core Fund, with a gross asset value of more than U.S.$1.2 billion and serving more than fifty institutional clients.

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[78] Percentage based on the 2001 rankings, as provided by Centerprise, courtesy of Espen Thoegersen.

[79] The respondents prefer to remain anonymous due to confidentiality agreements with colleagues and clients. Therefore, names and numbers might be fictional or assumed.

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Company A's Open-End Core Fund comprises 19% apartment investments, 44% office buildings, 8% retail buildings, and 29% industrial investments, geographically dispersed throughout the United States. Company A has built a strong focus on the residential markets, resulting in Multifamily Separate Accounts and Closed-End Apartment Funds. In addition, the firm owns two complementing subsidiaries: one focuses on providing property management for its residential investments, and the other is a development group, providing real estate development services to increase favorable investment opportunities.

2.1 Organization

A team of professionals providing the optimal portfolio creation, dynamic portfolio management, and constant performance benchmarking surrounds each investment client. Portfolio managers are the initial points of contact with the investment client. On a strategic level, they examine the portfolio's returns, trends, net operating income, cash flows, projections, and benchmarks. The asset manager works closely with the investment properties and the parties surrounding them. Asset managers focus their work around the investment properties and are in direct contact with the property managers and leasing brokers from whom they receive actual financials, such as leasing information, rent roll, and occupancy numbers. A mostly paper-based or somewhat automated flow via the firm's real estate management information system enables the various professionals to analyze the property information and present higher-level reporting to the investment client.

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2.2 Information Management

Property managers provide monthly property data through the firm's proprietary data information system to the asset managers. The property's leasing broker continues to provide leasing information via paper documents. On a property level, the asset managers evaluate and manage the properties, reporting via portfolio accounting systems to the portfolio managers. A proprietary portfolio asset management system enables the property manager to manipulate the data for presentation to the investment client. The systems in place are mostly financially driven, merely benefiting the firm's accounting departments. Simultaneously, through proprietary valuation models, GIS, and online research, the portfolio and asset managers have access to numerous national and local research resources that are integrated throughout the investment process.

2.3 Real Estate Technology

Company A is currently involved in a major upgrading of its management information systems. The system will migrate from an accounting system to one that specifically benefits the company's asset and portfolio managers. Where initially information was transferred from the firm's property management information system, through its portfolio accounting application, into the portfolio asset management application, now a Web-enabled Yardi platform will fully integrate this information flow. Each user of the system will be able to access any type of property data and "slice and dice" the information to any granularity required. Yardi enables the asset managers to look at property level information in detail without any paper intermediary product. Portfolio managers can now, using the same data warehouse system, analyze and provide the strategic planning on a portfolio level.

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2.4 Issues to Implementation

For the Yardi implementation, an absolute budget of U.S.$2.5 million is allocated. The firm's vice president of asset management, however, recognizes a wide variety of hidden costs, such as training (people), time (adaptation speed), and space (for hardware and software). For the latter reason, the firm debates data warehousing and outsourcing the hardware at Yardi facilities. He identifies reasons why a well-coordinated implementation and training process is so important: "It just is still too easy to use paper sources. One still lacks full confidence in the digital systems." He adds, however, that "with Web-enabled systems, the ease of use will increase and have a positive impact on the adoption."

3 AMB Property Corporation[80]

AMB was founded in 1983 by Douglas Abbey, Hamid Moghadam, and Robert Burke, whose partnership brings together real estate research experience, transaction modeling, structuring, and financing, and legal expertise. The firm's first strategy was to provide investment management and corporate advisory services, and to carefully engage in development activities. The lion's share of the company's activities during the 1980s, however, involved investment management—particularly on behalf of Hawaiian investors seeking to diversify into income-producing mainland properties. In the early 1990s, AMB was the first U.S. investment management firm to consolidate into a public real estate operating company. Now, AMB Property Corporation is a leading owner and

[80] Sources and acknowledgments: Wayne Pryor (Chief Technology Officer), John Roberts (President of Advisory), as well as the World Wide Web site (www.amb.com), corporate brochures, and annual reports.

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operator of industrial real estate (high throughput distribution facilities[81]) nationwide, including 1,017 buildings totaling more than 94.1 million square feet. AMB's total assets under management value U.S.$4.5 billion (versus U.S.$4.0 billion in 2000), U.S.$2.3 billion of which is private equity and the remainder is stock and debt.[82] With offices in San Francisco and Boston, AMB employs 185 professionals. AMB is different from the more focused investment managers in that it is a REIT. The difference is that a REIT measures its performance through income generated out of operating real estate (net operations income), while investment managers do so through the value of assets under management and the increase in assets through transactions.

