A DECISION SUPPORT SYSTEM FOR INCOME-PRODUCING REAL ESTATE DEVELOPMENT FEASIBILITY ANALYSIS AND ALTERNATIVE ASSESSMENT

A Dissertation

by

YOSAPORN LEELARASAMEE

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2005

Major Subject: Urban and Regional Science

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Approved as to style and content by:

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Major Subject: Urban and Regional Science

ABSTRACT

A Decision Support System for Income-Producing Real Estate Development

Feasibility Analysis and Alternative Assessment. (May 2005)

Yosaporn Leelarasamee, B.Arch., Silpakorn University;

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Chair of Advisory Committee: Dr. M. Atef Sharkawy

The purpose of this study is to design, develop, and evaluate a prototype scenario-assisted *decision support system* (DSS) for use in venture and alternative assessment during the predevelopment stage of income-producing real estate development. This research examines theoretical underpinnings and associated advancements related to income-producing real estate development and decision support systems. Particular emphasis was placed on synthesis of relating disciplines' models and advancements that support design and development of the decision support system. The result of the system design and development are embodied in a prototype scenario-assisted decision support system for income-producing real estate development (*DSSVenture*). The design and development of the program are documented in this dissertation.

Following the design and development stage, the validation of *DSSVenture*'s data and logic models was conducted based on two case studies from well-known real estate development publications. The system was then tested on a group of graduate students who enrolled in an advanced real estate development course at Texas A&M University to examine whether its facilitation objective had been achieved. Since this research hypothesized that the decision support system would facilitate developers' decision making during predevelopment stage of income-producing real estate development, three operational variables were tested, namely number of alternatives examined, time to reach decisions, and coefficient of projected net present value variations.

The testing results indicate that *DSSVenture* system significantly enhances comprehensiveness of the decision context by increasing the number of alternatives for developers. Since the use of the system significantly reduces developers' time to reach decisions, the efficiency of decision making is improved. Finally, the results of the study confirm that the use of *DSSVenture* system substantially diminishes variation of profit projection among decision makers. Therefore, the facilitation objective is achieved.

DEDICATION

To my beloved parents

ACKNOWLEDGEMENTS

If time that one took to accomplish a milestone in life can be compared with a journey, this Ph.D. study is among the longest routes I ever took. Along the way, there were a number of people who had influenced this accomplishment. I would like to dedicate this section to those who had touched my life.

First, I would like to thank my committee chair, Professor M. Atef Sharkawy, and committee members, Professor James W. Craig Jr., Dr. Mohammed E. Haque, and Dr. Michael D. Murphy, for their time and efforts in shaping up this dissertation. Their advices are invaluable to the achievement of the study. In addition, I would like to thank Dr. Chang-Shan Huang for his representation for Dr. Murphy in the final exam.

Aside from the academic matters, living in College Station is half the world away from where I belong. I am fortunate that I have many good friends who made my life away from home filled warmth, happiness, and good memories. Among others, I am very fortunate that I have been friends with two wonderful persons, Dr. Atch Sreshtraputra and his wife, Prakaimook. Their friendship makes me understand the true meaning of friends. Finally, I would like to extend my gratitude to Sudina Puangpetch for her tireless effort in editing my English writing in this almost-three-hundred-pages dissertation and for her kind companionship during my final stay at Texas A&M.

A special appreciation must be extended to Professor Sharkawy, who not only led me into the Ph.D. study, but also supported and mentored me through the long journey. His mentorship significantly influences the study as well as the way I live my life. His support granted me opportunities to gain invaluable experience for my future in both academic and professional worlds. For many years, his wife and he had become my family away from home.

This accomplishment would not have been possible without support from my family. First of all, I would like to extend a loving appreciation to my wife, Pattaraporn Leelarasamee, for her sacrifice of a teaching career at Chulalongkorn University and a Ph.D. study to make sure that my health and our family's well-being were well taken care of. Finally, I would like to extend my highest gratitude to my mother for her endless support. Her unconditional love and continuing encouragement enlightened me through this day of accomplishment. To my father: wherever you are in the heaven, I would like you to know that your thoughts always inspire. You are the inspiration of my developments. To my parents: The highest fortune in my life is being your son.

Finally, the long journey was through. I am fortunate that I had an opportunity to choose this route. I am glad that I took it. I am glad that I made it through. I am very glad that the above-mentioned persons had touched my life.

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INTRODUCTION

General Problem

The traditional assumption in the *decision support systems* (DSS) research is that if decision makers are provided with expanded processing capabilities, they will use them to analyze problems in greater depth and make better decisions as a result. This study traces decision making by real estate developers, with particular focus on feasibility assessment and venture considerations during the predevelopment stage of income-producing real estate. In addition, the study proposes to develop and evaluate a prototype decision support system for income-producing real estate; venture and alternative assessment (*DSSVenture*).

Real estate development is a multidisciplinary science, which commonly demands extensive investment. Real estate development is defined as the steps by which a property may be altered over time to increase its value or usefulness (Blew, 1989). A real estate development involves a number of people from various disciplines including, space users, developers, investors, owners/managers, service providers, lenders, service providers. Moreover, public interest must also be taken into consideration (Roulac, 1996b). By nature the practice of real estate development requires expertise in both physical and financial dimensions (Sharkawy, 1994). Real estate developers, among others, center themselves as key players who coordinate development activities from initiation to construction, operation, and eventually disposition.

This dissertation follows the format of *The Journal of Real Estate Research*.

Primary characteristics of real estate investment and market inefficiency are major factors that expose real estate investment to various types of risks. The risks in real estate development can be observed in terms of Business, Management, Financial, Political, Inflation, Liquidity, and Interest Rates (Etter, 1995f). Despite some uncontrollable factors, the primary characteristics of real estate can present entrepreneurs with numerous opportunities to generate extraordinary return (Pyhrr, Cooper, Wofford, Kapplin and Lapides, 1989).

Investment performance of income-producing real estate depends heavily on future operation. In other words, future operating incomes and expenses take a major role in determining the degree of success of the investment. Studies in early stages of income-producing real estate development are critical, as they establish a basis for strategic planning. By considering real estate investment characteristics, decisions made "now" are essential to future investment performance.

Developers must carefully assess development scenarios ranging from physical configurations, market situations, and venture structures to ensure physical sustainability, product marketability, and financial feasibility. In order to reach a strategic decision, they have to assess many development alternatives. Often, they have to conduct analyses with limited resources and within a narrow timeframe. Developers have to put much effort in time-consuming processes, which include finding the most reliable information, and repeatedly performing comprehensive analyses.

Decisions developers make in the predevelopment stage are very important. In many cases, the decisions affect significantly the future investment performance of the developed property. Implementing improper strategy can result in a low return on investment. At the extreme, it may lead to bankruptcy and may indebt developers seriously. Therefore, the uniqueness of decision making in such conditions provides opportunity of research and development.

Importance of the Problem

Factors in real estate development such as local markets, interest rates, and competitions influence investment performance. Changes in the physical dimensions, more or less, will affect development cost, which will eventually influence the financial dimensions, and vice versa. Since investors are unable to make perfect forecasts, they cannot eliminate risks. Understanding the impact of the uncertainties and decision factors can assist developers in making sound decisions as well as minimizing the possibility of loss.

Stephen Pyhrr, et al. (1989) present five levels of risk analysis that should be an integral part of real estate investment decisions: Basic Feasibility Model, Discounted Cash Flow from Most Likely Outcome, IRR Partitioning and Risk Absorption Analysis, Sensitivity Analysis, and Mote Carlo Risk Simulation. While these analyses are proven useful, they are also discussed as time-consuming, frustrating, and unproductive.

Computers have been used in real estate decision making for decades. However, due to formerly high costs of access to computer systems and software, only developers and financial institutions dealing with massive projects found using computers practical (Trippi, 1989). In the mid 1980s, as a result of lower computer cost, software became widely available. Decision support systems for real estate related decisions accordingly gained a more important role.

Real estate related decision support systems assist in handling semi-structured strategic problems, such as acquisition, divestment, expansion, renovation, and conversion of assets. A large number of systems have been developed to support decision-making process from the property management's point of view. Nonetheless, at the time of this study, systems developed to facilitate developer's decisions during the predevelopment stage have not been found.

As previously mentioned, decisions made in the predevelopment stage of real estate development are critical to future investment performance. Considering that risks are irrefutable, resources are limited, and time is essential, careful analyses during the predevelopment stage are indispensable. Under the same circumstance, developers who are equipped with the tools that facilitate the decision-making process will have competitive advantages over those who are not. Decision support systems reduce risks for investors and developers. Finally, researching and developing such systems will contribute knowledge in both real estate development and information technology fields.

RESEARCH PROBLEM

Problem Statement

The purpose of this study is to develop a prototype scenario-assisted decision support system for use in venture and alternative assessment during the predevelopment stage of income-producing real estate development (*DSSVenture*).

Research Objective

Recent developments in computer technology have decreased software and hardware costs. The objective of this study is to demonstrate how utilizing computer and information technology can facilitate human expert judgment in solving cognitive tasks in organized manner.[1] This study will develop a prototype system to facilitate decision quality by providing a user-friendly interface and organized views of alternatives in the predevelopment stage of income-producing real estate development. Fashioned after Peter Keen and Michael Scott Morton's (1978) view, the decision support system couples intellectual resources of individuals with the capabilities of computers to improve decision quality.

Research Hypotheses

This study proposes the below hypotheses in order to examine achievement of the proposed system, *DSSVenture*. In general, the proposed prototype *DSSVenture* will

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[1] In this study, *cognitive task* is defined as the derivation process of expected future investment performance including *net present value* (NPV) and *internal rate of return* (IRR), by comparing cash flows and capital investment of development scenarios.

significantly facilitate developer's decisions in scenario selection during the predevelopment stage of income-producing real estate development.

Hypothesis One

DSSVenture-assisted users will be able to consider a greater number of development alternatives than non-*DSSVenture*-assisted users.

Hypothesis Two

DSSVenture-assisted users will take less time to select a development alternative than non-*DSSVenture*-assisted users.

Hypothesis Three

Variance in profit projection among *DSSVenture*-assisted users will be lower than that among non-*DSSVenture*-assisted users.

Using decision support systems has been hypothesized in increasing decision quality by allowing more alternatives to be examined (Alter, 1980). Therefore, the first hypothesis investigates the benefits of the subject system in improving comprehensiveness of decision making. Through assistance of the subject system, the decision maker will be able to examine more development alternatives in comparison with non-*DSSVenture*-assisted group.

Time saving is one potential benefit of using a decision support system as it increases efficiency of decision making (Alter, 1980). The second hypothesis addresses the consequence of the subject system on time required to reach the decision. In addition, as critical factors change, reassessment is necessary to adjust development strategy to meet emerging new conditions. This hypothesis also explores a key benefit--better use of data resources (Keen and Scott Morton, 1978). The data resources established with assistance of the subject system will provide easy access to necessary information and enable decision makers to examine and select the data in a timely and organized manner.

The third hypothesis examines volatility of performance of the *DSSVenture*-aided group versus the non *DSSVenture*-aided groups, as a potential benefit of a decision support system is reduction in the diversity of performance (Alter, 1980). The range of development performance projection among decision-makers facilitated by the subject system will be narrower than that of non-*DSSVenture*-aided decision-makers.

Anticipated Benefits

The multidisciplinary theories underpinning the real estate development and real estate investment is well established. Likewise, analytical procedures in support of these theories are not only established, but often advanced. Despite this favorable environment, investment analysis of real estate development remains a segregated and time-consuming proposition. Decisions made during the predevelopment stage are usually framed by a small window of opportunity. Moreover, the opportunity is often complicated by developer's limited resources. However, the decisions made under the constraints result long-term consequences. As (Miles and Wurtzebach, 1977, p. 338) note: "The complexity of the real property development process implies the need to develop a computer simulation model designed to aid development period decision makings." This research seeks to make available a prototype decision support system prototype that facilitate*s* the process of examining project's feasibility, as well as identifying potential development-venture scenarios and their associated risks.

As a result, developer's limited resources can be spent wisely. The limited time, for example, can be focused on a development and analysis of potential alternatives instead of number crunching and data organizing. Moreover, developers can focus on identifying and examining sensitivity factors. Accordingly, *DSSVenture* can be used in finding a way to control or avoid their impacts. Meanwhile, other resources, such as capital, can be spent on acquiring meaningful and reliable information. Finally, within the limited window of opportunity, more alternatives can be evaluated. The possibility of proceeding with the optimum development-venture scenario can accordingly be increased. All this anticipations reduce the risk of real estate investment. In addition to the potential benefits for real estate developers, equity investors and the other key participants in the development process will be similarly benefit on finding the development's feasibility and risks involved.

LITERATURE REVIEW

Introduction

The purpose of this section is to review the state of knowledge and technological development relevant to income-producing real estate development decisions. The review examines previous work in the fields of real estate development, income-producing real estate investment, and information technology.

The first part of the review deals with identifying research and publications that cover real estate development practice in general. It covers real estate development principles, participants, processes, and the associated development synergy. Then, the review focuses on income-producing real estate investment related issues, namely risks, feasibility, and systematic investment analyses.

Since this research deals with development of a decision support system, information technology is an essential supporting field. The review accordingly covers research and publications related to the technology with a focus on decision support systems, and summarizes the history and technology of decision support systems. Next, the review narrows to discuss scientific advances in logic models, software, and decision support systems, in relevant to real estate industry. Furthermore, since computers play a significant role in completing a decision support system, computer science, with a focus on hardware and software availability, is also reviewed to establish a guideline for further development.

Exhibit 1 summarizes elements of the literature review and its interdisciplinary nature.

Exhibit 1

Literature Review – Disciplines and Emphasis Areas

Disciplines	Emphasis Areas
Real Estate Development	Multidisciplinary Planning Principles, Participants, Processes, and Synergy
Income-Producing Real Estate Investment	Market Research Systematic Investment Analysis Real Estate Investment Characteristics and Risks Financial Feasibility Analysis
Information Technology	Decision Support Logic Models for Feasibility Analysis Computer Science

Real Estate Development

The review begins with identifying research and publications related to real estate development, many of which were exceptionally comprehensive. Among many good publications, a large number of sources provide comprehensive coverage of real estate development fundamentals, including the process, the analysis, and the strategies. A variety of development sectors are explored including land development, residential development, office development, industrial park and building development, and retail development.

Authors of renowned publications covering real estate development fundamentals include James Graaskamp (1981), Howard Zuckerman and George Belvins (1991), Richard Peiser and Dean Schwanke (1992), Michael Miles, Richard Haney and Gayle Berens (1996), and Miles, Berens and Marc Weiss (2000). In addition, *Journal of Real Estate Research* (since 1986), *Journal of Real Estate Finance and Economics* (since 1988), *Journal of Real Estate Literatures* (since 1993), and *Journal of Property*

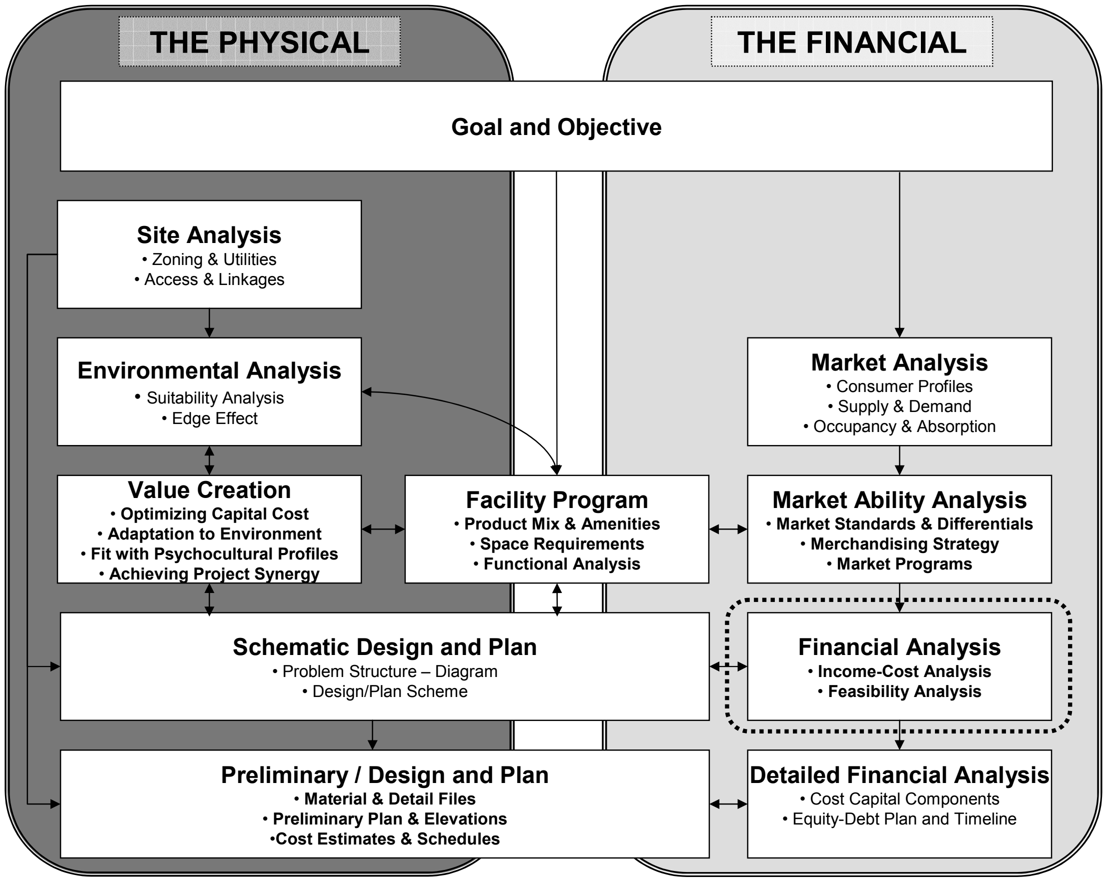
Research (since 1996) are among well-established scholarly journals with general focus on real estate issues.

Since this study deals with financial feasibility analysis during the predevelopment stage of income-producing real estate development, part of the review was conducted to determine how the analysis interrelates with the overall process. Before proceeding further in detail, understanding the nature and the process as fundamental to development is important.

The Graaskamp-Sharkawy's *Multidisciplinary Planning Model* – MDPM indicates the need for multidisciplinary integration of real estate development planning (Graaskamp and Sharkawy, 1971). The model provides a framework and general process in which the interfaces take place. Exhibit 2 reproduces the Multidisciplinary Development Planning Model (Sharkawy, 1971; Graaskamp, 1981). The focus of *DSSVenture* development is bounded by the dashed line in the following figure.

Exhibit 2

Multidisciplinary Development Planning Model (MDPM)



Based on Graaskamp and Sharkawy (1971), and Sharkawy (1971).

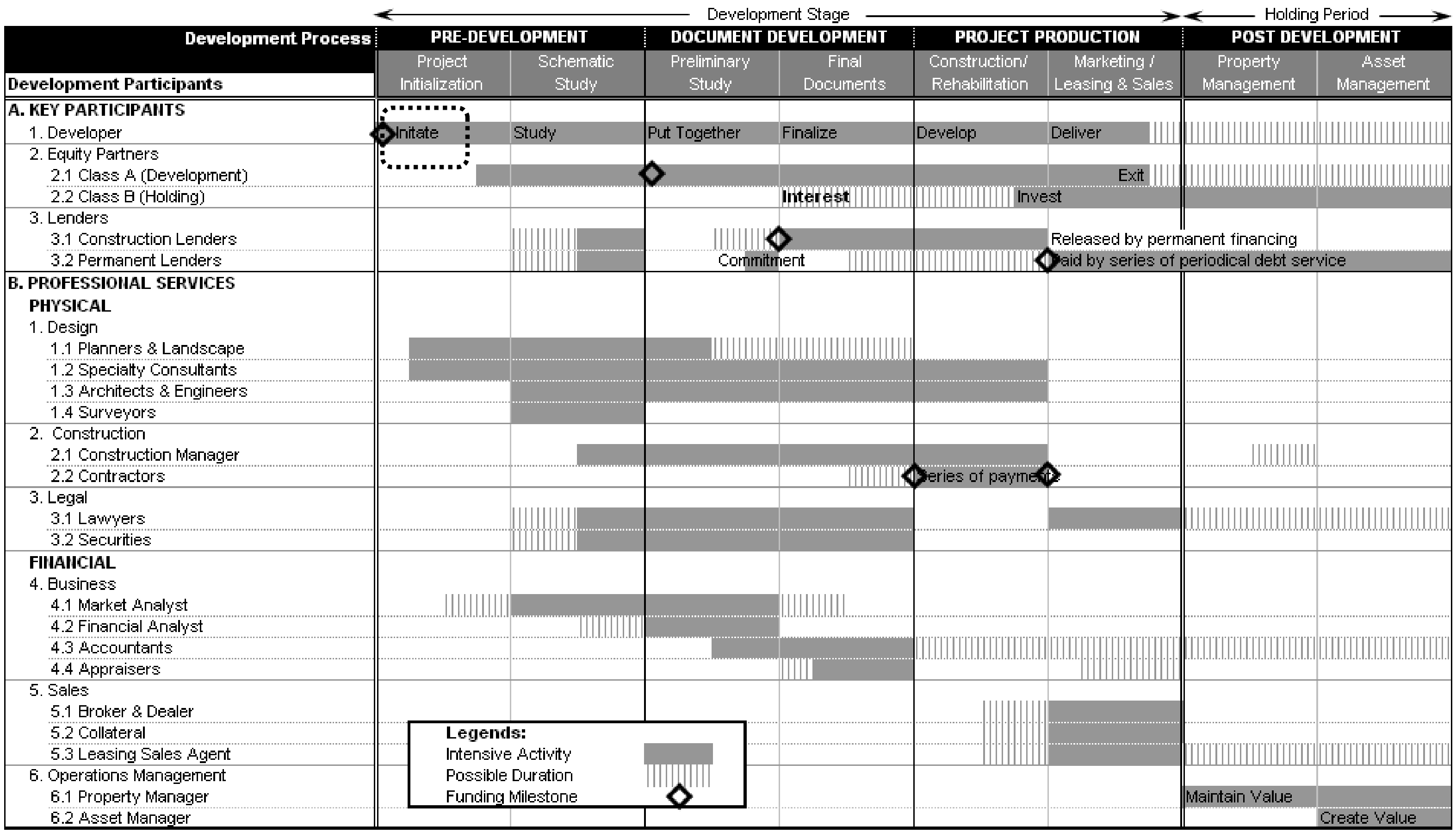
In order to understand the multidisciplinary nature of real estate development, the review looked into real estate development process and its participants. The general concepts of the processes have been well published. Among many sources identified in this review were Graaskamp (1981), David Arnold and W. O'Mara (1984), Zuckerman and Belvins (1991), Peiser and Schwanke (1992), Sharkawy (1994), Sharkawy and Michael Nobe (1995), Miles, et al. (1996), Nobe (1996), and Stephen Roulac (1996a).

Based on the review, one can conclude that development process is commonly divided into chronological phases according to concentration of activities and level of accomplishment. However, the number and title of development phases are different among sources. With a focus on sequences of development activities Arnold and O'Mara (1984) organizes development process into five phases, namely planning and initiation, feasibility, commitment, construction, and management and operation. Peiser and Schwanke (1992) divide the process into four major stages of predevelopment, Construction, Leasing, and Operations to explain the typical length of time related to each stage of the development. Sharkawy (1994) proposes a timeline which presents relationship between major participants and development activities. He divides the development process into eight chronological phases within four major stages of Predevelopment, Document Development, Project Production, and Post Development. His development process is graphically presented in Exhibit 3.

One can observe that, depending on the objective of the study, the authors utilize different techniques and terms to describe the development process. However, to establish a basis for this research, techniques and terms involving development process referred to this study are indebted to Sharkawy (1994) as he clearly presents the relationship between major participants and their corresponding duration of activities. The development stage, the focus of this study, is bounded by the dashed line in Exhibit 3.

Exhibit 3

Real Estate Development Stages and Major Participants

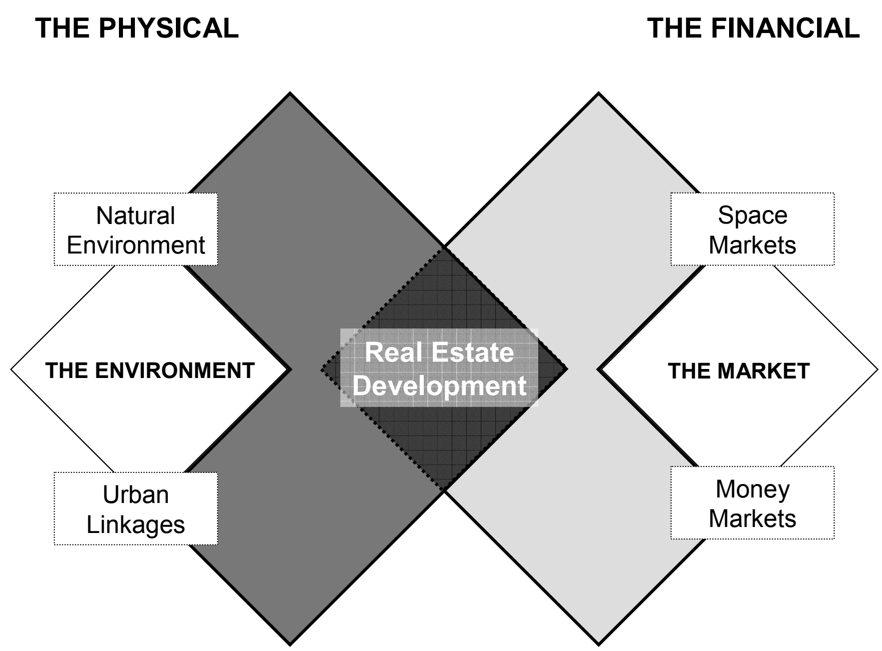


Based on Sharkawy (1994)

Relationship between real estate's physical attributes and its financial value is a topic of interest among real estate researchers. Sharkawy's (1994) *PHY-FI* model suggests trade-offs among the physical attributes and the financial value of real estates (Exhibit 4). His study proposes an integrative framework for design economy encompassing the cost-income-value continuum. Furthermore, it bridges the development-operations-disposition stages of real estate investment cycle.

Exhibit 4

Real Estate Development: Synergy of Physical and Financial Dimensions



Based on Sharkawy (1994)

A large number of studies reinforce the economic value trade-off paradigm. Kenton Ownbey, Davis Kyle and Havey Sundel (1994) present the relationship between economic value and location of income-producing properties. Sharkawy and Joseph Rabianski (1995) describe how design elements enhance real estate value. M. Brown (1999) concludes that spatial form is a significant factor that leads to economic failure of a commercial real estate. Bob Thompson and Michael Hills (1999) discuss changes in office buildings' value due to physical amenity improvement. Michael Bond, Vicky Seiler and Michael Seiler (2002) suggest that interrelationship between real estate's outward orientation and its economic value. Randall Guttery (2002) concludes that design significantly influences residential subdivision's value. Thomas Jackson (2002) suggests environmental factors are critical for economic value industrial real estates. In order to present that the value trade-off paradigm prevail across real estate industry, Exhibit 5 organizes the aforementioned studies by development sectors.

Exhibit 5

Economic Value Trade-Off Paradigm Supporting Studies

Sectors	Articles
Real Estate in General	▪ Sharkawy and Rabianski (1995) ▪ Roulac (1996a)
Residential	▪ Bond, et al. (2002) ▪ Guttery (2002)
Commercial: Retail	▪ Ownbey, Kyle and Sundel (1994) ▪ Brown (1999) ▪ Mejia and Eppli (2000)
Commercial: Office	▪ Thompson and Hills (1999)
Industrial	▪ Jackson (2002)

Income-Producing Real Estate Investment

The review suggests the abundance of research in relevant with income-producing real estate investment. Since this study focuses on facilitation of real estate developer's decisions during the predevelopment stage of income-producing real estate, understanding the current state of knowledge relevant to the decision context is particularly important. Therefore, this portion of the review focused on three major areas:

- Real estate market research
- Systematic investment analysis, and
- Feasibility and risk assessment

Real Estate Market Research

> Developers cannot be successful if they supply a product that is already in the market. Instead, they must seek an unmet need; in supplying that unmet need, they mush achieve a sustainable competitive edge that will allow them to reap the benefits of their monopoly position (Etter and Massey, 1995, p. 44).

Real estate market research analyses the supply and demand for a particular type of space within a given market area. A primary focus of the market research is to identify highest and best use of a property, which is defined as, "The reasonably probable and legal use of vacant land or an improved property that is physically possible, legally permissible, appropriately supported, financially feasible, and that results in the highest value" (Appraisal Institute, 1996, p. 297).

Many publications deliberately explain foundations and process of general real estate market analysis (Clapp, 1987; Clapp and Messner, 1988; Fanning, Grissom and

Pearson, 1994). Adrienne Schmitz and Deborah Bret (2001), and Wayne Etter and John Massey (1995) describe real estate market analysis through case studies. Stephen Messner (1969) pays attention to the analysis of a specific market environment, a university town. A few publications give in-depth discussions of the analysis of particular property segments such as senior housing (Gimmy and Boehm, 1988; Brecht, 2002), and sports facility (Gimmy, 1978).

This review discovers that definitions and quantifications of steps in real estate market analysis are used differently among the aforementioned sources. However, with a similar aim to identify the highest and best use, it could be observed that a typical market research includes an analysis of market trends and segmentation, consumer profiles, market area, and market supply and demand (Clapp and Messner, 1988; Etter and Massey, 1995; Schmitz and Brett, 2001).

Systematic Investment Analysis

For more than three decades, a large number of systematic investment analysis publications and studies have been published. Frederick Hiller (1963) is the earliest author this study reviews. He presents the use of statistical method for evaluation of risky investments. David Hertz (1964) suggests *Monte Carlo Simulation*, a quantitative assessment approach using probabilities to measure the risks involving capital investment. In 1979, Hertz adds an emphasis on the nature and the processing of data used in specific combinations of investment variables. Michael Harris and John Pringle (1985) suggest risk-adjusted discount rates for use when dealing with projects associated with atypical financing and non-average operating risks.

Since this research focuses on analysis of income-producing real estate development/investment feasibility, the review examines systematic investment analysis publications related to the industry. It found that the knowledge body of real estate systematic investment analysis was very well developed and documented. Many references are comprehensive, covering fundamentals, analyses, strategies, and decisions. These include John Wiedemer (1985), J. Canestaro (1989), Austin Jaffe and C. Sirmans (1989), and Deborah Ford (1994).

Research that particularly concerns the application of the analysis to real estate investment and development abounds. Peter Pellat (1971) presents criteria for real estate investment analysis under risky circumstances. Miles and Charles Wurtzebach (1977) propose a conceptual framework for real estate investment risk analysis. A computer simulation model was developed accordingly. William Martin (1978) suggests a *Rate-of-Return* model for evaluating income-producing real estate investment. James Venor (1989) identifies real estate investment risks that emerge in the 80s. With an aim to explain basic analytical tools for real estate investment analysis, Etter (1995e) assembles a number of literatures previously published through Texas A&M's *Real Estate Center*.

Feasibility and Risk Assessment

Risks associated with income-producing real estate cannot be evaluated without understanding how they are related to real estate characteristics (Etter, 1995f). Exhibit 6 on page 20 summarizes those primary real estate characteristics identified in his article.

Exhibit 6

Primary Real Estate Characteristics

Characteristics	Descriptions
Physical Immobility	Real Estate Investment property cannot be removed
Long Economic Life	Real Estate Investment property must produce cash returns over a long period in order to recover its cost and provide reasonable return to the investors.
Large Economic Size	Real Estate Investment (in most cases) requires large amount of capital investment compared to other kinds of investment; i.e., common stock.

Source: Etter (1995f, p. 12)

If a desired outcome were to be guaranteed, risks would not exist. However, bounded by the above characteristics, risks are inevitable in all real estate developments. Degrees of the risk depend on the difference between the desired and the actual outcome. Etter (1995f) describes seven relevant real estate investment risks, summarized in Exhibit 7. At the same time, with some control over a few critical factors such as location, the daunting characteristics can turn into competitive advantages that may generate attractive returns on the investment. More importantly, the investment feasibility of such assumptions has to be ensured.

Exhibit 7

Real Estate Investment Risks

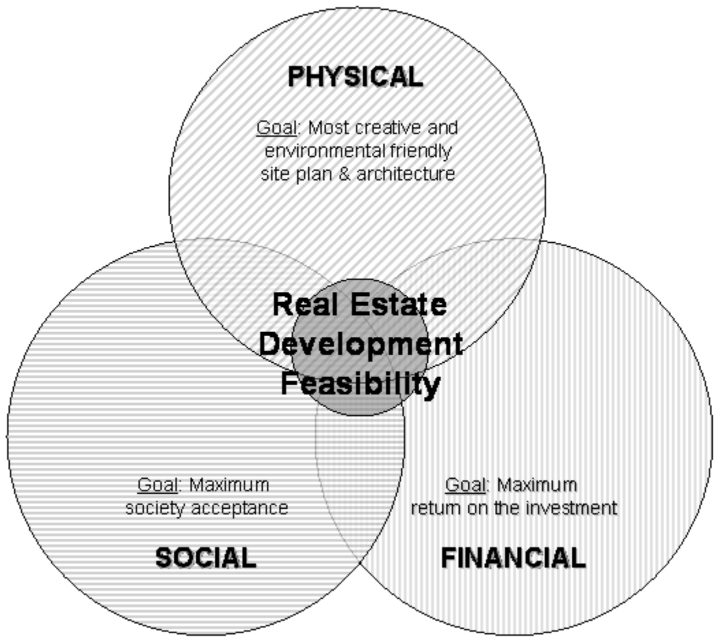
Risks	Descriptions
Business	The property will fail to generate sufficient cash flow. *Physical Immobility* and *Long Economic Life*
Management	The property managers will fail to respond properly to changes in the business environment and, therefore, fail to earn a satisfactory return. *Physical Immobility* and *Long Economic Life*
Financial	The property will have inadequate income to meet debt service requirements. *Physical Immobility*, *Long Economic Life* and *Large Economic Size*
Political	A government action adversely affects the property or the investor. *Physical Immobility* and *Long Economic Life*
Inflation	Cash benefits received in the future will have less purchasing power than an equal benefit received today. *Large Economic Size*
Liquidity	A property cannot be sold quickly without loss or large selling expenses. *Physical Immobility* and *Long Economic Life*
Interest Rate	The property's value will decrease because of increased interest rate. *Long Economic Life* and *Large Economic Size*

Source: Etter (1995f, p. 22)

A feasible real estate development project is not only financially sound, but also environmentally viable and physically creative (Sharkawy, 1994), and socially responsible (Leelarasamee, 2003). Exhibit 8 illustrates real estate development feasibility as a balance of environmental & physical, financial, and social dimensions. Consequently, in order to enhance the possibility of the project's feasibility, factors for each dimension have to be harmonized, synthesized, and balanced. During the predevelopment stage, many decisions have to be made to ensure the feasibility.

Exhibit 8

Real Estate Development Feasibility



Source: Leelarasamee (2003)

Decisions made during the predevelopment stage of real estate development are particularly important. They potentially change the development program, which eventually results in changes of development cost, future operating incomes and expenses, and financing criteria. Once decisions are made, the developer will coordinate production of a preliminary development documents. The next step is to test the project's financial feasibility. "If the property can generate adequate net operating income to support sufficient debt to finance the property, and provide satisfactory cash return to the developer-investor, the project is financially feasible" (Etter, 1995d, p. 3).

Various steps of financial feasibility analysis of income-producing real estate are called and quantified differently across the different publications. However, the most critical variables in determining feasibility for a real estate development are development cost, operating income and expense, financing, and return on investment (Cooper, 1974; Cooper, Pyhrr and William, 1983; Wiedemer, 1985; Canestaro, 1989; Jaffe and Sirmans, 1989; Pyhrr, et al., 1989; Ford, 1994; Etter, 1995c).

Financial analyses conducted during the predevelopment stage primarily aim at evaluating the interests of key participants previously identified in Exhibit 3. Different measures for evaluating investment performance include present value (Pyhrr, et al., 1989; Etter, 1995b), net present value (Pyhrr, et al., 1989; Etter, 1995b; Besley and Brigham, 1999), return on investment (Devine, 1980) and internal rate of return (Martin, 1978; Pyhrr, et al., 1989; Etter, 1995b).

Since key participants in real estate development are unable to make precise forecasts, risks exist in real estate investment. Progressively more detailed risk analyses are required. Five levels of risk analysis have been proposed, namely basic financial feasibility model, discounted cash flow from most likely outcome, internal rate of return partitioning and risk absorption analysis, sensitivity analysis, and monte carlo risk simulation (Harris and Pringle, 1985; Pyhrr, et al., 1989).

Decisions during the predevelopment stage are critical. Primarily, predevelopment is the planning stage that forms the basis for production, construction, marketing, and management in later stages. Due to the characteristics discussed above, decisions made during the predevelopment stage with limited resources and time more or less influence very long results, some of which may be pivotal. Exhibit 9 presents a timeline for developing and operating typical income-producing real estate.

Exhibit 9

Development and Operation of a Typical Income-Producing Real Estate

Pre Dev.	Const.	Leasing	Operations						
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Development									
		Operating							

Source: Peiser and Schwanke (1992)

During predevelopment, Project Initialization phase focuses on making decisions. Peiser and Schwanke (1984) present a number of decisions made during project initialization stage. Sharkawy and Nobe (1995) recognize the value of decisions during the stage and focused on development of clinical models. They develop the *Front-Door/Back-Door* financial decision support system accordingly to aid the process of development cost and market-based rental rate justification of an investment property. Since real estate development cost is among significant factors that influence decisions during the predevelopment stage, Nobe (1996) studies derivation of cost, and developed and proposed a decision support system accordingly.

Information Technology

Because this research deals directly with a decision support system designed for use during the predevelopment stage, this part of the review explores the literatures in the supporting areas of decision support systems related to real estate development. These areas include decision support system, logic models, computer science, and real estate decision supports.

Decision support systems in general explore the nature and advancement of the discipline. Relevant logic models follow to identify existing works and research in the areas related to the real estate industry. Computer science by necessity includes availability of computer hardware and software, because this research intends to use computer advancement to facilitate human decision-making expertise. The final part of the review includes previous and existing works in decision support relevant to the real estate industry in order to identify the availability of systems in the market.

Decision Support Systems

The root of decision support system in business analysis grew from the efforts of managers to apply quantitative models to daily problems and decisions that they faced in an organizational environment. A study by Robert Ferguson and Curtis Jones (1969) indicate that managerial decision abilities are significantly enhanced with assistance of a decision support systems. Since then, a number of studies confirm that decision support systems facilitate decision-making process and enhance decision quality (Alter, 1980; Devine, 1980; Sprague and Carlson, 1982; Thierauf, 1982; Sharda, Barr and McDonnel, 1988; Benbasat and Nault, 1990; Adelman, 1992).

With a large number of scholarly publications, the discipline of decision support systems has been well established. Dating back to the late 1960s, research in this area began with two most influential scholars, such as Michael Scott Morton and John Little. Articles on the system during the early days were published in business journals, such as *Management Science* (since 1956), *Harvard Business Review* (since 1922), and *Sloan Management Review* (since 1970). *Information & Management* and *Decision Support Systems* were later published in 1977, and 1985 respectively to accommodate studies in the field (Sprague and Watson, 1979).

According to D. Power (2003), Scott Morton (1968a) is acknowledged as a pioneer in model-driven decision support systems. A number of his studies associated with model-driven decision support systems have been published since the late 1970s and the early 1980s (Scott Morton, 1968b; Scott Morton and McCosh, 1968; Gorry and Scott Morton, 1971; Lorange and Scott Morton, 1974). Gordon Davis defines *Management Information Systems* (MIS) as, "an integrated, man/machine system for providing information to support the operations, management, and decision-making function in an organization" (Davis, 1974, p. 5).

Although decision support systems have been around for more than thirty years, their exact definition has been widely debated. The arguments commonly relate to the overlap and/or independence of the different types of systems, namely, Management Information System (MIS), Management Intelligence Systems (MINTS), and Expert Systems (ES). Keen and Scott Morton (1978) define a decision support system as computer's role in the decision-making process to assist decision makers in semi-structured tasks. Ralph Sprague and Eric Carlson (1982) describe the systems as interactive computer-based systems to help decision makers use data and models to solve unstructured problems. Robert Thierauf (1982) specifies the system's ten essential characteristics summarized in Exhibit 10. However, Robert Olson and James Courtney (1998) argue that typical decision support systems share distinguishing characteristics, including interactivity of data and models dealing with specific decisions that require human intervention and cannot be solved by the computer alone.

Exhibit 10

Essential Characteristics of DSS

Characteristics	Descriptions
1. Broad-Based Approach	▪ Goals and objectives oriented
2. Human/Machine Interface	▪ Human controlled decision-making process
3. Problem Solving Support	▪ Structured problems ▪ Semistructured problems ▪ Unstructured problems
4. Model Utilization	▪ Mathematical models ▪ Statistical models
5. Query Capabilities	▪ Information on demand
6. Output	▪ Strategic Level ▪ Tactical Level ▪ Operational Level
7. Integrated Subsystems	▪ System function unified
8. Comprehensive Data Base	▪ Data environment compatibility
9. Easy-to-Use Approach	▪ User Friendly
10. Adaptation	▪ Flexibility

Source: Thierauf (1996)

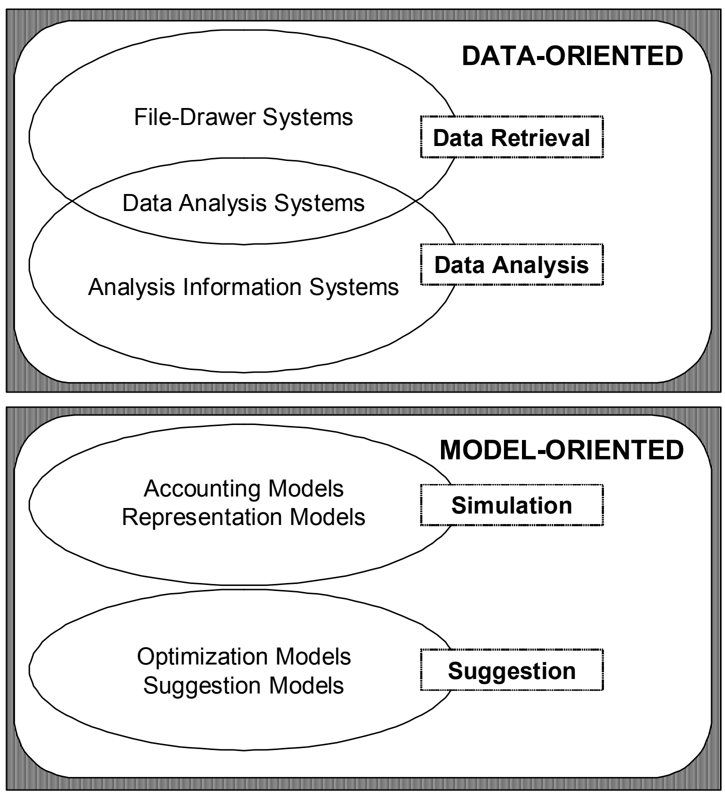
Some characteristics prevail across publications. Although these characteristics have been named differently depending on authors, they carry the same interpretation. Decision support systems' characteristics can be simplified as computer support, integrated logic and data models, interactivity, and user-friendliness (Keen and Scott Morton, 1978; Sprague and Carlson, 1982; Thierauf, 1982; Nagel, 1993; Finlay, 1994; Redman and Johnson, 1994)

Finally, a major value of decision support systems is in removing information overload and redundancy by summarizing, categorizing, and projecting important data. The systems decrease effort required to process large amounts of information and allow decision makers to focus more on critical elements and issues in the decision-making process.

Decision support systems can be categorized into two classifications depending on use and approach, namely data-oriented, and model-oriented systems (Alter, 1980). The two classifications are presented in Exhibit 11.

Exhibit 11

Decision Support System Classifications



Source: Alter (1980)

Evaluation is perhaps the most difficult aspect of a decision support system development (Keen and Scott Morton, 1978). A complete decision support system requires considerable time and effort to develop. To ensure the decision maker of the system's reliability, it is necessary to find out whether the developed system is effective. Leonard Adelman (1992) devotes an entire book describing fundamentals, and processes of decision support system evaluation. A number of studies assess the effectiveness of one or more decision support systems (Devine, 1980; Benbasat and Nault, 1990; Nobe, 1996; Kanungo, Sharma and Jain, 2001; Kaplan, 2001; Moynihan, Purushothaman, McLeod and Nichols, 2002).

Decision support systems have been involved for many decades not only in managerial business, but also in a variety of disciplines. Exhibit 12 identifies selected decision support systems studies and related disciplines.

Exhibit 12

DSS Studies in a Variety of Disciplines

Disciplines	Literatures
Agriculture	▪ Borgelt (1989) ▪ Klose (2001) ▪ Recio, Rubio and Criado (2003)
Business: Accounting and Finance	▪ Heymann and Bloom (1988) ▪ Moynihan, Purushothaman, McLeod, and Nichols (2002)
Business: Marketing	▪ Little (1975a; 1975b) ▪ Little and Cassettari (1984) ▪ Wallis (1989)
Business: Real Estate	▪ Trippi (1989) ▪ Nobe (1996) ▪ Ursery (2002)
Chemistry	▪ Sharma (2002)
Engineering	▪ Sobanjo (1991) ▪ Deb, and AWWA Research Foundation (2002)
Health Care and Medicine	▪ Chari, Baker, and Lattimore (1998) ▪ Volk, and Spann (2000) ▪ Kaplan (2001) ▪ Michalowski, Rubin, Slowinski, and Wilk (2003)
Industrial Management and Manufacturing	▪ Grabot, Blanc, and Binda (1996) ▪ Buehlmann, and Ragsdale (2000) ▪ Tsubone, Matsuura, and Kimura (1995)
Military Science	▪ Schank, Leverich, and Paul (1990) ▪ Robert (2001)
Logistics and Transportation	▪ Pararas (1982) ▪ Shen, and Khoong (1995) ▪ Basnet, Faulds, and Igbaria, (1996) ▪ Keenan (1998) ▪ Powell (2003) ▪ Ruiz, Maroto, and Alcaraz (2004)
Urban Planning	▪ Berke, and Stubbs (1989) ▪ Michael, and Densham (1996)

Logic Models for Financial Feasibility Analysis

Several researchers have developed models for financial feasibility analysis with goals of assisting in the analysis of risks involved at various decision points throughout the development. Miles and Wurtzebach (1977), Martin (1978), Wurtzebach and K. Kim (1979), Carlo Bagnoli and Barton Smith (1998), and Sharkawy and Yosaporn Leelarasamee (2002; 2003) incorporate equations known to financial and appraisal professionals in computer simulation models.

Internal Rate of Return is often used to evaluate the potential profitability of an investment. Martin (1978) proposes a computer probabilistic model incorporating the rate of return with risk analysis in evaluating income-producing real estate. The probabilistic model uses subjective probabilities to represent the future behavior of variables accounted in the model. The study suggests that the risk analysis model can help in assessing of the degree of risk associated with an income-producing real estate investment opportunity.

Wurtzebach and Kim (1979) suggest the interrelatedness of the development and the operating period of income-producing real estate. The idea of considering the development-operation continuum has become a standard of real estate investment analysis.

In classic theory, fuzzy logic is based on the central idea that each element in fuzzy sets can assume a value “from” zero “to” one, not strictly “either” one “or” zero. Bagnoli and Smith (1998) adopt the application of fuzzy logic to an income-producing property valuation model, since lack of precise information is usually common in real estate research. Given that a specified fuzzy input function result in a fuzzy set output, the study suggests that, the fuzzy sets can be combined to produce meaningful conclusions. Inferences can be made accordingly.

In the late 1990s and the early 2000s, Sharkawy and Leelarasamee produced a number of *Microsoft-Excel*®-based computer logic models. In 1997, they introduced *LDEV* decision support series. *LDEVOne* (Sharkawy and Leelarasamee, 2003) is the pioneer model that incorporates equations commonly known to income-producing real estate development professionals. With its focus on real estate developers' interest, the model aims particularly at feasibility analysis and risk assessment under alternative venture structure scenarios by projecting multi-year distributed cash flow given development cost, operating environment, financing criteria, holding period, and potential parties to the venture structure. *Back-Front* is a simplified quantification logic model determining the justified income-producing real estate development cost in a given market-based rental rate, and the required rental rates that make the project feasible given a specific design-based development cost estimate. *LDEVTwo* was introduced in the late 1990s, aiming to facilitate the analysis of land and condominium developments under alternative cost outlays and sales projections.

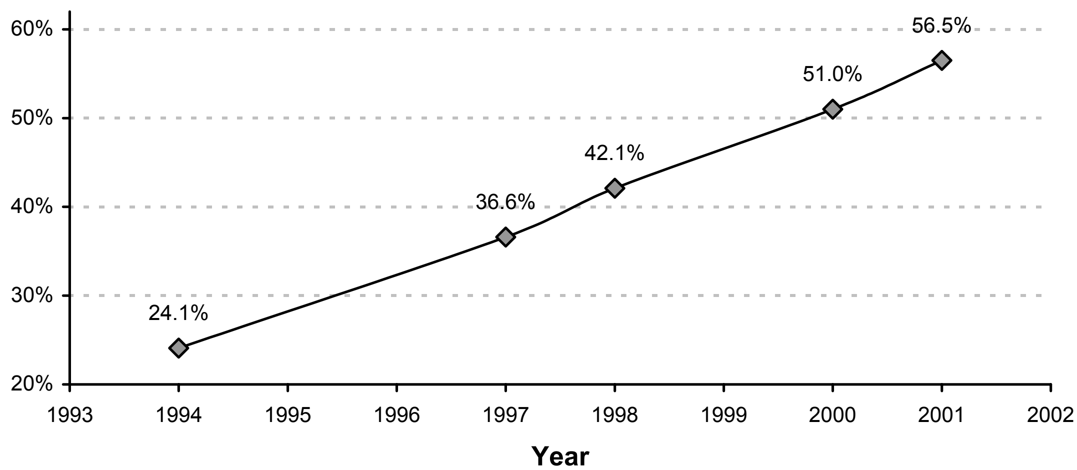
Computer Science

> A mainstream desktop computer that sold for $2,200 in 1993 may have included a 33 megahertz (MHz) central processing unit (CPU), 8 megabytes (MB) of dynamic random access memory (DRAM), a 210MB hard drive, a 15-inch monitor, as well as many other defining technological characteristics. In 1998, however, a desktop computer that sold for $2,200 would not likely be configured with a 450MHz CPU, 128MB of SDRAM, an 8,000MB hard drive, a 17-inch monitor, and included other advanced features unavailable in 1993, such as a DVD player and 3D-graphics capabilities. In this example, the observed prices for the 1993 and 1998 computers are identical. However, technological change over this 5-year period has been remarkable: CPU speed (MHz) jumped 1,263 percent (this actually understates the change in CPU performance3), system memory increased 1,500 percent, hard drive capacity increased 3,700 percent, and monitor size increased 13 percent. (Bureau of Labor Statistics, 2001)

Advances in the computer industry have enhanced and proliferated inexpensive hardware performance. Throughout the 1990s, several studies were conducted to investigate the relationship between price and performance of computer systems (Dave and Fitzpatrick, 1991; Harris and Dave, 1994; Rutherford and Wilhelm, 1999). These studies imply that computer hardware accessibility is a function of availability and affordability. Exhibit 13 depicts the increase in households with a computer.

Exhibit 13

Percent of U.S. Households with a Computer

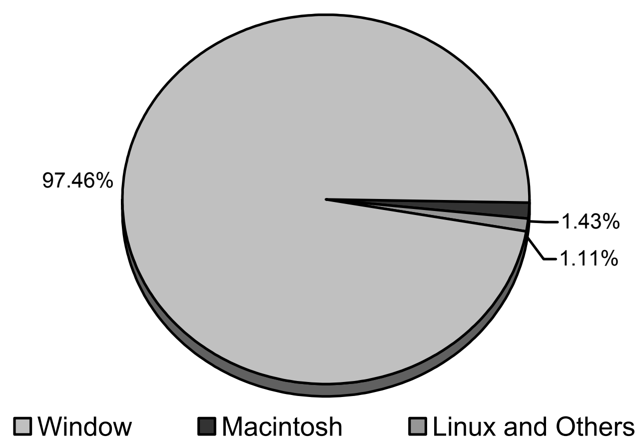


Source: Economics and Statistics Administration (2001)

A computer requires an Operating System (OS) as a basis of task performance. Microsoft's *Windows* and Apple's *Macintosh* have dominated personal computer markets for many years. As reported in September 2002, Microsoft's *Windows* operating system dominated the global operating system with a usage share of 97.46% (Loli-Queru, 2002). Apple's *Macintosh* became the second popular with a minor usage share figure of 1.43%. The remaining portion of the market, 1.11%, was shared among Linux (0.26%) and others, as shown in Exhibit 14. The numbers indicate clearly that the majority of computer-enabled development offices will be using Microsoft Windows. Consequently, in order to make *DSSVenture* accessible to a large number of potential development offices, the program should be compatible with *Windows* platform.

Exhibit 14

Operating Systems Usage Sharing



Source: Loli-Queru (2002)

Like other types of business, real estate companies normally start their software library with word processing and spreadsheet, for examples, *Microsoft Office*®, *WordPerfect Office*®, and *StarOffice*®. A real estate analysis package is the next important software title for many real estate professionals. Because this research develops a decision support system for use during the predevelopment stage, the review explored software that is capable of real estate analysis.

Computers have been involved in real estate investment decisions since the mid-1970s (Power, 2003). During the early days, computerizing an office was very expensive because of high access costs of computer systems and hardware. Real estate decision support systems became more accessible in the mid-1980s as personal computer became more common in offices. Accordingly, many off-the-shelf software packages were made available in response to the increasing market demand.

Real estate software has proven popular since the late 1990s and into the new millennium. Real estate software reviews during that period include Scott Morey (1997; 1999), Howard Franklin (1998), Laura Roe (1998; 2000), Lisa Mayfield (2000), and Cliff Ruemmler and Morey (2001). This review organizes real estate related software into three categories according to their intended functions, namely real estate development, property management, and investment analysis and appraisal.

Few systems can be categorized in the real estate development category. *DSSRED* was developed intending to aid decision makers in estimating construction cost (Nobe, 1996). The system proved effective since it reduced time required to reach a decision, and increased levels of confidence in the decision. *GeoVue®* is a commercial software that facilitate site selection processes by incorporating geographic information technology (GeoVue, 2003). Randy Southerland (2002) suggests that *GeoVue®* helps to reduce cost of site selection analysis and shortens the time-consuming process. *Timberline Office®* is designed to assist decision making during product development stage. *Timberline Office®* is capable of monitoring cash flow, forecasting development costs, and controlling budget (Mayfield, 2000; Best Software, 2004).

The functionality offered by many real estate-specific software applications enables real estate companies to expand the size of their portfolio with limited back office resources while simultaneously providing more meaningful and timely information to management, employees, and tenants. A surprisingly large number of software can be classified in property management category. For example, *Advanced Retail*® (Roe, 2000), *InSite Property Management*®, *OneWorld Xe*®, *PMS Plus*® (Yoder, 1987), *ProCalc Plus*® (Roe, 2000), *QuikScope*® (Jewell, 2000), *RentRoll 2000*® (Roe, 2000), and *Skyline*®. These software packages generally serve the purpose of collecting and providing meaningful data for management to reach a decision. However, every one of them are customized differently according to the operating detail and data involved.

A number of systems are capable of real estate investment analysis, and appraisal. *Argus*® is a leader in the industry focusing on lease-by-lease cash flow analysis and investment modeling for virtually any property type (Roe, 2000). For years, the market has been shared with other major players such as, *PlanEASe*® (Hanrahan, 1988), *ProCalc Plus*®, and *PRO-JECT*®. Other system packages capable of managing and analyzing real estate portfolio include *RealPlan*® (Roe, 1998) and *ReQuest*® (Miller, 2001). *PariTOP*® was designed to facilitate complex residential property appraisal process (Kettani and Khelifi, 2001). *RESRA*® is also utilized in the real estate appraisal field (Eliot, 1988).

Summary of Literature Review

Knowledge has been well established across the disciplines of real estate development, income-producing real estate investment, and information technology. Feasibility and risk analyses are complicated, yet critical in real estate development. Computers and decision supports have thrived in the real estate field. Four weaknesses are concluded below:

- **Independence**. Despite the apparent abundance of theories concerning the subject area, there appears to be lack of integration between decision support technology and knowledge during the predevelopment stage of income-producing real estate development.
- **Practicality**. Despite the in-dept knowledge, especially in the areas of systematic investment and risk analysis, there appears to be a lack of models that can be realistically utilized during the predevelopment stage, particularly from real estate developers' point of view.
- **Excessive Information**. In the area of computer science, technology is progressing at exceptional speed. Advances in computer performance make data computation much easier and cheaper. This advantage leads to excessive availability of information.
- **Flexibility.** Some of the models reviewed, especially in the area of real estate development, are static while the process of real estate development is contrarily dynamic and requires data to be input as it is received.

THEORY

This section discusses the central concept of this research based on current state of knowledge, as examined earlier in the literature review. As suggested by the research title, real estate development and decision support systems are the two primary areas in this study. In an effort to produce research that contributes to the fields, four strategies follow that address the perceived weaknesses outlined in the literature review:

- *Synergetic* System
- *Data Exchange*
- *Flexibility* Enhancement
- *Easy* Interface

In order to understand the context in which these strategies are employed, it is necessary to understand the environment encompassing income-producing real estate development. Therefore, development process, the key participants, their associated risks and returns, and potential venture and ownership forms will be also discussed. Next, this section deals with decision support systems as it pertains to how the use in the predevelopment stage of income-producing real estate could help reduce associated risks and create competitive advantages. Finally, this section will conclude with a closer examination of the four strategies mentioned above.

Real Estate Development Process

Income-producing real estate development is a synergy of physical, financial (Sharkawy, 1994) and social (Leelarasamee, 2003) dimensions. Exhibit 4 and Exhibit 8 illustrate how the synergy of the three elements is fundamental to a successful real estate development, which involves optimizing the value trade-offs among relating disciplines.

Each step in the development depends on the quality of the previous ones. The exact sequence of a real estate development process varies according to the scope and nature of the development. The income-producing real estate development process generally includes four sequential stages (Sharkawy, 1994):

- *Predevelopment*
- *Document Development*
- *Project Production*
- *Post Development*

Predevelopment Stage

The conception of an income-producing real estate development occurs in the predevelopment stage. The stage can be divided into two chronological phases beginning with the project initialization, and followed by the schematic study (Sharkawy, 1994). Development of *DSSVenture* aims to facilitate decisions made by income-producing real estate developer during this stage.

The project initialization phase marks the birth of the entire development. Opportunities for development are identified according to the developer's experience, judgment, intuition, and possibly based on limited preliminary research. During this phase, decision-making is arguably a primary activity. The initialization phase is usually conceived by the developer with his in-house team. However, later in the process, it may involve experts in fundamental development areas, such as architects, planners, and specialty consultants, who help the developer assess preliminary feasibility and explore potential opportunities. Nonetheless, it should be noted that the services provided by external consultants are commonly limited to a minimum until preliminary feasibility is ascertained. If the preliminary study indicates infeasibility of the project and the development is discontinued, the developer will be responsible for all costs incurred. On the other hand, in the case that preliminary feasibility analysis indicates promising future of the project, land purchase option may be pursued during this phase.

Once the preliminary feasibility is identified, development activities progress into the second phase, the schematic study. This stage usually takes the form of more detailed market analyses and schematic studies in architecture and planning to reach a conceptual design. During the course of development activities in the schematic study phase, the developer will begin soliciting commitments for financial support from potential equity partners and from lending institutions. Depending on the resources of the developer, services of planners, architects, engineers, construction managers, lawyers, financial analysts, market researchers, and other professionals may become more intensively involved to reach more accurate projections.

By the end of the predevelopment stage, preliminary market analyses, highest and best use programs, conceptual designs, rough construction estimates, and concept-stage financial proformas are completed. In addition, to confidently proceed into the next stage, the developer should be able to identify possible lending institutions and obtain commitments from equity partners. Land purchase contract may also be completed by the end of the predevelopment stage.

Document Development Stage

Document development is the stage of thorough study in every dimension. In addition to preparing necessary documents, key activities in this stage also include attaining investment and financing deal commitments. According to Sharkawy (1994), document development stage can be divided into two sequential phases, which are preliminary study, and final documents.

In the preliminary study phase, the development proceeds from conceptual schematic designs to more detailed preliminary designs. This is the phase of refinement of both the physical and the financial dimensions. With a goal to achieve highest and best use, the physical team produces the site plan, and building details and specifications while the financial team explores product marketability in the market, finalizes financial proformas, and documents financial feasibility. More detailed architectural and planning documents are taken into consideration when preparing the financial proformas. Information exchanges between the two teams throughout this stage comprises essential integration of both physical and financial inputs. By the end of this phase, the development should already have obtained letters of financial commitment from lenders, including construction lender (short-term) and permanent lender (long-term).

Following the preliminary study is the preparation of final documents. In general, the goal of final documents phase is to develop the working drawings and specifications. When this phase is completed, construction cost estimates and construction schedules are refined. With the financial commitment from construction and permanent lenders, final working drawings, specifications, budgets, and relevant contracts are prepared. Bidding and negotiations of the various portions of construction works proceed.

Earlier in the preliminary phase, final approvals from various commissions and regulatory agencies are sought. Hopefully, permits are obtained by the end of the document development stage.

Project Production Stage

After the construction contracts/agreements are signed, the construction loan is closed, and the permits from related commissions and agencies are obtained, the development progresses into project production stage, which is divided into two chronological phases, namely construction/rehabilitation and marketing & leasing (Sharkawy, 1994).

The construction/rehabilitation phase focuses on construction and rehabilitation activities that will conclude with a completed facility as planned in the earlier stages. However, since typical construction requires months or even years to complete, activities in the marketing & leasing phase (such as marketing, and leasing), usually commence at some point during the phase of construction/rehabilitation, depending on the nature of the product and the condition of the market. Upon completion of the physical improvement, as well as the fulfillment of the permanent financing requirements (i.e. when a required level of occupancy is guaranteed), the construction financing is released by the permanent loan. The development is ready to proceed to the post development stage.

Post Development

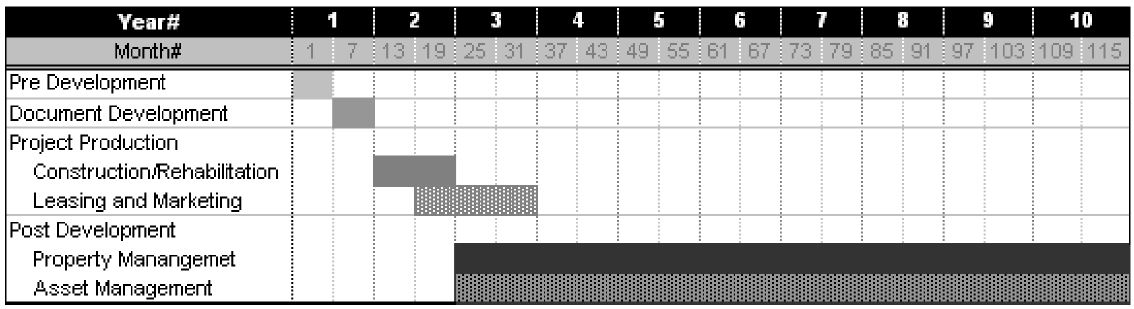
Depending on type of the property, the post development stage may include a continuation of sales, leasing, or a combination of both. In general, this stage involves two simultaneous phases, which are property management, and asset management phases (Sharkawy, 1994).

The property management is arguably the longest phase in the typical income-producing real estate development life span. Exhibit 15 presents duration of stages income-producing real estate development. This phase includes an on-going management and leasing with an aim to maintain and enhance physical and financial assets. Asset management, on behalf of the limited partners, insures that the property's physical and financial values will not corrode over time, due to internal obsolescence, or external obsolescence (Etter and Schmedemann, 1995, p. 38-41). Positioning the property in order to enhance its financial asset value is a primary objective for asset management. Depending on the perspective of the owner regarding the property and market conditions, the development may be entirely (or partially) sold to others, or may enter a new cycle of real estate development.

Exhibit 15 delineates normal duration for each stage of a typical income-producing real estate development in chronological order.

Exhibit 15

Duration of Stages in Income-Producing Real Estate Development



Based on Peiser and Schwanke (1992) and Sharkawy (1994).

Key Participants, and Their Associated Risks and Returns

A common goal of key participants in a development project is not only to recapture capital investment (return of investment), but also to gain appropriate profit (return on investment), commensurate with the level of risk involved (Etter, 1995c). Seven types of risk associated with real estate development and investment (Etter, 1995f) are previously summarized in Exhibit 7 on page 21. In income-producing real estate, the level of risk varies and decreases as the development progresses into each successive stage. As returns on investment normally reflect the level of associated risk of the investment, the return for each key participant usually varies according to the timing of their contribution in the development process and the duration of their participation. Their responsibilities in the development as well as the level of risks and possible liability are also major determinants of their return on investment.

Real Estate Developer (General Partner)

At first glance, real estate development and real estate investment may sound very similar. However, there are some differences in practice. Typical real estate investment involves buying a property with existing leases, though the property might require minor renovations and/or additional leasing. In contrast, real estate development usually centers upon identifying an opportunity, building a facility, and operating the business.

When two or more people are involved in a development, one (or more) is considered developer(s), depending on their magnitude of responsibilities. The developer is the first to become engaged in the development process. Besides being the project initiators, developers work with a variety of people from building professionals, to city administrations, to attorneys, to bankers, to people in construction trades, to investors, etc. in order to coordinate and run development activities.

The developer is mostly liable for a number of risks from the beginning. Overhead or professional service fees incurred during the uncertain project initialization phase remain solely the developer's responsibility until the commitment from equity partners is attained. In many cases, especially in developing countries, in order to secure a permanent loan the developer (as a general partner) has to provide personal guarantees for the loan.

Developers' compensation varies, depending on the venture structure and agreements on risks and returns associated with investment opportunities, and on the extent of needed studies and coordination of development activities. Developers are directly compensated in some combination of development fees, incentive fees (from operation and/or reversion), participation in cash flow from operations, and/or from reversion. In addition, some professional service fees, such as, architecture and engineering, construction management, general contracting, leasing, property management, and asset management, may also be received directly if the service is provided by the developer's in-house staffs, or indirectly if the service is provided by his associated firms (profit centers).

Equity Investors (Limited partners, or stockholders)

The developer may choose to invite equity investors. Depending on amount of capital required, equity investor may range from individuals to institutional entities. The equity investors make up the difference between the total project cost, the loan amount, as well as the developer's own contribution. Their investment is typically in the form of cash. However, landowners who contribute property to the project can also fall in this category. Professionals involved in project studies can also choose to receive their compensation in the form of equity participation. In any case, equity partners risk their contribution to the investment in anticipation of future distributed cash flow. The term "Equity Investors" is generally referred to partners in a limited partnership or stockholders in a limited liability company.

Lenders

Apart from real estate developer and equity investors, income-producing real estate development projects are typically funded by two separate lenders, namely construction lenders and permanent lenders, who finance the project in chronological order. The funds, in exchange for interest payments and fees, are provided in the form of short-term loan from the construction lenders, and long-term loan from the permanent lenders.

Construction Lenders finance the development activities during the construction/ rehabilitation phase. In order to minimize risks, the amount of the construction loan is normally limited to the amount of the approved permanent loan. The loan amount is typically disbursed in a number of payments based on construction completion. In other words, construction loans are secured not only by the commitment form the permanent lender, but also by the amount of construction work completed, and by the guaranteed that the project will be finished as specified in the permanent loan covenant.

Although construction lending seems relatively secure, risks are always unavoidable. The lender is still exposed at risks for the amount of the loan, in the event that the permanent loan take-out was withheld or canceled, or in the event that the permanent loan covenant is not achieved. Other risks involve contractors' failure to deliver on time, or if the developer fails to achieve required percentage of lease-up. In addition, there is also a risk that foreclosure proceeds will not cover the outstanding balance, in the event of default.

To minimize the risk, construction lenders normally prefer a sound development project, built in a sound established market, developed by a well-established developer and supported by "deep-pocket" equity investors. Insurance (completion bond) is a common risk transfer instrument that protects construction lenders against the loss associated with late completion and/or exceeding contracted amount.

Potential institutions that offer construction loans include commercial banks, savings and loan institutions, and private investors (Peiser and Schwanke, 1992). The permanent loan is closed as the construction and/or rehabilitation activity is completed, and as the project meets all requirements listed in the permanent loan covenant. The construction loan is simultaneously paid off.

The permanent lender risks the amount of unpaid mortgage principal balance over the term of the loan in exchange for interest payments and "front" fees. In other words, rather than risking their capital with a project that has not yet been completed, the permanent lenders minimize the risk of project's failure by funding only stabilized properties for longer period of time. However, the amount of mortgage provided is exposed to typical real estate investment risks identified earlier in Exhibit 7. The permanent loan is usually secured by the development, which includes land, the investor's equity, and usually the borrower's personal guarantees.

Potential institutions that offer permanent loans include commercial banks, insurance companies, real estate investment trusts, and pension funds (Peiser and Schwanke, 1992). Return to the permanent lender includes interest payments and "front" lending fees. In some cases, depending on the level of risk that the permanent lender wishes to take on, the interest rate is lowered in exchange for participation income from operations or reversion.

Ownership Forms and Structures

Like other businesses, the simplest form of income-producing real estate ownership is sole proprietorship. However, due to its large economic size characteristic (Etter, 1995d), income-producing real estate development demands considerable amount of capital, which commonly comes from multiple parties in more complicate partnership forms.

Individual project development is typically structured as a separate legal entity to provide the developer, equity partners, and lenders optimal benefits in terms of income, liability, and taxation. Real estate ventures are specifically designed to avoid dual taxation, maximize tax deductions, limit liability, and pass through losses from operations. Traditional forms include limited liability companies, sub-chapter S corporations, general and limited partnerships, personal and corporate trusts, and joint ventures.

Land Cost Deferral and Transfer

It is commonly known that cash transactions are instant and arguably risk-free. Receiving cash in exchange for the property is ideal for most property owners. However, land acquisition is a substantial portion of the development cost. Therefore, large amount of cash payments demanded for the land will translate into considerable amount of capital required in the development, with additional costs associated with interest to lenders or return to equity investors.

Private Money Mortgage (PMM) is a primary instrument, which developers use in their negotiation with property owners. If agreed, a PMM would allow the developer to divide a portion or all of the land acquisition costs into a series of future payments to be paid from future income from the development. The mortgage enables the development to begin with lower upfront capital. Depending on the agreement, a portion or all of the land acquisition cost will transform into a mortgage note that requires debt service from the development in a series of payments over a period of time. The project bears liability until the balance is completely released. Like a permanent lender, the property owner risks the amount of unpaid principal balance over a period of time in exchange for interest payments. Moreover, since land is typically sold for much more than the original acquisition cost, the full amount in case would contribute a considerable capital gain to the owner's tax income for the year. The mortgage divides the proceeds over a few years, reducing taxes while increasing income with additional interest. Depending on the property owner's level of income, a private money mortgage may result in substantial tax saving on the sale of the property.

An equity swap is another cost transfer instrument for the developer, generally offered to the property owner to reduce upfront capital required. Instead of paying for the acquisition in cash (or combination of cash and private money mortgage), the developer may offer equity participation (a percentage of future stake in the project) in exchange for a portion or all of the acquisition value. Ideally, the value of the stake offered should be noticeably higher than the value of the property in cash. If agreed, the property owner subordinates the property to the development and becomes an equity investor (a limited partner). The property owner's actual risks are limited to the original cost of the land. In return, the property owner will receive a percentage of cash flow from operation and/or reversion, depending on the agreement. Unlike a private money mortgage, the swap does not guarantee return. It is an investment, which bears higher return and higher risks.

The Value of Decision Support Systems during the Predevelopment Stage

Real estate development is a volatile industry. The success of a development project depends on synergy between the external environment (how well the product responds to the economy, the market, and the end-users); and the internal factors (how the development achieves the balance among cost, operation (income & value), financing, and venture structure). Understanding the need and complications of its environment can lead to the right synthesis of strategy and plan, which potentially enhance the probability of success.

Real estate investment characteristics (Exhibit 6, page 20) resemble a two-edge sword. With the right strategies, these characteristics can result in immense competitive advantages, for example, a signature quality and/or locational monopoly. However, with an inappropriate decision, these characteristics may leave the project with difficulties that can range from minor to serious. Such difficulties may require considerable capital to remedy or may result in an incurable product and a serious loss.

There are four major reasons that support use of decision support systems in income-producing real estate development, especially during the predevelopment stage:

- Real estate market research is a non-absolute science.
- Variations of factors often cause a chain-reaction through development and Post Development stages.
- Program and strategy deviations are easy to evaluate during predevelopment stage.
- Decisions have long-term impacts, and often incurable.

Real Estate Market Research Is a Non-Absolute Science

A major purpose of real estate market analysis is to enhance a development's possibility of success. The unmet market need, suggested by the analysis, provides critical information that leads to achieving highest and best use in development. Although the analysis enhances probability of selecting the right product mix into the right market, success cannot be guaranteed. As no one can make a perfect forecast, real estate market analysis is not an absolute science.

Market analysis is commonly based on projections of many factors. Eventually, the analysis provides recommendations that would be appropriate only if the market behaves as projected. Moreover, real estate markets are considered inefficient because complete information is not commonly available, usually expensive, and differs across sources (Etter and Massey, 1995). The inefficiency attribute further complicates real estate market analysis. In typical cases, getting an absolute set of data is difficult at best. Occasionally information is provided in optimistic-pessimistic scenarios (or in maximum-minimum range).

Real estate market analysis is not an absolute science that suggests an absolute answer. The analysis is influenced by the inefficiency of real estate markets. Therefore, a development program depends on an inaccurate, incomplete determination of optimistic-pessimistic scaled market data. Accordingly, analyzing and evaluating a multitude of potential development scenarios to reduce development risks and enhance synergy is essential.

Variations of Factors Often Cause a Chain-Reaction through Development and Post Development Stages

Because an absolute answer is not possible in real estate market analysis, likely variations in market data lead to a possible range of potential development scenarios. These variations include the magnitude of projected demand, the segmentation of such demand, the associated rental rates, and the occupancy rates. Variations eventually affect effective incomes, cash flows, and the investment performance. Variations also lead to different development scenarios at different costs, different equity and debt scenarios, and completely different investment performance outcomes. Variations in market data result in different scenarios, each with a different product-mix, architectural design scheme, building configuration, amenity combination, and detail specifications. Development cost, capital budget, and equity contributions have to be adjusted accordingly. These predevelopment-stage-variations lead to post-development-stage variations. For example, differences in building configurations result in different requirements and methods of maintenance, which directly influence operating expenses, net operating incomes, distributed cash flows, and eventually equity investors' returns.

Development design and quality can also influence project's capitalization rate, which varies due to risks and conditions of the market for the specific type of the development. Differences in the capitalization rate directly affects value of the property (income approach), which influences not only available debt, but also debt service required, cash flows distributed, equity amount contributed, and principal amount released at the end of the holding period. Eventually, variations in capitalization rates influence the investment performance.

The above series of impacts are only a few examples of development factors' chain reactions. Every variation leaves an influence, which consequently influences the capital budget, cash flow distribution, financing, equity contribution, and investment performance.

In addition, to ensure the probability of success, it is necessary to understand performance sensitivity to different development scenarios. The associated venture scenarios have to be tested under a multitude of combined projections regarding market demand, projected cost, facility operation, and financing. During the predevelopment stage, a large number of scenarios must be examined to consider the chain reaction of factors due to variations in market data.

As presented earlier in the literature review, studies during the predevelopment stage of income producing real estate usually involve limited resources and funds. Furthermore, developer's and his in-house staffs have to conclude studies within a limited time by and within a very tight budget. In order to increase a probability of success, the developer must examine many possible concepts and venture scenarios to reduce risk and increase returns.

Program and Strategy Deviations Are Easy to Evaluate during Predevelopment Stage

Adjusting development strategies and plans can be accomplished easily, during the predevelopment stage. The earlier necessary adjustments are made in the development process, the lower the associated costs. In the worst-case scenario, deciding *not* to proceed with a project will cost much less than if it is made later in the process.

Decisions Have Long-Term Impacts, and Often Incurable

Activities during the predevelopment stage are concerned with a number of analyses and decisions. A series of decisions during this stage usually start with an indispensable one, such as "Go & No-go" to proceed or to abandon the opportunity. Decisions then progress into more refined considerations regarding strategies, such as what product synergy to develop, and how to make it possible.

By nature of real estate investment, future operating performance determines an income-producing real estate development's success. Examining alternative scenarios during the early predevelopment stage is vital, as they enable sound strategic planning. By considering real estate characteristics, decisions made early are critical to future investment performance. Exhibit 15 on page 44 suggests that decisions made and implemented during the first twelve months of a typical income-producing real estate development project will influence its future for more than nine years.

Summary of Theory

Factors, both quantitative and qualitative, influence decisions in real estate development projects. Since no one can make a perfect forecast, risks cannot be eliminated. Comprehensiveness of the decision contexts can be improved by investigating alternative scenarios and by examining data sensitivity (Alter, 1980). Understanding the impact of development factors, each with its own variations, enables developers to understand possible range of risks and returns. Sensitive factors with high impact on development performance can be identified. Doing so allows the developer to pay more attention to control factors that influence potential causes of the impacts in order to prevent performance from falling out of the acceptable range. In addition, strategies based on a well-rounded comprehension of the economy and its impact on the market, the product, and of the related venture scenarios would most certainly enhance the probability of success. A model or system that provides real estate developers with comprehensive data and sensitivity would minimize development and investment risks.

A decision support system is an integrated logic and data model. It is not created with an aim to replace human expertise. To the contrary, the system is designed to utilize a developers' experience to enhance their decision capability and to facilitate the decision-making processes. Decision support systems should be incorporated into the predevelopment stage of income-producing real estate development to enable developers to identify sensitive factors, to evaluate possible risks, and to devise preventive strategies accordingly. By doing so, investment risks could be significantly reduced.

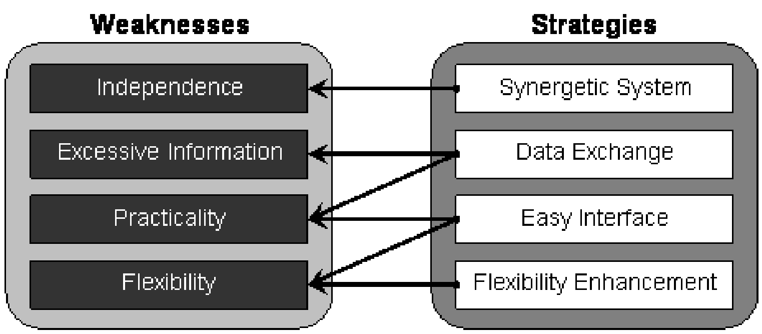
Since windows of opportunity are often narrow and few, many decisions have to be made as soon as possible. The proposed decision support system is expected to assist decision makers in examining abundant data in a timely and organized manner (Finlay, 1994, p. 186). Finally, as time is of the essence, such a tool can increase the quantity and quality of predevelopment analysis.

Strategy Development

As addressed at the beginning of this section, four strategies have been devised in response to the perceived weaknesses outlined at the end of the literature review. These strategies employed are further discussed in the results section, specifically in the part describing the design of the decision support system. Exhibit 16 graphically presents these strategies and their corresponding weaknesses overcome. The underlying premise for each strategy is outlined below.

Exhibit 16

Strategies and Corresponding Weaknesses

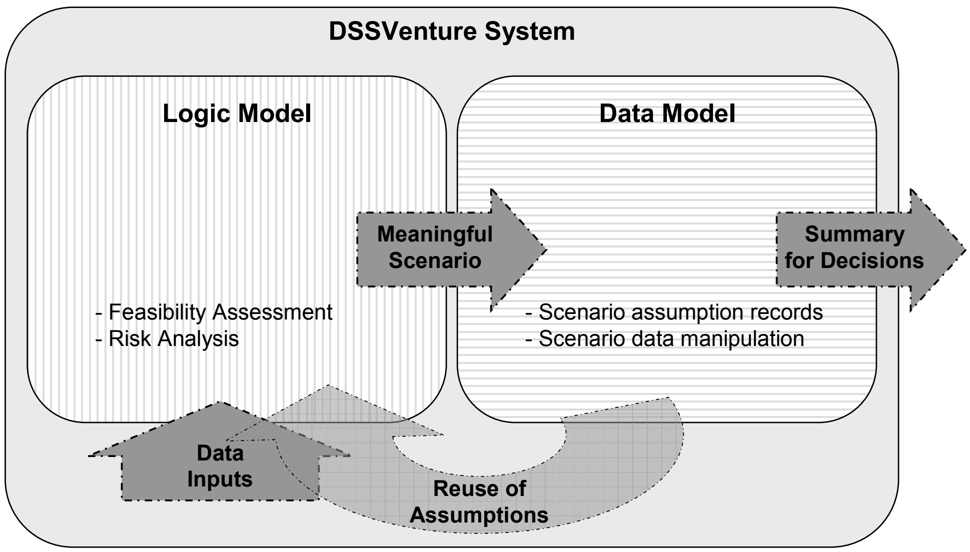


The Synergetic System Strategy

Because the literature review concluded that integration between decision support technology and knowledge during the predevelopment stage of income-producing real estate development was lacking, the synergetic system strategy is specifically developed to address the independence weakness. The lack of integration is apparent especially from developer's point of view. According to the system's definition, a system must integrate logic and data models (Finlay, 1994). Therefore, integrating logic and data models that facilitate decision-making process during predevelopment will achieve synthesis. Exhibit 17 conceptually diagrams *DSSVenture* system synergy.

Exhibit 17

Conceptual DSSVenture System Synergy



The Data Exchange Strategy

The data exchange strategy is specifically developed to address the practicality and excessive information weaknesses identified in the literature review. The strategy is achieved through facilitating data generating and data utilizing.

To address the practicality weakness, the first tactic of this strategy aims to facilitate data generating process. As decisions made during predevelopment deal so much with feasibility and venture structure, the system's logic model includes derivations of common project financial indicators such as, before-tax cash flow, net present value, and internal rate of return. The analysis includes feasibility projection for the development and each party participating in the venture. Facilitation can be achieved through using a pre-designed proforma that generates scenario results with as much automation as possible.

Data models for the proposed system include organizing scenarios' assumption and corresponding results. The second tactic deals with weakness caused by technology blooming. Data collecting begins when a meaningful development-venture scenario is created. The goal is to facilitate the process of storing and utilizing meaningful scenarios in which a pre-constructed rational database plays a significant role. Clearly, using automated commands minimizes the tedious tasks of manually inputting, gathering, manipulating, and searching the data.

The Flexibility Enhancement Strategy

The strategy specifically addresses the weaknesses relating to the lack of flexibility identified in the literature review. Three tactics are employed, namely, ease of data interactivity, ease of scenario manipulation, and ease of proforma customization.

Ease of data interactivity capitalizes on allowing users to enter data based on any level of detail. For example, total construction costs can be specified by using either net construction cost, or construction cost ratio. Operating expenses can be specified by using any combinations of net operating expenses, or operating expenses ratios.

Ease of scenario manipulation, alleviates the tedious process of generating meaningful sensitivity analysis. The tactic capitalizes on allowing users to compose a new development-venture scenario by using any combination of scenarios conceived by means of the ease of data interactivity tactic. When the same set of data inputs is needed, this tactic will reduce the number of tedious tasks of data input by allowing decision-makers to reuse a set of meaningful factors recorded in the database. Exhibit 18 presents examples of flexible scenario combinations.

Exhibit 18

Samples of Flexible Scenario Combinations

	Development Factor Scenarios by Category (Component)			
	Development Cost	Rental Rate	Occupancy	Financing Term
List of Possible Scenarios	Signature architecture	$12/SF above market	fully occupied	7% 20-Yr
	Avg building, Class-A amenities	$8/SF above market	market average	7% 15-Yr
	Avg building, Class-B amenities	market	10% below market	8% 25-Yr
	Avg building	below market Rate		6.5% 15-Yr, 10-Yr Balloon
Scenario 1	Signature architecture	$12/SF above market	fully occupied	**7% 20-Yr**
	Avg building, Class-A amenities	$8/SF above market	**market average**	7% 15-Yr
	Avg building, Class-B amenities	**market**	10% below market	8% 25-Yr
	Avg building	below market Rate	0	6.5% 15-Yr, 10-Yr Balloon
Assumptions:	Avg building specs, market rental rate, and market average occupancy, with 7% 20-Yr financing			
Scenario 2	Signature architecture	$12/SF above market	fully occupied	7% 20-Yr
	Avg building, Class-A amenities	$8/SF above market	**market average**	**7% 15-Yr**
	Avg building, Class-B amenities	**market**	10% below market	8% 25-Yr
	Avg building	below market Rate	0	6.5% 15-Yr, 10-Yr Balloon
Assumptions:	Avg building specs, market rental rate, and market average occupancy, with 7% 15-Yr financing			
Scenario 3	Signature architecture	$12/SF above market	fully occupied	7% 20-Yr
	Avg building, Class-A amenities	$8/SF above market	**market average**	7% 15-Yr
	Avg building, Class-B amenities	**market**	10% below market	**8% 25-Yr**
	Avg building	below market Rate	0	6.5% 15-Yr, 10-Yr Balloon
Assumptions:	Avg building specs, market rental rate, and market average occupancy, with 8% 25-Yr financing			
Scenario 4	Signature architecture	$12/SF above market	fully occupied	7% 20-Yr
	Avg building, Class-A amenities	$8/SF above market	market average	7% 15-Yr
	Avg building, Class-B amenities	**market**	**10% below market**	**8% 25-Yr**
	Avg building	below market Rate	0	6.5% 15-Yr, 10-Yr Balloon
Assumptions:	Avg building specs, market rental rate, and 10% below market occupancy, with 8% 25-Yr financing			

Finally, the entire system is designed with future expansion in mind. The system development attempts to meet not only current needs relating to income-producing real estate feasibility assessment, but also anticipates future needs. The ease of proforma customization tactic allows user to customize required details for a particular project directly within the *Microsoft Excel* ® -based proforma without complication of programming codes.

The Easy Interface Strategy

> Human–computer interaction may be defined simply as the direct, close-coupled computer usage by users. It covers both the human-computer processes and functions themselves and the hardware and software components which facilitate these interactions (Dix, Finlay, Abowd and Beale, 1998, p. 127).

Usability is an important consideration in designing of a decision support system. Brian Schackel (1991) defined usability as the capability of a system to be easily and effectively used by human. The strategy aims at designing easy-to-use human-computer interfaces. Attempting to maximize facilitation, the strategy suggests utilizing human-computer interface features observed from other models currently on the market. Developing *Microsoft-Windows* ® -styled interface is suggested since that operating system dominates the personal computer market. The interface's design will be presented in the results section of this research.

Overcoming the weakness of practicality is the ultimate target of this strategy because the system aims to provide more sophisticated methods and models. At the same time, it intends to simplify use. When use is simplified and more sophisticated methods and models are provided, a computer becomes a fully functional decision support system (Keen and Scott Morton, 1978).

METHODOLOGY

The purpose of this section is to describe in detail the methods employed in designing, developing, and evaluating the proposed venture and alternative assessment prototype decision support system for income-producing real estate (*DSSVenture*).

As previously mentioned, knowledge in the disciplines related to income-producing real estate development, systematic investment analysis, and information technology is very well established. Many off-the-shelf decision support systems have been made available since personal computer boom, all aiming to facilitate decisions in real estate industry. Similarly, a number of financial decision support templates have been tailor-made to suit certain development deals.

Among many financial decision support templates, Sharkawy and Leelarasamee's *LDEVOne* (2003) offers a comprehensive feasibility assessment proforma for income-producing real estate development. For more than seven years, *LDEVOne* has been extensively used by graduate students in the Land and Real Estate Development Program at Texas A&M University. In addition, it has been incorporated in a number of development-oriented courses since 1997 (Sharkawy, 2004).

The input and summary screen for *LDEVOne* appearing in Exhibit 19 accommodates input for *Cost* data①, *Operations*②, and *Venture Structure*③. The proforma automatically suggests potential *Financing* amounts ④ to facilitate venture structure decisions. In addition, risk assessment shows *internal rate of return* (IRR) for investors and *net present value* (NPV) for developers. Exhibit 20 presents the cash flow analysis screen, showing cash flow available for distributions Ⓐ, and proceeds to investors Ⓑ, property owners Ⓒ, and developer Ⓓ.

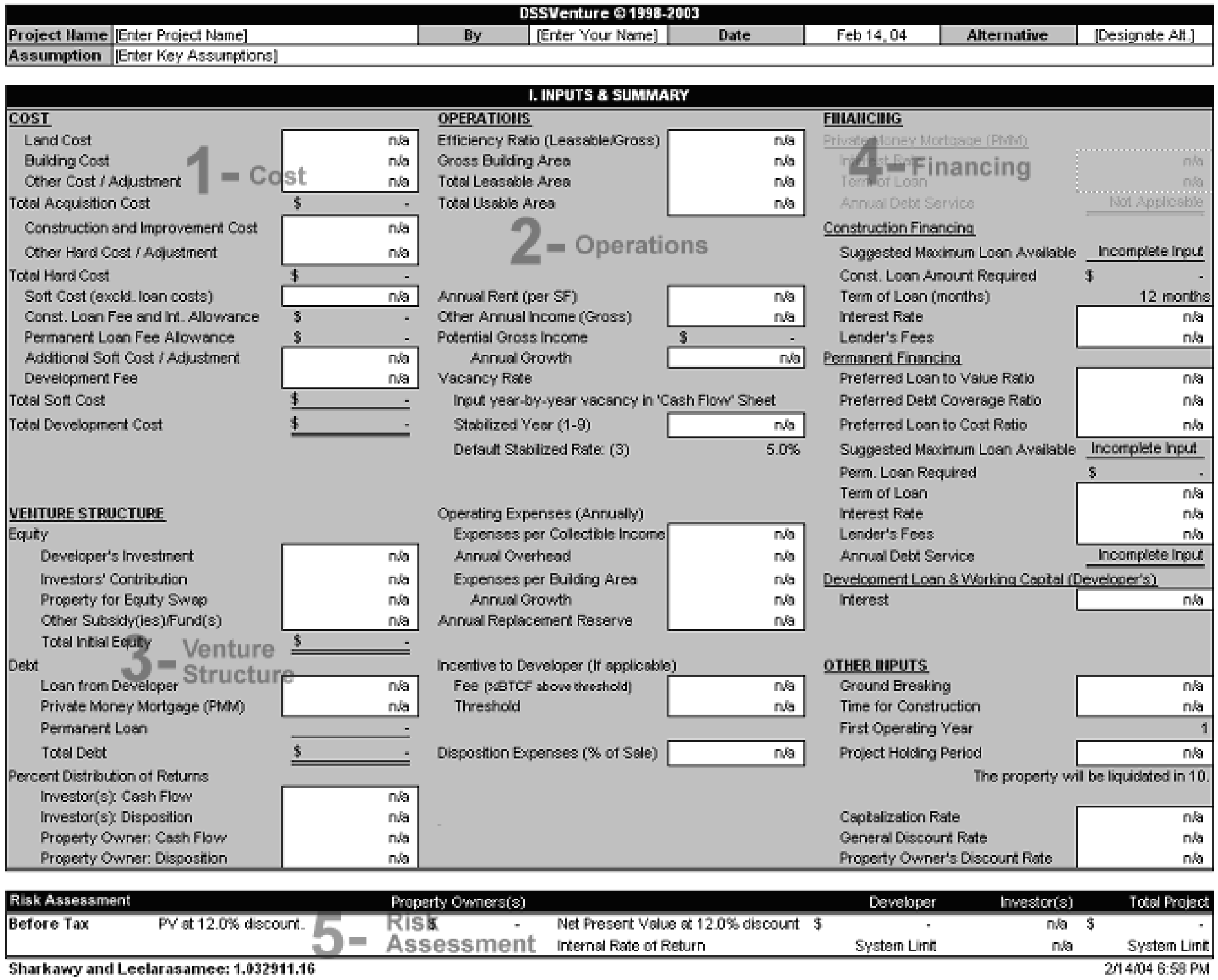
This research proposes to incorporate a user-friendly interface and a rational database for input to the *LDEVOne* proforma. Fashioned after Finlay's system development cycle (1994, p. 186), *DSSVenture*'s system development process is organized into two major stages:

- *Analysis-Development* (Predesign, and Production)
- *Validation-Testing* (Validation, and Testing)

Typical documentation and review phases focus on preparing written documentation regarding procedures and description of variables. However, in this dissertation, the results section will deliberately explain these procedures and variables. In addition, perceived strengths and limitations of the study and the system will be documented for recommendations and future research.