3.1 Organization

With only 185 employees, AMB follows an outsourcing model to facilitate the management of its large number of facilities. AMB builds a variety of alliances to add value by creating mutually beneficial relationships. The firm recognizes several types of relationships: "customer alliances" with users of high throughput distribution facilities (e.g., Dallas-Ft.-Worth International Airport and Emery Worldwide), "management alliances" with local property managers (e.g., Cushman & Wakefield, Campanelli Development International, and Trammell Crow Companies), "broker alliances" with premier leasing brokers (e.g., CB Richard Ellis, Colliers International, Insignia, and Trammell Crow), and "development alliances" with local and specialized real estate developers (e.g., Dienna Nelson Augustina Company, Lincoln Property, and Matrix Development Group). AMB further identifies five main function groups within the firm,

[81] The term "high throughput distribution facilities" is trade marked by AMB Property Corporation and refers to real estate that facilitates the movements of goods, oftentimes located near transportation hubs such as airports, ports, and freeway systems.

[82] As of December 31, 2001.

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focusing on management, transactions, development, operations, and private capital. Through its alliance programs, AMB is a "virtually integrated" organization that stretches far beyond its internal potential to extend its capabilities.

Information and communications technology is considered an important aspect of AMB's business model. As a REIT—in which the property income determines its success—operational efficiency is crucial. ICT, therefore, is seen as an investment as opposed to a cost-center, and is considered to be of strategic importance. Wayne Pryor, the firm's chief technology officer, therefore, is part of the company's senior executive committee and closely involved in determining the firm's strategies and business goals.

3.2 Information Management

AMB's core competence—the outsourced, virtually integrated, business model—also provides for the most challenging communication opportunities. Though internally dispersed over only two locations with 185 employees, AMB's network touches over 50 other organizations and more than 150 additional coworkers. In addition to these operational communication challenges, as a public company, AMB also has the obligation to report financial information to the public. The latter was recognized as one of the firm's biggest problem areas. With General Electric as a benchmark, it took AMB 14 days longer to report their financials to the U.S. stock exchanges. Wayne Pryor explains: "Through a new accounting and reporting system, we were able to accelerate our reporting from GE+14 [14 days longer than GE's reporting time] to GE-1 [one day sooner than GE's reporting time]." In addition, one of AMB's bottlenecks was its annual budgeting procedure. With a new information system in place, moving from a paper

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intense practice to Web-enabled one, AMB was able to cut 30 days from this process, affecting more than 150 AMB professionals.

3.3 Real Estate Technology

During Pryor's tenure with RREEF, he has developed a clear understanding of how to approach implementation processes for the successful adaptation and implementation of ICT within the AMB organization. "It all starts with the way we collect our data," he says, using as an example the major improvements AMB has made to data collection in the new accounting and reporting systems for the quarterly reporting to U.S. stock exchanges. "The data collected must be organized for it to become useful information. In turn, this information is analyzed and reported in order for the firm and its investors to make appropriate decisions. Through defined workflow processes and extensive collaboration, the decisions are executed in order to get the anticipated results. We constantly measure these results to see if we actually collect the proper data, making the cycle complete." With this, AMB is able to constantly improve upon its information management and consequent information systems.

In order for AMB to "catch up," it experienced a "spike in spending," which is expected to flatten out again in the next few years. "With our constant effort toward improving our business processes, we are currently implementing some major ICT projects to streamline the communication and information flow between our alliances and internal organization—with its greatest impact in the financial reporting cycles to the U.S. stock exchanges, and the annual budgeting cycles internally."

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3.4 Issues to Implementation

Because of AMB's virtually integrated organization structure, great effort has to be dedicated to the training of internal and third-party workers. One of AMB's larger projects was the implementation of CTI, a property management and accounting software, for its accounting and financial reporting activities. With the help of CTI, all users of the application were trained within two weeks at the CTI campus in Texas. Through constant assistance and collaboration, adaptation by third-party property managers has gone remarkably well, considering an often-experienced difficulty of getting outside organizations enthusiastic about adopting new applications and procedures. It is AMB's outsourced model and strong alliances that enabled them to successfully implement new communications methods and facilitating software applications. "As AMB, we demand participation of our partners throughout the country. Often, though, our partners and the business people, who are then the sponsors and leaders of the implementation process, initiate the requests for change. Without their buy-in, we will not even attempt to implement ICT," Pryor says to explain the importance of corporate and partner acceptance of ICT innovations.