Exhibit 19

LDEVOne: Input & Summary Screen



DSSVenture © 1998-2003

Project Name	[Enter Project Name]	**By**	[Enter Your Name]	**Date**	Feb 14, 04	**Alternative**	[Designate Alt.]
Assumption	[Enter Key Assumptions]						

I. INPUTS & SUMMARY

1 - Cost

COST	
Land Cost	n/a
Building Cost	n/a
Other Cost / Adjustment	n/a
Total Acquisition Cost	$ -
Construction and Improvement Cost	n/a
Other Hard Cost / Adjustment	n/a
Total Hard Cost	$ -
Soft Cost (excld. loan costs)	n/a
Const. Loan Fee and Int. Allowance	$ -
Permanent Loan Fee Allowance	$ -
Additional Soft Cost / Adjustment	n/a
Development Fee	n/a
Total Soft Cost	$ -
Total Development Cost	$ -

3 - Venture Structure

VENTURE STRUCTURE	
Equity	
Developer's Investment	n/a
Investors' Contribution	n/a
Property for Equity Swap	n/a
Other Subsidy(ies)/Fund(s)	n/a
Total Initial Equity	$ -
Debt	
Loan from Developer	n/a
Private Money Mortgage (PMM)	n/a
Permanent Loan	-
Total Debt	$ -
Percent Distribution of Returns	
Investor(s): Cash Flow	n/a
Investor(s): Disposition	n/a
Property Owner: Cash Flow	n/a
Property Owner: Disposition	n/a

2 - Operations

OPERATIONS	
Efficiency Ratio (Leasable/Gross)	n/a
Gross Building Area	n/a
Total Leasable Area	n/a
Total Usable Area	n/a
Annual Rent (per SF)	n/a
Other Annual Income (Gross)	n/a
Potential Gross Income	$ -
Annual Growth	n/a
Vacancy Rate	
Input year-by-year vacancy in 'Cash Flow' Sheet	
Stabilized Year (1-9)	n/a
Default Stabilized Rate: (3)	5.0%
Operating Expenses (Annually)	
Expenses per Collectible Income	n/a
Annual Overhead	n/a
Expenses per Building Area	n/a
Annual Growth	n/a
Annual Replacement Reserve	n/a
Incentive to Developer (If applicable)	
Fee (%BTCF above threshold)	n/a
Threshold	n/a
Disposition Expenses (% of Sale)	n/a

4 - Financing

FINANCING	
Private Money Mortgage (PMM)	
Interest Rate	n/a
Term of Loan	n/a
Annual Debt Service	Not Applicable
Construction Financing	
Suggested Maximum Loan Available	Incomplete Input
Const. Loan Amount Required	$ -
Term of Loan (months)	12 months
Interest Rate	n/a
Lender's Fees	n/a
Permanent Financing	
Preferred Loan to Value Ratio	n/a
Preferred Debt Coverage Ratio	n/a
Preferred Loan to Cost Ratio	n/a
Suggested Maximum Loan Available	Incomplete Input
Perm. Loan Required	$ -
Term of Loan	n/a
Interest Rate	n/a
Lender's Fees	n/a
Annual Debt Service	Incomplete Input
Development Loan & Working Capital (Developer's)	
Interest	n/a

OTHER INPUTS	
Ground Breaking	n/a
Time for Construction	n/a
First Operating Year	1
Project Holding Period	n/a
The property will be liquidated in 10.	
Capitalization Rate	n/a
General Discount Rate	n/a
Property Owner's Discount Rate	n/a

5 - Risk Assessment

Risk Assessment		Property Owners(s)		Developer	Investor(s)	Total Project
Before Tax	PV at 12.0% discount.	$ -	Net Present Value at 12.0% discount	$ -	n/a	$ -
			Internal Rate of Return	System Limit	n/a	System Limit

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Exhibit 20

LDEVOne: Cash Flow Schedule Worksheet

DSSVenture © 1998-2003

Project Name	Not Identified	By	Not Identified	Date	Feb 14, 04	Alternative	[Designate
Assumptions	Not Identified						

II. CASH FLOW SCHEDULE

	1	2	3	4	5	6	7	8	9	10	11
Projected BTCF From Operation										Disposition	
Rental Income	-	-	-	-	-	-	-	-	-	-	-
Other Income	-	-	-	-	-	-	-	-	-	-	-
Potential Gross Income	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vacancy Rate [Fill In]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.0%	5.0%
	15.0%	10.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Vacancy	-	-	-	-	-	-	-	-	-	-	-
Effective Gross Income	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operating Expense											
Expenses per Collectible Income	-	-	-	-	-	-	-	-	-	-	-
Annual Overhead	-	-	-	-	-	-	-	-	-	-	-
Expenses per Building Area	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Operating Income	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Service	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
PMM Debt Service	-	-	-	-	-	-	-	-	-	-	
Developer and Working Loan Interest	-	-	-	-	-	-	-	-	-	-	
Annual Replacement Reserve	-	-	-	-	-	-	-	-	-	-	
Before-Tax Cash Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Working Loan Required	-	-	-	-	-	-	-	-	-	-	
Developer and Working Loan Repayment	-	-	-	-	-	-	-	-	-	-	
Developer's Incentive	-	-	-	-	-	-	-	-	-	-	
Total BTCF (Operations) for Distribution	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Projected BTCF From Disposition					Disposition BTCF, if the development is sold at the end of a given year.						
Sales Revenue										$ -	
Disposition Expenses										-	
Net Disposition Income										$ -	
Balance: Permanent Loan										-	
Balance: Private Money Mortgage (PMM)										$ -	
Before-Tax Cash Flow										$ -	
Balance: Other Loans										$ -	
Total BTCF (Reversion) for Distribution										$ -	
Before-Tax Cash Flow Summary	1	2	3	4	5	6	7	8	9	10	11
Total Cash Flow	-	-	-	-	-	-	-	-	-	-	
Total Cash Flow for Distribution	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	

A = Cash Flow for Distribution

Distributed Before-Tax Cash Flow Summary	1	2	3	4	5	6	7	8	9	10	11
Investor(s)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Property Owner(s)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	

Before-Tax Risk Analysis (Total Development)	1	2	3	4	5	6	7	8	9	10	11
Debt Coverage Ratio (DCR)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
					Risk Analysis of the investment, if the development is sold at the end of a given year.						
Internal Rate of Return (IRR)					System Limit	System Limit	System Limit	System Limit	System Limit		
Net Present Value @ 12.0% Discount					$ -	$ -	$ -	$ -	$ -	$ -	

Project Profitability Analysis

Disposition at the end of	10	Internal Rate of Return (IRR)	System Limit
		Net Present Value (NPV)	$ -

Investors/Property Owners: Profitability Analysis (Before Tax)

Investor's(s') Participation	n/a	IRR to Investor(s)	n/a
		NPV to Investor(s)	n/a
Prpty Owner's(s') Participation	n/a	PV to Property Owner(s)	$ -

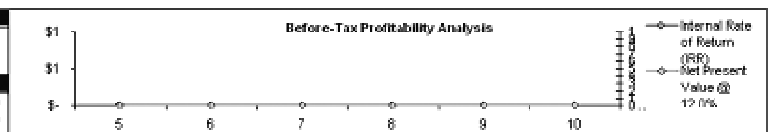

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Exhibit 20 (Continued)

DSSVenture © 1998-2003								
Project Name	Not Identified	**By**	Not Identified	**Date**	Feb 14, 04	**Alternative**	[Designate Alt.]
Assumptions	Not Identified						

III. VENTURE ANALYSIS

Development Entity	Capital Budget	1	2	3	4	5	6	7	8	9	10 Disposition
Total Development Cost	$ -										
Total Initial Equity	-										
Total Debt	$ -										
Distributed Cash Flow		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Investor(s)											
Total Capital Budget	$ -										
Total Cash Flow		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Property Owner(s)											
Property Acquisition Cost	$ -										
Investment	-										
Private Money Mortgage	-										
Total Cash Received at Closing	$ -										
Distributed Cash Flow		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Private Money Mortgage		-	-	-	-	-	-	-	-	-	-
Total Cash Flow		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Developer											
Investment	$ -										
Developer's Loan	-										
Development Fee - NET n/a	-										
Other Fee(s) and Adjustment(s) - NET	n/a										
Total Take Out (Cash Contribution)	$ -										
Distributed Cash Flow		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Loan		-	-	-	-	-	-	-	-	-	-
Interest / Repayment		-	-	-	-	-	-	-	-	-	-
Incentive Fees		-	-	-	-	-	-	-	-	-	-
Other Fee(s) and Adjustment(s) - NET		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Cash Flow	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

B - Proceeds to Investors

C - Proceeds to Property Owner

D - Proceeds to Developer

Venture Structure and Return Summary

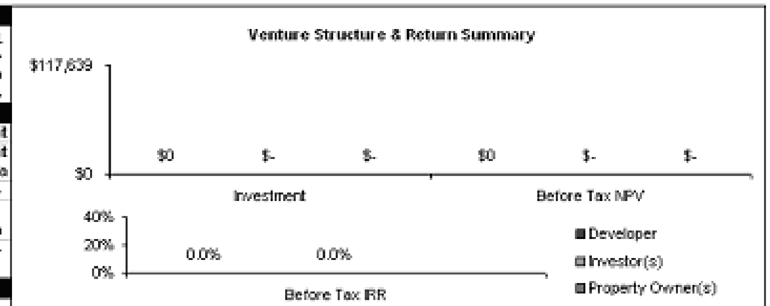
	Investment	% to Total	% Cash Flow	% Reversion
Developer	$ -	System Limit	100.00%	100.00%
Investor(s)	n/a	n/a	n/a	n/a
Property Owner(s)	n/a	n/a	0.00%	0.00%

Before Tax: Profitability Analysis

Internal Rate of Return	Project	System Limit
	Developer	System Limit
	Investor(s)	n/a
Net Present Value @ 12.0% Discount	Project	$ -
	Developer	$ -
	Investor(s)	n/a
Net Present Value @ 12.0% Discount	Property Owner(s)	$ -

Internal Rate of Return for Property Owner is not available. No property for equity swap.

Disposition at the end of 10



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Analysis-Development Stage

First step in analysis-development stage (Predesign phase) focuses on the development of system specifications. According to Finlay (1994), facilitation of decisions can be achieved through careful design and programming of the decision support system. To ensure that the facilitation objective will be achieved, it is important to refine areas of support that the prospect system will offer.

Based on the literature review and theory, real estate developers' decisions during predevelopment deal so much with examining project feasibility and risks under different physical and financial assumptions. For developers, the ultimate goal is not only to evaluate project feasibility in general, but also to refine the physical and financial assumptions with sensitivity analyses. In addition, since income-producing real estate development normally demands extensive capital, alternative venture structure has to be explored to achieve the optimal deal stakeholders involved.

Accordingly, *DSSVenture* program is aimed at facilitating decision making in feasibility analyses and development-venture alternative assessments. The primary areas of development in this research can be described as follows:

- *Risk Assessment*: This analysis is commonly represented by two financial assessment ratios, *Net Present Value* (NPV) for the developer, and *Internal Rate of Return* (IRR) for the investors. The ratios are derived by comparing equity investment paid during the beginning time interval of the development with a series of cash flow distributions from operation and disposition under a cost-income-operation- financing-and-venture scenario.

- *Development & Venture Alternative Assessment*: The assessment is conducted to explore possible variations with development scenarios and venture structure alternatives. The possible variations include physical configuration, operational strategy, financing structure, and venture structure. Alternative assessments are commonly conducted to explore sensitivity of variables, e.g. cost, operating expense ratio, etc.

Production, the following phase, deals with how the system specifications can be achieved. A model of the entire system will be proposed and described. Then, user interfaces will be developed and integrated with the logic and data models.

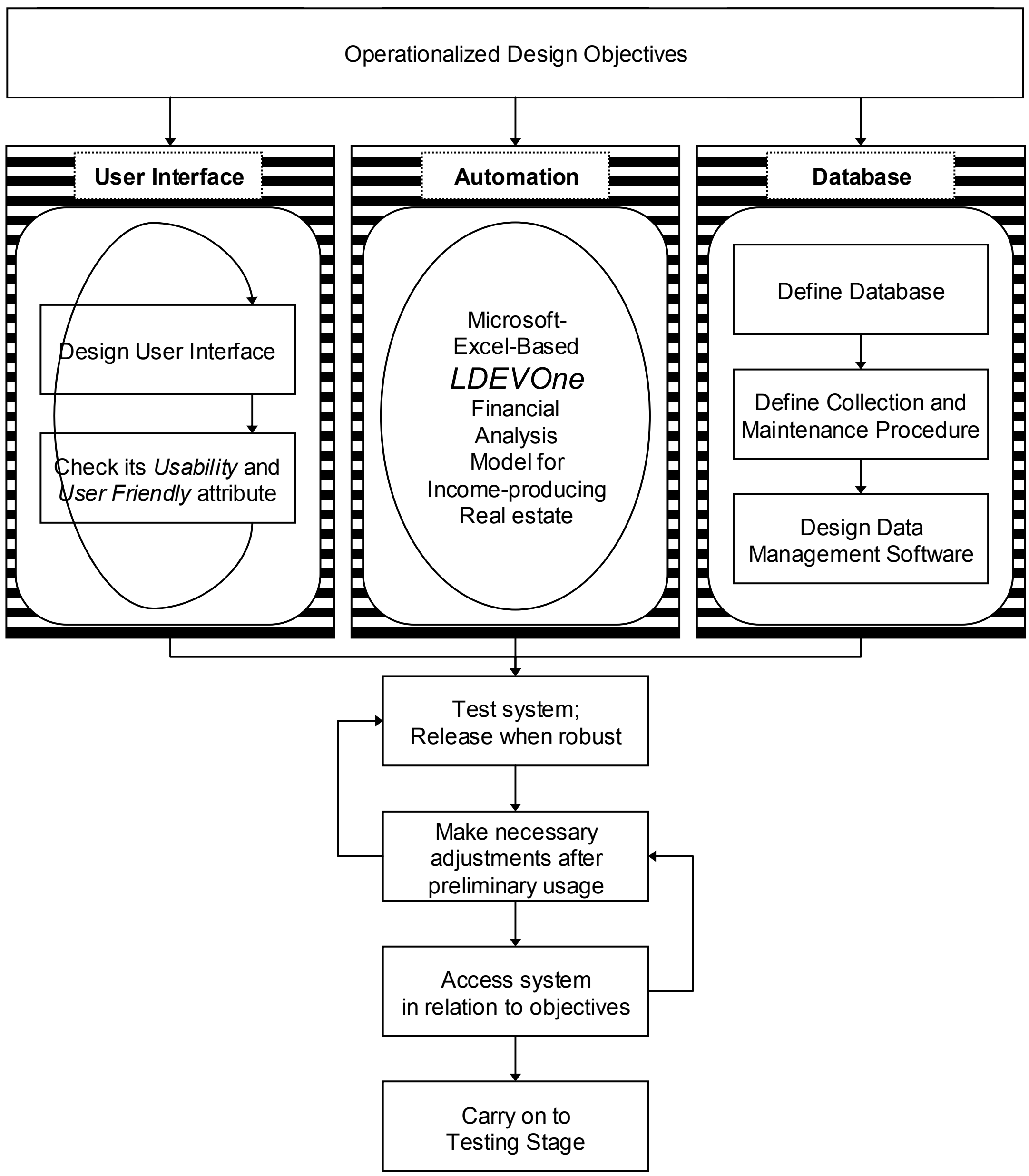
As stated earlier, *LDEVOne* proforma was developed and utilized over time within one of the United State's premier educational institutions. The model has proven to be reliable during seven years of application by students and faculty. Creating another model that serves the same purpose would most certainly be a repetitious effort. This study will instead examine the model reliability and will take advantage of its existence by incorporating *DSSVenture* with the power of *LDEVOne* proforma.

DSSVenture will be coded and compiled as a menu-driven *Microsoft Windows*®-based application because the menu-driven interface concept has been widely accepted (Dix, et al., 1998, p. 127), and the majority of personal computers are under *Microsoft Windows* ® operating system environment (Loli-Queru, 2002). *Microsoft Visual Basic*® in conjunction with *ActiveX*® technology is selected as the programming tools that will create and link system components such as user interfaces, logic model, and scenario database. *LDEVOne* will serve as the system's computation engine, while a *Microsoft Access* ® database module will serve as a scenario-recording and manipulating tool.

The user-friendly feature will be achieved through carefully designed user interfaces that effectively consummate the system and the user. The final product of this stage will be a complete system package for implementation and evaluation. Fashioned after Keen and Scott Morton's (1978) system development cycle, the proposed system development cycle is delineated in Exhibit 21 on page 70.

Exhibit 21

System Development Cycle



Based on Keen and Scott Morton (1978)

Validation-Testing Stage

Validation

Validation is an essential practice that proves a model dependable. Although it could be assumed that each part of *LDEVOne* would have been validated throughout years of use and development, the validation has not been documented. In addition, since *DSSVenture*'s computation depends entirely on *LDEVOne*'s integrity, the proforma has to be validated.

According to Finlay (1994), a logic model can be validated by one or both of the following approaches:

1. *Through the Logic.* This approach compares every part of the system's logic model with corresponding theories.
2. *Through the Output*. This approach examines if acceptable outputs are achieved, given a set of input variables.

In exploring the proforma, this study found that *LDEVOne* was designed to be flexible enough to accommodate many diverse income-producing real estate development structures. However, seven consecutive years of use and further development have not only provided the needed flexibility, but have also added considerable complexity in its formulas. As a result, the system logic for *LDEVOne* is very difficult to trace. The model has to be validated by using the *"Through the Output"* approach.

Two particular income-producing real estate development case studies provide sets of input variables and their corresponding outputs. To ensure integrity of the validation, the case studies are selected from two different authors. The selected cases include exhibits from Etter's *Conducting Multi-Year Analysis* (1995b, p. 61-65), and Peiser and Schwanke's *Multifamily Residential Development* (1992, p. 137-40). The reliability of *DSSVenture*'s calculation will be achieved through conformity of variable comparisons.

In addition, *DSSVenture* utilizes a set of user interfaces that interact with the proven calculation engine, *LDEVOne*. Accuracy of data-interchanges between the system's interfaces and between the input and output variables in the model is another critical issue that needs to be validated. By using the same approach, accuracy of data-interchange will be validated in two parts, for input and for output. First, accuracy of the input will be verified by comparing manual input variables in the system interfaces with corresponding input variables supplied into the proforma by system automation. Second, accuracy of the output will be verified by comparing automatically generated outputs from the proforma with corresponding outputs presented in the system's interfaces. The reliability of *DSSVenture* system's interfaces will be achieved through conformity in comparisons.

Testing

Once the system is validated, the next step is to determine whether the system is capable of achieving its purpose. As *DSSVenture*'s success was predefined as facilitating real estate developers' decisions, the general hypothesis is operationalized by the dependent variables of the number of the alternatives investigated (Hypothesis One), the time to reach a decision (Hypothesis Two), and the range of expected profit variations among subjects under the same circumstances (Hypothesis Three).

An evaluation experiment designed to address all sub-hypotheses will be conducted in an attempt to prove the general hypothesis. In addition, because these hypotheses deal directly with how the subject system interfaces with human subjects, evaluation research utilizing a survey instrument (Nagel, 1993) is chosen and incorporated into an untreated control group with pretest and posttest designs (Cook and Campbell, 1979).

Participants in the experiment will consist of 24 graduate students in Texas A&M's Land and Real Estate Development program. Although the selected subjects do not represent the entire population of the real estate profession, the participants are well educated and ready to enter the industry at a professional level in the near future. The participants are also assumed to have moderate external validity (generalizability). To ensure their knowledge and capability regarding real estate development strategic decisions, the subjects will be graduate students who enroll in an advanced real estate development course, *LDEV668: Real Estate Development Practice* (Sharkawy, 2004). Subjects are selected for the following three reasons.

1. The course is offered only in the pre-final semester of the Land and Real Estate Development curriculum. In addition, to enroll in the course, prerequisites such as *LDEV667: Design Development and Economy*, *FINC 635: Financial Management for Non Business Major*, and *FINC639: Real Estate Development Analysis*, or approval of the instructor are required to ensure students' readiness for advanced strategic contents. In other words, students who enroll in this course are expected to have good knowledge in the field of real estate development.

2. A large portion of the course deals directly with strategic venture structure and real estate development scenarios.
3. The course syllabus incorporates the use of *LDEVOne*, which was originally conceived for use in LDEV courses.

In an effort to enhance research integrity, the experiment will be conducted in the final quarter of the course. This conduct will insure that the subjects truly understand decision contexts associated with venture structures for income-producing real estate development. Furthermore, there will be an introduction including a lecture about *LDEVOne*, and a hands-on training session to the subject system. An outline of topics, which will be included in the lecture, is presented in Exhibit 22.

Following the lecture, all subjects will be introduced to the subject system in a hands-on training session. They will have an opportunity to run and explore the system first-hand by using a set of case studies' variables (Appendix A). Although the introduction session is scheduled for one hour, the principle investigator will be available as long as necessary to make sure that all questions about *DSSVenture* system and the *LDEVOne* proforma are fully addressed. As a result, all subjects are expected to have adequate knowledge regarding the decision context and to be comfortable with the subject system by the end of the session.

Exhibit 22

Conceptual Feasibility and Venture Assessment Discussion Outline

Topic	Discussion
Development Process	• Review of Income-Producing Real Estate Development Process
Development Feasibility	• Physical Feasibility • Financial Feasibility (*LDEVOne* and *DSSVenture*)
Financial Feasibility Assessment	• Types - Conceptual (*LDEVOne* and *DSSVenture*) - Preliminary - Detailed
Conceptual Financial Feasibility Assessment	• Components - Cost ▪ Land Cost ▪ Hard Cost ▪ Soft Cost - Operation ▪ Rental Income ▪ Other Income ▪ Vacancy ▪ Operating Expenses * Per Collectible Income (@EGI) * Per Building Area (@SF) * Overheads (Net) - Financing ▪ Construction Financing ▪ Permanent Financing ▪ Private Money Mortgage - Venture ▪ Equity * Equity Investment * Distribution % of Cash Flow % of Reversion * Measures of Returns Internal Rate of Return Net Present Value
Venture Structure	• Possible Venture Structures - Developer - Lenders - Equity Investors - Property Owner as a Lender (Private Money Mortgage) - Property Owner as an Equity Investor (Land for Equity Swap)

The experiment will be conducted in a following session because time is a dependent variable in the research hypothesis. Subjects will be allowed to explore feasibility analysis and make decisions in an open-ended session.

At the beginning of the experiment, each subject will draw a rolled-ticket from a closed container. Each ticket contains a temporary identification code that serves two purposes:

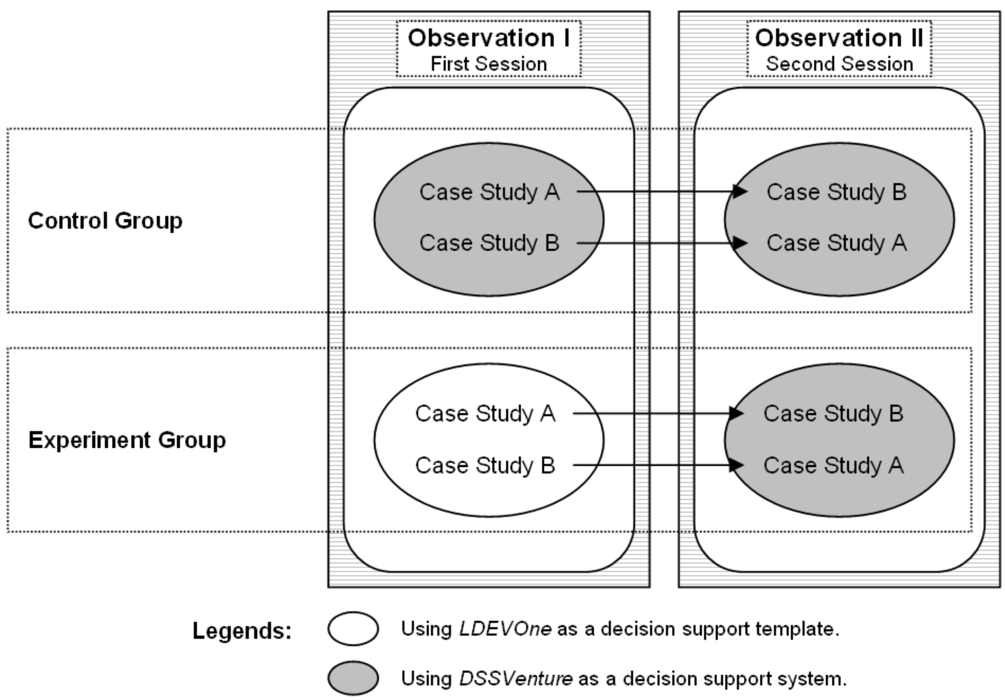
1. *Maintaining Subject's Anonymity*: The ticket assigns each subject with a temporary identification code for his or her responses without revealing a university-related identity. To ensure the subject's anonymity, the code will be a computer-random combination of three numerical digits, or three alphabetical letters.
2. *Matching Survey Reponses*: The identification code also serves to match two survey responses answered by the same person.
3. *Assigning Subject Groups*: The subjects will be randomly assigned to two separate groups, control and experiment groups, according to their identification code types. Numeric identification codes assign the subjects to the control group, while alphabetic identification codes assign the others to the experiment group.

All subjects will be given two identical income-producing real estate development case studies. Each case study requires each individual to make advance and fallback recommendations regarding development strategy and venture structure. By necessity, development feasibility, associated risks, and possible venture structures have to be analyzed. The case studies that will be used in the experiment are *Case Study A – Campus Point Student Apartments* (Appendix B) and *Texas A&M's New Academic Facility* (Appendix C).

Because two case study are involved, and also to minimize the impact caused by the difference in the nature of the two cases, half of the subjects in each group will be randomly assigned to case A-then-B experiment scheme, while the other half of each group will be assigned to case B-then-A experiment scheme. The random assignments will be pre-organized and will be presented later in this section. Subjects will be directionally tested on applying treatment of *DSSVenture* system. Exhibit 23 graphically explains the evaluation experiment data collecting process.

Exhibit 23

Evaluation Experiment Data Collecting Process



Prior to segregation of the groups, the subjects will receive a pre-organized experimental package that is labeled with corresponding identification. Each package is an enclosed envelop, which contains three sets of documents corresponding to individual's test scheme. In general, every package includes:

1. *Information Sheet* (Appendix D)
2. *First Observation Set* (Case Study I with a corresponding decision support assignment, and a survey instrument)
3. *Second Observation Set* (Case Study II with a corresponding decision support assignment, and a survey instrument)

The overall experiment schemes are summarized in Exhibit 24. In addition, a sample of case study first page, which includes an appropriate case study and a corresponding decision support assignment to individual's experiment scheme, for subject "JAF," is presented in Exhibit 25.

Before the experiment begins, the subjects will be asked to participate in a voluntary survey that asks them to specify the exact amount of time spent on the analysis, the number of alternatives examined, and their recommendations. In addition, with an aim to enhance the probability of receiving most accurate responses, the subjects will be reinformed that the survey is anonymous and unidentifiable. The survey will be separated from any grade they may receive from the instructor. Also, they will be informed that the temporary identification codes serve only for matching the two survey responses answered by the same person. Then, during the first observation, the control group will have access to *DSSVenture* system, while the experiment group will have access only to *LDEVOne*.

Exhibit 24

Subject's Identifications and Their Corresponding Test Schemes

Groups	Subject IDs	Case Studies: Tools	
		Pre-Test	Post Test
Control	112	A: DSSVenture	B: DSSVenture
	153	B: DSSVenture	A: DSSVenture
	252	A: DSSVenture	B: DSSVenture
	291	B: DSSVenture	A: DSSVenture
	338	B: DSSVenture	A: DSSVenture
	649	A: DSSVenture	B: DSSVenture
	675	B: DSSVenture	A: DSSVenture
	736	A: DSSVenture	B: DSSVenture
	760	B: DSSVenture	A: DSSVenture
	800	A: DSSVenture	B: DSSVenture
	834	B: DSSVenture	A: DSSVenture
	963	A: DSSVenture	B: DSSVenture
Experiment	ETM	A: LDEVOne	B: DSSVenture
	GXG	B: LDEVOne	A: DSSVenture
	HPP	A: LDEVOne	B: DSSVenture
	HYM	B: LDEVOne	A: DSSVenture
	JAF	A: LDEVOne	B: DSSVenture
	MHJ	B: LDEVOne	A: DSSVenture
	PIO	A: LDEVOne	B: DSSVenture
	PKF	B: LDEVOne	A: DSSVenture
	REJ	A: LDEVOne	B: DSSVenture
	SAH	B: LDEVOne	A: DSSVenture
	YEH	A: LDEVOne	B: DSSVenture
	ZVX	B: LDEVOne	A: DSSVenture

Legends: Case-A-then-B Group
Case-B-then-A Group

Exhibit 25

A Sample of Case Study Front Page

SESSION-I of the experiment

CASE STUDY I
TEXAS A&M'S STUDENT APARTMENT FACILITY

Instruction:

Please explore this case study by using LDEVOne Financial Decision Support Template. The template is located in "C:/Program Files/DSSVenture/Template" folder on your computer. To access the template, please double-click on "DSSVenture" , an MSExcel-Template icon.

LDEVOne

Decision support that is required for the session

Opening Note:

This case study is published strictly for DSS education and evaluation purposes. Information provided in the case does not necessarily spell out opinions of Texas A&M's officials.

Introduction

You are an Assistant Director for a real estate development/investment firm located in Dallas, Texas. Recently, your firm has been invited to submit a development proposal for a new Texas A&M's Student Apartment Facility. The facility is an integral part of a pending Texas A&M's mixed use 12-acre public/private co-development on College avenue, located in the north vicinity of the campus. Your boss, the Chief Financial Officer and Vice President for Real Estate has recently assigned you to assist him in handling the deal.

Texas A&M is seeking proposals by developers for 320 apartments. The university decided to sell a portion of the 12-acre Northgate property (or lease the ground) to the developer, and lease back the apartments at the lowest possible rate. The university will then rent the units to students to provide affordable housing at below market rental rates.

Since the apartments will be fully leased to a premier state university, this opportunity presents a low risk venture. Such property will certainly strengthen the company's real estate portfolio, and enhance its entry in the academic facility sector.

Your boss called and asked if you could assist him with conceptual feasibility analysis and explore possible venture structure for the opportunity. He would be back to the office tomorrow, and will have a meeting with you as soon as you are ready.

Conceptual Feasibility Analysis and Venture Structure

In response to your boss's request, you have decided that, at least, you would like to have a professionally prepared packet with the following items:

- *Conceptual Financial Analysis*, including a list of all assumptions made in the preparation of your analysis.
- *Recommended Venture Structure (with an alternative fall-back scenario)*
- *An evaluation of* relative sensitivity of critical variables used in the analysis

Key Parties and Their Interests:

- *Texas A&M (The Property Owner and the Tenant)*: The University owns a 12-acre property on College Avenue that has been under-utilized for many years. A study by the Graduate Program in Land Development suggested a master-planned development of "*Campus Circle*," a mixed-use urban village. In early 2004, the university decided to sell (or lease) a portion of the 12-acre property to a developer who would be interested in developing a student apartment facility that

Subject ID: JAF — Case Study I: TAMU's Student Apartment Facility - 1

Subject's identification code

Moreover, since the case studies require gathering information from pages of reading, individuals' reading paces more or less influence time to reach decisions, which could be a threat to internal validity due to interactions with selection (Cook and Campbell, 1979). To eliminate the threat, a table of input summary will be attached at the end of each case. Corresponding tables are included at the end of Appendix B and Appendix C respectively for the case study A and B.

Immediately after each subject finishes the case study, a survey will be administered. Questions in the survey will include his or her recent decision-making experience. The survey is conducted in accordance with the Belmont Report (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1978) and the Texas A&M protocol for human subject research. The approved Texas A&M's *Institutional Review Board* (IRB) the information sheet, application, and the survey instrument are presented respectively in Appendix D, E, and F.

The survey instrument is considered a reliable test device because many of the questions in the survey are quantifiable. In addition, for questions based on the test taker's perception (i.e. confidence in the decision made), a scale similar to that used for instructor evaluations will be used in the survey since most students are already familiar with this type of rating scale.

The second experimental observation will begin immediately after each subject submits the answer sheet and the survey paper. The second observation sequences are the same as those of the first observation. However, all subjects will have access to the *DSSVenture* system.

Documentation and Review

The documentation and review stage of this research focuses on preparing written documents regarding the procedures and/or description of variables. Although a commercial grade instruction manual is commonly developed in this stage, it was limited in the proposal to include only the information necessary for the validation-testing stage as well as for the written dissertation. For the purpose of this study, the documentation stage will be discussed in the Results and Conclusion sections, with emphases on screen development, implications for developers as well as potential users, perceived strengths and weaknesses of the study, and recommendations for future research.

RESULTS

This section describes the results of Analysis-Development and Validation-Testing stages of the prototype system development. Fashioned after Finlay (1994), the Analysis-Development stage begins with a predesign phase, which includes defining the system's specifications and refining its logic and data models. The predesign is followed by a production phase, which involves the system's design, development, and programming. The prototype program will be completed at the end of the production. The Validation-Testing stage follows to verify the system's dependability and effectiveness respectively with logic-model and interface validations and with an evaluation experiment.

With an aim to overcome perceived weaknesses identified in the literature review, the theory section develops four strategies as guideline incorporating system analysis and development namely synergetic system, data exchange, easy interface, and flexibility enhancement. The filing cabinet concept is utilized as a supporting technique in developing the system based on these strategies. The cabinet concept will be described in detail in the Analysis-Development stage.

On the technical side, *Microsoft Visual Basic®* is a programming platform for windows-style user interface development. This part of the development aims at achieving flexibility enhancement and easy interface strategies. *DSSVenture* is a synergetic system that integrates user interfaces with an intelligent *Microsoft Excel®*-based decision support proforma. In addition, the program also incorporates using a dynamic *Microsoft Access*®-based data file that aims to offer *ease of data interactivity* and *ease of scenario manipulation* that leads to achievement of data exchange strategy.

Analysis-Development

Predesign

The purpose of the predesign phase is to define *DSSVenture* system's specifications. As discussed in the Methodology, the development of *DSSVenture* aims to facilitate developers' decisions in two primary areas of feasibility analysis and development-venture alternative assessment. Therefore, achieving the facilitation objective depends on the system's abilities and effectiveness in estimating project scenario feasibility as well as organizing development-venture alternative comparisons.

Developers' decisions during predevelopment deal extensively with examining project feasibility and risks under different physical and financial assumptions. As discussed in the literature review and the theory sections, *internal rate of return* (IRR), and *net present value* (NPV) are commonly used as feasibility and risk measurements among developers. It is also apparent that the ability to estimate these two measurements is required in *DSSVenture* system.

In order to minimize risks in predevelopment developers always have to conduct sensitivity analyses not only to identify sensitive factors, but also to figure out how to control the factors or to avoid the consequences. In addition, an income-producing property normally demands extensive capital investment. Alternative venture structures also have to be examined to achieve the optimal deal for stakeholders involved. A similar nature of sensitivity analyses and alternative assessments indicates that developers must deal with not only multiple development, but also venture structure assumptions. Thus, to achieve the facilitation objective, a system feature that allows decision makers to initiate, organize, and compare multiple development-venture scenarios in an organized manner is as well required.

Followed after Keen and Scott Morton (1978), the specifications include the system's function, interface, and coordination requirements. Based on the facts presented above and the technical facts presented in the methodology, Exhibit 26 summarizes *DSSVenture* system's specifications and requirements.

Exhibit 26

DSSVenture System's Specifications

Requirements	Specifications
Function: "How" the system will assist real estate developers in making decisions during the predevelopment stage of income-producing real estate development.	• Financial feasibility analysis • Sensitivity analysis • Development-venture alternative assessment
Interface: "How" the system will communicate with users.	• Windows-style user interfaces
Coordination: "What" resources will be available, and "how" relevant information will be used to facilitate decisions.	• Feasibility and risk assessment indicators: i.e. Net Present Value (NPV) and Internal Rate of Return (IRR) • Interactivity between the logic and data models • Data manipulation according to user's preference

Based on Keen and Scott Morton (1978)

Production

This stage focuses on how the identified specifications discussed in the predesign could be achieved. Consistent with Keen and Scott Morton's (1978) view, *DSSVenture* is not designed to replace human expertise. Rather, the program utilizes machine's computing and data organization efficiencies to facilitate the decision-making process by enhancing decision capability. Facilitation of developers' decisions during predevelopment is a primary objective of *DSSVenture* development.

Per system specifications, *DSSVenture*'s functions include feasibility analysis, sensitivity analysis, and development-venture scenario assessment. *DSSVenture* system requires not only an ability to enable decision-makers to assess a development-venture scenario effectively, but also the ability to enable handling scenario findings in an organized manner. To achieve these goals, this study uses computers' efficiency in executing pre-identified cognitive tasks.[2] NPVs and IRRs for the developer and all parties involved in the development result from the system's computation.

In addition, since sensitivity analysis and alternative assessment require multiple scenario analyses, the computer's ability to efficiently handle and cross-reference a large amount of data has to be incorporated. Developers' expertise plays a significant role in determining reasonable scenario assumptions and corresponding results. Depending on decision makers' judgment, the scenario assumptions and results can be recorded in a pre-written database file for further analyses and comparisons.

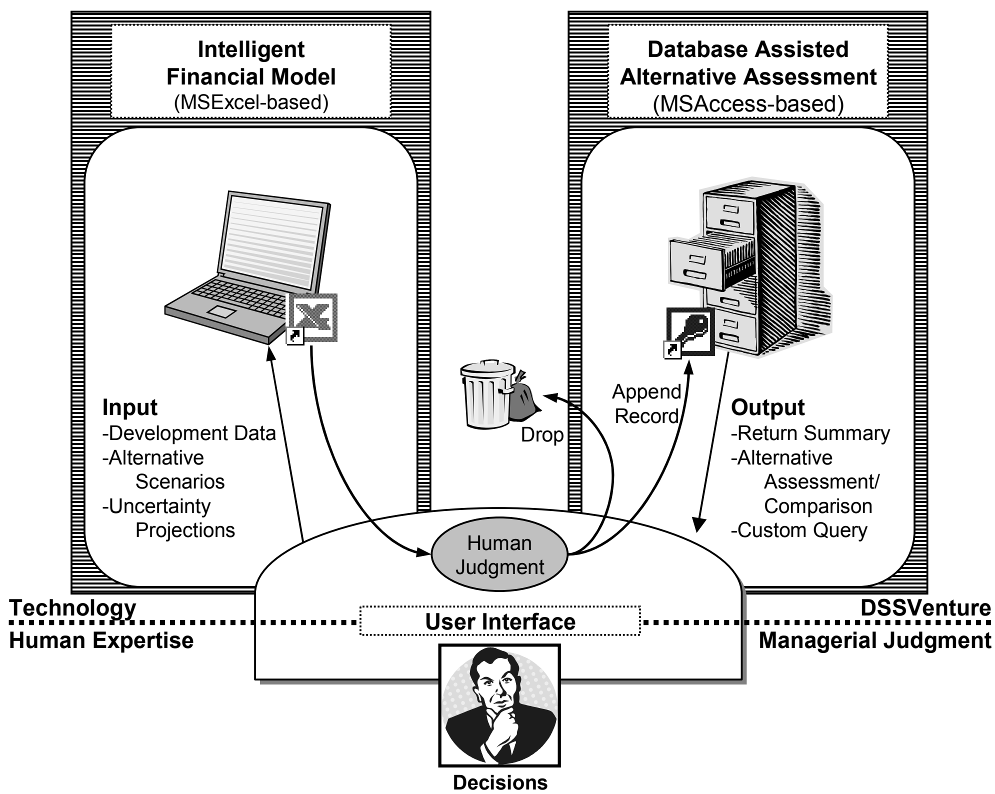
---

[2]The derivation process of development capital budgeting, cash flow projection, and feasibility assessment of a development-venture scenario assumption

In short, the logic model estimates feasibility and risk analysis indicators (NPVs and IRRs) based on given scenario assumptions. If a scenario assumption is determined reasonable, it can be recorded in the data model for further analyses and comparisons. This conceptual system integration is illustrated in Exhibit 27.

Exhibit 27

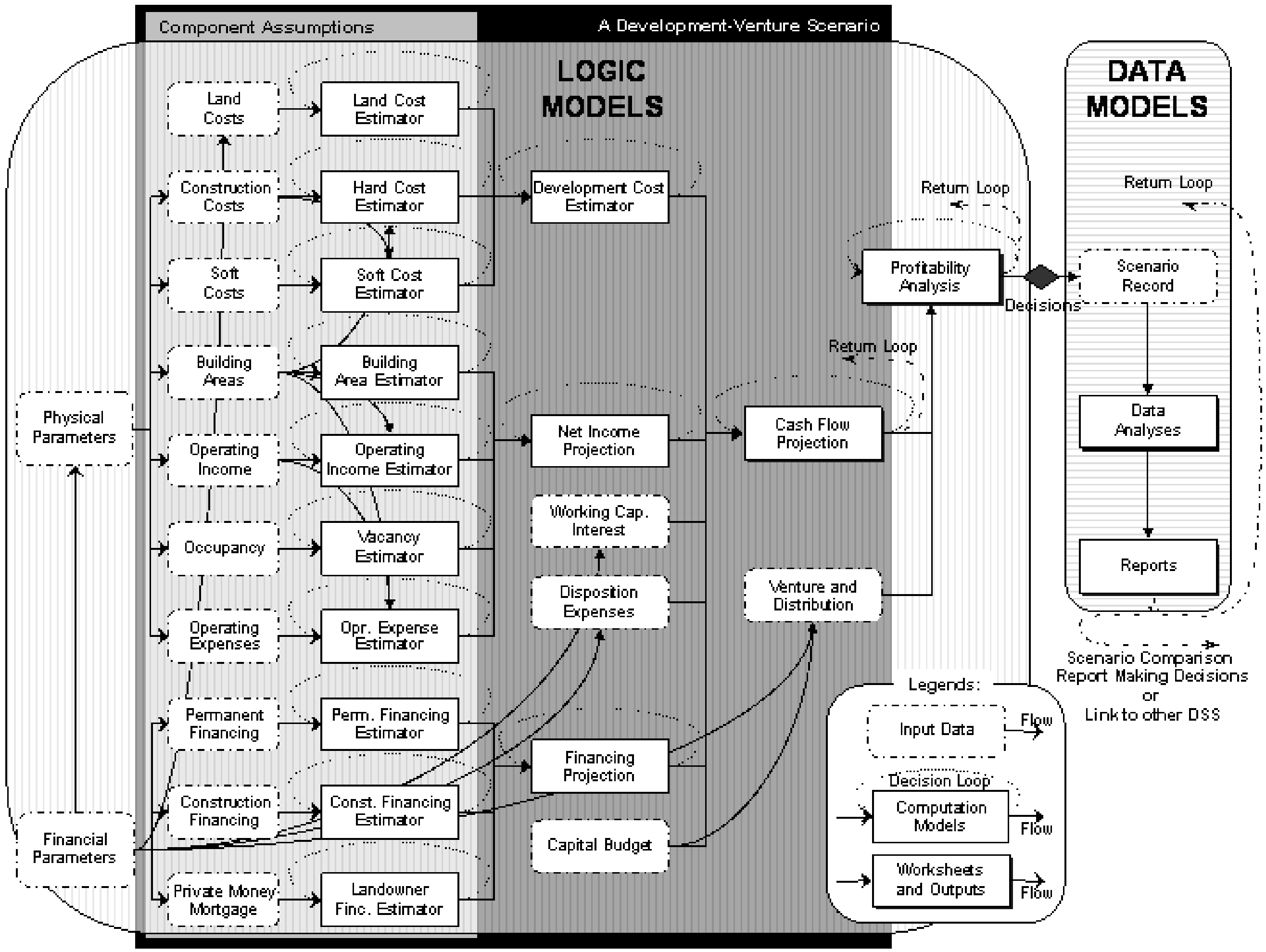
Conceptual System Integration



Based on the specifications and the conceptual integration, this study then developed *DSSVenture*'s detail logic and data models (Exhibit 28). Detail input variables needed for calculation will be identified, organized, and described below.

Exhibit 28

Logic and Data Model Synthesis



DSSVenture's logic model provides an automation and calculation framework that projects cash flows from operation and disposition based on a set of assumptions. The logic model accordingly estimates profitability and risk indicators (NPVs and IRRs) for every party involved in the development based on their comparisons of initial investment and expected future cash distributions. A development-venture scenario consists of sixty input variables. In order to assist decision makers in organizing these many variable inputs, these input categories are assisted by ten smaller estimator modules, namely land cost, hard cost, soft cost, physical area, income, vacancy, operating expense, permanent financing, construction financing, and landowner financing (private money mortgage). Flows of these modules to their corresponding categories are explained by arrow lines in Exhibit 28 (page 88). By means of organizing variables within smaller estimator modules, developers can notice impacts due to adjusting a few related factors at a time.

From the left of the Logic and Data Model Synthesis diagram, an analysis of development-venture scenario starts by passing input variables through the ten estimator modules for detail automation and computation. Results of modules' automations and computations are then relayed to three corresponding projection modules, namely development cost, net income, and financing. The cash flow module produces the scenario's before-tax cash flow estimations, based on the preceding modules' results, disposition expense input, and working capital interest input. Finally, by assuming a venture and distribution assumption, the logic model estimates profitability indicators (NPVs and IRRs) for every party involved in the development.

At this point, depending on the decision maker's judgment, the set of assumptions and variable inputs can be recorded in the data model for further analyses and reports. Otherwise, the variable and assumption set can be dropped or modified if it is determined unreasonable. In *DSSVenture*, a scenario is a record of combined development input/output variables.

Due to the inefficiency nature of real estate markets, many factors are likely volatile. Developers have to be informed of impacts on development feasibility and risks due to changing assumptions. Output variables stored in each scenario record has to reflect the latest value of the changes. Therefore, these scenarios' outputs have to be dynamically automated and calculated in the logic model to reflect latest assumption changes.

With the system specifications and the Logic and Data Model Synthesis in mind, a filing cabinet framework was developed as guideline for interface design and connectivity. The framework is similar to a two-drawer filing cabinet that is labeled with project-level information, namely the project's title, the groundbreaking year, the construction course, and discount rates.

The first drawer stores [component] assumption folders. The drawer consists of ten folders for each component category organized after the ten estimator modules presented in the Logic and Data Model Synthesis diagram (Exhibit 28). These folders organize records of possible detail variable sets for each corresponding development component categories. The categories correspond to the ten estimators mentioned above: land cost, hard cost, and etc.

The second drawer contains folders, which one of each represents a possible development-venture scenario. In general, a development-venture scenario is a record of inputs and outputs resulting from a combined component assumptions and a set of venture structure and distribution inputs. Detail values of each component assumption are dynamically linked to their corresponding sources folder in the [component] assumption drawer.

The conceptual filing cabinet framework is presented with a sample series of development-venture scenario assumptions in Exhibit 29. Tables in Exhibit 30 to Exhibit 39 summarize the framework as it expands over the entire system.

Exhibit 29

System Filing Cabinet Framework

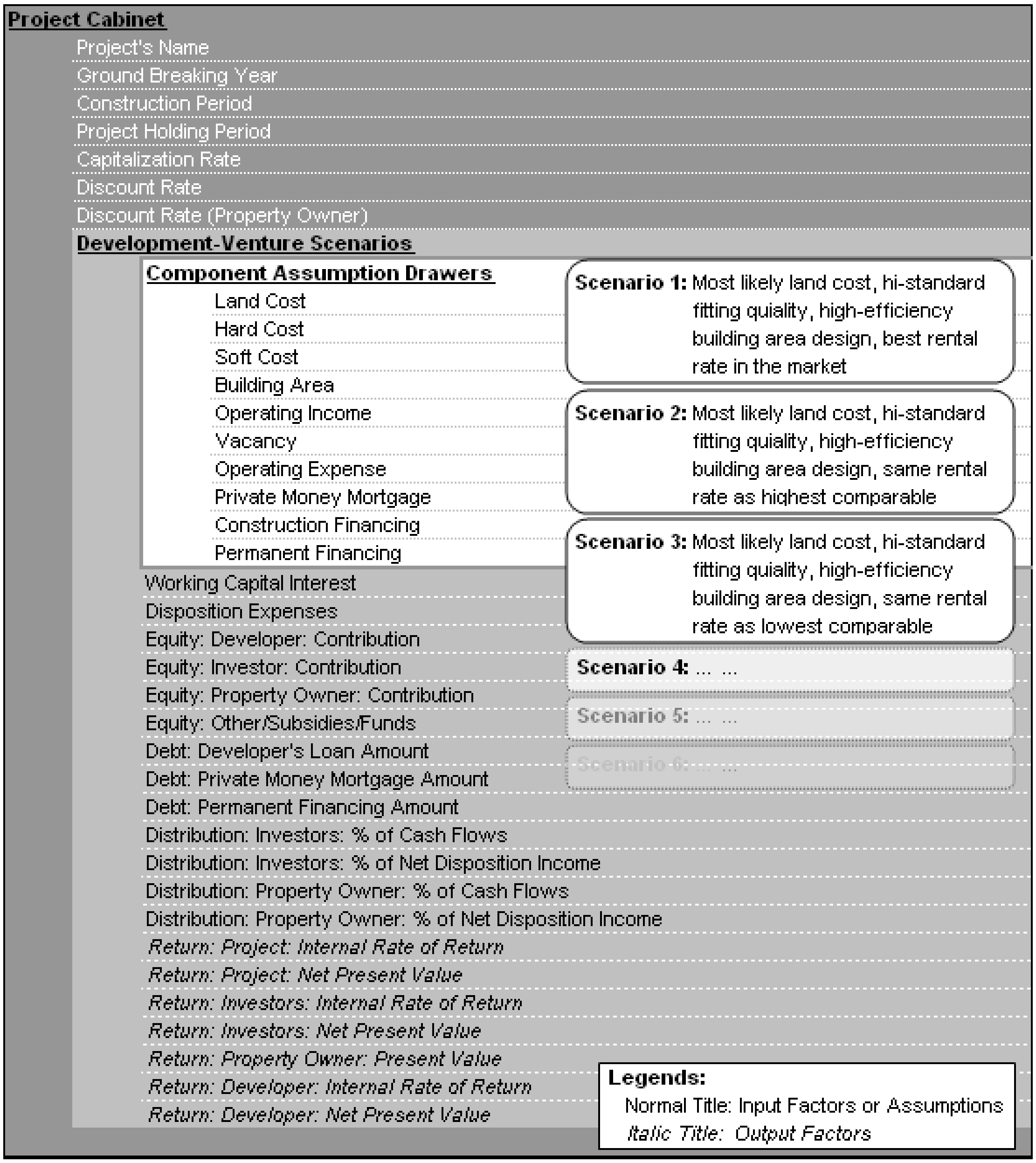


Exhibit 30

Land Cost Assumption Folder

Land Cost Assumption Folder	
Land Cost Assumption	**Scenario Samples:** 1. Maximum acceptable 2. Most likely 3. Most desirable
Land Cost	
Building Cost	
Other/Adjustment	

Exhibit 31

Hard Cost Assumption Folder

Hard Cost Assumption Folder	
Hard Cost Assumption	**Scenario Samples:** 1. Hi-standard fitting quality 2. Most likely 3. Minimum acceptable fitting
Construction/Improvement/Rehabilitation	
Other/Adjustment	

Exhibit 32

Soft Cost Assumption Folder

Soft Cost Assumption Folder	
Soft Cost Assumption	**Scenario Samples:** 1. Pesimistic 2. Most likely 3. Optimistic
Soft Cost (excluding lending costs)	
Other/Adjustment	
Development Fee	

Exhibit 33

Building Area Assumption Folder

Building Area Assumption Folder	
Building Area Assumption	
Efficiency Ratio	
Gross Building Area	**Scenario Samples:** 1. High-efficiency bldng design 2. Med-efficiency bldng design
Leasable Area	
Usable Area	

Exhibit 34

Operating Income Assumption Folder

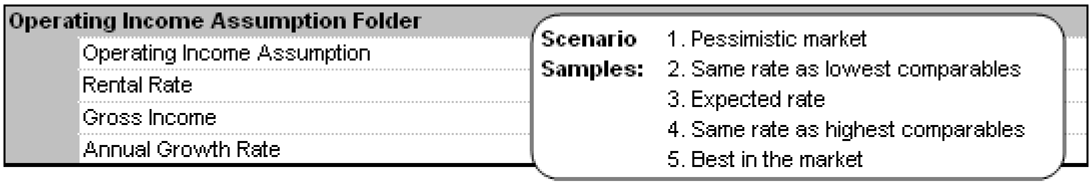


Exhibit 35

Vacancy Assumption Folder

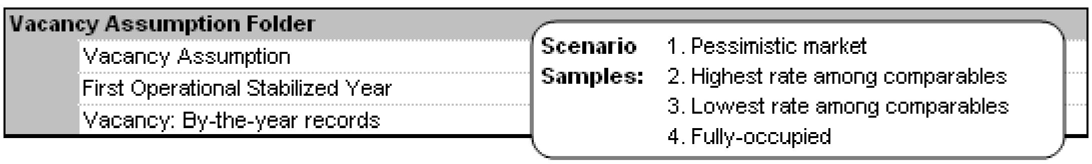


Exhibit 36

Operating Expense Assumption Folder

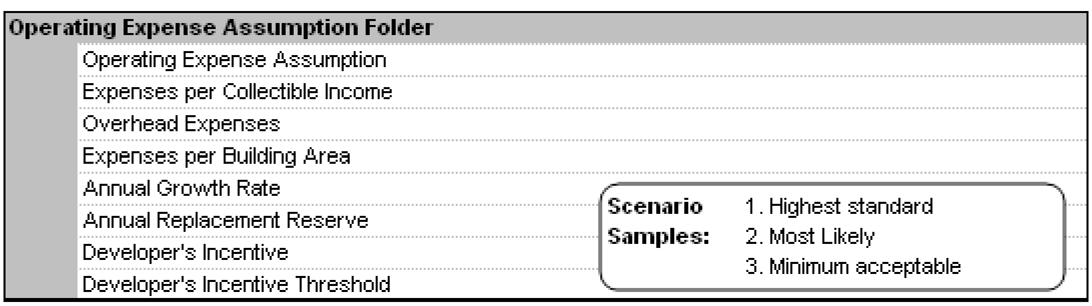


Exhibit 37

Permanent Financing Assumption Folder

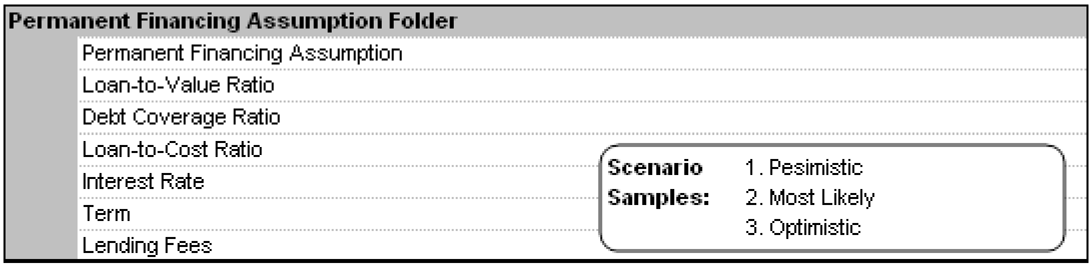


Exhibit 38

Construction Financing Assumption Folder

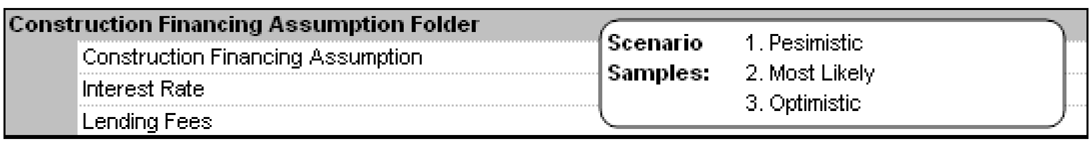
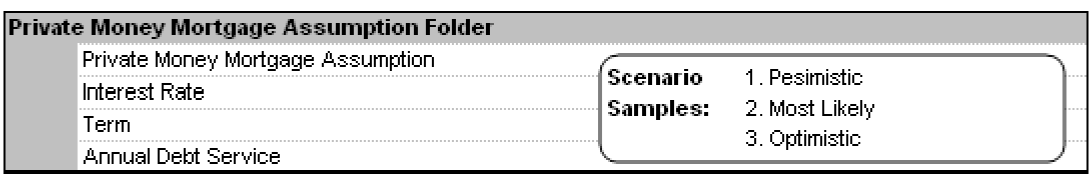


Exhibit 39

Private Money Mortgage Assumption Folder



As proposed in the Methodology, *DSSVenture* needs to be compatible with *Microsoft Windows®* operating systems. As a result, this study utilized *Microsoft Visual Basic®* version 6.0 (service pack 4) as the programming aid for interface design and application module linkages. *Microsoft Excel®* version 2000, was used to provide supporting platform for *LDEVOne* proforma, while the data model was developed by using *Microsoft Access®* version 2000. On the users' side, a computer system with *Microsoft Window®* (version *ME* or higher) and *Microsoft Excel®* (version 97 or higher), is required to run the prototype system.

Based on the Logic and Data Model Synthesis and the filing cabinet framework, twenty-seven user interfaces were designed, developed, and programmed. Additionally, thirteen system features were developed and integrated with the program and user interfaces with an aim to overcome perceived weaknesses identified in the literature review. Exhibit 40 summarizes these thirteen features and their strategies endeavored in a metric diagram. *DSSVenture*'s features details are described in Appendix G.

Exhibit 40

DSSVenture Program's Features and Corresponding Strategies

Features \ Strategies	Synergetic System	Data Exchange	Easy Interface	Flexibility Enhancement
▪ Data Interactivity	○	○	○	○
▪ Database Organization		○	○	○
▪ Scenario Duplication			○	○
▪ Drob-down selection box		○	○	○
▪ Pop-up Tip	○		○	
▪ Error Message	○		○	
▪ Default Value	○		○	
▪ Calculation Assistant	○		○	○
▪ Traditional Window Program Dialog			○	
▪ Traditional Menu Bar			○	
▪ Auto Save			○	
▪ Print		○	○	
▪ Analysis Expandability				○

The remainder of this section explains selected user interfaces representing each of the essential parts of *DSSVenture*. These user interfaces include project detail, project initialization wizard, development-venture scenario, scenario summary, and filter selection screens. Individual screen capture with highlights on essential interface elements are used as a means of explanation. In order to realistically demonstrate the use of the system, these interfaces are presented using a set of data from *Case Study A – Campus Point Student Apartments* (Appendix B) to simulate a feasibility analysis. The interfaces presented in this study were captured by using a personal computer running on *Windows XP®* (Professional Edition – service pack 2) platform. By following the same sequence and format, all other interfaces are described in Appendix H.

It should be noted that the prototype *DSSVenture* is in color and interactive. However, in accordance with the requirements of Texas A&M's Thesis Office, user interfaces presented in this publication has to be in black and white. Many screen captures are scaled down to fit in a required page margin. In addition, the program interactivity cannot be presented in print. These presentations may not convey the entire effect achieved by *DSSVenture*. Readers are encouraged to contact the author to obtain an installation compact disc to fully experience the program. The author's contact information can be found in the system's *About* screen at the end the appendix.

Project Detail Screen

When the *New* [analysis] menu command[3] is executed, *DSSVenture* program opens with a dialog box that requires the user to name the project a title and to select a location

[3] The *New* [analysis] menu command is located on the menu bar in the top portion of the Menu Screen.

to save the file. The program then makes an identical copy of the *DSSVenture* database template to the specified location. *DSSVenture* then loads Project Detail screen.

The screen accommodates eight input and an output fields of project level data as summarized in Exhibit 41 When data input is completed, a click on the *Done* command button in the lower right portion of the screen, unloads the form. If the session is running in *New* [analysis] mode, the program will execute the Project Initialization Wizard screen. Otherwise, it will return to the Development-Venture Scenario screen. Later, the Project Detail screen can be reactivated by a button command on Development-Venture Scenario screen. Exhibit 42 presents a screen capture of the interface.

Exhibit 41

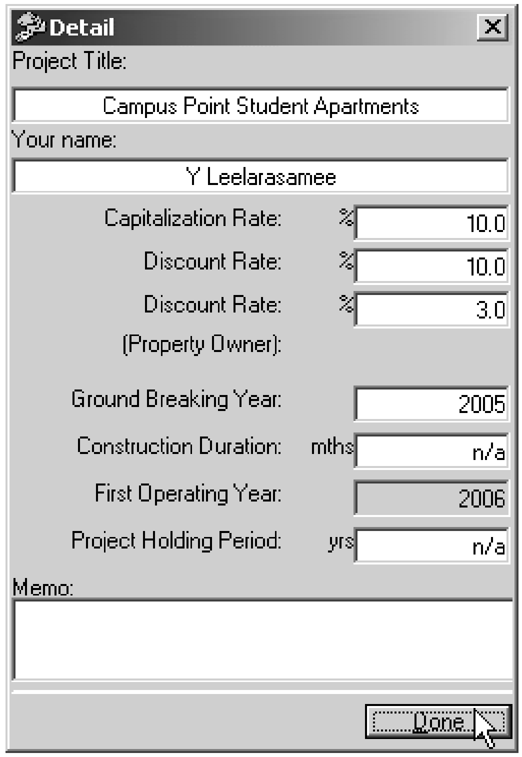
Project Detail Screen Data

Forward Screen Linkages:	* (if called by *New Analysis* command) Project Initialization Wizard Screen * (if called by *Detail* button command - in *Main Scenario* Screen) None	
Backward Screen Linkages:	n/a	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / LDEVOne / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Project Title:	Summary / Project Name:
	Your Name:	Summary / By:
	Capitalization Rate: (%)	Summary / Capitalization Rate: (%)
	Discount Rate: (%)	Summary / General Discount Rate: (%)
	Discount Rate (Property Owner): (%)	Summary / Property Owner's Disc Rate: (%)
	Ground Breaking Year:	Summary / Ground Breaking
	Time for Construction: (months)	Summary / Time for Construction: (months)
	First Operating Year:	Summary / First Operating Year:
	Project Holding Period: (years)	Summary / Project Holding Period: (years)

Note: Grey Title indicates an output field.

Exhibit 42

Project Detail Screen Capture



Project Initialization Wizard Screen

This screen was designed to assist the decision maker in structuring the two primary development scenarios, most likely and worst scenario. The most likely scenario is a situation, which all factor values have the highest occurrence possibility. On the other hand, the worst scenario is a situation originated with a pessimistic perspective. The worst scenario is normally formed by using all development factors' pessimistic values. The pessimistic view informs the decision maker of the bottom-line in the worst possible case.

This screen involves neither formula calculation, nor link to the database file. Data from all input fields are directly transferred to automatically originate the two primary scenarios in the project database file. Exhibit 43 and Exhibit 44 present the interface's base data and screen capture respectively.

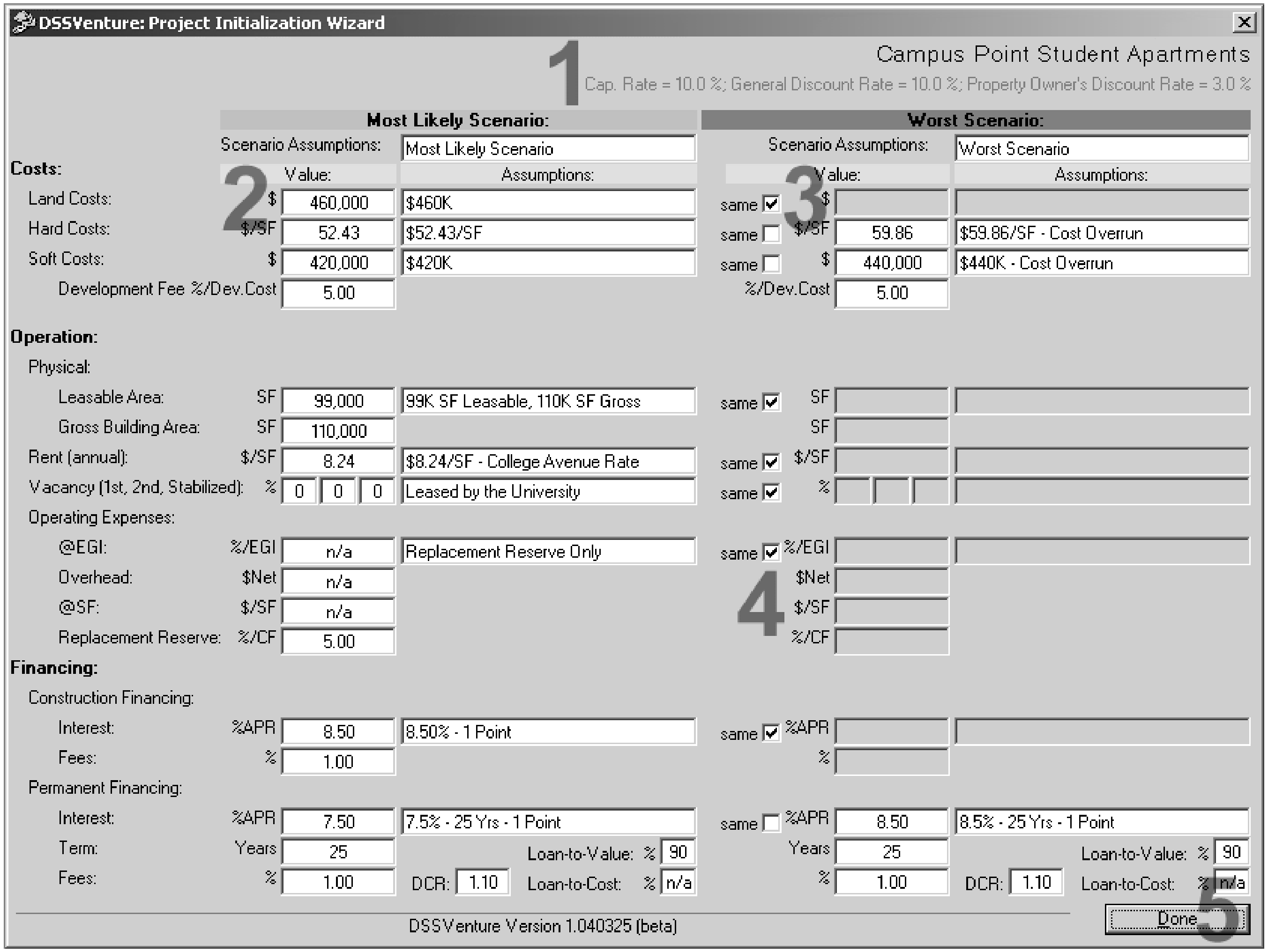
Exhibit 43

Project Initialization Wizard Screen Data

Forward Screen Linkages:	*Development-Venture Scenario* Screen	
Backward Screen Linkages:	n/a	
Logic Models:	n/a	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	n/a	n/a

Exhibit 44

Project Initialization Wizard Screen Capture



In the final process of the *New* [analysis] procedure command, the wizard screen loads as the Project Detail screen disappears. Information in the upper right portion of the interface informs the decision maker of project level data completed in the preceding screen ①. Since the screen was designed to facilitate the origination process of the fundamental scenarios, key input values and their corresponding component assumptions are grouped into two columns for the most likely scenario ② and the worst scenario ③.

Like other kinds of business, some factors in income-producing real estate development are controllable and remain consistent across the two scenarios. Therefore, every component assumption was designed and programmed with an option that allows the same assumption setting to apply across the two scenarios. These options are available as check boxes situated between the two scenario columns④. If an option box is checked, the corresponding component assumption setting from the most likely scenario side will be applied in the worst scenario side.

Clicking the *Done* command button ⑤ confirms the completion of the two primary scenario settings. *DSSVenture* program automatically originates the two primary scenario records with corresponding sets of given data as the wizard screen unloads. The Development-Venture Scenario screen is then executed.

Development-Venture Scenario Screen

The Development-Venture Scenario screen is the only user interface in the scenario level and is intended to be the central interface that provides a summary of key scenario assumptions and corresponding results. Moreover, the interface also offers necessary control bars and buttons for originating new scenarios, navigating the database, and examining existing scenarios. The screen is also equipped with command buttons and drop-down selection boxes that allow users to access or make reference to component assumption modules.

The Development-Venture Scenario screen can be executed by two means. First, the screen is activated at the end of the menu command's *New* [analysis] procedure. The screen loads as the Project Initialization Wizard screen disappears. Second, the screen is the first interface activated when the menu command's *Open* [an existing project] procedure is executed.

This central control interface involves scenario assumptions that refer to ten component assumption modules listed in the logic and data model synthesis diagram. Exhibit 45 illustrates the screen's data covering a full list of variable connections.

Exhibit 45

Development-Venture Scenario Screen Data

Forward Screen Linkages:	Land Cost Assumption Screen Hard Cost Assumption Screen Soft Cost Assumption Screen Building Area Assumption Screen Operating Income Assumption Screen Vacancy Assumption Screen Operating Expense Assumption Screen Private Money Mortgage Financing Assumption Screen Construction Financing Assumption Screen Permanent Financing Assumption Screen	
Backward Screen Linkages:	n/a	
Logic Models:	LDEVOne / Internal Calculations	
Data Models:	Manual Inputs / LDEVOne / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Land Acquisition Cost Assumption:	Summary / Land Cost: ($)
		Summary / Building Cost: ($)
		Summary / Other Cost/Adjustment: ($)
	Land Acquisition Cost: ($)	Summary / Total Land Acquisition Cost: ($)
	Hard Cost Assumption:	Summary / Construction and Improvement Cost: ($/SF)
		Summary / Other Hard Cost / Adjustment: ($)
	Hard Cost: ($)	Summary / Total Hard Cost: ($)
	Soft Cost Assumption:	Summary / Soft Cost (excld. loan costs): ($)
		Summary / Additional Soft Cost / Adjustment: ($)
		Summary / Development Fee: (%)
	Soft Cost: ($)	Summary / Total Soft Cost: ($)
	Total Development Cost: ($)	Summary / Total Development Cost: ($)
	Building Area Assumption:	Summary / Gross Building Area: (SF)
		Summary / Total Leasable Area: (SF)
		Summary / Total Usable Area: (SF)
	Leasable Areas: (SF)	Summary / Total Leasable Area: (SF)
	Income Projection Assumption:	Summary / Annual Rent (per SF): ($/SF)
		Summary / Other Annual Income (Gross): ($)
	Income Projection: ($)	Summary / Potential Gross Income: ($)
	Vacancy Projection Assumption:	Summary / Stabilized Year:
		Cash Flow Schedule / Vacancy Yr 1: (%)
		Cash Flow Schedule / Vacancy Yr 2: (%)
		Cash Flow Schedule / Vacancy Yr 3: (%)
		Cash Flow Schedule / Vacancy Yr 4: (%)
		Cash Flow Schedule / Vacancy Yr 5: (%)
		Cash Flow Schedule / Vacancy Yr 6: (%)
		Cash Flow Schedule / Vacancy Yr 7: (%)
		Cash Flow Schedule / Vacancy Yr 8: (%)
		Cash Flow Schedule / Vacancy Yr 9: (%)
	Vacancy: (%)	Summary / Stabilized Year Vacancy Rate:

Continued on next page.

Note: Grey Title indicates an output field.

Exhibit 45 (continued)

Continued from previous page.

	DSSVenture Interface	LDEVOne Variables
Variable Connectivity:	Operating Expense Assumption:	Summary / Expenses per Collectible Income: (%EGI)
		Summary / Annual Overhead: ($)
		Summary / Expenses per Building Area: ($/SF)
		Summary / Annual Growth: (%)
		Summary / Annual Replacement Reserve: (%CF)
		Summary / Developer's Incentive Fee: (%CF above threshold)
		Summary / Developer's Incentive Threshold: ($)
	Disposition Expenses:	Summary / Disposition Expenses: (%Sale)
	Private Money Mortgage Assumption:	Summary / Interest Rate: (%)
		Summary / Term of Loan: (years)
	Private Money Mortgage: ($)	Summary / Private Money Mortgage (PMM): ($)
	Interest Rate: (%)	Summary / Interest Rate: (%)
	Term of Loan: (year)	Summary / Term of Loan: (years)
	Construction Financing Assumption:	Summary / Interest Rate: (%)
		Summary / Lender's Fees: (%Loan)
	Construction Financing: ($)	Summary / Const. Loan Amount Required: ($)
	Interest Rate: (%)	Summary / Interest Rate: (%)
	Permanent Financing Assumption:	Summary / Preferred Loan to Value Ratio
		Summary / Preferred Debt Coverage Ratio
		Summary / Preferred Loan to Cost Ratio
		Summary / Term of Loan: (years)
		Summary / Interest Rate: (%)
		Summary / Lender's Fees: (%Loan)
	Permanent Financing: ($)	Summary / Perm. Loan Required: ($)
	Interest Rate: (%)	Summary / Interest Rate: (%)
	Term of Loan: (year)	Summary / Term of Loan: (years)
	Working Capital Interest: (%)	Summary / Working Capital Interest: (%)

Continued on next page.

Note: Grey Title indicates an output field.

Exhibit 45

Development-Venture Scenario Screen Data – (continued)

Continued from previous page.

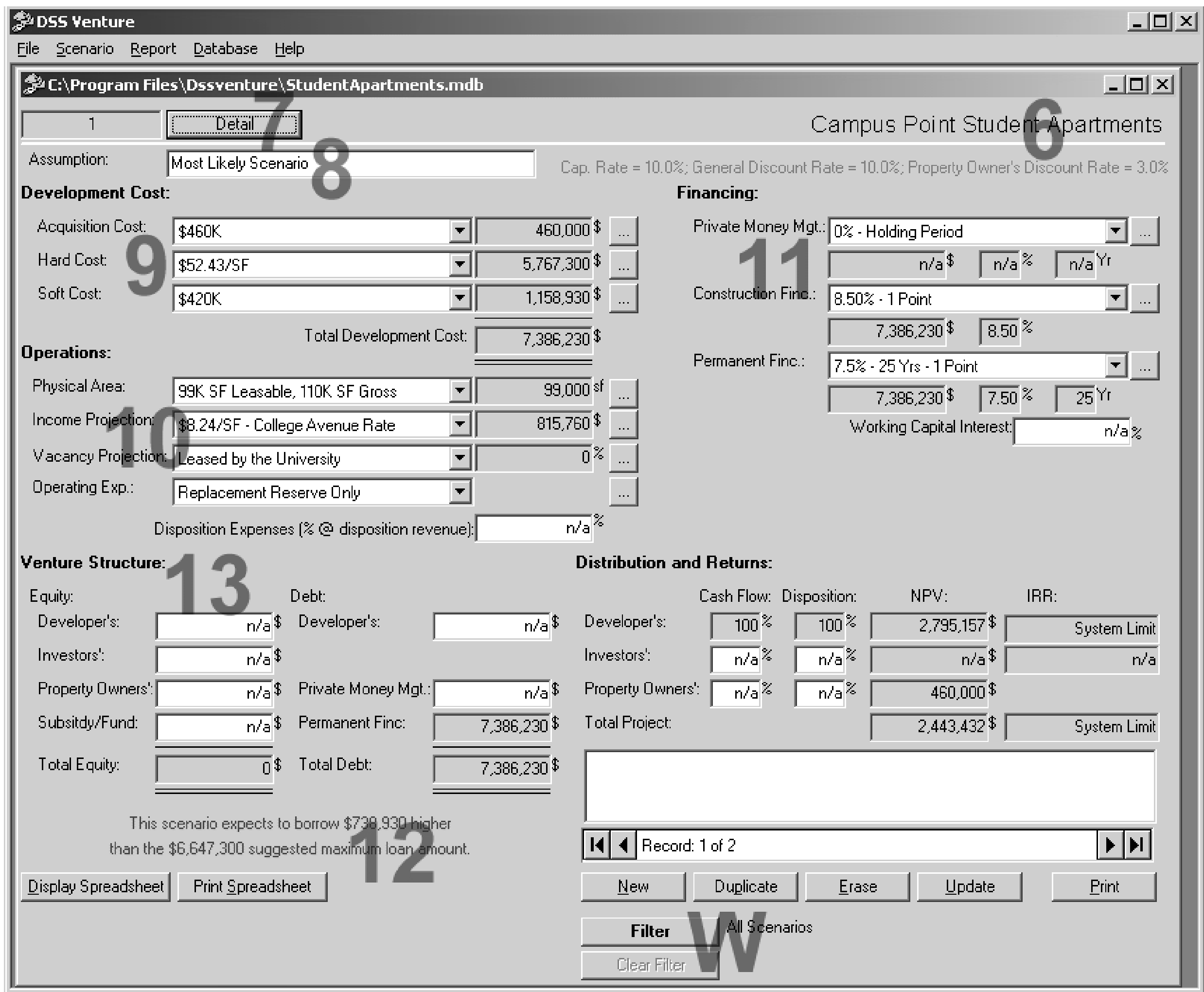
Variable Connectivity:	DSSVenture Interface	LDEVOne Variables
	Equity: Developer's: ($)	Summary / Developer's Investment: ($)
	Equity: Investors': ($)	Summary / Investors' Contribution: ($)
	Equity: Property Owner's: ($)	Summary / Property for Equity Swap: ($)
	Equity: Subsidy / Fund: ($)	Summary / Other Subsidy(ies)/Fund(s): ($)
	Total Equity: ($)	Summary / Total Initial Equity: ($)
	Debt: Developer's: ($)	Summary / Loan from Developer: ($)
	Debt: Private Money Mortgage: ($)	Summary / Private Money Mortgage (PMM): ($)
	Debt: Permanent Financing: ($)	Summary / Permanent Loan: ($)
	Total Debt: ($)	Summary / Total Debt: ($)
	Cash Flow: Developer's: (%)	n/a
	Cash Flow: Investors': (%)	Summary / Investor(s): Cash Flow: ($)
	Cash Flow: Property Owner': (%)	Summary / Property Owner: Cash Flow: ($)
	Disposition: Developer's: (%)	n/a
	Disposition: Investors': (%)	Summary / Investor(s): Disposition: ($)
	Disposition: Property Owner'(%)	Summary / Property Owner: Disposition: ($)
	NPV: Developer's: ($)	Summary / Developer: Net Present Value: ($)
	NPV: Investors': ($)	Summary / Investor(s): Net Present Value: ($)
	NPV: Property Owner': ($)	Summary / Property Owner: Net Present Value: ($)
	NPV: Total Project: ($)	Summary / Total Project: Net Present Value: ($)
	IRR: Developer's: (%)	Summary / Developer: Internal Rate of Return (%)
	IRR: Investors': (%)	Summary / Investor(s): Internal Rate of Return: ($)
	IRR: Total Project: (%)	Summary / Total Project: Internal Rate of Return: (%)
	Project Title:	Summary / Project Name:
	Capitalization Rate: (%)	Summary / Capitalization Rate: (%)
	Discount Rate: (%)	Summary / General Discount Rate: (%)
	Discount Rate (Property Owner): (%)	Summary / Property Owner's Disc Rate: (%)

Note: Grey Title indicates an output field.

To describe techniques in constructing a meaningful scenario, Exhibit 46, Exhibit 47, and Exhibit 48 present a series of Development-Venture Scenario screen captures. These scenario screen captures are presented with highlights on major fields and controls relevant to the activity as a user proceeded.

Exhibit 46

Development-Venture Scenario Screen Capture



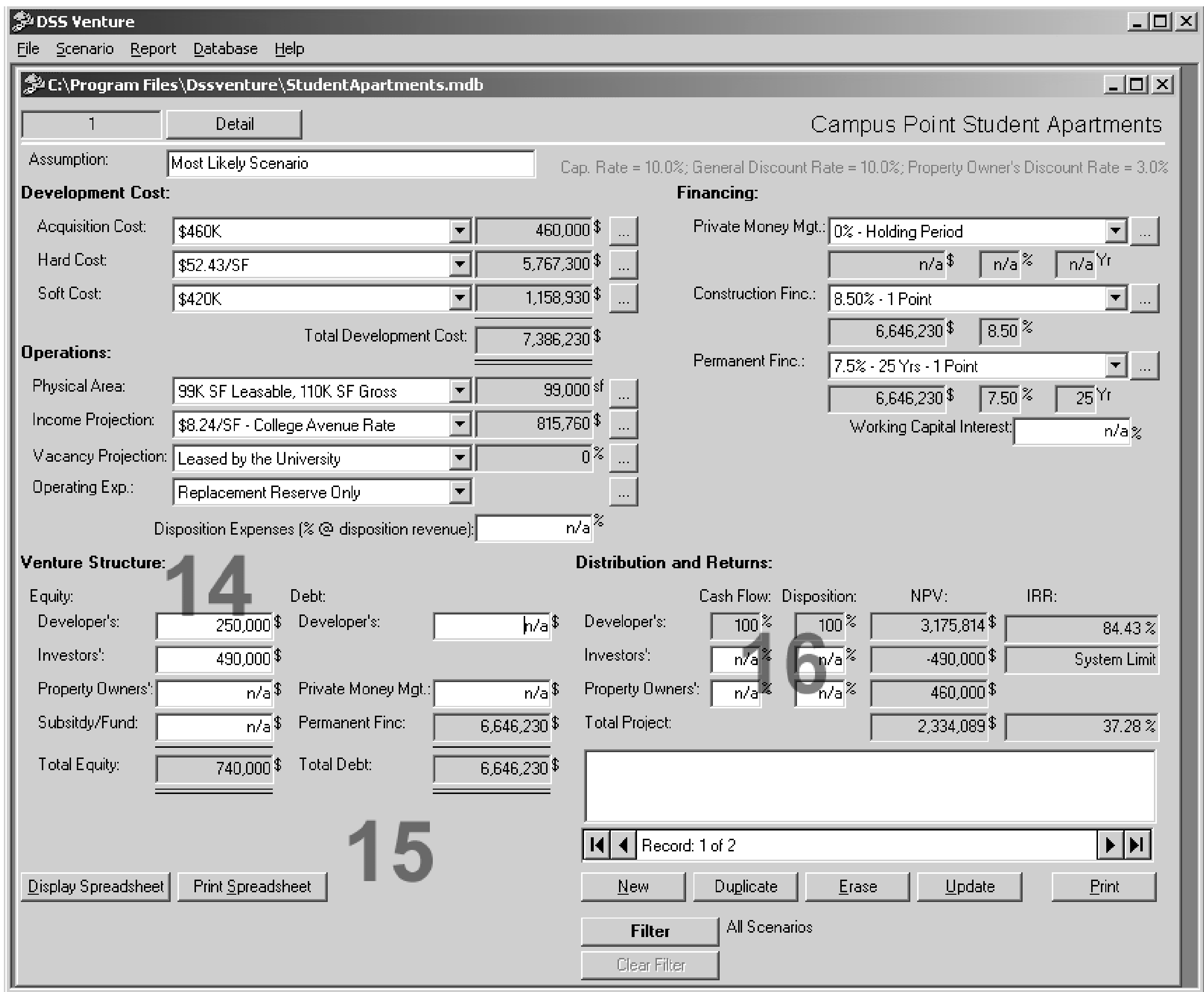
Consistent with the Project Initialization Wizard screen, project level information is summarized on the upper right portion of the screen⑥. If necessary, the project level data can be modified by executing the Project Detail screen with a click at *Detail* button⑦, located on the upper left portion of the screen.

In *DSSVenture*, a scenario is a record of combined development input/output factors. Each scenario is unique and can be identified by a brief description recorded in the assumption field⑧. A scenario record displayed on this screen summarizes feasibility assessment of sixty development input factors. Forty-one of these input factors are classified in three major assumption categories; namely, Cost⑨, Operations⑩, and Financing⑪. For the purpose of enhancing organization of information, these categories are organized in ten smaller groups of component assumptions corresponding to ten estimator modules listed in the logic and data model synthesis diagram.

Another key feature of this screen is an interactive financing status panel⑫. This panel provides the required permanent loan amount for the scenario setting in comparison with the available amount suggested by the logic model proforma. When the scenario setting requires a permanent loan amount that is larger than a suggested loan amount, the scenario interface display a red notification message⑫ informing the user of the excess amount as compared to the available amount. This indicates that the scenario under consideration is not feasible. In order for the project to become feasible, equity investment and debt conditions⑬ have to be modified. Exhibit 47 (Capture#2) presents the screen after the venture investment amount has been modified.

Exhibit 47

Development-Venture Scenario Screen Capture#2 – with Equity Investments



Once a potential venture ⑭ has been identified, the notification message disappears⑮. Another requirement for the project's success is to make sure that every party involved in the venture is satisfied with returns generated from the prospect investment. This step is addressed by figuring out appropriate distributions⑯ of both operating cash flow and disposition income. Exhibit 48 (Capture#3 on page 111) presents the screen with a venture structure that meets the above two requirements⑰.

An acceptable scenario will be automatically recorded in the database file by one of following actions:

- The user initiates a new scenario record.
- The user navigates to another record.
- The user exits the program.

The navigation bar⑱ in the lower right portion of the screen may be used to move around the database file to examine other scenarios. Otherwise, a new scenario can be created by clicking the *New* [scenario] button for a new record, or the *Duplicate* [scenario] button⑲ for a new record based on the information presented on the current screen.

As the central control interface, this screen is designed with ten command buttons that execute corresponding component assumption screens.[4] These controls are square buttons located next to each of component assumption fields.

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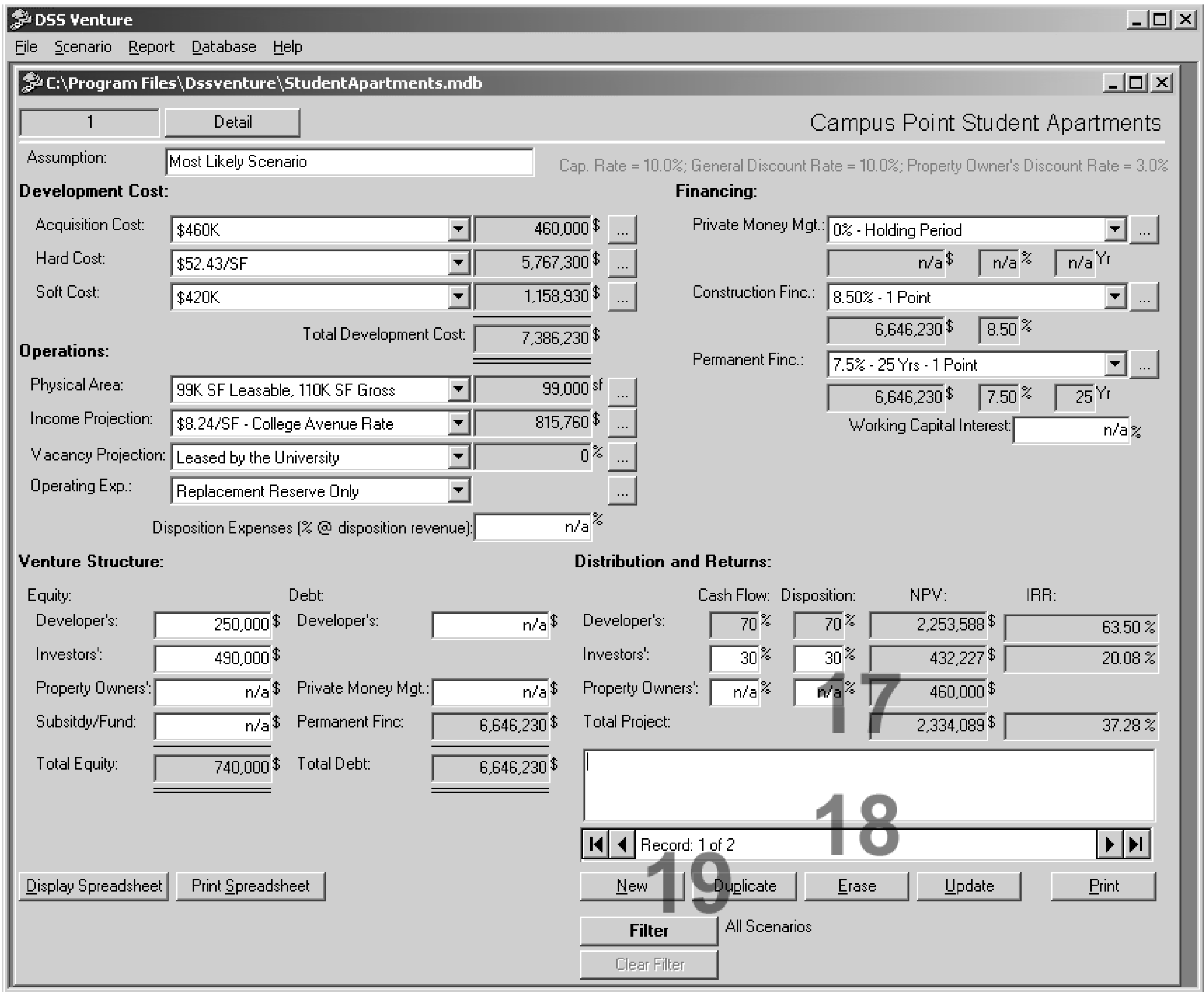
[4] Details and descriptions of these screens are attached in Appendix H.