4 Company B[83]

With U.S.$2.9 billion in real estate equity investments, Company B ranks in the top 40 U.S. investment management firms, elevated by its parent company to one of the largest asset management firms in North America. Company B focuses on the management of core and value-added investment strategies in the private real estate

[83] The respondents prefer to remain anonymous due to confidentiality agreements with colleagues and clients. Therefore, names and numbers might be fictional or assumed.

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equity markets. On behalf of pension plans and individual and commingled accounts, Company B invests in commercial real estate in all major property types (office, warehouse, retail, research and development, residential, hotels and industrial) in all major U.S. markets.

4.1 Organization

Company B's senior management and investment committee leads the 40-person[84] organization, which is divided into portfolio teams, each with a dedicated client and investment focus. Each client team is headed by a senior staff member and includes professionals from the various focus groups within the firm: portfolio management, product development, consultant relations, acquisitions, research, and business operations. The latter three business units support the client teams to provide consistency of focus. A senior relationship manager is the key contact with the client, while the rest of the team provides insight on the investments, markets, strategies, risks, performances, and so forth. The firm's financial reporting function is partially managed by the parent organization through its extensive accounting department.

Recognizing deficiencies in Company B's current information management system, a special business operations group was formed with the primary focus of evaluating, analyzing, and upgrading the firm's information management system. It was through this group that Company B channeled its frustrations about the ongoing lack of up-to-date and real-time management information that is increasingly needed for accurate and swift investment decisions and client relations.

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[84] A large majority of the accounting team belong to the firm's parent company and thus are not included in the 40 headcount.

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4.2 Information Management

Prior to 2000, more than 30 property management sites uploaded property information on a monthly basis into the Company B's general ledger systems via a simple dial-up modem connection. Time and again, differences between beginning and ending balances and other transmission errors obligated the accounting and technology team to constantly check, support, and troubleshoot the information flows. Meanwhile, the firm's internal systems did not allow for instant and up-to-date access of any type of management information that was needed on a property or portfolio. In 2000, the firm therefore embarked on an ambitious three-step technology implementation plan that would overhaul the firm's existing information system into a new, integrated, and innovative management information system. As part of this effort, Company B first studied the technology efforts of 11 competitors and 30 property managers to assess its needs and the project's feasibility. After this benchmarking, the firm immediately instigated the technology implementation.

4.3 Real Estate Technology

The three-step process to implement information and communications technology at Company B entailed (1) the creation of a new data warehouse, where all nonproperty data would be stored and made accessible; (2) the implementation of a new accounting/asset management system that allows the management of each property's information, and (3) the implementation of an internal management-level information system that provides the necessary "slicing and dicing" and summarization of the underlying data to facilitate the work of Company B's professionals. With this new information system, the firm's

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professionals have instant access to any type of summary reporting that can be used for requests for proposals and for client purposes, both internal and external.

Step (1) is to implement an in-house-developed data warehouse that will hold non-property-related data, such as information about investors, companies, and valuation processes. The data warehouse will also provide document storage capabilities for items such as investment briefs and valuation memos. The data warehouse will seamlessly integrate with existing and to-be-implemented applications such as Yardi and Argus.

Step (2) of the implementation project allows the firm's third-party property managers to instantly enter day-to-day transactions that will immediately be reflected in the property and portfolio information. It is expected that in 90% of cases, Company B "can dictate its property manager's choice of accounting system." In only 10%, when it concerns a minority stake or special investment product, such as hotel investments, properties will be accounted for with the company's current software, and summary level financial and leasing data will be imported from structured CSV files.[85] Company B expects a significant weekly reduction in support time due to this new information system, generating a timesaving in technological support and troubleshooting. "It will reduce accounting time, systems time, and time for troubleshooting," stated the firms' business annalist. "We still will have the validity checks on accuracy and so forth, but these will be conducted much more efficiently," she added.

Company B's step (3) includes the development of an intranet-type management-level information system that allows for both internal and external customized access to the large pool of data and information. Only in a later and to-be-determined stage might

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[85] A CSV (comma-separated values) is a uniform and widely exchangeable database file format.

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the intranet "opened up" for access to portfolio information by the firm's investment clients.

4.4 Issues to Implementation

In order to prepare the firm's professionals for these initiatives in information and communications technology, Company B's chief technology officer has engaged in a series of training sessions that focus on general aspects of information and data systems. "While some of the training dealt with the day-to-day aspects of using the system, the larger part of the training dealt with understanding what information was available, how it was structured, and how different groups within the organization might use the information. For example, before our training an accountant might think: "That property is sold. We don't need to indicate what property type it is." After our training, the accountant would understand that the marketing area might very well need to know the property type of a sold property to complete a RFP."

With Yardi established as the underlying accounting and management system, the firm's information systems move from being an accounting system to being a more elaborate asset management system. Following the technological implementation of the new information management system, the firm must focus, first, on the education of its accountants and, second, on the asset and portfolio managers. Also, the firm will extensively facilitate the education of the on-site property managers. Because the developed systems are based on existing and popular applications such as Yardi and Argus, each property manager has access to a variety of alternative training opportunities.

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5 Henderson Global Investors[86]

Henderson Global Investors stems from the late-nineteenth century when the firm was set up to administer the estates of Alexander Henderson, the first Lord Faringdon and one of the greatest investors of his time. In 1934, Henderson expanded into investment management, and in 1974, the firm added pension fund management to its range of services. In 1992, Henderson acquired Touche Remnant from Société Générale to become the largest investment trust manager in the United Kingdom—only later to be bought by AMP, one of Australia's leading financial services companies. For its North American expansion, Henderson acquired the Hartford-based Phoenix Realty Advisors in 1999. Now, Henderson Global Investors provides investment products and services for both individuals and institutions in Europe, Asia Pacific, and North America, managing more than U.S.$147 billion[87] in assets with more than 1,800 employees worldwide.

Henderson Global Investors is represented in the United States by its offices in Hartford and Chicago. In addition to real estate advisory services, the U.S. branches also manage its mutual funds where it experiences the fastest growth. Between the two U.S. locations, Henderson employs approximately 65 professionals and manages over U.S.$1 billion in core and satellite direct property assets. Henderson manages core, added value, and opportunistic investment funds grouped in their *core* and *satellite* investments (the latter includes property investments of all risk classes within developing and emerging countries), *property securities*, and *strategic property allocations*.

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[86] Sources and acknowledgements: Douglas Pearce (Director of Information Technology), James Martha (Director of Portfolio Management), Edward Pierzak (Director of Research), and J. P. Rachmaninoff (Director of Acquisitions), as well as corporate brochures and the World Wide Web sites (e.g., LexisNexis and www.hendersonna.com).

[87] Henderson Global Investors, as of December 31, 2001.

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5.1 Organization

Henderson's Client Relations team maintains the contact with its investment clients. This team is responsible for all communications with the outside world, including all reporting on investment funds and portfolios. Portfolio and asset managers prepare, analyze, and manage the investment portfolios in close collaboration with Henderson's two-person research department as well as its three-person acquisitions and dispositions group. In addition to Henderson's corporate-accounting department, the firm has a fund-accounting department that only deals with the financials of properties and portfolios. Over the last two years, the IT department has grown from 2 to 7. This was done in order to facilitate some anticipated changes and the needs of a growing organization.

5.2 Information Management/ Client Reporting

Prior to Henderson's current technology initiatives (including the development of a client reporting application), asset and portfolio managers received and maintained property data from outsourced property managers into its MRI system. The quarterly financials were manually copied from MRI and inserted into an Excel worksheet that allowed the fund accountants to check and verify the data. After approval by the director of fund accounting, the information was reviewed and formatted by the client relations department, only then to be modified and completed by its portfolio managers. After their approval, and a final graphic revision by the client relations department, the production team produced the quarterly reports. "This process was like a fire drill, as it had to be executed for each of our five funds, every quarter, again and again," the director of information technology commented, expressing the growing frustration of Henderson's professionals with this cumbersome procedure. Meanwhile, rather separately,

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Henderson's research, and acquisitions and disposition departments provided the added services needed to maintain an optimal client relationship and a most productive and profitable investment portfolio. Property or portfolio information that was needed by either party was obtained through the informal and internal communication lines, using either email or hardcopy. Through Henderson's client relations department, information was distributed, explained, and reviewed with the investment clients. Delivery was usually in hardcopy format by ground mail, but increasingly often in PDF format by email.