Exhibit 48

Development-Venture Scenario Screen Capture#3 – with a Reasonable Venture Structure

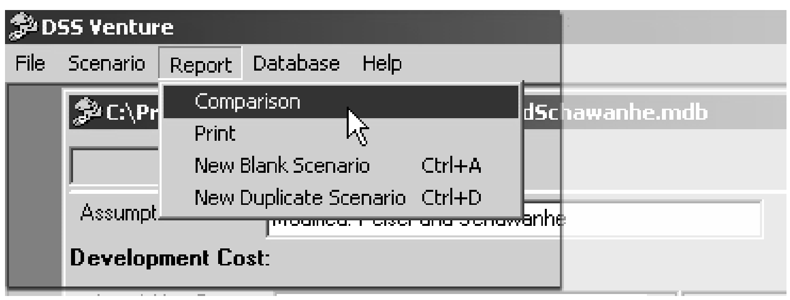


Scenario Summary Screens

Scenario summary screens are comprised of a user interface and a spreadsheet output developed with an aim to assist decision makers with a meaningful summary of values from development-venture scenario records. The summary screens are among the most important functions incorporated in the program's database feature. The scenario summary can be executed by the Menu screen's *Comparison* menu command (Exhibit 49).

Exhibit 49

Menu Access to Scenario Summary Screens



DSSVenture's summary screens offer an automated procedure that allows the users to produce a summary of selected input/output variables from development-venture scenario records according to their current decision preference. An output produced by this screen is in *Microsoft Excel®* spreadsheet form. Exhibit 50 and Exhibit 51 respectively present screen captures of the variable selection screen and the summary output worksheet.

Exhibit 50

Scenario Summary Screens: Variable Selections for a Summary View

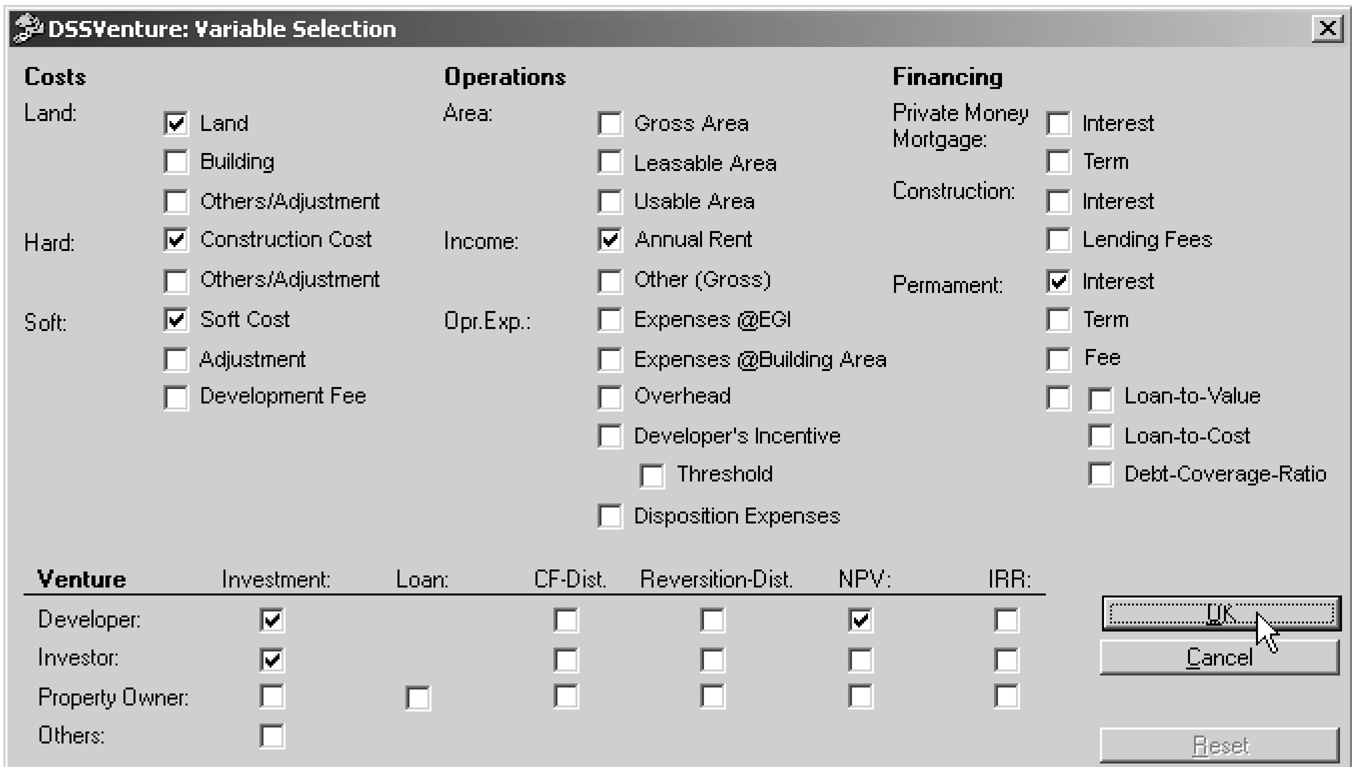


Exhibit 51

Scenario Summary Screens: Variable Summary Worksheet

Microsoft Excel - ScenarioSummary1

File Edit View Insert Format Tools Data Window Help

Project: **Campus Point Student Apartments**
By: Y Leelarasamee
Date: 9/23/2004 3:06 PM

Scenario	Assumptions	Land Cost	Hard Cost	Soft Cost	Rent ($/SF)	Perm.Loan Int.	Eq. Inv. - Investor	Eq. Inv. - Developer	Developer's NPV
10	Worst Scenario - $550K Land - with PMM 3yr 5%	550,000	59.86	440,000	8.24	8.5	360,000	250,000	991,305
16	Worst Scenario - $480K Land $300K in 5%3YR-PMM	480,000	59.86	440,000	8.24	8.5	440,000	250,000	966,545
15	Worst Scenario - $480K Land $280K in 5%3YR-PMM	480,000	59.86	440,000	8.24	8.5	460,000	250,000	939,920
14	Worst Scenario - $480K Land $280K in 5%2YR-PMM	480,000	59.86	440,000	8.24	8.5	460,000	250,000	931,731
17	Worst - $480K Land - with PMM 3yr 5% - Low EQ	480,000	59.86	440,000	8.24	8.5	430,000	100,000	929,934
2	Worst Scenario	460,000	59.86	440,000	8.24	8.5	720,000	250,000	745,387
13	Worst Scenario - $480K Land	480,000	59.86	440,000	8.24	8.5	740,000	250,000	704,778
12	Worst Scenario - $500K Land	500,000	59.86	440,000	8.24	8.5	760,000	250,000	664,205
11	Worst Scenario - $550K Land	550,000	59.86	440,000	8.24	8.5	820,000	250,000	564,750
1	Most Likely Scenario	460,000	52.43	420,000	8.24	7.5	490,000	250,000	2,253,588
4	Most Likely Scenario - Soft Cost Overrun	460,000	52.43	440,000	8.24	7.5	500,000	250,000	2,216,717
5	Most Likely Scenario - Hi Interest	460,000	52.43	420,000	8.24	8.5	490,000	250,000	1,827,733
3	Most Likely Scenario - Hard Cost Overrun	460,000	59.86	420,000	8.24	7.5	700,000	250,000	1,263,086
6	Most Likely Scenario - Development Cost Overrun	460,000	59.86	440,000	8.24	7.5	720,000	250,000	1,238,856
7	Worst Scenario - $460K Land - with PMM 3yr 5%	460,000	59.86	440,000	8.24	8.5	260,000	250,000	1,205,613
8	Worst Scenario - $480K Land - with PMM 3yr 5%	480,000	59.86	440,000	8.24	8.5	280,000	250,000	1,154,863
9	Worst Scenario - $500K Land - with PMM 3yr 5%	500,000	59.86	440,000	8.24	8.5	300,000	250,000	1,104,161
18	Worst - $480K Land - with PMM 3yr 5% - Mid EQ	480,000	59.86	440,000	8.24	8.5	380,000	150,000	1,016,272

Filter : All Scenarios

Comparison Summary

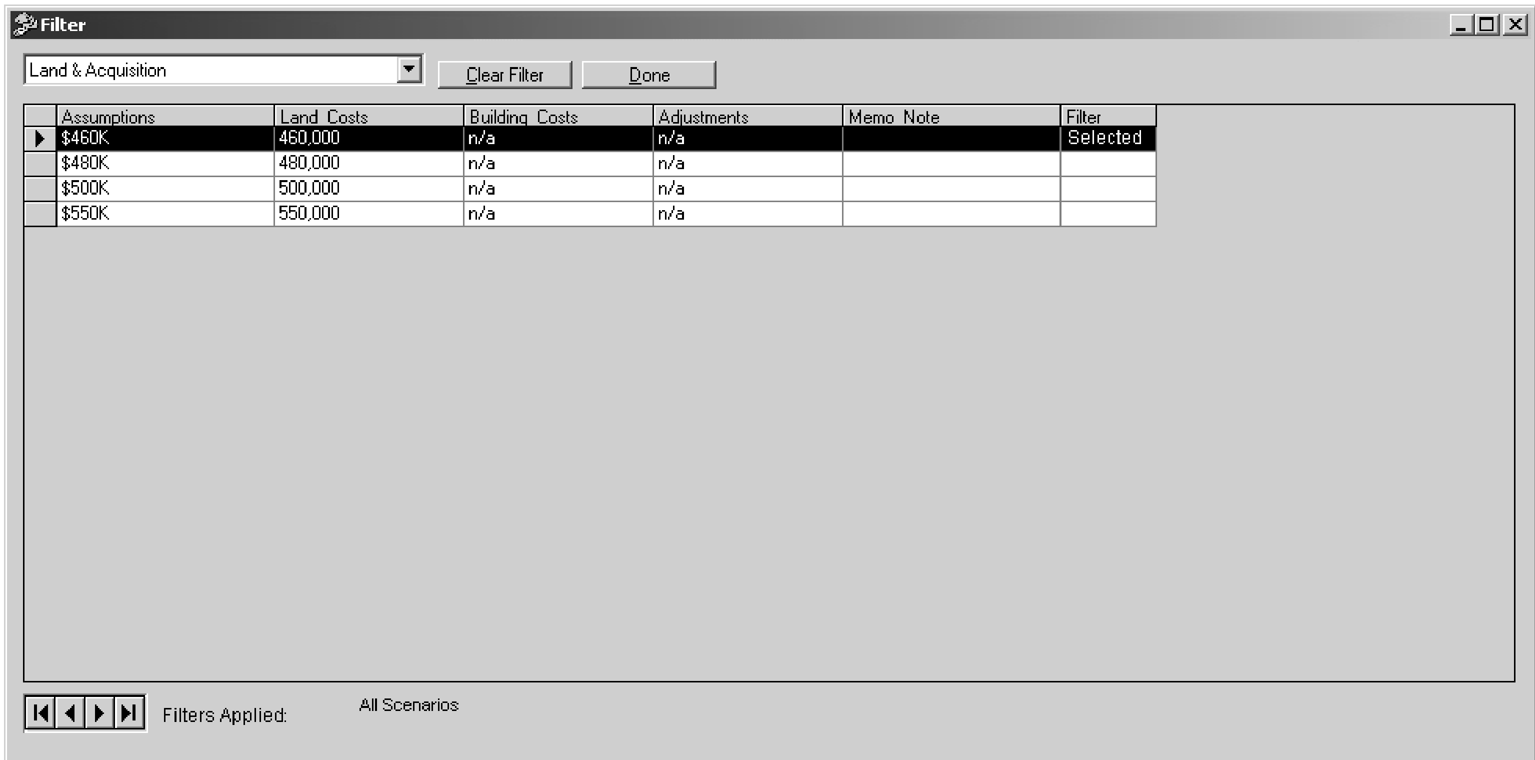
Ready

Filter Selection Screen

The Filter Selection screen is another database feature included with *DSSVenture*. This screen is executed by the *Filter* command button (Ⓦ in Exhibit 46 on page 107) located in the lower right portion of the Development-Venture Scenario screen. The purpose of this screen is to allow decision-makers to select to display *only* scenarios that meet certain decision criteria. A screen capture is presented in Exhibit 52. The capture presents a sample situation in which the decision maker wanted to display *only* development-venture scenarios that relate to the $460,000 land acquisition cost assumption. When a filter is applied, only the scenarios that match the filter criteria will remain available in Development-Venture Scenario screen. The filter can be deactivated by unselecting a criteria or clicking on the *Clear Filter* button on the screen.

Exhibit 52

Filter Selection Screen Capture



Validation-Testing

This stage aims at finding whether the system developed in the previous stage has achieved its objective of facilitating developers' decisions during the predevelopment stage of income-producing real estate development. As discussed in the Methodology, the Validation-Testing stage is divided into two major phases, namely model validation, and hypothesis testing. The purpose of the validation phase is to ensure the system's dependability in terms of computation and data-interchange. The testing phase aims to verify usability, and effectiveness of the *DSSVenture* system.

Validation

Validation is indispensable for ensuring the system's dependability. As discussed in the Methodology, *DSSVenture* needs to be validated in two dimensions, namely the logic model, and the user interfaces. In this study, the *Through the Output* approach is selected for both dimensions. The logic models will be validated by verifying two sets of outputs produced by the program's logic model with two corresponding sets of known outputs. The user interfaces will be validated by verifying inputs typed in *DSSVenture*'s user interfaces with corresponding inputs automated into the logic model. In addition, the interface validation will compare output variables that are automatically computed by the *LDEVOne* with their corresponding data displayed on *DSSVenture*'s interface screens. Known sets of output were obtained from proformas for two case studies. These include exhibits from Etter's *Conducting Multi-Year Analysis* (1995a, p. 61-65) and Peiser and Schwanke's *Multifamily Residential Development* (1992, p. 137-40).

At the end of the validation phase, the logic model's dependability is verified with a few notes due to differences in model's assumptions. However, the user interface's accuracy of data-interchange set was verified with one-hundred percent identical results.

Validation of the Model

In order to produce a straightforward comparison, input variables applied in the proforma should be drawn directly from the reference. However, due to the inefficient nature of the real estate market, much acquired data may not be instantly compatible with a logic model. Some data may need to be thoroughly justified a strong understanding of the model's assumptions.

The first validation of the model's outputs utilized a proforma presented in Etter's *Conducting Multi-Year Analysis* case (1995a, p. 61-65) as a reference[5] (Exhibit 53). Some variables had to be justified in order to be compatible with the proforma. These justified variables are marked with numbering shades. Descriptions of the justification are provided as this validation proceeds.

---

[5] As a reference of the validation, a *Microsoft Excel®* reproduction of the case proforma and a series of corresponding LDEVOne spreadsheet are attached in Appendix I and J.

Exhibit 53

LDEVOne Inputs and Source Variables

from Conducting Multi-Year Analysis Case Proforma

LDEVOne.xlt			Etter's Multi-Year Analysis	
Descriptions	**Input**		**Descriptions**	**Value**
Costs			**Cost Assumptions**	
Land Cost	$ 130,680		Land Cost	$ 130,680
Other Cost / Adjustment	$ 612,080		Building Cost	$ 612,080
Operations			**Operation and Resale Assumptions**	
Gross Building Area	20,000 SF	1	Square Feet of Net Leasable Space	20,000 SF
Total Leasable Area	20,000 SF			
Total Usable Area	20,000 SF			
Annual Rent (per SF)	$6.60/SF		Rent per SF per year (0.55*12)	$6.60/SF
Other Annual Income (Gross)	-		Miscellaneous Income	-
Annual Growth	3.0%		Annual Growth Rate: Income	3.0%
1st Yr Vacancy	5.0%	1	Vacancy Rate	5.0%
2nd Yr Vacancy	5.0%			
Stabilized Year (1-9)	2			
Annual Overhead	36,000		Operating Expenses	36,000
Annual Growth	3.0%		Annual Growth: Expense	3.0%
Disposition Expenses (% of Sale)	4.0%		Selling Expenses	4.0%
Construction Financing				
Interest Rate	0.0%			
Permanent Financing			**Mortgage Assumptions**	
		2	Loan Amount	557,070
Term of Loan	25 years		Loan Term	25 years
Interest Rate	12.1254%	3	Interest	12%
Mortgage Constant and Annual Payment are automatically calculated (12 pmts/year)		2	Mortgage Constant	0.1275
			Annual Payment	$ 71,026
Other Inputs			**Other Assumptions**	
Capitalization Rate	10.0%		Market Capitalization Rate	10.0%
Project Holding Period	5	1		
Venture Structure				
Developer's Investment	$ 185,690		Initial Equity	$ 185,690

Note
1 Facts from the exhibit.
2 LDEVOne.xlt automatically calculates Loan Amount
3 Effective Interest Rate for a 12-payments/year 12% APR.

The justification of building areas and other input variables based on the facts presented in the proforma are highlighted with shade #1. In addition, in calculating an annual debt service amount, Etter's proforma utilized one-payment-per-year assumption, while the LDEVOne computed the debt service with a more detailed monthly payment assumption (shade#2). Although Etter's assumption is good for classroom explanation, *LDEVOne*'s assumption is more commonly practiced. Therefore, under the same financing amount of $557,070 with a 25-year 12%-interest permanent loan, the one-payment-per-year and the twelve-payment-per-year assumptions require two different debt service amounts of $70,406.35, and $71,026.41 respectively. These scenarios will result in more than a $600 inconsistency in before-tax cash flow amount calculated. Therefore, in order to compare the cash flow outputs influenced by two different assumptions, a verification of debt service amount and before-tax cash flow has to be separated. A verification of the model's monthly debt service scheme was conducted by using a commonly known *Microsoft Excel®*'s *PMT* function (Exhibit 54). A justified 12.1254% permanent financing interest rate was then applied in the model to level the annual debt service amount and proceed with the verification (shade# 3 in Exhibit 53).

Once the input variables had been justified, the next step was to compare the proforma's outputs with those presented in the reference case. Exhibit 55, Exhibit 56, and Exhibit 57 (from page 121 to 123) respectively present the comparisons of the outputs for total development cost, annual before-tax cash flow from operation, and a before-tax cash flow from disposition.

Exhibit 54

Verification of LDEVOne's Output: Annual Debt Service

by Using Conducting Multi-Year Analysis Case Proforma

LDEVOne.xlt		Microsoft Excel's PMT function	
Loan Amount	557,070	PV	$ 557,070
Term of Loan (monthly)	25 years	Nper	300 pmts
Interest Rate	12.0%	Rate	1%
		FV	$ -
		PMT	$ 5,867
Annual Debt Service	**$70,406.35**	**Annual Debt Service**	**$70,406.35**

Exhibit 55

Verification of LDEVOne's Output: Total Development Cost

by Using Conducting Multi-Year Analysis Case Proforma

LDEVOne.xlt		Etter's Multi-Year Analysis		
Descriptions	Outputs	Descriptions	References	
			Original	Calculated
Total Acquisition Cost	$ 130,680	Cost of Land		$ 130,680
Total Hard Cost	$ 612,080	Cost of Building		$ 612,080
Total Development Cost	**$ 742,760**	**Total Cost**		**$ 742,760**

Exhibit 56

Verification of LDEVOne's Output: Before-Tax Cash Flow from Operation

by Using Conducting Multi-Year Analysis Case Proforma

LDEVOne.xlt	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1 Rental Income	$ 132,000	$ 135,960	$ 140,039	$ 144,240	$ 148,567	$ 153,024
2 Other Income	-	-	-	-	-	-
Potential Gross Income	132,000	135,960	140,039	144,240	148,567	153,024
Vacancy Rate	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
3 Vacancy	(6,600)	(6,798)	(7,002)	(7,212)	(7,428)	(7,651)
4 Effective Gross Income	$ 125,400	$ 129,162	$ 133,037	$ 137,028	$ 141,139	$ 145,373
Operating Expense						
Expenses per Collectible Income	-	-	-	-	-	-
Annual Overhead ($36,000 gross)	(36,000)	(37,080)	(38,192)	(39,338)	(40,518)	(41,734)
Expenses per Building Area	-	-	-	-	-	-
5 Total Operating Expense	$ (36,000)	$ (37,080)	$ (38,192)	$ (39,338)	$ (40,518)	$ (41,734)
6 Net Operating Income	$ 89,400	$ 92,082	$ 94,844	$ 97,690	$ 100,620	$ 103,639
7 Annual Debt Service	$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	
PMM Debt Service	-	-	-	-	-	
Developer and Working Loan Interest	-	-	-	-	-	
Annual Replacement Reserve	-	-	-	-	-	
Before-Tax Cash Flow	$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 29,594	
Working Loan Required	-	-	-	-	-	
Developer and Working Loan Repayme	-	-	-	-	-	
Developer's Incentive	-	-	-	-	-	
8 Total BTCF (Operations) for Distribution	$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 29,594	

Etter's Multi-Year Analysis	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1 Potential Gross Income	$ 132,000	$ 135,960	$ 140,039	$ 144,240	$ 148,567	$ 153,024
2 Miscellaneous Income	$ -	-	-	-	-	-
3 Less Vacancy	(6,600)	(6,798)	(7,002)	(7,212)	(7,428)	(7,651)
4 Effective Gross Income	$ 125,400	$ 129,162	$ 133,037	$ 137,028	$ 141,139	$ 145,373
5 Less Operating Expenses	(36,000)	(37,080)	(38,192)	(39,338)	(40,518)	(41,734)
6 Net Operating Income	$ 89,400	$ 92,082	$ 94,844	$ 97,690	$ 100,620	$ 103,639
7 Mortgage Payment	(71,026)	(71,026)	(71,026)	(71,026)	(71,026)	
8 Before Tax Cash Flow from Operations	$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 29,594	

Exhibit 57

Verification of LDEVOne's Output: Before-Tax Cash Flow from

Disposition Output by Using Conducting Multi-Year Analysis Case Proforma

LDEVOne.xlt	Year 1	2	3	4	5	6
9 Sales Revenue					$ 1,036,391	
10 Disposition Expenses					(41,456)	
11 Net Disposition Income					$ 994,935	
12 Balance: Permanent Loan					**(533,309)**	
Balance: Private Money Mortgage (PMM)					-	
Before-Tax Cash Flow					$ 461,627	
Balance: Other Loans					-	
13 Total BTCF (Reversion) for Distribution					$ 461,627	
Etter's Multi-Year Analysis	**Year 1**	**2**	**3**	**4**	**5**	**6**
9 Expected Resale Price					$ 1,036,391	
10 Less Selling Expenses					(41,456)	
11 Net Resale Price					$ 994,935	
12 Less Unpaid Mortgage Balance					**(530,528)**	
13 Before Tax Cash Flow from Resale					$ 464,408	

Based on the results shown in these exhibits, *LDEVOne*'s total development cost, and annual before-tax cash flow from operations were verified. However, the amounts of before-tax cash flow from disposition differ (row#13 in Exhibit 57) since they were influenced by two different debt service assumptions (row#12). The difference in annual debt service amounts of the one- and the twelve-payment-per-year schemes results in uneven mortgage balances at the end of the holding period. Similar to the debt service verification, the balance produced by *LDEVOne* had to be verified separately from the model. By using Etter's (1995a) constant payment mortgage approach, an amortization table was manually produced for the financing term. Exhibit 58 presents the table with a highlight on the unpaid mortgage balance at the end of the fifth year. Accordingly, the *LDEVOne*'s outstanding balance (row#12 in Exhibit 57) output is verified.

Exhibit 58

Amortization Table

Yr#	Mth#	Begining Bal.	Interest Monthly	Interest Annually	PMT Monthly	PMT Annually	Principal Monthly	Principal Annually	Ending Bal.
1	1	$ 557,070	(5,629)		5,918.87		(290)		556,780
	2	556,780	(5,626)		5,918.87		(293)		556,487
	3	556,487	(5,623)		5,918.87		(296)		556,191
	4	556,191	(5,620)		5,918.87		(299)		555,892
	5	555,892	(5,617)		5,918.87		(302)		555,591
	11	554,035	(5,598)		5,918.87		(321)		553,714
	12	553,714	(5,595)	(67,347)	5,918.87	71,026	(324)	(3,680)	553,390
2	13	553,390	(5,592)		5,918.87		(327)		553,063
	24	549,604	(5,553)	(66,875)	5,918.87	71,026	(365)	(4,151)	549,239
3	36	544,967	(5,507)	(66,343)	5,918.87	71,026	(412)	(4,684)	544,555
4	48	539,736	(5,454)	(65,742)	5,918.87	71,026	[illegible]	(5,284)	539,271
5	58	534,867	(5,405)		5,918.87		(514)		534,353
	59	534,353	(5,399)		5,918.87		(520)		533,833
	60	533,833	(5,394)	(65,064)	5,918.87	71,026	(525)	(5,962)	$ 533,309
6	72	527,174	(5,327)	(64,300)	5,918.87	71,026	(592)	(6,726)	526,582
7	84	519,661	(5,251)	(63,437)	5,918.87	71,026	(668)	(7,589)	518,993
8	96	511,185	(5,165)	(62,464)	5,918.87	71,026	(754)	(8,562)	510,431
9	108	501,622	(5,069)	(61,367)	5,918.87	71,026	(850)	(9,660)	500,771
10	120	490,832	(4,960)	(60,128)	5,918.87	71,026	(959)	(10,899)	489,873
11	132	478,659	(4,837)	(58,730)	5,918.87	71,026	(1,082)	(12,296)	477,577
12	144	464,925	(4,698)	(57,154)	5,918.87	71,026	(1,221)	(13,873)	463,704
13	156	449,430	(4,541)	(55,375)	5,918.87	71,026	(1,378)	(15,651)	448,053
14	168	431,949	(4,365)	(53,368)	5,918.87	71,026	(1,554)	(17,658)	430,395
15	180	412,226	(4,165)	(51,104)	5,918.87	71,026	(1,754)	(19,923)	410,472
16	192	389,973	(3,940)	(48,549)	5,918.87	71,026	(1,978)	(22,477)	387,995
17	204	364,868	(3,687)	(45,667)	5,918.87	71,026	(2,232)	(25,359)	362,636
18	216	336,543	(3,401)	(42,415)	5,918.87	71,026	(2,518)	(28,611)	334,025
19	228	304,586	(3,078)	(38,747)	5,918.87	71,026	(2,841)	(32,280)	301,745
20	240	268,532	(2,713)	(34,608)	5,918.87	71,026	(3,205)	(36,419)	265,327
21	252	227,855	(2,302)	(29,938)	5,918.87	71,026	(3,617)	(41,088)	224,238
22	264	181,962	(1,839)	(24,670)	5,918.87	71,026	(4,080)	(46,357)	177,881
23	276	130,184	(1,315)	(18,725)	5,918.87	71,026	(4,603)	(52,301)	125,581
24	288	71,767	(725)	(12,019)	5,918.87	71,026	(5,194)	(59,007)	66,573
25	300	5,860	(59)	(4,453)	5,918.87	71,026	(5,860)	(66,573)	$ (0)
Total			(1,218,590)	(1,218,590)	1,775,660	1,775,660	(557,070)	(557,070)	

Note: Based on a $557,070 mortgage on a 25 years 12.1254% Interest Term

Ending balance at the end of the 60th month

The second validation of *LDEVOne* logic model utilized a proforma presented in Peiser and Schwanke's *Multifamily Residential Development* case (1992, p. 137-40) as a reference[6]. From the case's exhibits, it can be seen that factors and calculations presented in the case were rounded to the nearest dollar value. In contrast, the subject proforma takes advantage of computer's ability in detailed computing. Thus, to establish a level ground, the Peiser and Schwanke's proforma was literally reproduced. *Microsoft Excel*® spreadsheets with automated calculation features were used for the reproduction. All automated calculations utilized in the reproduction were calibrated with appropriate logics and information presented in the case. Furthermore, all decimal points were accounted for.

Once the proforma was reproduced with detailed numbers, it was ready for use as a reference for the validation. Accordingly, *LDEVOne*'s inputs and their corresponding referenced information are summarized in Exhibit 59. By using a row number located on the left of each item's description, each variable can be referred back to a corresponding source in Appendix L. Although most variables can be related to an item in the reference proforma, some variables had to be justified.

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[6] Details of the original and the automated Peiser and Schwanke's proformas are attached in Appendix K and L. A series of *LDEVOne* spreadsheets utilized in the validation are shown in Appendix M.

Exhibit 59

LDEVOne Inputs and Source Variables

from Multifamily Residential Development Case Proforma

LDEVOne.xlt			Peiser and Schwanke's		
Description	**Input**	*	**Row**	**Description**	**Value**
Cost & Physical					
Land Cost	$552,875		42	Subtotal Land Cost	$552,875
Hard Cost	$35.00/SF		45	Subtotal Building Construction Cost	$35.00/SF
Soft Cost (Excluding Loan)	$172,352	1	46	Architecture	20,000
			47	Engineering and Appraisal	35,000
			48	Furnishing	10,000
			49	Marketing	45,000
			50	Professional Fees	5,000
			55	Construction Financing: Miscellaneous	5,000
			66	Title Insurance	29,352
			67	Liability Insurance	10,000
			68	Property Taxes During Construction	10,000
			69	Audit Cost	3,000
Development Fee	3.926077%	4	75	Development Fee	5%
Additional Soft Cost / Adjustment	$150,000		76	Contigency	$150,000
Gross Building Area	133,420 SF		7	Total SF	133,420 SF
Leaseable Area	133,420 SF		7	Total SF	133,420 SF
Usable Area	133,420 SF		7	Total SF	133,420 SF
Operation & Disposition					
Annual Rent per SF	$8.25/SF		104	Rent per SF	$8.25/SF
Other Income (Gross)	$25,000		14	Miscellaneous	$25,000
Annual Growth	4%		105	Rent Appreication Rate	4%
Stabilized Year	2	3			
Annual Overhead	($64,800)		26	Subtotal Payroll	($64,800)
Expenses per Building Area	($2.17)		34A	Subtotal Expenses per SF	($2.17)
Annual Growth	4%		139	(no description)	4%
Disposition Expenses (% of Sale)	4%		118	Sales Commission and Expenses	4%

Continued on next page

Exhibit 59 (Continued)

Continued from previous page

LDEVOne.xlt			Peiser and Schwanke's		
Description	**Input**	*	**Row**	**Description**	**Value**
Construction Financing					
Interest Rate	10.5%		54	Rate	10.5%
Lender's Fees	1%		60	Construction Loan Points	1.0%
Permanent Financing					
Preferred Loan to Value Ratio	65.59246%	5			
Interest Rate	10.5%		90	Interest Rate	10.5%
Term of Loan	30 years		91	Term	30 years
Preferred Debt Coverage Ratio	1.25		92	Debt Coverage Ratio	1.25
Lender's Fees	2.5%	2	59	Mortgage Broker	1.0%
			61	Permanent Loan Points	1.0%
			62	Attorney Fees	0.5%
Other Input					
Time for Construction	12		54	Months	12
Project Holding Period	7		85	Years of Analysis	7
Capitalization Rate	9%		115	Capitalization Rate at Sale	9.0%
General Discount Rate	20%		84	NPV Discount Rate	20%
Venture					
Developer's Investment	$1,423,901		88	Equity	$1,423,901
On Cash Flow Schedule Sheet					
Vacancy Year 1	45.65%		133	Vacancy Rate	46.69%
Vacancy Year 2	4.89%		106	Vacancy Rate	5.00%
On Venture Summary Sheet					
Development Fee - NET	0.00%	3			

Note:
1, 2. Calculated value
3. Facts from the proforma
4, 5. Justified value to fit the reference's proforma contents

Soft cost (shade#1) was justified by using a summation of professional service and financing fees in the referenced case. A permanent financing fee in the proforma was a summation of Peiser and Schwanke's permanent financing related items (shade#2). Stabilized year input (shade#3) was assumed directly from the facts presented in the source proforma. The development fee was carefully justified because the fee assumed in the source proforma was a percentage of total hard cost alone. However, the fee applied in the subject model has to be a percentage of every cost involved. A justified development fee of 3.926077% (shade#4) was formulated to achieve the same development fee amount of $239,235 presented in the proforma. Finally, as preferred loan-to-value ratio was absent in the reference, a value of 65.59246% (shade#5) was assumed for *LDEVOne* to reach the same permanent financing level of $5,224,387.

After these input variables were applied in place, total development cost is the first output to be verified. Exhibit 60 verifies total development cost outputs produced by the *LDEVOne* proforma in comparison to the figures produced by the referenced proforma.

Exhibit 60

Verification of LDEVOne's Output: Total Development Cost

by Using Multifamily Residential Development Case Proforma

LDEVOne.xlt		Peiser and Schwanke's		
Descriptions	Outputs	Descriptions	References	
			Original	Calculated
		Land Cost	502,791	
		Land Carry (12%, 3 Months)	15,084	
Land Cost	$552,875	Approval Fees and Startup Costs	35,000	$552,875
Hard Cost	$4,669,700	Hard Cost		$4,669,700
		Architecture	20,000	
		Engineering and Appraisal	35,000	
		Furnishing	10,000	
		Marketing	45,000	
		Professional Fees	5,000	
		Construction Financing: Miscellaneous	5,000	
		Title Insurance	29,352	
		Liability Insurance	10,000	
		Property Taxes During Construction	10,000	
Soft Cost (excld. loan costs)	$172,352	Audit Cost	3,000	$172,352
		Construction Loan Interest	365,707	
Const. Loan Fee and Int. Allowance	$417,951	Construction Loan Fee	52,244	$417,951
		Mortgage Broker	52,244	
		Permanent Loan Points	52,244	
Permanent Loan Fee Allowance	$130,610	Attorney Fees	26,122	$130,610
Development Fee	$239,235	Development Fee		$239,235
Additional Cost/Adjustment	$150,000	Contigency ($10,000 rounded up)		$150,000
Total Development Cost	**$6,332,723**	**Total Capital Cost**		**$6,332,723**

Following the verification of total development cost outputs was a validation of cash flow projection. In the first run, two series of effective gross income (EGI) produced by the subject and the referenced proforma did not agree. This was because the annual vacancy assumptions were different between the two proformas. *LDEVOne* was developed based on the assumption that annual vacancy is accounted in every income category. However, the referenced proforma does not apply vacancy rate to "other income" category. Exhibit 61 presents the different effective gross income outputs due to inconsistent assumptions.

In order to continue with the process, effective gross income outputs must be validated separately. The validation of effective gross income outputs was verified by comparing results produced by the *LDEVOne* with a series of the income derived by manual calculations. This verification is presented in Exhibit 62 on page 131.

The next step in the validation process was to assume justified vacancy rates, which leveled *LDEVOne's* effective income outputs with those presented in the reference. A list of these justified rates is presented in Exhibit 63 on page 131. Without any further justification, the subject proforma was verified with similar outputs from the referenced case. Verifications of the subject proforma's outputs are presented in a series of tables. Exhibit 64, Exhibit 65, Exhibit 66, and Exhibit 67 respectively present verifications of effective gross income outputs, before-tax cash flow from operation outputs, a before-tax cash flow from disposition output, and return on investment outputs.

Exhibit 61

Comparison of Effective Gross Income Outputs by Using

Multifamily Residential Development Case Proforma – a Difference due to Assumptions

LDEVOne.xlt	Year 1	2	3	4	5	6	7
1 Rental Income	$1,100,823	$1,144,856	$1,190,651	$1,238,277	$1,287,808	$1,339,320	$1,392,893
2 Other Income	25,000	26,000	27,040	28,122	29,246	30,416	31,633
3 Potential Gross Income	1,125,823	1,170,856	1,217,691	1,266,398	1,317,054	1,369,736	1,424,526
Vacancy Rate	46.69%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
4 Vacancy	(525,647)	(58,543)	(60,885)	(63,320)	(65,853)	(68,487)	(71,226)
5 Effective Gross Income	$600,176	$1,112,313	$1,156,806	$1,203,078	$1,251,201	$1,301,249	$1,353,299

Peiser and Schwanke's	Year 1	2	3	4	5	6	7
1 Gross Rent	$1,100,823	$1,144,856	$1,190,651	$1,238,277	$1,287,808	$1,339,320	$1,392,893
Vacancy Rate	46.69%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
4 Vacancy	(513,974)	(57,243)	(59,533)	(61,914)	(64,390)	(66,966)	(69,645)
3 Adjusted Gross Income	$586,849	$1,087,613	$1,131,118	$1,176,363	$1,223,417	$1,272,354	$1,323,248
2 Other Income	25,000	26,000	27,040	28,122	29,246	30,416	31,633
5 Total Revenue	$611,849	$1,113,613	$1,158,158	$1,204,484	$1,252,664	$1,302,770	$1,354,881

Exhibit 62

Validation of LDEVOne's Effective Gross Income Outputs by Using

Multifamily Residential Development Case Proforma

LDEVOne.xlt	Year						
	1	2	3	4	5	6	7
1 Potential Gross Income	$1,125,823	$1,170,856	$1,217,691	$1,266,398	$1,317,054	$1,369,736	$1,424,526
2 Vacancy Rate	46.69%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Vacancy	(525,647)	(58,543)	(60,885)	(63,320)	(65,853)	(68,487)	(71,226)
3 Effective Gross Income (Output)	$600,176	$1,112,313	$1,156,806	$1,203,078	$1,251,201	$1,301,249	$1,353,299
Manual Calculations	Year						
	1	2	3	4	5	6	7
1 Potential Gross Income (PGI)	$1,125,823	$1,170,856	$1,217,691	$1,266,398	$1,317,054	$1,369,736	$1,424,526
2 Vacancy Rate	46.69%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
- Vacancy (PGI x Vac Rate)	(525,647)	(58,543)	(60,885)	(63,320)	(65,853)	(68,487)	(71,226)
3 Effective Gross Income (PGI - Vacancy)	$600,176	$1,112,313	$1,156,806	$1,203,078	$1,251,201	$1,301,249	$1,353,299

Exhibit 63

LDEVOne (Justified) Vacancy Inputs and Reference from Multifamily Residential Development Case Proforma

LDEVOne.xlt		Peiser and Schwanke's		
Description	Input *	Row	Description	Value
On Cash Flow Schedule Sheet				
Vacancy Year 1	45.6532033%	133	Vacancy Rate	46.69%
Vacancy Year 2	4.8889701%	106	Vacancy Rate	5.00%

Exhibit 64

Verification of LDEVOne's Outputs: Effective Gross Income Comparison (with Justified Vacancy Rates)

by Using Multifamily Residential Development Case Proforma

LDEVOne.xlt	Year						
	1	2	3	4	5	6	7
1 Rental Income	$1,100,823	$1,144,856	$1,190,651	$1,238,277	$1,287,808	$1,339,320	$1,392,893
2 Other Income	25,000	26,000	27,040	28,122	29,246	30,416	31,633
3 Potential Gross Income	1,125,823	1,170,856	1,217,691	1,266,398	1,317,054	1,369,736	1,424,526
Vacancy Rate	45.65%	4.89%	4.89%	4.89%	4.89%	4.89%	4.89%
4 Vacancy	(513,974)	(57,243)	(59,533)	(61,914)	(64,390)	(66,966)	(69,645)
5 Effective Gross Income	$611,849	$1,113,613	$1,158,158	$1,204,484	$1,252,664	$1,302,770	$1,354,881

Peiser and Schwanke's	Year						
	1	2	3	4	5	6	7
1 Gross Rent	$1,100,823	$1,144,856	$1,190,651	$1,238,277	$1,287,808	$1,339,320	$1,392,893
Vacancy Rate	46.69%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
4 Vacancy	(513,974)	(57,243)	(59,533)	(61,914)	(64,390)	(66,966)	(69,645)
3 Adjusted Gross Income	$586,849	$1,087,613	$1,131,118	$1,176,363	$1,223,417	$1,272,354	$1,323,248
2 Other Income	25,000	26,000	27,040	28,122	29,246	30,416	31,633
5 Total Revenue	$611,849	$1,113,613	$1,158,158	$1,204,484	$1,252,664	$1,302,770	$1,354,881

Exhibit 65

Verification of LDEVOne's Outputs: Before-Tax Cash Flow from Operations (with Justified Vacancy Rates)

by Using Multifamily Residential Development Case Proforma

LDEVOne.xlt	Year						
	1	2	3	4	5	6	7
5 Effective Gross Income	$611,849	$1,113,613	$1,158,158	$1,204,484	$1,252,664	$1,302,770	$1,354,881
Exp. per Collectible Inc.	-	-	-	-	-	-	-
Annual Overhead	(64,800)	(67,392)	(70,088)	(72,891)	(75,807)	(78,839)	(81,993)
Expenses per Building SF	(289,139)	(300,705)	(312,733)	(325,243)	(338,252)	(351,782)	(365,854)
6 Total Operating Expense	($353,939)	($368,097)	($382,821)	($398,134)	($414,059)	($430,621)	($447,846)
7 Net Operating Income	$257,910	$745,517	$775,337	$806,351	$838,605	$872,149	$907,035
8 Annual Debt Service	(573,474)	(573,474)	(573,474)	(573,474)	(573,474)	(573,474)	(573,474)
PMM Debt Service	-	-	-	-	-	-	-
Developer and Working Loan Interest	-	-	-	-	-	-	-
Replacement Reserve	-	-	-	-	-	-	-
9 Before-Tax Cash Flow	($315,565)	$172,042	$201,863	$232,876	$265,130	$298,675	$333,561
10 Working Loan Required	315,565	-	-	-	-	-	-
11 Developer and Working Loan Repayment	-	(172,042)	(143,522)	-	-	-	-
12 Developer's Incentive	-	-	-	-	-	-	-
13 Total BTCF (Operations) for Distribution	$-	$-	$58,340	$232,876	$265,130	$298,675	$333,561

Peiser and Schwanke's	Year						
	1	2	3	4	5	6	7
5 Total Revenue	$611,849	$1,113,613	$1,158,158	$1,204,484	$1,252,664	$1,302,770	$1,354,881
Operating Expenses	(353,939)	(368,097)	(382,821)	(398,134)	(414,059)	(430,621)	(447,846)
Other Expenses	-	-	-	-	-	-	-
6 Total Expenses	($353,939)	($368,097)	($382,821)	($398,134)	($414,059)	($430,621)	($447,846)
7 Net Operating Income	$257,910	$745,517	$775,337	$806,351	$838,605	$872,149	$907,035
8 Annual Debt Service	(573,474)	(573,474)	(573,474)	(573,474)	(573,474)	(573,474)	(573,474)
Reserve During Lease-Up	315,565	-	-	-	-	-	-
9 Total Before Tax Cash Flow	$-	$172,042	$201,863	$232,876	$265,130	$298,675	$333,561

Exhibit 66

Verification of LDEVOne's Outputs: Before-Tax Cash Flow from Disposition (with Justified Vacancy Rates)

by Using Multifamily Residential Development Case Proforma

LDEVOne.xlt	Year						
	1	2	3	4	5	6	7
14 Sales Revenue							$10,481,291
15 Disposition Expenses							(419,252)
16 Net Disposition Income							$10,062,040
17 Balance: Permanent Loan							(4,968,411)
Balance: Private Money Mortgage							-
Before-Tax Cash Flow							$5,093,628
Balance: Other Loans							-
18 Total BTCF (Disposition) for Distribution							$5,093,628

Peiser and Schwanke's	Year						
	1	2	3	4	5	6	7
14 Sales Price							$10,481,291
15 Commission							(419,252)
16 Adjusted Sales Price							$10,062,040
17 Mortgage Balance							(4,968,411)
18 Total Cash Flow from Sale before Tax							$5,093,628

Exhibit 67

Verification of LDEVOne's Outputs: Returns on Investment (with Justified Vacancy Rates)

by Using Multifamily Residential Development Case Proforma

LDEVOne.xlt	Year 0	1	2	3	4	5	6	7
Investment	($1,108,336)							
Developer's Loan	-							
Development Fee - NET	-							
Other Fee(s) and Adjustment(s) - NE	n/a							
19 Total Capital Budget	($1,108,336)							
13 Distributed Cash Flow (from Operation)		-	-	58,340	232,876	265,130	298,675	333,561
18 Distributed Cash Flow (from Disposition)		-	-	-	-	-	-	5,093,628
Distributed Cash Flow		$-	$-	$58,340	$232,876	$265,130	$298,675	$5,427,189
10 Loan		(315,565)	-	-	-	-	-	-
11 Interest / Repayment		-	172,042	143,522	-	-	-	-
12 Incentive Fees		-	-	-	-	-	-	-
Other Fee(s) and Adjustment(s)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
20 Total Cash Flow	($1,108,336)	($315,565)	$172,042	$201,863	$232,876	$265,130	$298,675	$5,427,189
			23	**Before Tax Internal Rate of Return**			**28.678%**	
			24	**Net Present Value @ 20 %**			**$698,495**	

Peiser and Schwanke's	Year 0	1	2	3	4	5	6	7
19 Equity	($1,108,336)	($315,565)						
13 Annual Cash Flows	-	-	172,042	201,863	232,876	265,130	298,675	333,561
18 Cash Flow from Sale	-	-	-	-	-	-	-	5,093,628
20 Total Before Tax Cash Flows	($1,108,336)	($315,565)	$172,042	$201,863	$232,876	$265,130	$298,675	$5,427,189
			23	**Before Tax Internal Rate of Return**			**28.678%**	
			24	**Net Present Value @ 20 %**			**$698,495**	

The results of the two preceding validations indicate that *LDEVOne* proforma is capable of producing reliable supporting projections for income-producing real estate development feasibility assessments and risk analyses. However, real estate markets are dynamic and inefficient, which makes speculating data forms and units difficult. Although *LDEVOne* proforma is flexible to enough to overcome many commonly known assumptions, the possibility of facing an unsupported assumption still exists. Users still need to use their expertise and judgment to justify the information factors and make the figures compatible with the proforma.

As illustrated in Exhibit 27 (Conceptual System Integration), *DSSVenture*'s computation depends entirely on *LDEVOne* logic model. For this reason, when the proforma is validated, the validity of *LDEVOne* system's computability is assumed.