5.3 Real Estate Technology

Upon the purchase of PRA by Henderson in 1999, the company's director of information technology immediately started to analyze the many distributed functionalities and applications throughout Henderson's departments and locations. This analysis resulted in a company-wide (North American) effort to create a centralized database that would hold all relevant property and portfolio information and could be accessed by all departments for analysis, review, reporting, benchmarking, and research purposes. In the summer of 2000, the plans were finalized and fully embraced by the firm's management team.

Henderson's new information system is being built around its core MRI application. A data warehouse organizes all data that now can be accessed through a proprietary front-end interface. This front-end interface is now simultaneously accessed by the firm's fund accountants, portfolio and asset managers, and client relations managers. With regard to direct online client access to their reports, "client's still are not interested in online access," says the director of portfolio management, a pattern which is also recognized by

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the director of technology, who adds: "Later next year, however, we will provide them access to their PDF archives via a secure Web interface." Within four months of making that statement, the technology team had the client reporting data warehouse completed and started with the training of internal and external professionals. Henderson used to work with only one or two different property managers, now there are eight. As a service aspect, each of them has adopted the MRI application in order to engage in a streamlined data exchange between the property level and the portfolio level information at the Henderson offices.

5.4 Issues of Implementation

The various departments and professionals of Henderson receive the new technologies with mixed emotions. The greatest impact on the acquisitions and disposition process is the fact that the brokerage community has embraced technology for more innovative communication. Ninety-five percent of the leads for acquisitions "are provided by the brokerage community via email and at least 75% through 'snail mail.'" The initial screening process, the underwriting, and the formal due diligence is found to be barely affected by technology other than a speedier information exchange. The director of acquisitions finds the Internet a helpful tool for the dissemination of market information and a positive accelerator of the communication process with the brokerage community. "In the past, we had to rely on the information that was passed on to us via the—admittedly self serving—brokerage community. Now, there is more and better information available via reliable, independent sources." The director of research confirms these findings in regard to accessibility of his research data. Both departments

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expect positive impact from Henderson's new centralized information system for accessing historic, benchmarking, and portfolio data.

With more than 20 years experience, the director of portfolio management watches the developments with some caution: "We spend more time today than we did one year ago, while not making any more money per se" on our core business processes, referring to the implementation of yet another information system. "Ten years ago, we made the conscious decision to work with MRI. Since then, we have continued to streamline our information management processes through its various versions, the migration to MRI with our property managers, the third-party application updates for apartment properties, the integration with Yardi for one of our largest pension plans, and now again with the new data warehouse." Aside from this rationale, Martha sees the company's information technology initiatives as a clear attempt to "keep us competitive" and recognizes the effort to make information flows more efficient while providing more information in a timely manner. In addition, he recognizes a generation issue, where 30-year-old professionals take less time to get proficient with new technologies than their more senior colleagues.

6 UBS Realty Investors

UBS Realty[88] finds its roots in Aetna Insurance's pension money management business. In 1996, a group of executives at Allegis Capital bought Aetna's money management activities, only to sell it again to the Swiss banking giant UBS in 1999, holding more than U.S.$750 billion assets under management. The acquired firm

[88] Sources and acknowledgements: Thomas Farrell (Technology), David Ingram (Asset Management), John Connelly (Acquisitions) and sources such as the World Wide Web and LexisNexis.

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immediately was merged into UBS's asset management group with its headquarters in Hartford, Connecticut. With additional offices in San Francisco and Dallas (and a small satellite office at UBS in New York), UBS Realty Investors' employees numbered approximately 130 professionals (with 20 more in New York), while holding an aggregated portfolio of close to U.S.$10 billion. U.S.$6.5 billion is invested in domestic real estate for domestic clients, and foreign investors account for U.S.$3 billion. Only two funds dominate UBS's investment portfolio, one of which holds more than U.S.$3 billion in 100 residential properties, totaling more than 32,000 units. Sixty percent is invested in core investments. Slightly more than 20% is taken by value-added investments and slightly less than 20% in opportunistic investments.