Validation of the Interface

As proposed in the Methodology section, validation of the interface utilized the same approach as that of the previous validation, *Through the Output*. A verification of data-interchange was divided into two parts of interface data input and interface data output. Accuracy of the interface data input was verified by comparing a set of manual input variables in the system interfaces with their corresponding input variables in *LDEVOne*. In addition, for the interface data output, the accuracy was verified by comparing a set of *LDEVOne*'s automatically generated output variables with their corresponding outputs presented in the system's interface. Each screen was validated individually by using development variables from Peiser and Schwanke's *Multifamily Residential Development* case study (1992, p. 137-40).

The study results indicate that *DSSVenture*'s user interfaces are capable of linking accurate data between users and the logic system as all input and output variables are correspondingly verified for screens in each category, namely development cost, operation, financing, and development-venture scenario. The codes that connect the user interfaces with the logic models are also validated accordingly. As supporting evidences, data input typed in the interfaces and their linked inputs in the *LDEVOne* as well as data outputs produced by the proforma and their linked outputs in the system interface are summarized in a series of tables in Appendix N. A series of user interface screen captures and their corresponding *LDEVOne* worksheets are also attached at the end of the Appendix N.

Testing

As previously described in the Methodology section, the research's goal of facilitation was tested using three operational hypotheses. The general and test hypotheses are restated below:

- General Hypothesis. The proposed prototype *DSSVenture* will significantly facilitate developer's decisions in scenario selection during the predevelopment stage of income-producing real estate development.
    - Hypothesis One. *DSSVenture*-assisted users will be able to consider a greater number of development alternatives than non-*DSSVenture*-assisted users.
    - Hypothesis Two. *DSSVenture*-assisted users will take less time to select a development alternative than non-*DSSVenture*-assisted users.

- Hypothesis Three. Variance in profit projection among *DSSVenture*-assisted users will be lower than that among non-*DSSVenture*-assisted users.

The testing was conducted in Langford Architecture Center's computer laboratory (Landford-A119). The *DSSVenture* program was installed and tested on 31 computer systems on March 29, 2004. All experimenting system setups were equipped with a two-gigahertz *Intel's Pentium-IV* processor with a 512-megabytes memory. Details of these systems are attached in Appendix O. An introductory session was conducted on March 30, 2004. The testing process started with a recapitulated lecture on feasibility analysis and venture structure. The session was subsequently followed by a hands-on demonstration of the subject program, using a case study as a model for explanation (Appendix A). The evaluation experiment was conducted during the following class session (April 1, 2004). Twenty-one graduate students from the Land and Real Estate Development program participated in the study by completing two case studies (Appendix B and C) and two corresponding research surveys (Appendix F). Although the two case studies selected for the experiment are equally compatible in work amount, there might be some differences in the nature of the cases. While case study A relates to feasibility analyses and risk assessments of a multi-family residential development project, case study B refers to development of an academic building for a single tenant with a long-term lease contract.

The twenty-one participants were randomly divided into two groups, the control and the experiment groups. Half of the subjects in each group were randomly assigned to the case A-then-B experiment scheme, while the other half of each group were assigned to the case B-then-A experiment scheme in order to minimize impacts caused by differences on the case studies' nature. As presented in the Methodology, in the pre-test observation, participants in the control group had access to *DSSVenture* system, while those in the experiment group had access to the *LDEVOne*. All subjects had access to *DSSVenture* during the post-test observation.

Since participation was on a voluntary basis, only nineteen survey responses were submitted. In addition, because the study was intended to compare each individual's response regarding pre- and post-test decision experience, a valid individual's record required two survey responses. One pre-test survey paper was found completely unanswered. For this reason, only eighteen subjects are qualified. Information collected from these surveys establishes the data set for research analyses (Appendix P).

The data set comprises ten survey responses from the control group and eight survey responses from the experiment group. These qualified subjects along with their corresponding pre-organized case sequences and required decision support tools are summarized in Exhibit 68.

Exhibit 68

Qualified Subjects' Surveys and Their Corresponding Case Studies, and Tools

Groups	Subject IDs	Case Studies: Tools	
		Pre-Test	Post Test
Control	153	B: DSSVenture	A: DSSVenture
	252	A: DSSVenture	B: DSSVenture
	291	B: DSSVenture	A: DSSVenture
	338	B: DSSVenture	A: DSSVenture
	649	A: DSSVenture	B: DSSVenture
	675	B: DSSVenture	A: DSSVenture
	760	B: DSSVenture	A: DSSVenture
	800	A: DSSVenture	B: DSSVenture
	834	B: DSSVenture	A: DSSVenture
	963	A: DSSVenture	B: DSSVenture
Experiment	ETM	A: LDEVOne	B: DSSVenture
	JAF	A: LDEVOne	B: DSSVenture
	MHJ	B: LDEVOne	A: DSSVenture
	PKF	B: LDEVOne	A: DSSVenture
	REJ	A: LDEVOne	B: DSSVenture
	SAH	B: LDEVOne	A: DSSVenture
	YEH	A: LDEVOne	B: DSSVenture
	ZVX	B: LDEVOne	A: DSSVenture

Legends: Case-A-then-B Group
Case-B-then-A Group

The experiment uses inferential statistics to draw conclusions about the entire population based on the sampling data. Therefore, it is important to understand general demographic characteristics of the participants. According to the survey, fifty percent of these subjects had educational background in North America, while the rest were educated in Asia (Exhibit 69). While finance, economics, and construction were reportedly familiar practices among participants, architectural practice was reportedly the most comfortable. A bar chart in Exhibit 70 illustrates average subjects' skills by discipline. The scale of zero to five indicates average comfort level respectively from the lowest (zero) to highest (five). A summary of raw data collected from the data set is attached in Appendix P for further cross-examination of demographic and results.

Exhibit 69

Demographic by Region of Educational Background

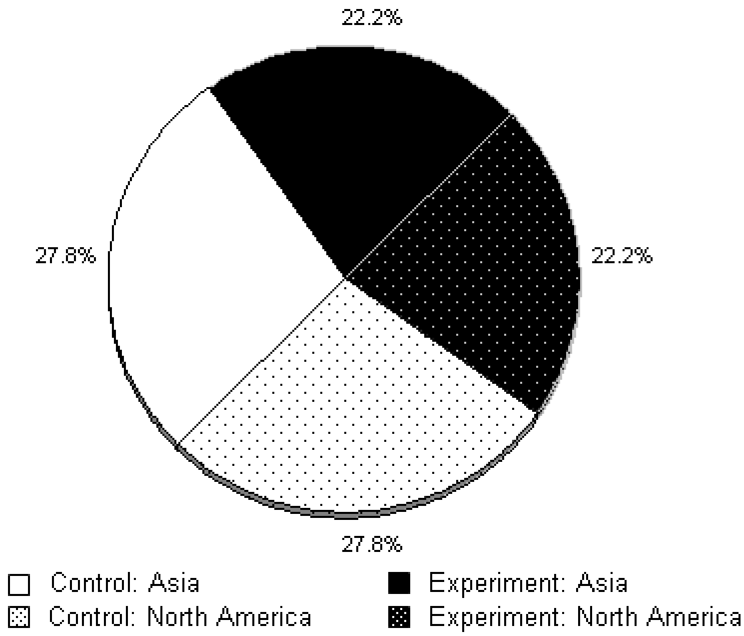
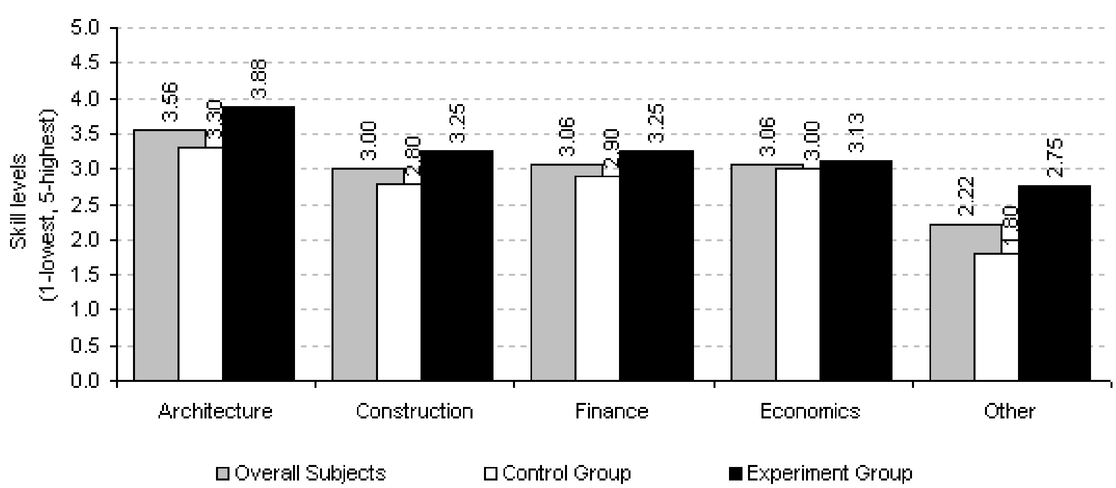


Exhibit 70

Demographic by Skills



Hypothesis One (Number-of-Alternatives-Examined Test)

The results of this study indicate that, decision makers assisted by *DSSVenture* system are able to initiate and examine significantly more alternatives than those not assisted by the system. Based on a sample size of ten participants in the control group and eight participants in the experiment group, pre-test survey results indicate a mean number of alternatives examined of 5.3 scenarios (with assistance of *DSSVenture*), and 3.8 scenarios (without assistance of *DSSVenture*). When all users had access to the subject system in the post-test experiment, the survey results point to increases in the mean number of alternatives examined to 6.0 scenarios and 7.6 scenarios for the control and the experiment groups respectively. These figures represent a 13.2% increase in average number of alternatives examined by subjects in the control group utilizing *DSSVenture* system in both experiments. In comparison, this represents a 103.2% increase for the control group (those going from manual *LDEVOne* to full *DSSVenture* system). Individuals' changes in number of alternatives examined are summarized and presented in Exhibit 71. Exhibit 72 illustrates changes in the mean number of alternatives examined.

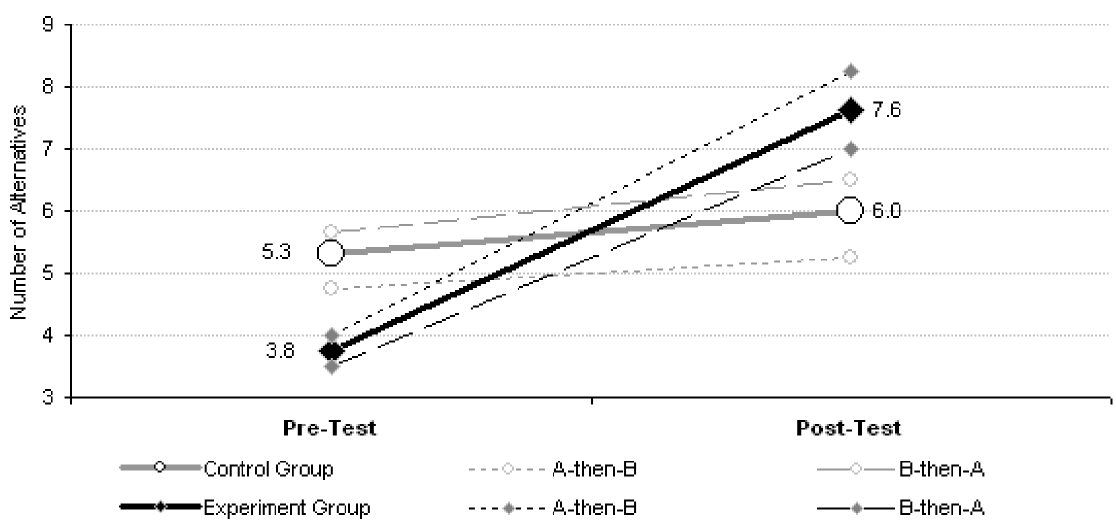
Exhibit 71

Number-of-Alternatives-Examined Table – All Subjects

Group	Subject ID	No. of Alternatives Examined		
		Pre-Test	Post-Test	Change
Control	153	5	8	**3**
10 subjects	252	4	7	**3**
	291	6	6	-
	338	6	8	**2**
	649	7	6	**(1)**
	675	5	5	-
	760	4	4	-
	800	5	4	**(1)**
	834	8	8	-
	963	3	4	**1**
	Mean	**5.30**	**6.00**	**13.2%**
Experiment	ETM	4	7	**3**
8 subjects	JAF	2	8	**6**
	MHJ	4	7	**3**
	PKF	4	5	**1**
	REJ	8	14	**6**
	SAH	4	8	**4**
	YEH	2	4	**2**
	ZVX	2	8	**6**
	Mean	**3.75**	**7.63**	**103.3%**

Exhibit 72

Changes in Mean Number of Alternatives Examined



The increase in mean number of alternatives examined for the control group between the two experiments is plausible. There was an expected maturation effect revealed by the experience in previous decision contexts. Although the case studies used in both experiments were not the same, common development decisions related to project's feasibility and risk assessment were similar. Due to the experience from the first session, these participants were expected to become more aware of key issues that could affect project feasibility. This could explain the 13.2% increase for the control group. Therefore, a 90.0% (103.2% - 13.2%) difference in mean number- of-alternatives-examined was a potential credit of the subject system.

In order to determine if the increase is statistically significant, a pool *t*-test was conducted by using *Microsoft Excel*®'s data analysis feature. The test was run to find out whether the null hypothesis[7] (μ_{control} - $\mu_{\text{experiment}} \geq D_0$) could be rejected. The null hypothesis would be rejected if the *t*-statistic value is equal to or smaller than the negative *t*-critical value of (t-statistic $\leq -t_{\alpha\ 0.05}$).

Exhibit 73 presents a summary table of the pool *t*-test. It indicates a *t*-statistic of −3.9064, which is less than the negative *t*-critical value of 1.7459 for a 95% confidence level. The level of significance *p*-value is reported at 0.0006. Therefore, the null hypothesis was rejected. This indicates a significant difference in number of alternatives examined.

[7] Changes in the mean number of alternatives examined in the experiment group are not more than those in the control group.

Exhibit 73

Changes in Mean Number of Alternatives Examined – All Subjects

Pool *t*-Test (α = 0.05)		
	Control	*Experiment*
Mean	0.7000	3.8750
Variance	2.2333	3.8393
Observations	10	8
Pooled Variance	2.93594	
Hypothesized Mean Difference	0	
df	16	
t Stat	**-3.9064**	
P(T<=t) one-tail	**0.0006**	
t Critical one-tail	**1.7459**	

Additional analyses were conducted to examine whether a change in case sequence had impacts on the decision experience. Results of both subexperiment groups resembled those of the entire sample set. Exhibit 74 displays the data set of survey results organized by case-sequence subexperiment group. Exhibit 72 on page 143 illustrates results of the case-A-then-B, and the case-B-then-A groups in dotted and dashed line respectively.

Exhibit 74

Number-of-Alternatives-Examined Table – Subexperiment Groups

Case A-then-B				
Group	Subject ID	No. of Alternatives Examined		
		Pre-Test	Post-Test	Change
Control	252	4	7	**3**
4 subjects	649	7	6	**(1)**
	800	5	4	**(1)**
	963	3	4	**1**
	Mean	**4.75**	**5.25**	**10.5%**
Experiment	ETM	4	7	**3**
4 subjects	JAF	2	8	**6**
	REJ	8	14	**6**
	YEH	2	4	**2**
	Mean	**4.00**	**8.25**	**106.3%**

Case B-then-A				
Group	Subject ID	No. of Alternatives Examined		
		Pre-Test	Post-Test	Change
Control	153	5	8	**3**
6 subjects	291	6	6	-
	338	6	8	**2**
	675	5	5	-
	760	4	4	-
	834	8	8	-
	Mean	**5.67**	**6.50**	**14.7%**
Experiment	MHJ	4	7	**3**
4 subjects	PKF	4	5	**1**
	SAH	4	8	**4**
	ZVX	2	8	**6**
	Mean	**3.50**	**7.00**	**100.0%**

Based on a sample set of four participants in the control group and four participants in the experiment group, survey results from the case-A-the-B sub group respectively represent a 10.5% and a 106.3% increases in mean number of alternatives examined. Accordingly, this result indicates a t-statistic value of -2.6656, which is less than the negative t-critical value of 1.9432 for a 95% confidence level. The level of significance p-value is reported at 0.0186. Therefore, the null hypothesis was rejected for the case-A-then-B group. On the other side, based on six control and four experiment participants in the case B-then-A sub group, the survey results respectively indicate a 14.7% and a 100.0% increase in mean number of alternatives examined. For the case B-then-A group, the null hypothesis was also rejected because this statistic result indicates a *t*-statistic value of −2.5007, which is less than the negative *t*-critical value of 1.8595 (95% confidence level). The level of significance *p*-value is reported at 0.0185. Pool *t*-test statistics for both subexperiment groups are summarized in Exhibit 75.

Exhibit 75

Changes in Mean Number of Alternatives Examined – Subexperiment Groups

Case A-then-B Pool *t*-Test (α = 0.05)		
	Control	*Experiment*
Mean	0.5000	4.2500
Variance	3.6667	4.2500
Observations	4	4
Pooled Variance	3.95833	
Hypothesized Mean Difference	0	
df	6	
t Stat	**-2.6656**	
P(T<=t) one-tail	**0.0186**	
t Critical one-tail	**1.9432**	

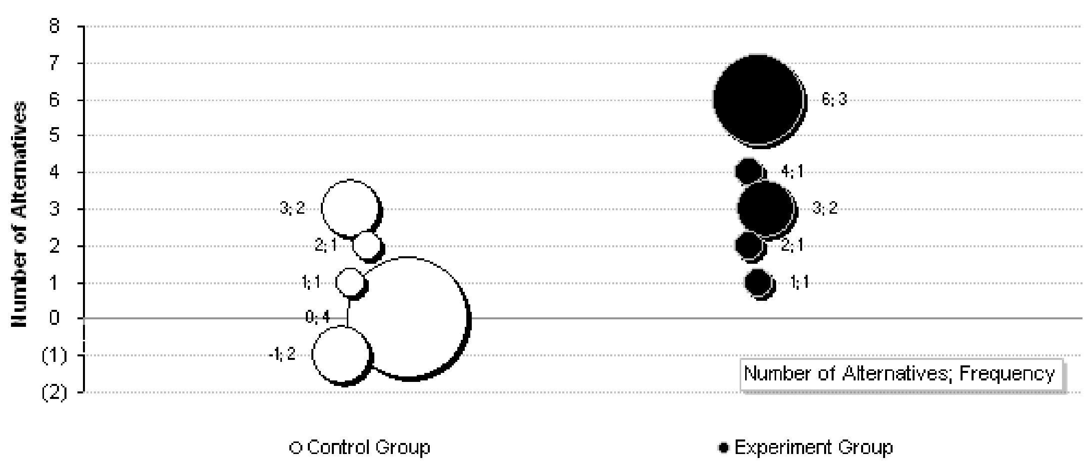
Case B-then-A Pool *t*-Test (α = 0.05)		
	Control	*Experiment*
Mean	0.8333	3.5000
Variance	1.7667	4.3333
Observations	6	4
Pooled Variance	2.72917	
Hypothesized Mean Difference	0	
df	8	
t Stat	**-2.5007**	
P(T<=t) one-tail	**0.0185**	
t Critical one-tail	**1.8595**	

As supporting evidence for the conclusion, a bubble diagram in Exhibit 76 on illustrates distribution of individials' changes in number of alternatives examined during the pre- and post-test experiments. The bubble's diameter represents frequency of subjects in the data point.

Based on the above analyses, these survey results suggested that, regardless of the case's nature, *DSSVenture* does significantly enhance comprehensiveness of the decision context. Decision makers with assistance of the system are able to initiate and examine significantly more alternatives than those without assistance of the subject system, regardless of situations' difficulty. However, the results also suggested that the degree of statistical significance varied from case to case.

Exhibit 76

Distribution and Frequency of Changes in Number of Alternatives Examined



Hypothesis Two (Time-to-Reach-Decisions Test)

The result of this study indicate that decision makers with assistance of *DSSVenture* system are able to reach a decision in significantly less time than those without assistance of the system. Based on the data set, the pre-test survey results indicate that participants spent average time of 91.0 minutes (control group) and 88.1 minutes (experiment group) to reach a decision. When all users had access to the subject system in the post-test experiment, the survey results indicate decreases in mean time to reach decisions to 86.5 minutes, and 61.3 minutes respectively for the control, and the experiment groups. This statistics represents a 4.9% decrease in mean time to reach decisions of the control subjects who utilized *DSSVenture* system in both experiments. In comparison, the statistics represents a 30.5% decrease in mean time to reach decisions of the experiment subjects who shifted from using *LDEVOne* to *DSSVenture* system. The time test is graphically presented in Exhibit 78.

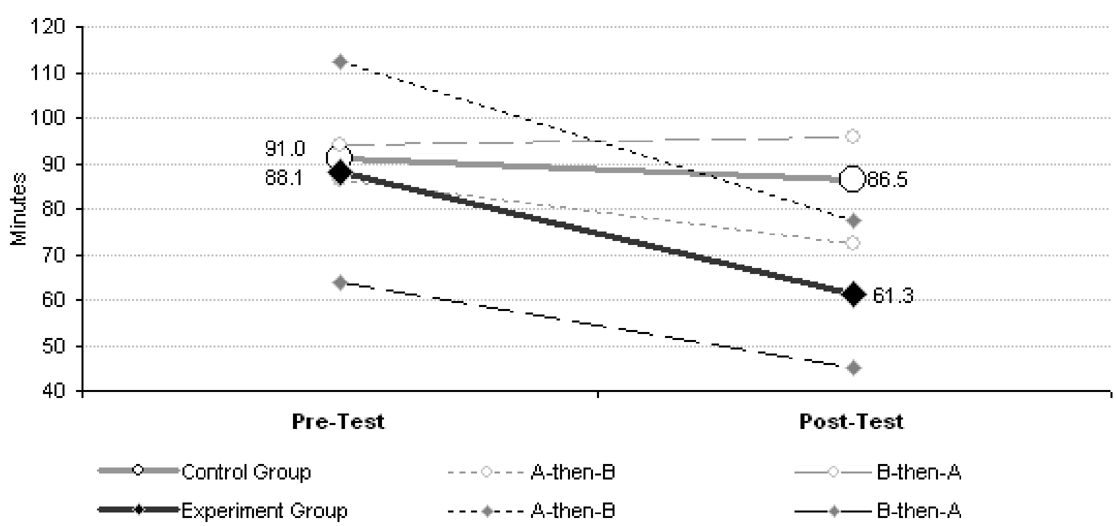
Exhibit 77

Time-to-Reach-Decisions Table – All Subjects

Group	Subject ID	Minutes		
		Pre-Test	Post-Test	Change
Control	153	60	45	(15)
10 subjects	252	15	20	5
	291	70	80	10
	338	90	90	-
	649	120	110	(10)
	675	75	90	15
	760	120	120	-
	800	165	120	(45)
	834	150	150	-
	963	45	40	(5)
	Mean	**91.00**	**86.50**	**-4.9%**
Experiment	ETM	135	70	(65)
8 subjects	JAF	135	105	(30)
	MHJ	90	60	(30)
	PKF	40	30	(10)
	REJ	90	45	(45)
	SAH	45	30	(15)
	YEH	90	90	-
	ZVX	80	60	(20)
	Mean	**88.13**	**61.25**	**-30.5%**

Exhibit 78

Changes in Mean Time to Reach Decisions



A plausible reason for the control group's decreased mean time to reach decisions in the two experiments can be explained by a maturation effect resulting from increased efficiency. For these participants, the post-test experiment was the second feasibility and risk analysis utilizing the same decision support tool. Although the case was different, participants were expected to be more familiar with the *DSSVenture* system. Therefore, efficiency in using the tool must have improved. This could explain the 4.9% decrease in mean time to reach decisions for the control group. Therefore, a 25.9% (30.5% - 4.9%) difference in mean time to reach decisions decrease can be attributed to the *DSSVenture* system.

To determine if the decrease is statistically significant, a pool *t*-test was conducted. The test was aimed to examine whether the null hypothesis[8] (μ_{control} - $\mu_{\text{experiment}} \leq D_0$) could be rejected. The null hypothesis will be rejected if the *t*-statistic value is equal to or higher than the *t*-critical value of (*t*-statistic $\geq t_{\alpha\ 0.05}$).

Exhibit 79 below presents a summary table of the pool *t*-test. It indicates a *t*-statistic of 2.5397, which is greater than the *t*-critical value of 1.7459 for a 95% confidence level. The level of significance *p*-value is reported at 0.0109. Therefore, the null hypothesis was rejected. This indicates a significant difference in time to reach decisions.

[8] Null Hypothesis Two: Changes the mean time to reach decisions in the experiment group are not more than in the control group.

Exhibit 79

Changes in Mean Time to Reach Decisions – All Subjects

Pool *t*-Test (α = 0.05)		
	Control	*Experiment*
Mean	-4.5000	-26.8750
Variance	280.2778	428.1250
Observations	10	8
Pooled Variance	344.96094	
Hypothesized Mean Difference	0	
df	16	
t Stat	**2.5397**	
P(T<=t) one-tail	**0.0109**	
t Critical one-tail	**1.7459**	

The same data analyses were conducted to examine whether a change in case sequence had impacts on the decision experience. Exhibit 78 on page 150 illustrates results from case-A-then-B, and case-B-then-A groups in dotted and dashed lines respectively. The results from both subexperiment groups resembled those concluded from the entire data set. Further details are reported below.

Exhibit 80

Time-to-Reach-Decisions Table – Subexperiment Groups

Case A-then-B				
Group	Subject ID	Minutes		
		Pre-Test	Post-Test	Change
Control	252	15	20	5
4 subjects	649	120	110	(10)
	800	165	120	(45)
	963	45	40	(5)
	Mean	**86.25**	**72.50**	**-15.9%**
Experiment	ETM	135	70	(65)
4 subjects	JAF	135	105	(30)
	REJ	90	45	(45)
	YEH	90	90	-
	Mean	**112.50**	**77.50**	**-31.1%**

Case B-then-A				
Group	Subject ID	Minutes		
		Pre-Test	Post-Test	Change
Control	153	60	45	(15)
6 subjects	291	70	80	10
	338	90	90	-
	675	75	90	15
	760	120	120	-
	834	150	150	-
	Mean	**94.17**	**95.83**	**1.8%**
Experiment	MHJ	90	60	(30)
4 subjects	PKF	40	30	(10)
	SAH	45	30	(15)
	ZVX	80	60	(20)
	Mean	**63.75**	**45.00**	**-29.4%**

For the case-A-the-B group, the survey results indicate a 15.9% and a 31.1% decreases in mean time to reach decisions of the control participants and the experiment participants, respectively. As presented in Exhibit 81, with 95% confidence interval, the *t*-statistic and the *t*-critical value are reported at 1.2153 versus 1.9432. In this case, the t-statistic is less than the critical value. Therefore, this study cannot reject the null hypothesis A-then-B subexperiment group. However, for the case-B-the-A group, the survey results revealed a 1.8% increase and a 29.4% decrease in mean time to reach decisions. With 95% confidence interval, the *t*-statistic was reported at 3.2621, which is greater than the *t*-critical values of 1.8595. Hence, the null hypothesis was rejected for the case-B-then-A group.

Exhibit 81

Changes in Mean Time to Reach Decisions – Subexperiment Groups

Case A-then-B Pool *t*-Test (α = 0.05)		
	Control	*Experiment*
Mean	-13.7500	-35.0000
Variance	472.9167	750.0000
Observations	4	4
Pooled Variance	611.45833	
Hypothesized Mean Difference	0	
df	6	
t Stat	**1.2153**	
P(T<=t) one-tail	**0.1349**	
t Critical one-tail	**1.9432**	

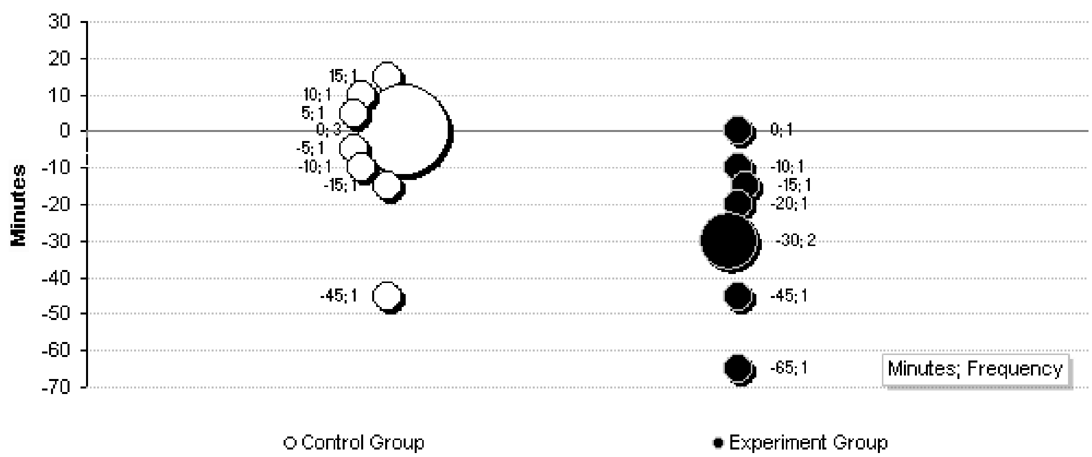
Case B-then-A Pool *t*-Test (α = 0.05)		
	Control	*Experiment*
Mean	1.6667	-18.7500
Variance	106.6667	72.9167
Observations	6	4
Pooled Variance	94.01042	
Hypothesized Mean Difference	0	
df	8	
t Stat	**3.2621**	
P(T<=t) one-tail	**0.0057**	
t Critical one-tail	**1.8595**	

According to the results reported above, it can be seen that, in general, decision-makers with assistance of *DSSVenture* system are able to reach a decision in significantly less time than those without assistance of the system. However, because one case sequence can prove significance in time to reach decisions while the other cannot, these changes in case studies' nature influenced the variable. In other word, with assistance of *DSSVenture*, developers' time to reach decisions can be decreased. However, the amount of time reduced may vary according to the difficulty of the project examined.

In order to offer a supporting evidence for the conclusion, Exhibit 82 depicts distributions of individuals' changes in time to reach decisions by experiment groups. The diameter of a bubble represents frequency of subjects in the data point.

Exhibit 82

Distribution and Frequency of Changes in Time to Reach Decisions



Three following exhibits offer supporting results that reinforce findings discovered in the hypothesis one and two. Exhibit 83 summarizes the results with highlights on the number of subjects whose number of alternatives examined increased and time to reach decisions decreased in the experiment. Exhibit 84 organizes the same result in two case-sequence subexperiment groups. Exhibit 85 graphically compares these percentage results for overall experiment.

Exhibit 83

Result Summary – Hypothesis I & II – All Subjects

Group	Subject ID	to reach the decision: No. of Alternatives Examined			Minutes		
		Pre-Test	Post-Test	Change	Pre-Test	Post-Test	Change
Control	**153**	5	8	**3**	60	45	**(15)**
10 subjects	252	4	7	**3**	15	20	5
	291	6	6	-	70	80	10
	338	6	8	**2**	90	90	-
	649	7	6	(1)	120	110	**(10)**
	675	5	5	-	75	90	15
	760	4	4	-	120	120	-
	800	5	4	(1)	165	120	**(45)**
	834	8	8	-	150	150	-
	963	3	4	**1**	45	40	**(5)**
	Mean	**5.3**	**6.0**	**13.2%**	**91.0**	**86.5**	**-4.9%**
		Subjects w. increased		4	Subjects w. decreased		4
		no.-of-alternatives-examined		**40.0%**	time-to-reach-the-decision		**40.0%**
		Subjects with both decreased time to reach the decision					**2**
		and increased number of alternatives examined					**20.0%**
Experiment	**ETM**	4	7	**3**	135	70	**(65)**
8 subjects	**JAF**	2	8	**6**	135	105	**(30)**
	MHJ	4	7	**3**	90	60	**(30)**
	PKF	4	5	**1**	40	30	**(10)**
	REJ	8	14	**6**	90	45	**(45)**
	SAH	4	8	**4**	45	30	**(15)**
	YEH	2	4	**2**	90	90	-
	ZVX	2	8	**6**	80	60	**(20)**
	Mean	**3.8**	**7.6**	**103.3%**	**88.1**	**61.3**	**-30.5%**
		Subjects w. increased		8	Subjects w. decreased		7
		no.-of-alternatives-examined		**100.0%**	time-to-reach-the-decision		**87.5%**
		Subjects with both decreased time to reach the decision					**7**
		and increased number of alternatives examined					**87.5%**

Exhibit 84

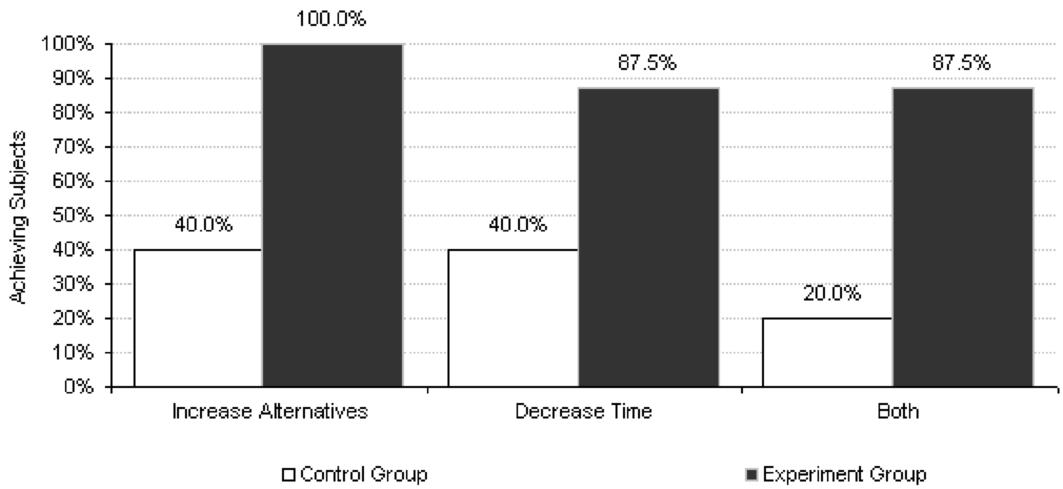
Result Summary – Hypothesis I & II – Subexperiment Groups

Group	Subject ID	Case A-then-B					
		No. of Alternatives Examined			Minutes		
		Pre-Test	Post-Test	Change	Pre-Test	Post-Test	Change
Control	**252**	4	7	**3**	15	20	5
4 subjects	**649**	7	6	(1)	120	110	**(10)**
	800	5	4	(1)	165	120	**(45)**
	963	3	4	**1**	45	40	**(5)**
	Mean	**4.8**	**5.3**	**10.5%**	**86.3**	**72.5**	**-15.9%**
		Subjects w. increased		2	Subjects w. decreased		3
		no.-of-alternatives-examined		**50.0%**	time-to-reach-the-decision		**75.0%**
		Subjects with both decreased time to reach the decision					**1**
		and increased number of alternatives examined					**25.0%**
Experiment	**ETM**	4	7	**3**	135	70	**(65)**
4 subjects	**JAF**	2	8	**6**	135	105	**(30)**
	REJ	8	14	**6**	90	45	**(45)**
	YEH	2	4	**2**	90	90	-
	Mean	**4.0**	**8.3**	**106.3%**	**112.5**	**77.5**	**-31.1%**
		Subjects w. increased		4	Subjects w. decreased		3
		no.-of-alternatives-examined		**100.0%**	time-to-reach-the-decision		**75.0%**
		Subjects with both decreased time to reach the decision					**3**
		and increased number of alternatives examined					**75.0%**

Group	Subject ID	Case B-then-A					
		No. of Alternatives Examined			Minutes		
		Pre-Test	Post-Test	Change	Pre-Test	Post-Test	Change
Control	**153**	5	8	**3**	60	45	**(15)**
6 subjects	291	6	6	-	70	80	**10**
	338	6	8	**2**	90	90	-
	675	5	5	-	75	90	**15**
	760	4	4	-	120	120	-
	834	8	8	-	150	150	-
	Mean	**5.7**	**6.5**	**14.7%**	**94.2**	**95.8**	**1.8%**
		Subjects w. increased		2	Subjects w. decreased		1
		no.-of-alternatives-examined		**33.3%**	time-to-reach-the-decision		**16.7%**
		Subjects with both decreased time to reach the decision					**1**
		and increased number of alternatives examined					**16.7%**
Experiment	**MHJ**	4	7	**3**	90	60	**(30)**
4 subjects	**PKF**	4	5	**1**	40	30	**(10)**
	SAH	4	8	**4**	45	30	**(15)**
	ZVX	2	8	**6**	80	60	**(20)**
	Mean	**3.5**	**7.0**	**100.0%**	**63.8**	**45.0**	**-29.4%**
		Subjects w. increased		4	Subjects w. decreased		4
		no.-of-alternatives-examined		**100.0%**	time-to-reach-the-decision		**100.0%**
		Subjects with both decreased time to reach the decision					**4**
		and increased number of alternatives examined					**100.0%**

Exhibit 85

Result Summary – Hypothesis I & II – Graphic Comparisons



The hypothesis one aims to find whether *DSSVenture* has an impact on enhancing developers' comprehensiveness of the decision context by increasing the number of alternatives examined. The result indicates that all participants (100%) in the experiment group reported an increase in the number of alternatives examined, as compared to a 40% of participants in the control group. The two case-sequence subexperiment groups (Exhibit 84) indicate results in the same direction with only a 50% and a 33% of control subjects in the case A-then-B and the case B-then-A group. As a supporting reason for the hypothesis one's conclusion, it can be seen that a potential benefit of *DSSVenture* program is to enhance developers' comprehensiveness in exploring the decision context regardless of situations' nature.

In other dimension, decreases in time to reach decisions are discovered in an 87.5% of participants in the experiment group versus a 40% of participants in the control group.

For the case B-then-A group, results reveal the same direction with all (a 100%) of the experiment subgroup versus a 16.7% of the control subgroup (Exhibit 84). However, the case A-then-B subgroup indicate different result. The decrease in time to reach decisions were reported by the same percentage (a 75%) of participants in both control and experiment groups. The same number of subjects, whose time to reach decisions decreases in the experiment, confirms a similarity to the subgroup's pool statistics results that the null hypothesis cannot be rejected (Exhibit 81).

The results indicate another potential benefit of *DSSVenture* program in enhancing decision efficiency by reducing to time to reach decisions. The decreases in time to reach decisions were discovered in overall subject, but not in all case-sequence subexperiment groups. Potentially, enhancement of decision efficiency varies due to the difficulty of the situation.

Hypothesis Three (Coefficient of Variation Test)

"Large economic size" is among important characteristics that distinguishes real estate from other types of investment (Etter, 1995d). Real estate development commonly requires a large amount of capital. Nevertheless, one can never be sure what "the large amount" means in term of dollars. Capital involved in real estate development varies due to countless reasons ranging from project's size, location, to building specs. A potential benefit of using a decision support system is the reduction in diversity of performance.

The third hypothesis examines volatility of performance resulting from the *DSSVenture* program. As addressed in the Literature Review, financial analyses conducted during the predevelopment stage are primarily aimed at evaluating the interests of key participants by using two common risk evaluation measures, namely *Net Present Value* (NPV) and *Internal of Rate Return* (IRR). Since the *DSSVenture* was developed from developers' points of view, NPV was selected to compare investment performance under alternative scenarios or in comparing two developments.

Although standard deviation is a useful measure of data variability, it is not a fair measure for evaluating projected net present values of two development projects. A simple explanation is that the two projects may differ in magnitude of capital required for the investment, and accordingly, the magnitude of projected NPV amounts. Lyman Ott and Michael Longnecker (2001, p. 93) suggest the use of *coefficient of variation* (CV) to measures the variability in the values relative to the magnitude of the population mean. The CV is a unit-free number and expressed as a percentage of the population's standard deviation compared to the population's mean. In this study, the coefficient of variation was utilized as the device for comparing variations of projected net present value amounts. Therefore, the two experiments would have equivalent degrees of variability if subjects' projected NPVs from both groups represent the same CV.

The analysis was conducted by using data sets organized by two case-sequence subexperiment groups. For case A-then-B subexperiment group, the results indicate a 52.2% difference in coefficient of variation for the control participants. The coefficient ratio decreased from 54.55% in the pre-test experiment to 2.34% in the post-test experiment. In contrast, for the experiment participants, the coefficient ratio experienced a 65.24% decrease from 72.42% (pre-test) to 7.28% (post-test). For case B-then-A subexperiment group, the results indicate a 2.5% difference in the coefficient of variation of the control participants. The variation ratio decreased from a 13.63% in the pre-test experiment to an 11.13% in the post-test experiment. In contrast, for the experiment samples, the coefficient ratio experienced a 16.63% decrease, from 45.73% (pre-test) to 25.10% (post-test). Exhibit 86 presents coefficient of variation for the two case-sequence groups. Exhibit 87 illustrates a comparison of the variation from the pre- and the post-experiments.

Based on the data set and the comparison above, it can be seen that decreases in coefficient of projected net present value variation from experiment groups are more substantially than that from control groups in both case-sequence. Participants in the experiment group are those who went from manual *LDEVOne* proforma in the pre-test observation to *DSSVenture* system in the post-test observation. Therefore, a 13.03%[9] difference in coefficient of variation in the case A-then-B group and a 14.13%[10] are potential credits of the subject system. Therefore, based on these comparisons, it can be concluded that the group of *DSSVenture*-assisted decision makers could produce profit projection that are more likely to be consistent than those without assistance of the system Exhibit 87.

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[9] CV difference for the experiment group – CV for the control group (72.42%-7.18%)-(54.55%-2.34%) = 13.03%

[10] CV difference for the experiment group – CV for the control group (41.73%-25.10%)-(13.36%-11.13%) = 14.13%

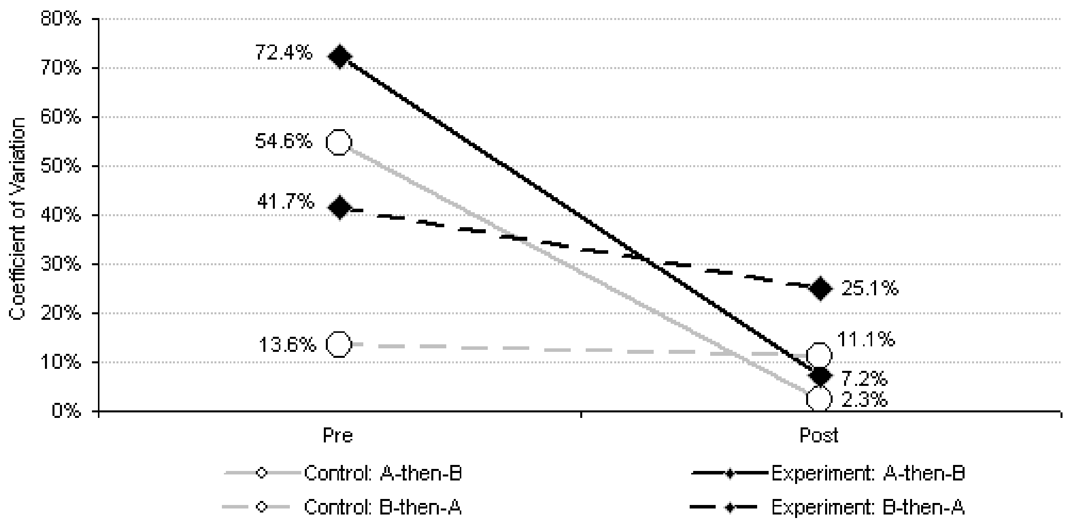
Exhibit 86

Result Summary Table - Coefficient of Variation

Group	Subject ID	Suggested Net Present Value	
		Pre-Test	Post-Test
Case A-then-B Group			
Control	252	7,565,357	5,839,851
	649	7,465,721	5,595,415
	800	1,064,635	5,540,148
	963	6,938,504	5,612,113
Mean		5,758,554	5,646,882
Standard Diviation		3,141,343	132,271
Coefficient of Variation		54.55%	2.34%
Experiment	ETM	1,007,861	4,500,818
	JAF	3,600,129	5,081,123
	REJ	1,301,824	4,322,045
	YEH	1,014,226	4,503,522
Mean		1,731,010	4,601,877
Standard Diviation		1,253,599	330,590
Coefficient of Variation		72.42%	7.18%
Case B-then-A Group			
Control	153	5,124,991	5,676,773
	291	3,769,337	6,209,374
	338	5,566,665	7,361,046
	675	5,026,865	6,548,890
	760	5,607,005	7,459,897
	834	5,505,907	7,453,912
Mean		5,100,128	6,784,982
Standard Diviation		695,159	754,986
Coefficient of Variation		13.63%	11.13%
Experiment	MHJ	5,510,023	2,408,984
	PKF	7,613,404	3,682,551
	SAH	5,209,288	2,096,479
	ZVX	2,360,302	2,746,700
Mean		5,173,254	2,733,679
Standard Diviation		2,158,838	686,046
Coefficient of Variation		41.73%	25.10%

Exhibit 87

Coefficient of Variation Test



Documentation and Review

As previously discussed in the Methodology, this dissertation constitutes the results of the Documentation and Review phase of this research. In addition to the written material contained herein, the reader is also encouraged to request a demonstration disc of the prototype program. The author's contact information can be found in *DSSVenture*'s *About* screen in Appendix H.

CONCLUSION

Overview

This study presents the development of a prototype decision support system for feasibility analysis, alternative assessments, and related testings in income-producing real estate development. The prototype *DSSVenture* was developed and documented in this study. After the design and development stage of the system, *DSSVenture*'s logic and data models were validated. The system was then tested to determine if its main objective, facilitation of developers' decisions during the predevelopment of income-producing real estate, had been achieved. The testing was conducted by applying use of the system on a group of graduate students who enrolled in an advanced real estate development course at Texas A&M University. This research tested three operational variables: number of alternatives examined, time to reach decisions, and coefficient of projected net present value variations. The testing results indicate that:

1. *DSSVenture* significantly enhances comprehensiveness of decision context by increasing the number of alternatives examined, regardless of situations' difficulty.
2. *DSSVenture* significantly contributes to the efficiency of decision-making process by reducing decision makers' time to reach decisions. However, the results also indicate that the decrease in time to reach decisions varies according to project difficulty.
3. *DSSVenture* substantially reduces variation in profit projection among decision makers.