6.1 Organization

UBS Realty acquires, owns, and sells real estate investments for their 200 investment clients, mostly inherited from Aetna. For this, UBS facilitates acquisition, asset and portfolio management, and disposition activities in-house. In addition, service activities such as research, legal counsel, and accounting surround the core business of investment management. The portfolio managers are the points of contact with the investment clients. Property management is an outsourced activity and under supervision of the 15-person asset management team.

6.2 Information Management

As a central hub in the organization, UBS's asset managers communicate with internal departments such as research, acquisitions, and portfolio management, which in turn communicate with the real estate investment client. In its communication with the property managers, the asset manager receives once per month a "chartered account level

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reporting." Every week, day-to-day property updates are exchanged via email, fax, or telephone. In addition, the asset manager is responsible for directing outside companies, approving annual budgets, making decisions on rent and operations, dealing with capital issues, and looking at income and physical aspects if the acquisitions department is sourcing new opportunities.

Throughout the firm, UBS recognizes three stages of work, "information accumulation, information distribution, and the understanding of it," says one acquisitions professional, indicating the pivot role of information. "Real estate, like all assets, is valued based on a series of expected payoffs. Expectations are a function of information. Most importantly, no piece of information is ever ignored. As a result, the contribution of technology is not to produce efficiency (i.e., lower cost or time savings), but to increase the set of information available to make a decision. Our decision-making ability may not be any better over the past five years, but we sure do look at a lot more stuff," he continues, emphasizing the need and impact of technology.

6.3 Real Estate technology

With a group of 12 professionals, Thomas Farrell runs UBS's IT department, servicing their 130 colleagues in three locations. As UBS Realty changed hands twice in the past six years, the firm had a "clean slate" to begin with in regard to the technology implementation. Part of the sales agreement was that the newly founded investment firm had to get rid of Aetna's technology platform. Consequently, the first undertaking was the selection of a new general ledger system. CTI was chosen as UBS's accounting and commercial property management software application. A second step was to add a data warehouse that gradually would eliminate the various personal and decentralized

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databases. A new interface was developed in-house to facilitate the information flow from the general ledger to the data warehouse.

In addition to this implementation, an intranet was introduced in 1999 to facilitate more extensive reporting functions, as CTI was clearly focused on financial recording. In addition to the intranet's department-oriented reporting functions, the site provides property-focused summary pages that are accessible to all professionals throughout the organization. On the property recording side, UBS decided to leave the choice of application with the 70 property managers with which it maintains relationships. Via predetermined forms and pre-created interfaces, property information can be disseminated quickly with limited manual interference. A new system layered on top of this was a proprietary lease information system to improve the management of the investment assets.

Another large undertaking was the firm's proprietary research information system. This internal system is populated by third-party data providers and relates to investment properties and markets. With a complementing toolset ("research on demand"), UBS's professionals have instant access to high-level research information on population and demographics, growth projections, vacancies, new construction, and so forth. An acquisition tool facilitates the acquisitions and dispositions team with summary and evaluation capabilities on markets and investment properties. In the course of UBS's ongoing development efforts, this third-party data will be further integrated with the internal knowledge base to continue to allow for a seamless information system and knowledge tool.

To date, clients have no direct access to UBS Realty's information systems. "We just haven't seen the demand for online access," UBS Realty's technology director says.

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UBS's client services department relies heavily on the information system and feeds the client customized and coordinated hardcopy reports. As part of UBS's larger organization, UBS Realty taps into the UBS extranet platform to allow only a few select investment clients to query the status of their portfolios. In this case, the information is sent to the UBS mother organization, where it is consolidated with other investment instruments (e.g., one of UBS's largest investment vehicles, Agrivest).

Big projects to come are an integrated workflow system for the quarterly reporting process, the further integration of the lease data collection system, as well as ongoing improvements in communications between the various internal and third-party (e.g., property managers') information systems.

6.4 Implementation

A great rationale surrounds the professionals of UBS in regard to the implementation and impact of information technology. "Technology changes have only second-order impact on the investment process. Market cycles, the economy, and the opportunity cost of capital have far greater impact on the process and overwhelm the impact of change in technology," says the firm's acquisitions manager. In addition, "the individuals in a position to effectuate these changes are at the biggest risk of losing position as a result of these changes. Most senior executives, brokers, and other decision makers have only limited exposure to technology and are only slowly incorporating it into their work process." This is why UBS Realty spends a great deal for training and works hard to include the professionals throughout the organization in the development of new software applications.