Implications for Developers

At this early stage of development, *DSSVenture* is robust enough for implementation and evaluation. However, due to the limitation in its logic model's assumptions and data analyses, the prototype version still needs additional programming as well as continued linkages in order to effectively benefit developers in the field and meet commercial software standards. As a result, *DSSVenture* program will furnish developers with a quick, reliable, and consistent tool that helps identifying potential opportunities, possible returns, viable alternatives, and relevant risks. This application of the system is particularly useful especially for small developers with limited resources.

Implications for Other Users

A fully developed *DSSVenture* system has a potential to benefit many professionals involved in real estate development. In particular, the program could serve as an aid for anyone concerned with project feasibility and associated risks such as equity investors, construction lenders, and permanent lenders.

The evaluation experiment has also revealed that real estate development students are among those who could benefit from the system. To be sure, the art of negotiation and deal making is an attribute that distinguishes successful developers from others. In advanced learning, strategies can be explained and demonstrated through the use of the system without the hassles of manual number crunching. Development-venture scenarios can be orderly organized, efficiently summarized, and precisely pointed out as needed without difficulty of running through a pile of prints. Therefore, class discussions can be focused entirely on achieving the optimum deal and examining data sensitivity. Students can follow the point without being confused with calculation and scenario organization.

Strengths and Limitations of the Study

During the course of design and development, notes were continually taken to ensure that any weaknesses found would be documented. With generous help of a couple of graduate students in Land and Real Estate Development program at Texas A&M University, several pre-tests were conducted to identify potential weaknesses and strengths of the study. Many limitations had been overcome as the system underwent countless revisions. A summary of such limitations follows:

- **Flexibility.** Although the prototype program was developed with flexibility in mind, the feature had been achieved only in data input dimension. As documented in the logic model validation, it can be seen that the program lacks flexibility in terms of proforma's logic assumptions. The absence of flexibility thus impedes the facilitation objectives as some input variables need to be justified by the decision maker before they can be applied in the program's user interfaces. Although the logic model can be directly customized by using *Microsoft Excel*®, the user's expertise with computers along with thorough understanding of the sophisticated model is essentially required. In addition, the customizing process is time-consuming and error-prone. A survey response suggested that the program should be equipped with an "undo" function, which provides users with an option to revert their data setup in case a mistake occurred. Although these limitations were not detrimental to testing of the system, they should be overcome in a commercial grade edition.

- **Scope.** Feasibility assessment using the *DSSVenture* system is limited to analysis at the before-tax level, due to the model's logic limitations. Although before-tax analyses are adequate for preliminary decisions, after-tax analysis deals with returns that might be achieved from the investment, due to tax shelter benefits. Although taxation is complicated and vary across markets and situations, it could be accommodated by developing calculation modules that allow users to manually configure typical tax conditions. Expectedly, eliminating this limitation could increase substantially the number of professionals who could benefit from *DSSVenture* program.
- **Linkage to Data Source.** *DSSVenture*'s database file cannot be linked to and from other sources. In *DSSVenture*, a new project analysis always has to starts with a blank database file. When the analysis is completed, development-venture and assumption records are contained strictly within the file. In other words, any parts of an established analysis's data set cannot be shared with others. However, there are some typical component scenarios, which can be used throughout the industry; for example, construction cost and operating expense ratios based on the building's type and specification. These component assumption settings can be repeatedly utilized in projects that share similar properties. By allowing decision makers to reuse typical data, time can be saved and typographical errors can

be reduced. Although this limitation does not interfere with the facilitation objective, its availability would potentially enhance developers' ability to devise creative scenarios in timely manner. Moreover, with widely used internet technology and commercial compact disc databases, many of these typical references are available online and off-the-shelf. The program should be continuously developed to expand assumption record sharing capability and enable linkage to existing commercial sources available.

- **Data Analysis.** The prototype program offers a menu option that duplicates the completed database file for further cross analysis. However, in the evaluation experiment, none of the participants exercised this option. This could be because using a raw database is an advanced procedure that requires expertise in handling a computerized database. Like other limitations, data analysis limitation does not impede the facilitation objective. However, if this limitation can be improved upon, decision makers will benefit more from the program. Further development of the program should include automated features that assist decision makers in extensive analyses of the data source, which may include an automated sensitivity analysis feature, and a Monte-Carlo risk simulation feature.

The major strengths of the system include three important features as demonstrated in the screen captures.

- **Friendly Interfaces.** As illustrated by the screen captures, *DSSVenture* is very user-friendly. This strength is supported by the fact that all users were able to begin using the system and master its function to produce meaningful decision support information within the first hour, which is a very short learning curve by any standard.

- **Saving Time.** *DSSVenture* expedites decision-making process by decreasing the time to reach decisions. This means time can be spent on other tasks, such as procuring reliable and meaningful information, researching sensitive variables, identifying potential deals, and even pursuing other potential opportunities.
- **Comprehensiveness.** *DSSVenture* program also enhances the decision makers' comprehensiveness of the decision contexts by increasing the number of alternatives to be examined. This means the decision makers will have an opportunity not only to see, but also to be informed of more viable alternatives, potential returns, and associated risks. The quality of the decision as well as the level of confidence in the decision should increase accordingly.
- **Consistent Output.** *DSSVenture* program relies on computers' efficiency in conducting pre-programmed cognitive tasks. Since the program passed the validation in the testing stage, results are certainly dependable and consistent in both formats and applications. Moreover, by allowing decision makers to reuse component scenario settings, the program offers a high level of variable consistency by eliminating typographical errors caused by repeatedly entering the same data set. Therefore, instead of being concerned

with the accuracy of data inputs, decision makers can focus on other matters that are also critical to the decision, such as initiating creative development-venture scenarios and examining sensitive variables.

- **Integrative Synergy.** The prototype program initiates a synergy of a computerized database and an established logic model by using integrative user-friendly interfaces. Based on the results of this study, coupled with developers' expertise, the completed *DSSVenture* is expected to be a supporting tool that assists developers in obtaining competitive advantages in income-producing real estate development.

Recommendation for Further Study

Based on the conclusion, implications, strengths and limitations discussed above, this study identifies the following areas of research and development for future improvement of the system:

- Continued development of code modules to increase system's robustness
- Continued development of calculation modules to increase flexibility and expand coverage of projection
- Continued development of data module to achieve data sharing attribute
- Continued development of automated data analysis feature
- Continued tests of facilitation attributes (number of alternatives examined, time to reach decisions, and coefficient of variation)

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APPENDIX A

INPUT SHEET FOR DSSVENTURE DEMONSTRATION

Input Summary Sheet: *The Academic Place* - an 17,900-SF office building in *Campus Circle*	Most Likely	Worst Scenario
Development Costs		
Land Cost	$220,000	More
Hard Cost	$77.83 @SF	$83.18 @SF
Soft Cost		
Soft Cost (Excluding Loan)	$84,700	$90,500
Development Fees	5.0%	
Operation		
Area		
Leaseable Area	16,100	
Gross Building Area	17,900	
Annual Rent	$18.01 @SF	$17.72 @SF
Vacancy		
1st Year	10.0%	
2nd Year	5.0%	
3rd Year	3.0%	
First Stabilized Year	3	
Operating Expenses (annually)		
General Operating Expenses	3.0% @EGI	
Expenses per Building Area	$0.65 @SF	
Property Tax (Overhead)	40,000	
Replacement Reserve Fund	3.0% @EGI	
Financing		
Permanent Financing		
Term	25 years	
Interest (APR)	7.5% APR	8.5% APR
Fee (%)	1.0%	
Ratios		
Loan-to-Value	80.0%	
Debt-Coverage Ratio	1.25	
Construction Financing		
Interest	8.5% APR	
Fee	1.0%	
Other Factors		
Groundbreaking	2005	
Capitalization Rate	10.0%	
General Discount Rate	10.0%	
Property Owner's Discount Rate	5.0%	
Venture		
Developer		
Maximum Investment	$110,000	
Required NPV	$160,000	
Required IRR	25.0%	
Investor		
Maximum Investment	$900,000	
Required IRR	20.0%	
Property Owner		
Maximum PMM	$30,000	

1. What is your recommended venture structure (advance and fallback)?
2. If the land cost could not be agreed at 220K, what would be the maximum land cost that you would recommend (and how)?
3. What would be the range of possible Net Present Value to the Developer

APPENDIX B

CASE STUDY A – CAMPUS POINT STUDENT APARTMENTS

Opening Note

This case study is published strictly for DSS education and evaluation purposes. Information provided in the case does not necessarily spell out real situation and/or opinions of Texas A&M's officials.

Introduction

You are an Assistant Director for a real estate development/investment firm located in Dallas, Texas. Recently, your firm has been invited to submit a development proposal for a new Texas A&M's Student Apartment Facility. The facility is an integral part of a pending Texas A&M's mixed use 12-acre public/private co-development on College avenue, located in the north vicinity of the campus. Your boss, the Chief Financial Officer and Vice President for Real Estate has recently assigned you to assist him in handling the deal.

Texas A&M is seeking proposals by developers for 320 apartments. The university decided to sell a portion of the 12-acre Northgate property (or lease the ground) to the developer, and lease back the apartments at the lowest possible rate. The university will then rent the units to students to provide affordable housing at below market rental rates.

Since the apartments will be fully leased to a premier state university, this opportunity presents a low risk venture. Such property will certainly strengthen the company's real estate portfolio, and enhance its entry in the academic facility sector.

Your boss called and asked if you could assist him with conceptual feasibility analysis and explore possible venture structure for the opportunity. He would be back to the office tomorrow, and will have a meeting with you as soon as you are ready.

Conceptual Feasibility Analysis and Venture Structure

In response to your boss's request, you have decided that, at least, you would like to have a professionally prepared packet with the following items**:**

- *Conceptual Financial Analysis*, including a list of all assumptions made in the preparation of your analysis.
- *Recommended Venture Structure (with an alternative fall-back scenario)*
- *An evaluation of* relative sensitivity of critical variables used in the analysis

Key Parties and Their Interests

- *Texas A&M (The Property Owner and the Tenant)*: The University owns a 12-acre property on College Avenue that has been under-utilized for many years. A study by the Graduate Program in Land Development suggested a master-planned development of "*Campus Circle*," a mixed-use urban village. In early 2004, the university decided to sell (or lease) a portion of the 12-acre property to a developer who would be interested in developing a student apartment facility that would be leased back to the university for 15-year renewable term. Individual units would be rented to qualified students by the university at below market rates. The university is interested in minimizing its lease payments for the finished facility.

- *Your Development Company (The Developer)*: The real estate development company specializes in multifamily residential development. The company has focused in the Dallas and Arlington metro for more than 10 years. The company seeks opportunity to develop additional properties without a high-risk exposure, and to enter the university-affiliated student-housing sector. Typical company investment per-property is not to exceed $250,000. Equity investors are expected to demand a 25% minimum IRR.
- *Associated Real Estate Investment Funds (Optional Investors)*: $800,000 Maximum investment per property with a minimum return of 20%-IRR.

The Development

- *The Master Plan*: As proposed by the Graduate Program in Land Development, *"Campus Circle"* is a mixed-use urban village development on the University's 12-acre site in Northgate. The project would include a 95,700 square foot of academic facilities, a hotel/conference facility, 320 apartment units, 140 traditional and luxury sports condominiums, and retail space for food, beverage, service, and general merchandise. The development would involve Tax Increment Financing for the infrastructure, public financing for the conference center, and private financing for the hotel, retail, and housing segments.
- *The Market*: Average annual rents for comparable apartments in Bryan/College Station are $14.18/SF, $12.21/SF, and $13.20/SF respectively for one-, two-, and three-bedroom unit type. Market occupancy rate is reported at 94% and is expected to decline in the short term. On the other hand, *College Avenue* apartments, a graduate student housing apartment complex owned and operated by the university, have been fully occupied since it is leased at below market rates. In 2004, *College Avenue* apartments are leased at $9.20/SF and $7.68/SF for one- and two-bedroom unit type respectively.
- *The Site:* The site is a portion of the 12-acre. There is no asking price set for the property. However, according to a Brazos County Appraisal District, the property is worth approximately $460,000 in the current market.
- *The Facility*: The housing project has only been conceptually designed in *Campus Circle* report. A final design has to be developed by an architectural firm and approved by the city. Following are the concept-stage data:
    - *Units and Building Area Requirements*: Preliminary building facility program consists of 30 1-BR, 50 2-BR, and 40 3-BR apartments, with unit size at 550 SF, 850 SF, and 1,000 SF each respectively. Based on the company's experience in multi-family housing design, 90% building efficiency could be expected. Therefore, the 99,000 leasable square feet would require gross building area of about 110,000 SF. Construction quality is assumed comparable to those of *College Avenue* apartments. A summary follows:

Student Apartment Facility - Average Annual Rent Table			
	1-BR	2-BR	3-BR
Units	30 Units	50 Units	40 Units
Area	550 SF	850 SF	1,000 SF
Total Area	16,500 SF	42,500 SF	40,000 SF
Total Leasable Area		99,000 SF	
If rented at "***market rate***"			
Annual Rent per SF	$14.18/SF	$12.21/SF	$13.20/SF
Annual Revenue	$233,970	$518,925	$528,000
Total Revenue		$1,280,895	
Average Rent – Market Rate		**$12.94 /SF**	
If rent at "***College Avenue's rate***"			
Annual Rent per SF	$9.20/SF	$7.68/SF	$8.44/SF
Annual Revenue	$151,751	$326,358	$337,674
Total Revenue		$815,782	
Average Rent – College Avenue's Rate		**$8.24 /SF**	

- *Construction*: Construction cost is estimated at $52.43 per SF. As the cost of construction materials has been fluctuating recently, the total cost could climb up to $59.86 per SF. A 12-month construction period is projected with a 2005 construction start.
- *Professional Services*: Total cost for professional services (e.g. architects, engineers, etc.) is expected to range from $420K to $447K. In addition, your company typically charges 5% of development cost as a Development Fee to cover its overhead, transportation, supplies, etc.

o *Operations*: Upon completion, the entire facility will be triple net leased to Texas A&M University. The department of student life will be responsible for leasing individual units to qualified students. The university will be responsible for operating expenses (i.e. cleaning, utilities, and securities). The building owner will be responsible for a 5% replacement reserve fund.

o *Financing*: Based on the company's financing experience, a 25-year permanent financing with 7.5% APR plus 1-point fee is most likely. However, the interest rate may fluctuate to 8.5%. To compensate for the below-market lease to tenant that is very unlikely to default, the lender agreed to a relatively high loan-to-value ratio of 90% (compared to 80% market rate), and relatively low debt-coverage ratio of 1.1 (compared to 1.25 market rate). Construction financing is expected at 8.5%APR with 1-point lending fees.

o *Other Factors*: Due to an exceptional location and a low-risk tenant, the project's capitalization rate is expected to be 10% (compared to 12.5% market rate). The company and the investors usually assume a 10% general discount rate. Property owners' discount rate of 3% is usually assumed.

A minute ago, your boss called, and asked you to consider the two strategic scenarios (Buy, or Lease the property), and be creative as much as you can to generate possible venture structures. Along with your recommendation, he would like to find out at least the following:

1. Equity Investment range from both the Developer and the Investors.
2. Range of possible Net Present Value to the Developer.

3. Your recommended and fallback venture structures (with expected Net Present Values).
4. Maximum land cost that the project could afford if the apartment is leased to TAMU at College Avenue's rate and the market-appraised value could not be agreed.

The opportunity has been included in tomorrow's executive meeting agenda, which your attendance is required. Wouldn't it be a chance to catch the spotlight?

Input Summary Table

Factors	Range of Possible Values	
Development Costs	**Most Likely**	**Worst Scenario**
Land Cost	$460,000	
Hard Cost	$52.43 /SF	$59.86 /SF
Soft Cost		
Soft Cost (Excluding Loan)	$420,000	$440,000
Development Fees	5.0% of Development Cost	
Operation		
Area		
Gross Building Area	110,000 SF	
Leasable Area	99,000 SF	
Vacancy		
Year 1	0.0%	
Year 2	0.0%	
Year 3	0.0%	
First Stabilized Year	Year-1	
Operating Expenses		
Replacement Reserve Fund	5.0% of Cash Flow	
Financing		
Permanent Financing		
Term	25 years	
Interest (APR)	7.5% APR	8.5% APR
Fee (%)	1.0%	
Ratios		
Loan-to-Value	90.0%	
Debt-Coverage Ratio	1.10	
Construction Financing		
Interest	8.50%	
Fee	1.0%	
Other Factors		
Groundbreaking	2005	
Capitalization Rate	10.0%	
Discount Rates		
Developer & Investors	10.0%	
Property Owner	3.0%	
Venture		
Developer		
Desired NPV	$1,000,000 (and 25% IRR)	
Maximum Investment	$250,000	
Investor		
Required IRR	20.0%	
Maximum Investment	$800,000	

APPENDIX C

CASE STUDY B – TEXAS A&M'S NEW ACADEMIC FACILITY

Opening Note

This case study is published strictly for DSS education and evaluation purposes. Information provided in the case does not necessarily spell out real situation and/or opinions of Texas A&M's officials.

Introduction

A couple hours ago, your boss, the CFO and VP for Development, was at a lunch meeting with a key member of Texas A&M's development council to gather more information about the Student Apartment Facility. In the meeting, he was advised that, in addition to the discussed Apartment Facility, the master plan also included a 95,700-SF academic facility, which the university was also looking for a creative venture to develop. Although the call for proposal has not been officially announced, preliminary development details have been discussed in the meeting.

Unlike most investment properties, the entire facility will be under a triple net lease to the university, and will be operated under the university's budgets. The project is considered attractive yet very low risk, because the tenant is a distinguished public university. Addition of such property will enable the company to capitalize on a vast new market segment, as well as diversify the company's real estate portfolio.

It was 4:30 pm. Your boss called. He let you know that the preliminary information of the Academic Facility had been faxed to his secretary. He asked you to go through the information, run feasibility analysis, and explore as many viable venture structures as possible. He would arrive tomorrow morning, and would have a meeting with you while the ideas were fresh.

Conceptual Feasibility Analysis and Venture Structure

In response to your boss's request, you have decided that as a minimum, you would like to have a professionally prepared packet with the following items:

- *Conceptual Feasibility Analysis*, including a list of all assumptions made in the preparation of your analysis.
- *Recommended Venture Structure (with alternative fallback scenario).*
- *An evaluation of relative sensitivity* of critical variables used in the analysis.

Key Parties and Their Interests:

- *Texas A&M (The Tenant and Property Owner)*: The University owns a 12-acre property on College Avenue that has been under-utilized for years. The University is looking for a creative way to provide additional academic spaces under recent budget constraints. Therefore, no capital investment is expected, and expenses should be kept to a minimum. In 2004, the university decided to sell (or lease) a portion of the 12-acre property to a developer who would be interested in developing a 95,700 SF. academic facility that would be leased back to the university for 15-year renewable term. The university is interested in minimizing its expenses that may involve with the finished facility.

- *Your Development Company (The Developer)*: The company always welcomes opportunity to build and diversify real estate investment portfolio with acceptable-to-minimum associated risks. Typical budget per property is up to $250,000 with a preferred-25% minimum return – IRR. Higher investment range is possible but very unlikely.
- *Associated Real Estate Investment Funds (Optional Investors):* Require a minimum return of 20%-IRR on buildings with AAA-rated tenants**.** Equity investment budget is up to $1,200,000 per property with AAA-rated tenants.

The Development

- *The Master Plan:* "*Campus Circle*" is a mix-used urban village development on the 12-acre site in the Northgate area. The project would include a 95,700 square foot academic facility, a hotel/conference facility, 320 apartment units, 140 traditional and luxury sports condominiums, and retail space for food, beverage, service, and general merchandise. The development would involve Tax Increment Financing for the infrastructure, public financing for the conference center, and private financing for the hotel, retail, and housing segments.
- *The Site:* The site is a portion of the 12-acre. There is no asking price set for the property. However, according to a Brazos County Appraisal District, the property is worth approximately $600,000 in the current market.
- *The Facility:* The facility has been conceptually designed in *Campus Circle* report. However, final design has to be developed by an architecture firm and approved by the university and the city. Following are the concept-stage data:
  - *Building Area Requirements and Construction*: The building has to meet university's standard and has to be in accordance with the university's guidelines. Preliminary building facility program requires 95,700 SF, mainly for faculty offices, lecture rooms, auditoriums, and supporting facilities. Required building area and specifications are comparable to Wehner building on West Campus (built at approximately $120.57/SF). Your colleague in construction department has suggested that, with slightly different specifications per industry standards for office buildings, the building could be built at $103.84/SF. A 12-month construction period is projected with ground breaking in the beginning of 2005.
  - *Professional Services*: Total cost for professional services (e.g. architects, engineers, etc.) is expected to range from $554K to $590K. In addition, your company typically charges 5% of total development cost as a Development Fee to cover its overheads, transportation, supplies, etc.
- *Operations*: Upon completion, the facility will be entirely leased to Texas A&M as a single tenant. Facility operating expenses (e.g. cleaning, utilities, and security) will be under university's budget. The building owner will be

responsible only for a 5% replacement reserve fund (5% of EGI). At present, average rental rate for comparable space in B/CS market is $17.5/SF annually.

- *Financing:* Based on the company's financing experience, a 25-year permanent financing with 7.5%APR plus a 1-point lending fee is most likely. However, the interest rate may fluctuate to 8.5%. To compensate for the below-market lease to the tenant that is very unlikely to default, the lender has agreed to a relatively high loan-to-value ratio of 90% (compared to 80% market rate), and relatively low debt-coverage ratio of 1.1 (compared to 1.25 market rate). Construction financing is expected at 8.5% APR with 1-point lending fees.
- *Other Factors:* Given that the university will lease the entire facility on a long-term contract, the project is considered very low risk. Therefore, capitalization rate is advised at 9.5%. The company and the investor usually assume a 10% general discount rate. Property Owner's discount rate is usually assumed at 3%.

A minute ago, your boss called again. He informed you that it was most likely to lease the building to the university at $15.45/SF. However, he asked you to be as creative as you can to generate possible venture scenarios. Along with your recommendation, he would like to find out at least the following:

1. Equity Investment range from both the Developer and the Investors.
2. Range of possible Net Present Value to the Developer.
3. Your recommended and fallback venture structures (with expected Net Present Values).
4. Maximum land cost that the project could afford if the building is leased to TAMU at $14.5/SF ($3 /SF below market) and the market-appraised value could not be agreed.

Input Summary Table

Factors	Range of Possible Values	
Development Costs	Most Likely	Worst Scenario
Land Cost	$600,000	
Hard Cost	$103.84 /SF	$120.57 /SF
Soft Cost		
Soft Cost (Excluding Loan)	$554,000	$590,000
Development Fees	5.0% of Development Cost	
Operation		
Area		
Gross Building Area	95,700 SF	
Leasable Area	95,700 SF	
Rental Rate	$15.45 /SF	$14.50 /SF
Vacancy		
Year 1	0.0%	
Year 2	0.0%	
Year 3	0.0%	
First Stabilized Year	Year-1	
Operating Expenses		
Replacement Reserve Fund	5.0% of Cash Flow	
Financing		
Permanent Financing		
Term	25 years	
Interest (APR)	7.5% APR	8.5% APR
Fee (%)	1.0%	
Ratios		
Loan-to-Value	90.0%	
Debt-Coverage Ratio	1.10	
Construction Financing		
Interest	8.50%	
Fee	1.0%	
Other Factors		
Groundbreaking	2005	
Capitalization Rate	9.5%	
Discount Rates		
Developer & Investor	10.0%	
Property Owner	3%	
Venture		
Developer		
Desired NPV	$1,000,000 (or 25% IRR)	
Max Investment	$250,000	
Investor		
Maximum Investment	$1,200,000	
Required IRR	20.0%	

APPENDIX D

APPROVED INFORMATION SHEET

Figure 1

Approved Information Sheet

INFORMATION SHEET

A Decision Support system for development of income-producing real estate; alternative assessment and venture structure (DSSVenture)

Please read the entire document carefully. You and your classmates (approximately 30 students) are being requested to participate in a written research survey. You are selected to be a possible participant because you are well educated in real estate development related disciplines and ready to enter real estate development industry at professional level in the near future.

The purpose of this survey is to aid in the evaluation of real estate development alternative and venture decisions. The survey is conducted in partial fulfillment of the requirements for the degree of Doctor of Philosophy for Yosaporn Leelarasamee, College of Architecture, Texas A&M University.

The survey is conducted and collected by the third person other than the instructor. If you agree to participate in this study, you will be asked to make a recommendation on a real estate development case study, then response to a written research survey, attached. The survey will take approximately 5 minutes. Your response is anonymous. The records of this study will be kept private. No identifiers linking you to the study will be included in any sort of report that might be published. Research records will be stored securely and only the principal investigator, Yosaporn Leelarasamee, will have access to the records.

You understand that your participation in this study is voluntary. There is no consequence to any classes you enroll. If you decide to participate, you are free to refuse to answer any of the questions that may make you uncomfortable, and may withdraw any time, without any consequences. Your decision whether or not to participate will not affect your current or future relations with Texas A&M University. You understand there will be no compensation for your participation in this survey. Known risks and benefits for your participation are little to none. Known risks may include lost of time. And, known benefits may include gaining experience in making real estate development decision. For more information regarding the study, you can contact the principal investigator with any questions.

You understand that this research study has been reviewed and approved by the Institutional Review Board – Human Subjects in Research, Texas A&M University. For research-related problems or questions regarding subjects' rights, you can contact the Institutional Review Board through Dr. Michael W. Buckley, Director of Research Compliance, Office of Vice President for Research at (979) 845-8585 (email: mwbuckley@tamu.edu).

You have read and understand the explanation provided to you. You have had all of your questions answered to your satisfaction. By proceeding into the attached written survey, you voluntarily agree to participate in this study.

Principal Investigator: **Date**
Yosaporn Leelarasamee
Department of Landscape Architecture and Urban Planning
College of Architecture, Texas A&M University
College Station, TX 77843-3137
+1(979) 260-4299, E-mail: yosaporn@leelarasamee.com

Other Contact:
Professor M. Atef Sharkawy
Department of Landscape Architecture and Urban Planning
College of Architecture, Texas A&M University
College Station, TX 77843-3137
+1 (979) 845-7883, E-mail: sharkawy@tamu.edu

Approved by
Texas A&M University IRB
DEC 11 2003
Good Thru Nov 24, 2004
Protocol # 2003-0563

1

APPENDIX E

APPROVED IRB APPLICATION

Figure 2

Approved Texas A&M's IRB Application

VPR
Office of the Vice President for Research

Office of Research Compliance

Administration and Special Programs

Academy for Advanced Telecommunication and learning Technologies

Institute for Scientific Computation

Laboratory Animal Resources and Research

Microscopy and Imaging Center

Office of Business Administration

Office of Graduate Studies

Office of Sponsored Projects

Texas A&M University Research Park

Date November 25, 2003

MEMORANDUM

TO: Yosaporn Leelarasamee
LAUP
MS 3137

FROM: Dr. E. Murl Bailey, CIP, Advisor
Institutional Review Board
MS 1112

SUBJECT: IRB Protocol Review

Title: A Decision Support System for Development of Income-Producing Real Estate: Alternative Assessment and Venture Structure (DSS Venture)

Protocol Number: 2003-0563
Review Category: Exempt from Full Review
Approval Date: November 25, 2003 **to** November 24, 2004

The approval determination was based on the following Code of Federal Regulations
http://ohrp.osophs.dhhs.gov/humansubjects/guidance/45cfr46.htm

________ **46.101(b)(1)**	________ **46.101(b)(4)**
✓ ________ **46.101(b)(2)**	________ **46.101(b)(5)**
________ **46.101(b)(3)**	________ **46.101(b)(6)**

Remarks: Request of waived signed consent has been approved.

The Institutional Review Board – Human Subjects in Research, Texas A&M University has reviewed and approved the above referenced protocol. Your study has been approved for one year. As the principal investigator of this study, you assume the following responsibilities:

***Renewal*:** Your protocol must be re-approved each year in order to continue the research. You must also complete the proper renewal forms in order to continue the study after the initial approval period.

***Adverse events*:** Any adverse events or reactions must be reported to the IRB immediately.

***Amendments*:** Any changes to the protocol, such as procedures, consent/assent forms, addition of subjects, or study design must be reported to and approved by the IRB.

***Informed Consent/Assent*:** All subjects should be given a copy of the consent document approved by the IRB for use in your study.

***Completion*:** When the study is complete, you must notify the IRB office and complete the required forms.

Page 1 of 2

Texas A&M University

1112 TAMU
318 Administration Building
College Station, Texas
77843-1112

979.845.8585
FAX 979.862.3176

Figure 2 (Continued)

Revised January 15, 2003

Texas A&M University
IRB Application
Protocol for Human Subjects in Research
Part I: Summary Cover Sheet

IRB # 2003-0563
(Internal use only)

If Requesting Exempt Status, Check Here ✓ (Exempt from Full Board Review)
Please check or provide details on the following information (enter N/A if not applicable)
New submission ✓ Re-submission ____
Principal Investigator Name Yosapom LEELARASAMEE Faculty ____ Staff ____ Graduate Student ✓ Undergraduate Student ____
Department LAUP Mail Stop 3137 Phone (979)739-1674
Email leelarasamee@yahoo.com Fax n/a

Is this study part of a Thesis or Dissertation? Yes ✓ No ____ If Yes, do you have Committee Approval? Yes ✓ No ____
Co-Principal Investigator Name n/a Faculty ____ Staff ____ Graduate Student ____ Undergraduate Student ____
Department n/a Mail Stop n/a Phone n/a
Email n/a Fax n/a
Funding Amount n/a

Graduate Committee Chair/Faculty Advisor Name (if student) Professor M. Atef Sharkawy
Department LAUP Mail Stop 3137 Phone (979)845-7883
Email sharkawy@tamu.edu Fax (979)845-1784
Research Methodology: Qualitative ____ Quantitative ✓ Both ____
Project Title A Decision Support System for Development of Income-Producing Real Estate: Alternative Assessment and Venture Structure (DSSVenture)
Funding Agency n/a
Funding Administrator: RF ____ TAES ____ TEES ____ TAMU ____ TTI ____
Funding Status: Funded ____ Not Funded ✓ Pending ____ **(Please attach a copy of Grant Proposal)**

RECEIVED
NOV 14 2003

Risk Management Matrix

Seriousness of Risk		Probability That Something Will Go Wrong: A — Likely to occur immediately or in a short period of time, expected to occur frequently	B — Probably will occur in time	C — May occur in time	D — Unlikely to occur
	I May Result in Death	5	5	4	3
	II May Cause severe injury, major damage or loss, and/or result in negative publicity for the participant involved	5	4	3	2
	III Participation presents a minimal threat to safety, health and well-being of participants	4	3	2	1
	IV No more than minimal risk	3	2	1	1

Red Zone - 4 thru 5 Yellow Zone - 2 thru 3 Green Zone - 1

If your protocol falls in the **Yellow** or **Red Zone** please call (979) 458-3624 for further instructions.

What do you have in place to reduce the risks that have been identified? 1 Initial Score 1 Final Score

Activity	Associated Risks	Method to Manage
n/a PAPER SURVEY.	n/a LOST OF TIME.	n/a 15-20 MINUTES SURVEY.

Page ____ of ____

Email irb@tamu.edu or call (979) 458-4067 with any questions regarding this form.

Figure 2 (Continued)

Revised January 15, 2003

Objective Estimate of Risk to Subject: None ___ Low ✔ Moderate ___ High ___

Will Existing Documents Be Used? Yes ___ No ✔ Will Existing Specimens Be Used? Yes ___ No ✔

Gender of Subjects: Male ___ Female ___ Both ✔ Estimated Age of Subjects 18+ Total Participants (est.) ~ 30

Location of Research: College of Architecture, Texas A&M University

Subjects Recruited From:

___Psychology Subject Pool
___Other Subject Pool
✔ Other TAMU Students
___Community
___Women/Fetuses
___Children
___Prisoners
___Hospitals
___Treatment Centers
___Schools
___Others

Recruitment Method:

___Direct person-to-person contact
___Telephone solicitation (attach script)
___Newspaper Advertising (attach ad copy)
___Posted Notices (attach copy)
___Letter (attach copy)
✔ Other (describe) A Class Session

Compensation for Subjects Yes ___ No ✔ (If Yes, attach regular payment schedule)
Deception Used Yes ___ No ✔ (If Yes, attach debriefing form)
Research/Course Credit for Subjects Yes ___ No ✔

Invasive or Sensitive Procedures: Yes ___ No ✔

___Blood Samples
___Urine Samples
___Physical Measurements (electrodes, etc.)
___Stress Exercise
___Review of Medical/Psychological Records
___rDNA
___Other (specify):

Sensitive Subject Matter: Yes ___ No ✔

___Abortion
___AIDS/HIV
___Alcohol
___Body-composition
___Criminal-activity
___Depression
___Drugs
___Other (specify)
___Learning Disability
___Psychological inventory
___Sex
___Suicide

Use of Video or Audio Taping None

If yes, answer the following:
Retained Yes ___ No
Length of time retained: ___
Destroy/Erase Yes ___ No
Other ___
Use specified in consent form Yes ___ No

Provisions for Confidentiality/Anonymity

___Replies Coded
___Secure Storage
✔ Anonymous Response OR
___Confidential
(Cannot be both anonymous and confidential)

Requesting waiver of signature on consent form. Yes ✔ No ___ **If Yes, Attach justification for waiver request. Criteria for waiver request can be found in the Federal Regulation section 45 CFR 46.116 and 46.117 at the following web address:** http://ohrp.osophs.dhhs.gov/humansubjects/guidance/45cfr46.htm#46.116

Location where consent forms will be filed:

(Consent forms must be kept on file for 3 years after the completion of the project. It is best to keep the forms in a campus office in a locked filing cabinet.)

Do you have any relationship with any or all of the subjects, other than your investigator role? Yes ___ No ✔

If yes, you must explain the relationship in the "selection of subjects" section and how you will avoid any type of coercion (doctor-patient, teacher-student, counselor-student, etc.)

Abstract: Please provide a brief statement, in lay terminology, outlining the purpose of this study. ***(Why you are doing this research project, and what you propose to learn.)***

The study was proposed as a part of my dissertation, "A Decision Support System for Development of Income-Production Real Estate: Alternative Assessments and Venture Structure (DDSVenture)". The purpose of the survey is to learn the differece in decision-making experience among DSSVenture-assisted users and non-DSSVenture-assisted users.

Page ___ of ___

Email irb@tamu.edu or call (979) 458-4067 with any questions regarding this form.

Figure 2 (Continued)

Revised January 15, 2003

Part II:

Part A

I have read the Belmont Report, "Ethical Principles and Guidelines for the Protection of Human Subjects of Research" and subscribe to the principles it contains. In light of this Declaration, I present for the Board's consideration the following information, which will be explained to the subject about the proposed research.

SIGNATURE ____________________________

PI NAME Yosaporn Leelarasamee

1. **Selection of Subjects**

   a. Source and number

   The subjects for this study will consist of Texas A&M Univerisity graduate students in the College of Architecture who are majoring in the Land Development (LDEV). Total subjects are approximately thirty.

   b. Method of recruitment and selection

   Subjects involved in the study will be all graduate students who are enrolled in a chosen Land Development (LDEV) course. They will be randomly divided into one control and one test groups. Each subject will draw a pairing stickers from an enclosed container. The Principle Investigator will not see the drawn sticker. The purpose of the pairing sticker is only to pair pre- and post- test surveys answered by the same subject. Those with numeric pairing sticker will be the control-group, and those with alphabetic pairing sticker will be the test-group.

   c. Ages and gender

   The demographic composition (age, gender, race, etc.) of this group will vary and be dependent on who is enrolled at the time of the study is conducted.

   d. Compensation

   There is no compensation involved.

Page ____ of ____

Email irb@tamu.edu or call (979) 458-4067 with any questions regarding this form.

Figure 2 (Continued)

Revised January 15, 2003

e. Location and duration of experiment

The experiment will last approximately 2-3 hours, and will be conducted within the premise of College of Architecture, Texas A&M University.

f. Specific steps to ensure confidentiality or anonymity of responses of results

Survey responses will be anonymous and coded for control- or test-groups. The survey will be collected by third person other than the principle investigator and the faculty responsible for the class.

g. The investigator's relationship to subjects

There is no relationship between principal investigator and subjects.

2. **Purpose of study**

The study was proposed as a part of my dissertation, "A Decision Support System for Development of Income-Production Real Estate; Alternative Assessments and Venture Structure (DDSVenture)". The purpose of the survey is to learn the differece in decision-making experience among DSSVenture-assisted users and non-DSSVenture-assisted users.

Page ____ of ____

Email irb@tamu.edu or call (979) 458-4067 with any questions regarding this form.

Figure 2 (Continued)

Revised January 15, 2003

3. Research procedures

Following the assignment of a development alternative and venture selection case study, subject will be randomly divided into a control and a test groups. Both groups will be given access to the subject System (DSSVenture*) to aid in the assignment. Upon completion of the assignments (real estate development case study**), both groups will be asked to participate in a written survey (attached). The students will then be given a second development alternative and venture selection case study assignment. Only the control group will be given access to the same computer decision support system to aid in the assignment. Upon completion of the assignment, both groups will once again be asked to participate in the same written survey.

Note:
*DSSVenture: A computer-based decision support program, integrating the use of rational database and financial-proforma developed based on well-established real estate development related theories.
** Real Estate Development Case Study: Attached

a. Physical/Behavioral Aspects

There will be no special physical or psychological conditions.

b. Deception of Coersion

There will be no deception or coercion in the study.

4. Risks and Benefits to Subjects

a. A description of any potential risks of discomforts to the subject.

There is little to no anticipated risks to the subjects.

b. A definition of benefits to the research subject or alternatives for participation in the study.

There is little to no anticipated benefits to the subjects. Participation in the survey (attached) will be voluntary. There will be no consequences if they choose not to participate. Responses will be anonymous.

c. Do not include broad benefits to society of potential research benefits to a group as a benefit to the subjects.

Page ____ of ____

Email irb@tamu.edu or call (979) 458-4067 with any questions regarding this form.

Figure 2 (Continued)

Revised January 15, 2003

Part B.

SIGNATURE ASSURANCE: ***(this should be the last page of the protocol application before attachments)***

Principal Investigator/Graduate Student Assurance Statement:

I understand Texas A & M University's policy concerning research involving human subjects and I agree:

1. To accept responsibility for the scientific and ethical conduct of this research study;
2. To obtain prior approval from the Institutional Review Board before amending or altering the research protocol or implementing changes in the approved consent form:
3. To immediately report to the IRB any serious adverse reactions and/or unanticipated effects on subjects which may occur as a result of this study;
4. To complete, on request by the ~~IRB, the~~ Continuation/Final Review Forms.

SIGNATURE: ____________ DATE: Nov. 12, 2003

TYPED NAME: Yosaporn Leelarasamee E-MAIL: yosaporn@leelarasamee.com

***Faculty/Research Advisor's Assurance Statement:**

I certify that I have read and agree with this proposal, that the PI has received adequate training to perform this research, and will receive adequate supervision while performing this research.

SIGNATURE: M. Atef-Sharkawy DATE: 11/12/03

TYPED NAME: Professor M. Atef Sharkawy E-MAIL: sharkawy@tamu.edu

*** If the principal investigator is completing this project to meet the requirements of a Texas A & M University academic program, or is a student, both the student's faculty/research advisor and the departmental head should sign the Signature Assurance Sheet.**

****Department Head**

This is to certify that I have reviewed this research protocol and agree that the research activity is within the mission of the Department and appropriate for the responsibilities and assigned duties of the principal investigator.

SIGNATURE: ____________ DATE: 11/12/2003

TYPED NAME: Professor Walter Gillis Peacock E-MAIL: peacock@archone.tamu.edu

****If the principal investigator is also the Head of the department, the College Dean or equivalent should sign the Signature Assurance Sheet.**

Page _____ of _____

Email irb@tamu.edu or call (979) 458-4067 with any questions regarding this form.

Figure 2 (Continued)

Justification for waiver of signed consent

(Required only if requesting waiver of signature on consent document)

*Note: Information sheet must be submitted and written in second person of the subject

I certify that my research study meets all of the following criteria:

✓ **45 CFR 46.116**

1. The research involves no more than minimal risk to the subjects;
2. The waiver of alteration will not adversely affect the rights and welfare of the subjects;
3. The research could not practicably be carried out without the waiver or alteration; and
4. Whenever appropriate, the subjects will be provided with additional pertinent information after participation.

or

___ **45 CFR 46.117**

1. The only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confideniality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern; or
2. That the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context. In cases in which the documentation requirement is waived, the IRB may require the investigator to provide subjects with a written statement regarding the research.

A Decision Support System for Development of Income Productng Real Estate;

Project Title Alternative Assessments and Venture Structure (DSSVenture)

Signature

October 24, 2003

Date

Yosaporn Leelarasamee

Print Name

Email irb@tamu.edu or call (979) 458-4067 with any questions regarding this form.

APPENDIX F

SURVEY INSTRUMENT SAMPLE

Figure 3

Survey Instrument Sample – Subject's ID "JAF"

RESEARCH SURVEY

TEXAS A&M UNIVERSITY
COLLEGE OF ARCHITECTURE

Decision Support System for Income-Producing Real Estate;
Venture and Alternative Assessment (DSSVenture)

This survey consists of 2 demographic questions, and 6 survey questions on two pages. Please read each statement carefully and select one of the alternatives by marking the appropriate spaces. Your response is anonymous. **Do not write your name on this survey**.

- Pairing SubjectID: JAF
- This survey is conducted in corresponding to Case Study I.
- The subject had access to LDEVOne Financial Decision Support Template

PART – I
Demographic Questions.

1. Please indicate the continent, which your Bachelor degree was awarded.
   - ○ North America (United States and Canada)
   - ○ South America
   - ○ Asia
   - ○ Africa
   - ○ Australia
   - ○ Europe
   - ○ Other

2. Mark your experience / Comfort level.

	None		Average		High
Architecture Design / Planning	○	○	○	○	○
Construction Cost Estimating	○	○	○	○	○
Financing	○	○	○	○	○
Land Economic / Appraisal	○	○	○	○	○
Other	○	○	○	○	○

Subject ID: JAF: Case Study I – page 1

Figure 3 (Continued)

PART – II
Survey Questions

3. What is your recommendation?

____

____

   3.1. What is the expected Net Present Value to the Developer for the recommend scenario?

____

____

   3.2. What is the expected Internal Rate of Return to the Developer for the recommended scenario?

____

____

4. What is your alternative-recommendation (fallback scenario)?

____

____

   4.1. What is the expected Net Present Value to the Developer for the fallback scenario?

____

____

   4.2. What is the expected Internal Rate of Return to the Developer for the fallback scenario?

____

____

5. To reach the decision, how many minutes did you spend in researching and examining alternatives?
☐ Hr(s): ☐ Minute(s)

6. To reach the decision, how many alternatives did you examine?
☐ alternative(s)

7. Indicate your overall confidence level for your decisions?

	None			Medium			Very High
Recommendation	○	○	○	○	○	○	○
Alternative Recommendation (fallback)	○	○	○	○	○	○	○
Overall	○	○	○	○	○	○	○

8. Your comments about DSSVenture (if any).

____

____

____

This is the end of the survey.
Thank you for your participation.

Subject ID: JAF: Case Study I – page 2

APPENDIX G

DSSVENTURE'S PROGRAM FEATURES

Data Interactivity Feature

As discussed in the Theory, variations of a factor can cause a chain-reaction throughout a scenario. Therefore, it is important to provide decision makers with interactivity of data inputs and outputs. Data Interactivity Feature enables decision makers to realize instant impacts resulting from changing assumptions. The interactivity feature incorporates every user-interface in *DSSVenture* program. When a factor is modified, the proforma instantly calculate and inform the user with outputs resulting from the modification. A chain-reaction of the impact can be observed instantly throughout the development scenario.

Database Organization Feature

The Database Organization Feature is a key development of *DSSVenture* program. As shown in the Conceptual System Integration and Logic and Data Model Synthesis diagrams, a database model is one of the key elements synthesized in *DSSVenture* system. Once the decision maker has produced a reasonable scenario, database organization allows them to record the scenario for future reference and comparisons. Figure 4 presents a sample of the feature in a component assumption screen (Permanent Financing) with a highlightⒶ on database control bar. Figure 5 on page 211 presents the Development-Venture Scenario with highlights on the following features:

- **The database control bar**①: Programmed to allow users to navigate around scenario (or assumptions) records with an ease of clicking forward and backward arrows.
- **The filter command button**②: Used to focus on specific scenarios with one or more specific assumptions. For this example, the filter is applied when the decision maker needs to focus on only development-venture scenarios, which land and construction costs are equal to \$436,000 and \$85.30/SF respectively.
- **The data comparison menu command**③: Designed to assist decision makers in summarizing selected input and output variables. When the comparison menu command is executed, a variable selection screen provides the decision maker with choices of variables to be included in a scenario summary worksheet. Figure 6 on page 212 presents the variable selection screen, while Figure 7 on page 213 presents a scenario summary in *Microsoft Excel*® worksheet format.