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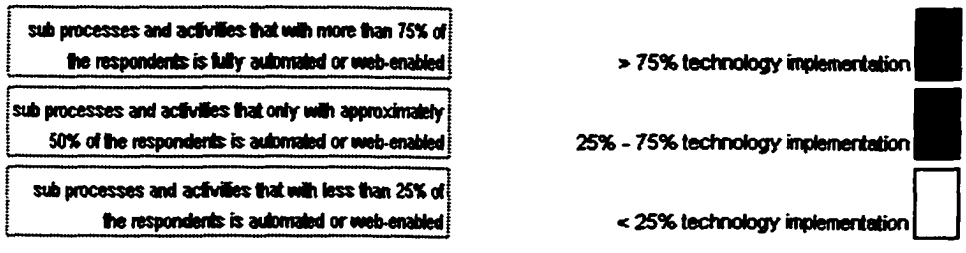
APPENDIX E:

Indication of Technology Impact on Real Estate Investment Management Process

Legend:



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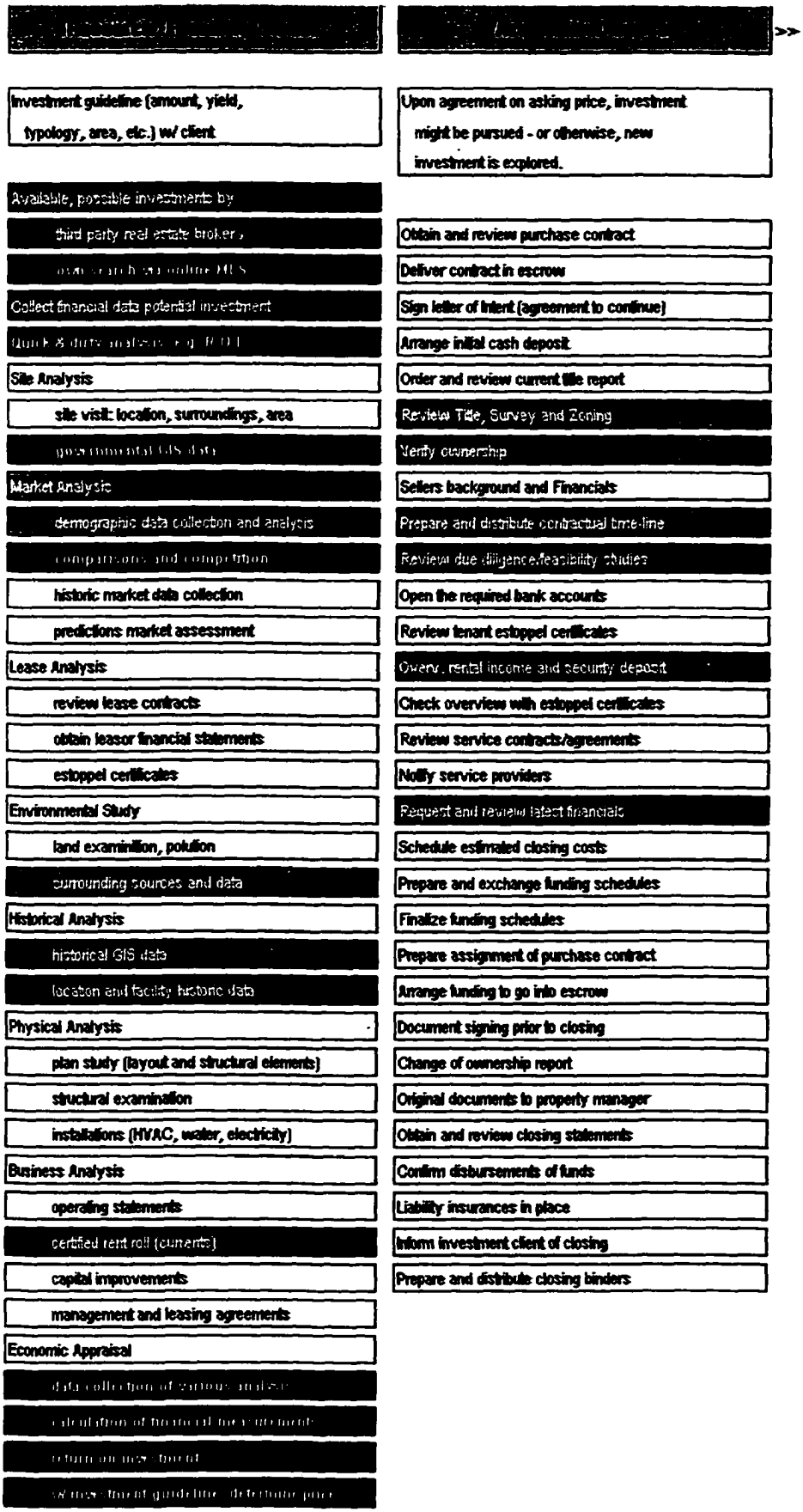

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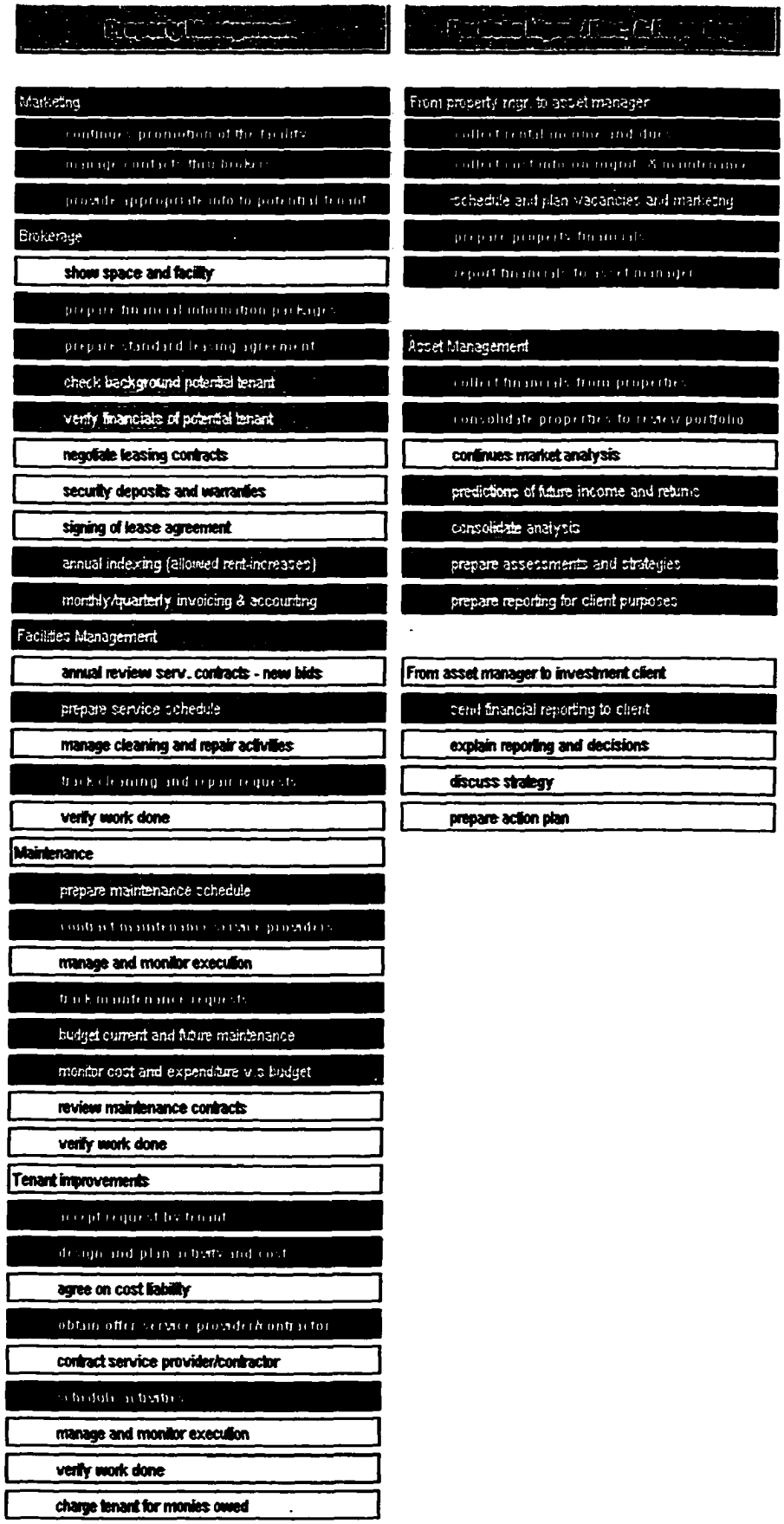

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