Figure 4

Database Organization Feature: Permanent Financing Assumption Screen

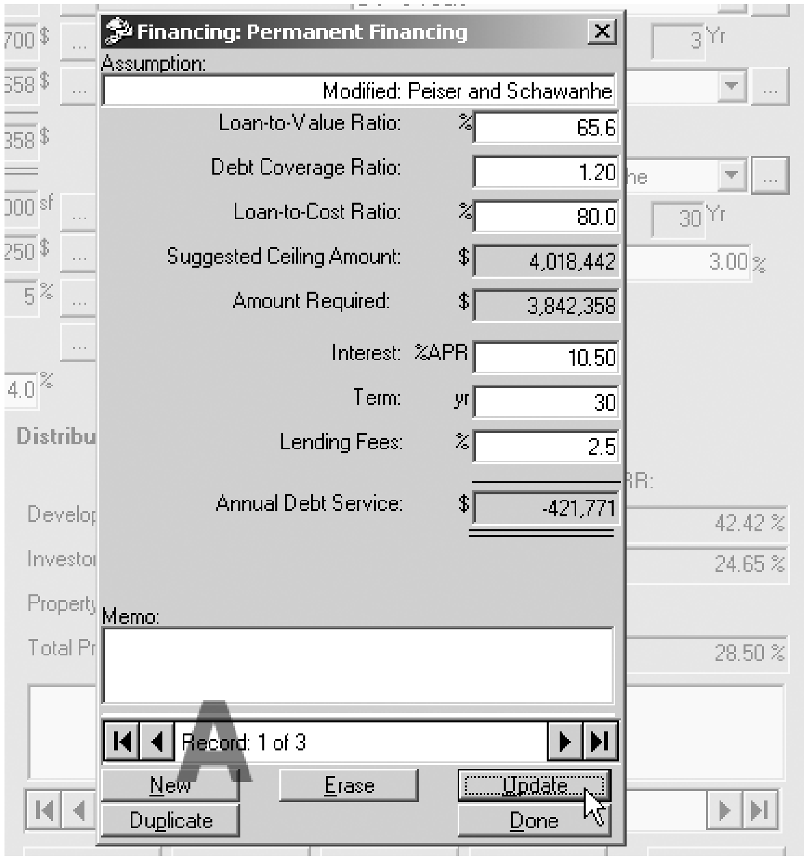


Figure 5

Database Organization Feature: Development-Venture Scenario Screen

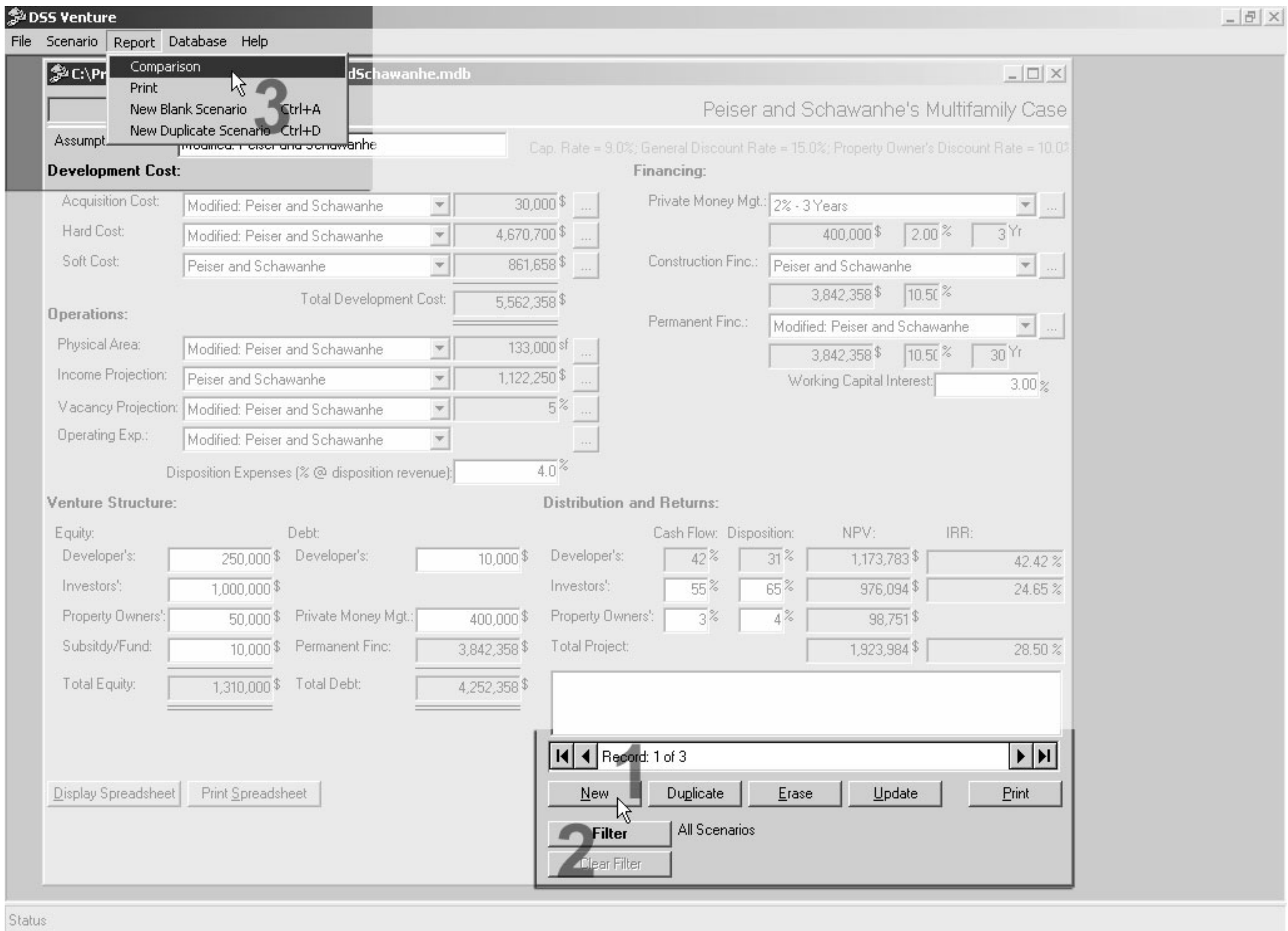


Figure 6

Database Organization Feature: Variable Selection Screen

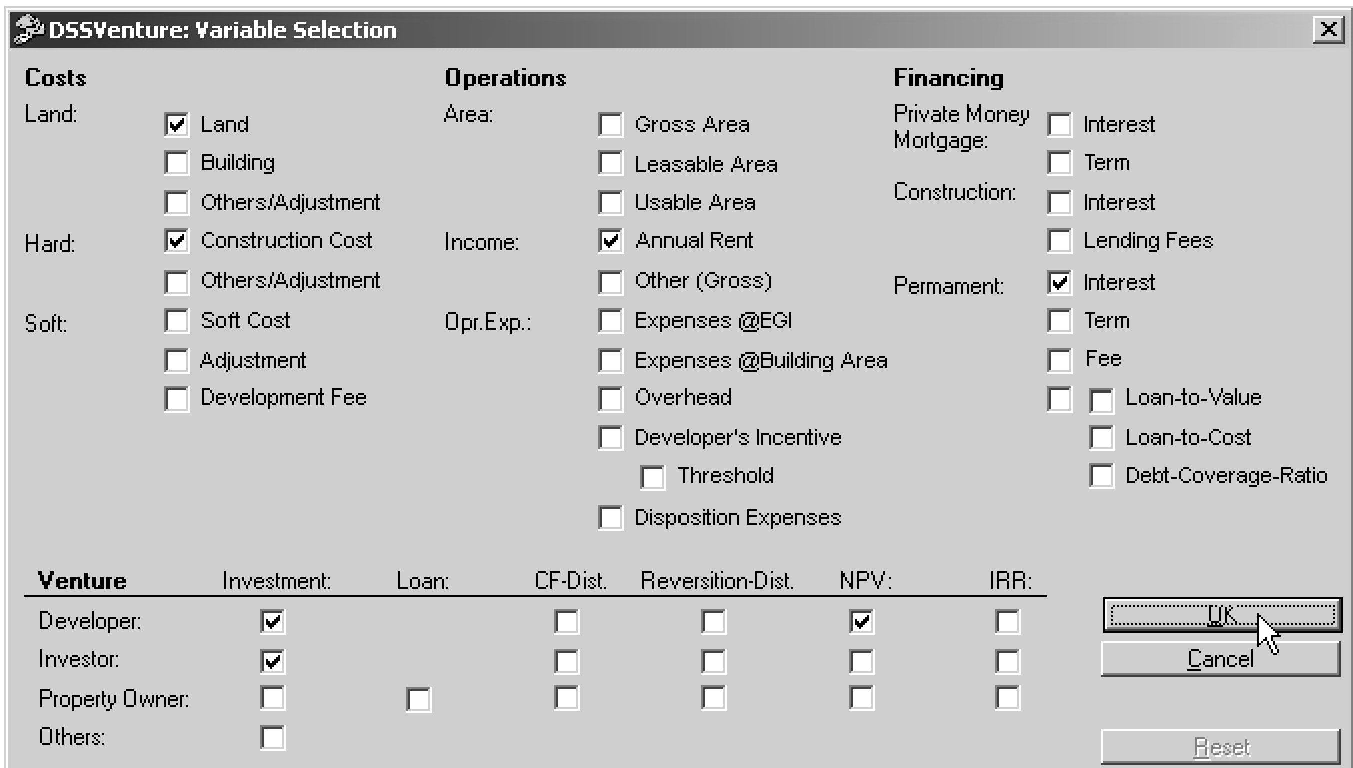


Figure 7

Database Organization Feature: Scenario Summary Worksheet

Microsoft Excel - ScenarioSummary1

Project: **Campus Point Student Apartments**
By: Y Leelarasamee
Date: 9/23/2004 3:06 PM

Scenario	Assumptions	Land Cost	Hard Cost	Soft Cost	Rent ($/SF)	Perm.Loan Int.	Eq. Inv. - Investor	Eq. Inv. - Developer	Developer's NPV
10	Worst Scenario - $550K Land - with PMM 3yr 5%	550,000	59.86	440,000	8.24	8.5	360,000	250,000	991,305
16	Worst Scenario - $480K Land $300K in 5%3YR-PMM	480,000	59.86	440,000	8.24	8.5	440,000	250,000	966,545
15	Worst Scenario - $480K Land $280K in 5%3YR-PMM	480,000	59.86	440,000	8.24	8.5	460,000	250,000	939,920
14	Worst Scenario - $480K Land $280K in 5%2YR-PMM	480,000	59.86	440,000	8.24	8.5	460,000	250,000	931,731
17	Worst - $480K Land - with PMM 3yr 5% - Low EQ	480,000	59.86	440,000	8.24	8.5	430,000	100,000	929,934
2	Worst Scenario	460,000	59.86	440,000	8.24	8.5	720,000	250,000	745,387
13	Worst Scenario - $480K Land	480,000	59.86	440,000	8.24	8.5	740,000	250,000	704,778
12	Worst Scenario - $500K Land	500,000	59.86	440,000	8.24	8.5	760,000	250,000	664,205
11	Worst Scenario - $550K Land	550,000	59.86	440,000	8.24	8.5	820,000	250,000	564,750
1	Most Likely Scenario	460,000	52.43	420,000	8.24	7.5	490,000	250,000	2,253,588
4	Most Likely Scenario - Soft Cost Overrun	460,000	52.43	440,000	8.24	7.5	500,000	250,000	2,216,717
5	Most Likely Scenario - Hi Interest	460,000	52.43	420,000	8.24	8.5	490,000	250,000	1,827,733
3	Most Likely Scenario - Hard Cost Overrun	460,000	59.86	420,000	8.24	7.5	700,000	250,000	1,263,086
6	Most Likely Scenario - Development Cost Overrun	460,000	59.86	440,000	8.24	7.5	720,000	250,000	1,238,856
7	Worst Scenario - $460K Land - with PMM 3yr 5%	460,000	59.86	440,000	8.24	8.5	260,000	250,000	1,205,613
8	Worst Scenario - $480K Land - with PMM 3yr 5%	480,000	59.86	440,000	8.24	8.5	280,000	250,000	1,154,863
9	Worst Scenario - $500K Land - with PMM 3yr 5%	500,000	59.86	440,000	8.24	8.5	300,000	250,000	1,104,161
18	Worst - $480K Land - with PMM 3yr 5% - Mid EQ	480,000	59.86	440,000	8.24	8.5	380,000	150,000	1,016,272

Filter : All Scenarios

Comparison Summary

Ready

Scenario Duplication Feature

A development-venture scenario and a component assumption normally comprise multitude of factors. In order to explore sensitivity of a factor, an analysis is usually conducted by changing one factor at a time and leaving other factors intact. As a result, creating a new scenario by typing the same set of factors is tiresome and time-consuming. Many times, data inconsistency can be caused by typographical errors.

The Scenario Duplication Feature was developed with an aim to facilitate data sensitivity analysis, and scenario conception process. The *Duplicate* [current scenario or assumption] button in all system interfaces automatically generates a new record by using the latest assumptions and values appearing on the screen. The new record is then ready for modification. Although a traditional new blank scenario function is not as convenient, it is also incorporated through use of the *New* [scenario or assumption] button on every screen. Figure 8 presents a sample of the feature Ⓑ in a component assumption screen (Soft Cost). Figure 9 presents the *Duplicate* buttons © in Development-Venture Scenario screen.

Figure 8

Scenario Duplication Feature: Soft Cost Assumption Screen

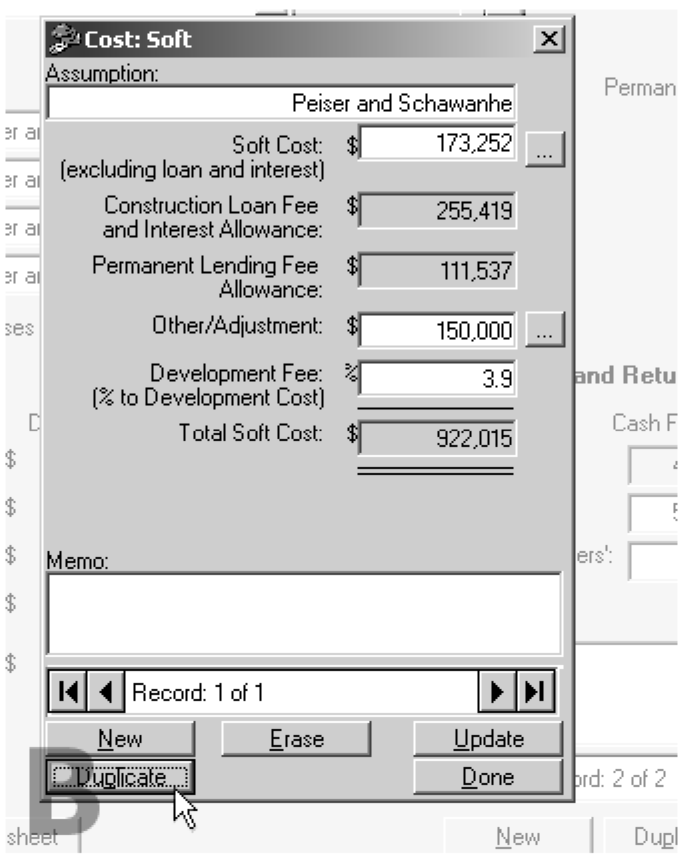
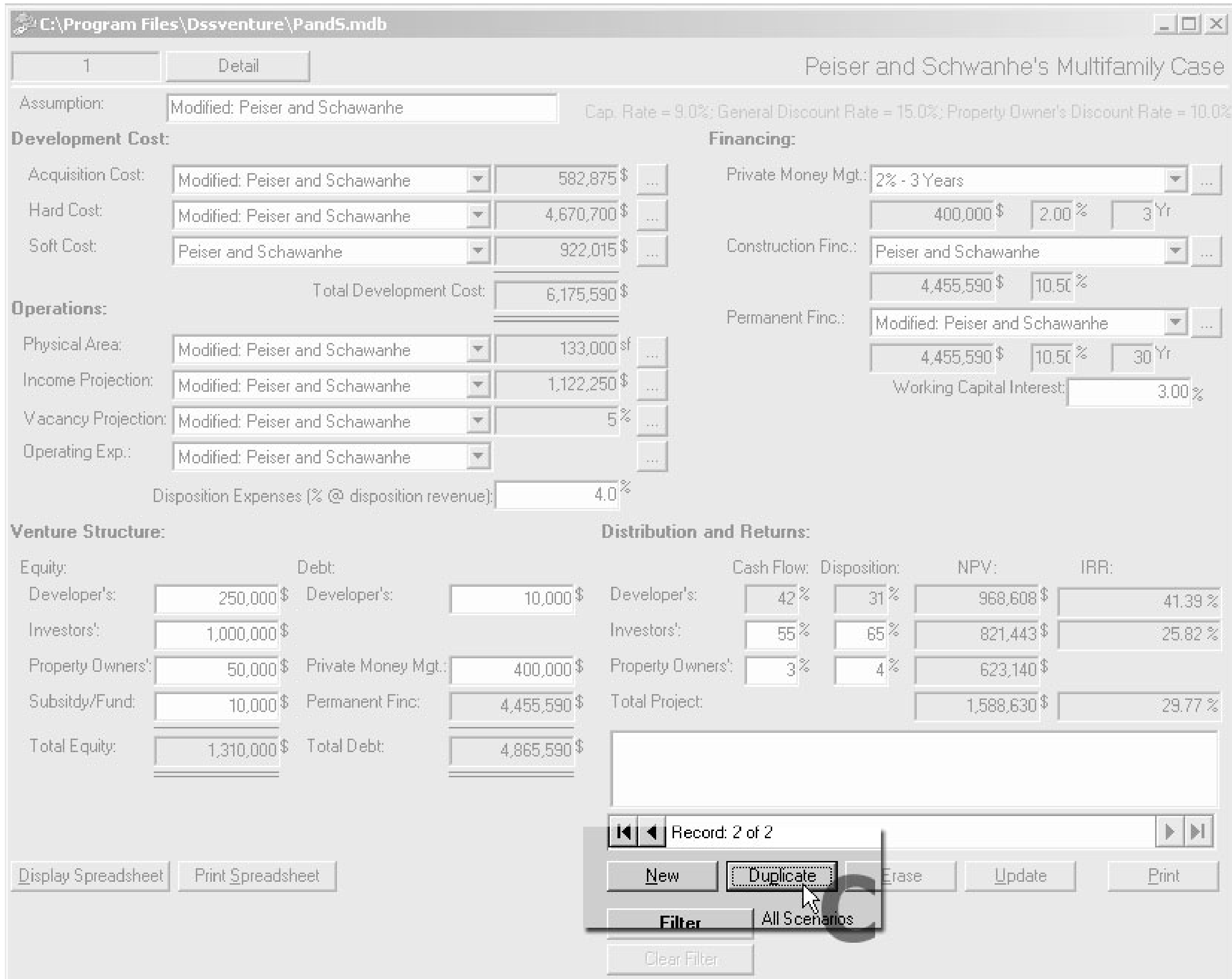


Figure 9

Scenario Duplication Feature: Development-Venture Scenario

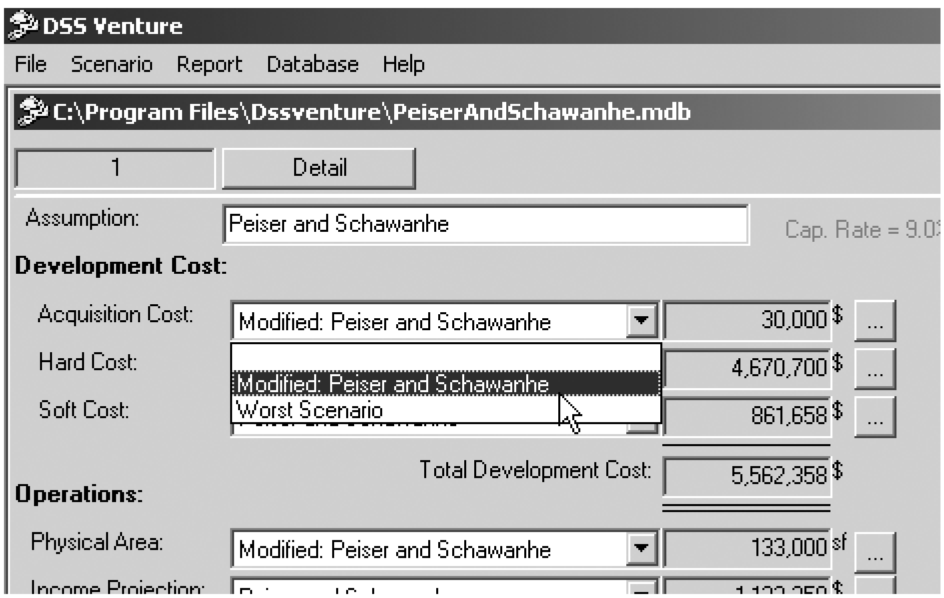


Drop-Down Selection Box Feature

When performing a sensitivity analysis, it is commonly known that a component assumption can be used repeatedly. Capitalizing on user's familiarity with currently available programs, *DSSVenture* provides drop-down selection boxes that allow users to apply a pre-specified set of inputs variable repeatedly. Without a tedious task of typing a set of inputs over again in every related scenario, *DSSVenture*'s interface was programmed to incorporate existing data with the selection box feature to allow users to recall and apply an appropriate set of pre-utilized factors in the calculation. This feature aims not only to expedite decision-making process, but also to enhance data input consistency. The drop-box feature is demonstrated in Figure 10.

Figure 10

Drop-Down Selection Box Feature

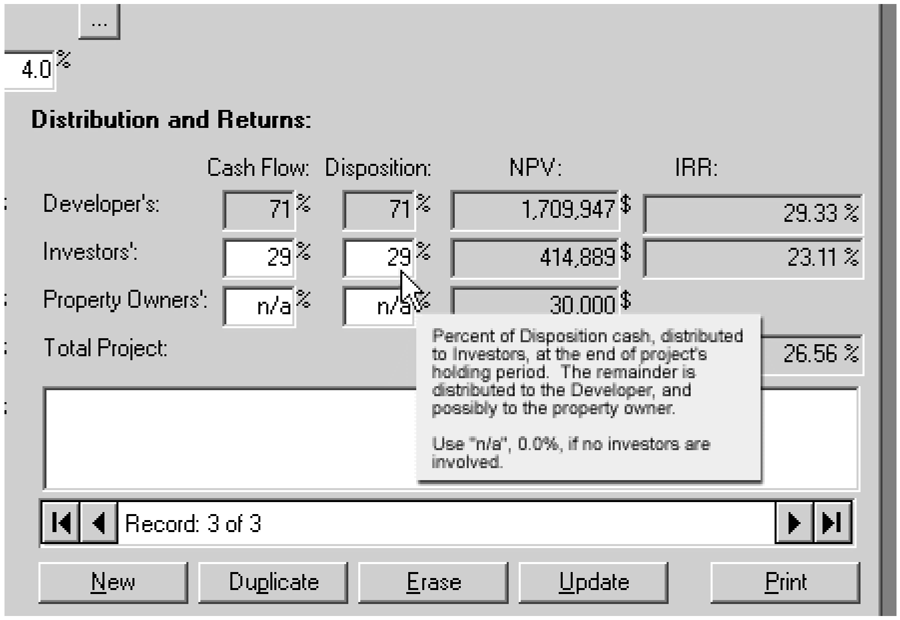


Pop-up Tip Label Feature

The Pop-up Tip Label is among popular features widely adopted in *Windows*-based commercial applications. A pop-up label is normally displayed in a brief moment after the cursor stops over an input or an output field. In *DSSVenture* program, the label was programmed to present necessary information about the object pointed to, including input and output fields, drop-down selection boxes, and command buttons. Figure 11 demonstrates the Pop-up Tip Label Feature when the cursor stops over the input field of investors' percentage of disposition income distribution.

Figure 11

Pop-up Tip Label Feature

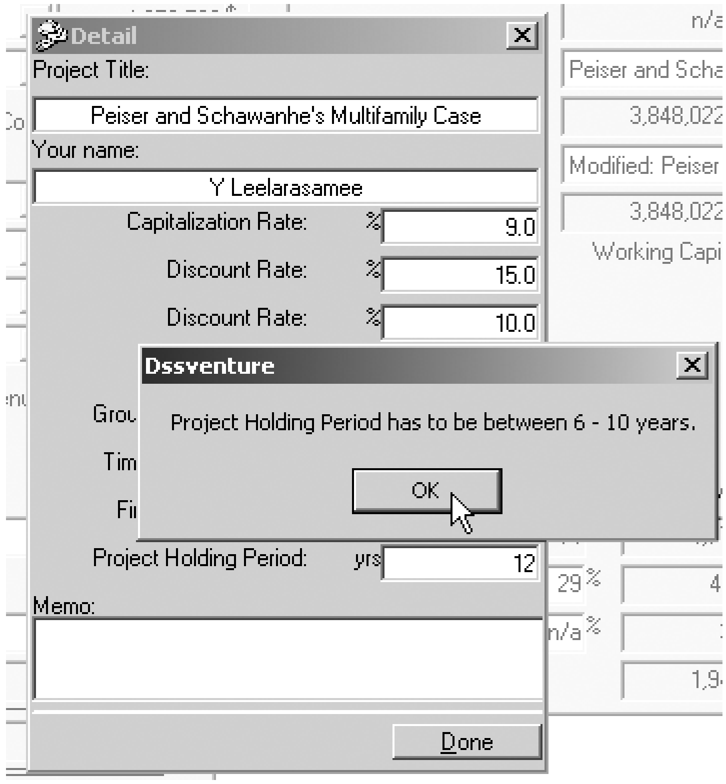


Error Message Feature

Similar to most commercial programs, *DSSVenture* offers an Error Message Feature. When a violation occurs, an error message with appropriate description will be displayed in a pop-up dialog window. Figure 12 presents an error dialog window, when the project's holding period input validation rule is violated. Error loops were programmed to display the dialog window until the *OK* command button is executed. The input value in the corresponding field (Project Holding Period, in this case) will be changed to a default value.

Figure 12

Error Message Feature



Default Value Feature

The prototype *DSSVenture* includes Default Value Feature that allows an analysis to be performed with a minimum numbers of inputs required. Every *DSSVenture*'s interface screen always starts with a default "n/a" in all input fields. For most input variables, leaving an "n/a" means the factor is not applicable in the scenario. However, for some input factors, assumptions are far more complicated since the program was designed to resemble real situations. With an "n/a" in a variable input field, *DSSVenture* assumes a default value for the factor to process calculation. Figure 13 presents a list of default values assumed for in *DSSVenture*.

In addition, the Default Value Feature plays a considerable role in preventing computation errors due to data's type-mismatch. If a character-numeric type-mismatch error occurs, an error loop will automatically convert the data to "n/a." The error loop will then informs the user of the error with the preceding Error Message Feature. The default value will be assumed until an appropriate input is applied.

Figure 13

List of Default Values Assumed for Input Factors

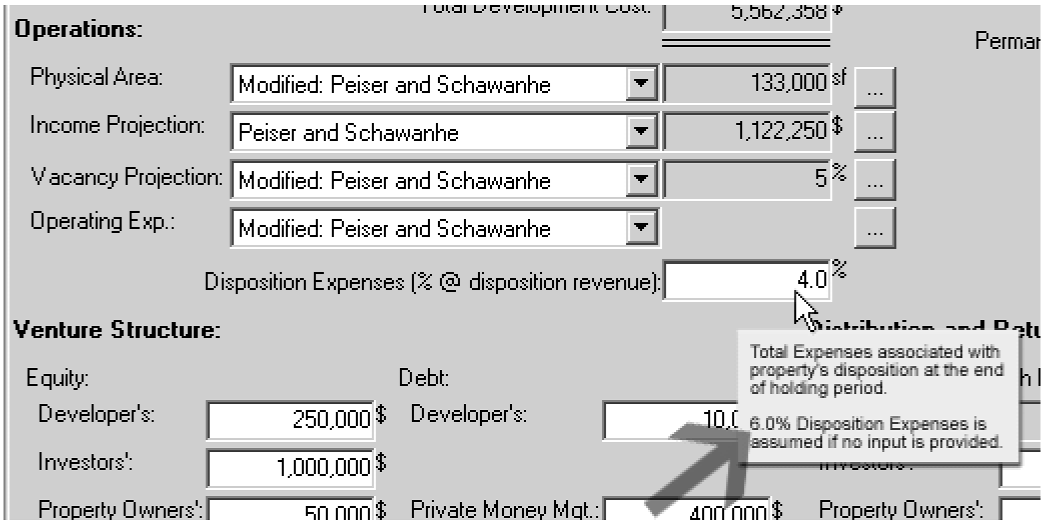
Factors	Default Values
Costs	
Land Costs	
Land Cost	$0.0
Building Cost	$0.0
Other Cost / Adjustment	$0.0
Hard Costs	
Construction / Imprv. Cost	$0.0/SF
Other Hard Cost / Adjustment	$0.0
Soft Costs	
Soft Cost (excld. loan costs)	$0.0
Additional Soft Cost / Adj.	$0.0
Development Fee	0.0%
Operations	
Building Areas	
Gross Building Area	Leaseable/80%
Total Leasable Area	***Required***
Total Usable Area	Gross Area
Operating Incomes	
Annual Rent (per SF)	$0.0/SF
Other Annual Income (Gross)	$0.0
Annual Growth	2.0%@YR
Vacancy Rates	
Stabilized Year	yr-3
Vacancy Rate: Yr-1	15%
Vacancy Rate: Yr-2	10%
Vacancy Rate: Yr-3	5%
Vacancy Rate: Yr-4 to Yr-9	preceding yr value
Operating Expenses	
Exp. per Collectible Income	0.0%@EGI
Annual Overhead	$0.0
Exp. per Building Area	$0.0/SF
Annual Growth	Income Growth
Replacement Reserve	0.0%@CF
Developer's Incentive	0.0%@CF
Incentive Threshold	$0.0
Disposition Expenses	6.0%@Revenue

Factors	Default Values
Financing	
Permanent Financing	
Preferred Loan-to-Value Ratio	100.0%
Preferred Debt Coverage Ratio	1.0
Preferred Loan-to-Cost Ratio	100.0%
Term of Loan	***Required***
Interest Rate	***Required***
Lender's Fees	0.0%
Construction Financing	
Interest Rate	Perm. Finc. Interest
Lender's Fees	0.0%
Private Money Mortgage	
Interest Rate	0.0%
Term of Loan	Holding Period
Working Capital Interest	0.0%
Venture Structure	
Equity	
Developer's Investment	$0.0
Investors' Contribution	$0.0
Property for Equity Swap	$0.0
Other Subsidy(ies)/Fund(s)	$0.0
Debt	
Loan from Developer	$0.0
Private Money Mortgage (PMM)	$0.0
Percent Distribution of Returns	
Investor(s): Cash Flow	0.0%
Investor(s): Disposition	0.0%
Property Owner: Cash Flow	0.0%
Property Owner: Disposition	0.0%
Others	
Ground Breaking	yr-0
Time for Construction	12 Months
Project Holding Period	10 Years
Capitalization Rate	10.0%
General Discount Rate	12.0%
Property Owner's Discount Rate	General Disc Rate

DSSVenture program informs users of the default value through use of the Pop-Up Tip Label Feature. Figure 14 presents an example of a default value notification when a mouse cursor stops over the disposition expense input field.

Figure 14

Default Value Feature



Calculation Assistant Feature

In real estate development, some input factors may comprise multiple calculations, for example land acquisition costs. Hence, a calculation is often needed to modify the data into a unit that is appropriate for the model. *DSSVenture* program is equipped with an optional Calculation Assistant Feature that will facilitate the calculation of data inputs.

Using Land Cost component assumption screen as a model for explanation, Figure 15 presents the Calculation Assistant Feature. When needed, a calculation assistant screen can be executed by a square button on the right-hand side of the input field①. In this case, Land Acquisition Cost Calculator screen② is activated. With its five input fields available, total land acquisition cost can be computed from up to five land plots. A click at *Update* button③ will instantly relay the calculated value to a corresponding input field④ in Land Cost component assumption screen. Figure 16 lists component assumption screens equipped with the feature.

Figure 15

Calculation Assistant Feature

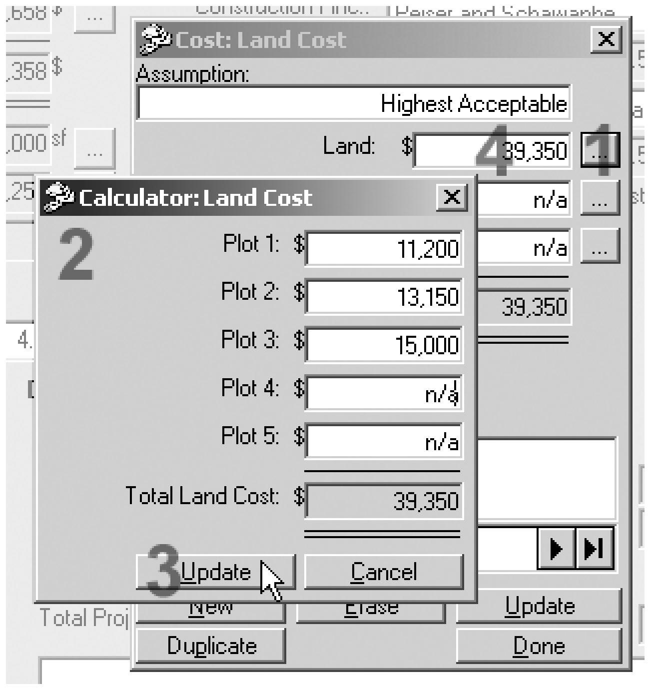


Figure 16

Calculation Assistant Feature: List of Related Input Fields

Component Screens	Input Factors with Calculation Assistant Feature
Land Cost	Land
	Building
	Other/Adjustment
Hard Cost	Other/Adjustment
Soft Cost	Soft Cost (Excluding Loan Fee and Interest Allowance)
	Other/Adjustment
Income Projections	Other Annual Incomes (Gross)
Operating Expenses	Expenses @EGI
	Annual Overhead
	Expenses @SF

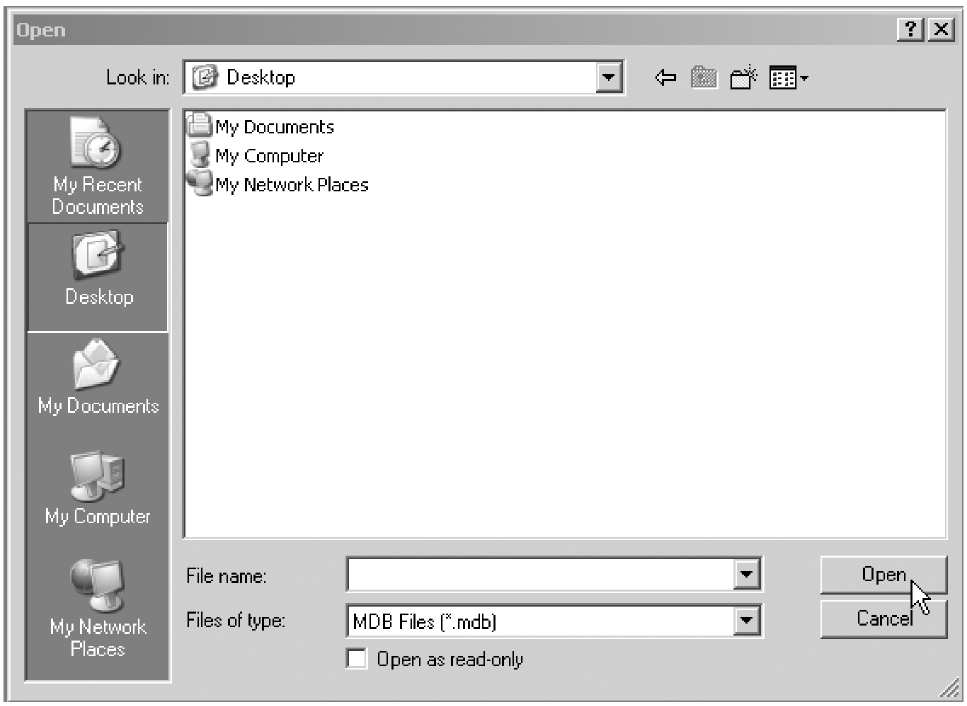
Traditional Windows Program Dialog Feature

Since the majority of business computer users are familiar with *Microsoft Windows* ® operating systems, *DSSVenture* follows the program tradition for easy operation. These features include form- and menu-oriented design, point-and-click command execution, and *Windows'* traditional communication dialog boxes.

Figure 17 presents a sample of the traditional communication dialog box utilized in *DSSVenture*. This dialog box is among popular interfaces used in communication between the user and the computer in *Windows*-based programs, such as *Internet Explorer®*, and *Microsoft Office®* suite. The dialog box presented in the exhibit offers a means to locate and select a database file for use in the program.

Figure 17

Traditional Windows Program Dialog Feature

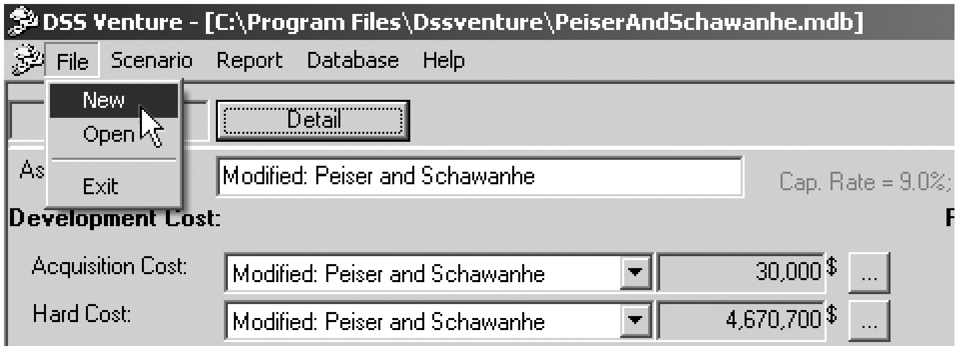


Traditional Menu Bar Feature

This feature was designed to appeal to experienced computer users. *DSSVenture* is equipped with a traditional menu bar located in the top left corner of the program's main window. Clicking on any of the words will either activate drop-down cascading menus, or execute a corresponding command. Figure 18 demonstrates the Traditional Menu Bar Feature waiting for a click to execute a command programmed for the cascading menu.

Figure 18

Traditional Menu Bar Feature



Auto Save Feature

All input and output variables in a scenario are critical data. They are automatically saved as the user proceeds through the system. Auto Save Feature is programmed to safeguard information in the event that a power or other type of computer failure occurs. At any time, the user can shut down the computer or exit *DSSVenture* system. Upon returning to the system, all scenarios and assumptions recorded will be available.

Print Feature

When a printout is needed, *DSSVenture* program provides four printing options. These options and their detail descriptions are listed in Figure 19 below.

Figure 19

Print Feature

Print Commands	Print Outs
Print Spreadsheet	Current Scenario: *LDEVOne* Spreadsheet (only summary page).
Print This Scenario	Current Scenario: *Development-Venture Scenario Screen*.
Print This Scenario with Detail	Current Scenario: *Development-Venture Scenario Screen* with *Land Cost Component Assumption* Screen, *Hard Cost Component Assumption* Screen, *Soft Cost Component Assumption* Screen, *Building Area Component Assumption* Screen, *Income Component Assumption* Screen, *Vacancy Component Assumption* Screen, *Operating Expense Component Assumption* Screen, *Private Money Mortgage Financing Component Assumption* Screen, *Construction Financing Component Assumption* Screen, *Permanent Financing Component Assumption* Screen, and *LDEVOne* Spreadsheet (all pages).
Print Everything	All Scenarios: The same printouts with Print This Scenario with Detail Option.

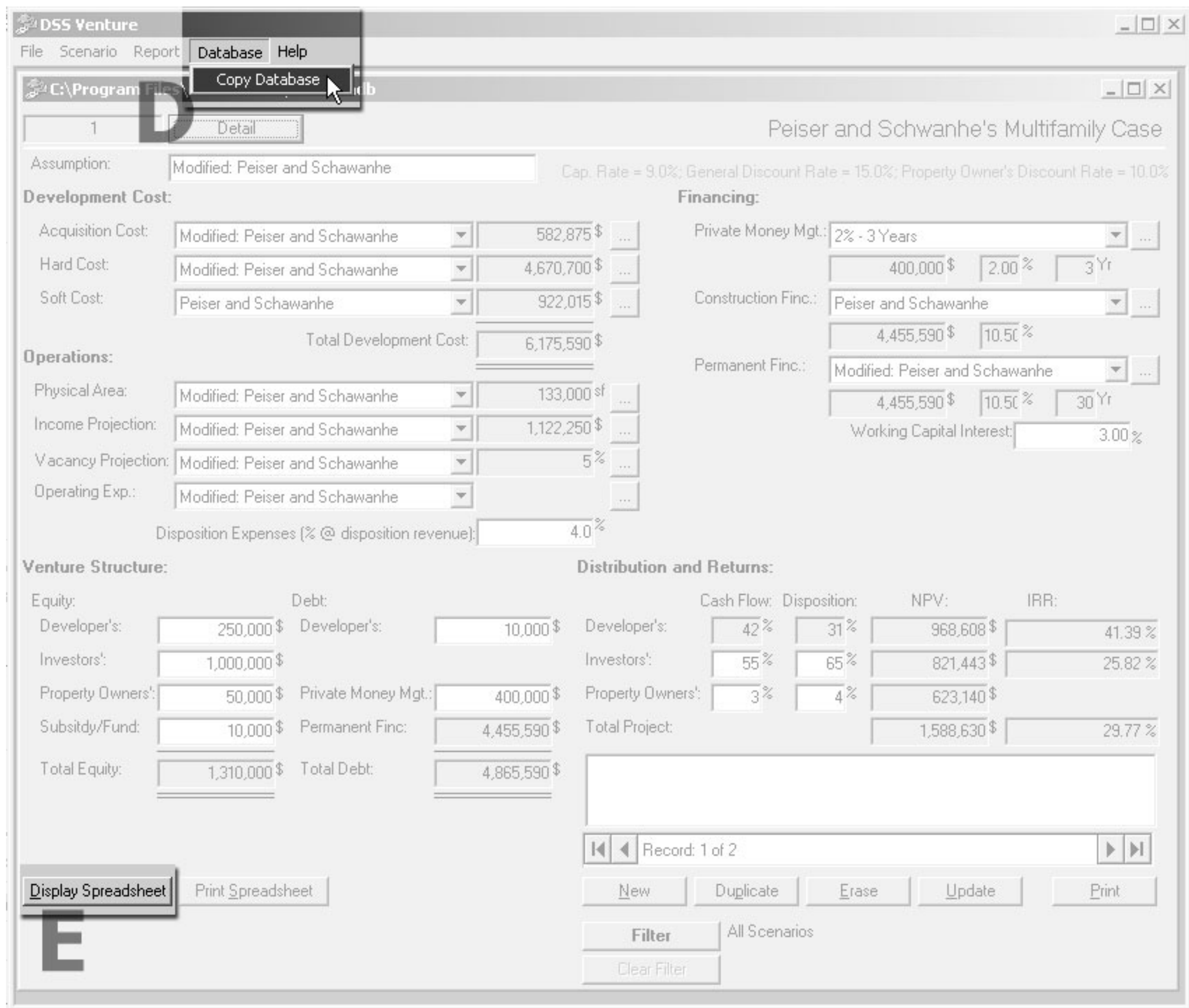
Analysis Expandability Feature

DSSVenture is designed with a future expansion in mind. It was originally devised with intent of providing a full supporting analysis for real estate development decision during the predevelopment stage. *DSSVenture* system's complex calculation and database are based on the *LDEVOne.xlt*, a *Microsoft-Excel*®-based proforma, and *DSSVenture.mdb*, a *Microsoft-Access*®-based data model. Depending on the decision maker's computer skills, the system computation can be directly customized as needed in the proforma. In addition, the complete database can be downloaded and manually cross-examined as needed outside the system environment.

Figure 20 presents the Analysis Expandability Feature. A complete database file can be copied by the highlighted *Copy Database* menu commandⒹ. A click on the *Display Spreadsheet* command buttonⒺ loads the *LDEVOne* proforma with input/output factors currently shown in the system's interfaces. With a careful program coded in *DSSVenture*'s interfaces, these input/output factors shown in the proforma are dynamically linked with variables in the system. Depending on the user's computer skill, the proforma is ready for customization through use of *Microsoft Excel*'s interface. In addition, the spreadsheet is ready for detail presentation.

Figure 20

Analysis Expandability Feature



APPENDIX H

ADDITIONAL USER INTERFACE DETAILS

Introduction Screen

The Introduction Screen was developed with the goals of reinforcing the underlying objectives and strategies employed in the design and development of *DSSVenture* system, as well as encouraging the use of technology in real estate development and feasibility analysis. Information shown on this screen includes the program title, reinforcing graphics, the copy right, and the software version.

This screen automatically loads when the program is executed. The screen will disappear when the user clicks on any part of the screen. The screen will also disappear automatically after ten seconds of presentation. The menu screen is the next interface activated when the introduction screen unloads. Figure 21 and Figure 22 present the screen's data and the screen capture.

Figure 21

Introduction Screen's Data

Forward Screen Linkages:	Menu Screen	
Backward Screen Linkages:	n/a	
Logic Models:	n/a	
Data Models:	Embeded Bitmap Graphic	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	n/a	n/a

Figure 22

Introduction Screen Capture

Menu Screen

The Menu Screen is the first interface executed when the Introduction Screen disappears. On the technical side, this screen accommodates a large number of invisible procedural code modules. Throughout a computing session, these modules provide complex instructions for internal computations, internal linkages among data models, logic models, and supporting programs. Therefore, the menu screen was configured to appear as the application background until the program completely unloads.

Apart from providing the invisible codes, the Menu Screen offers a traditional *Windows* menu bar at the top portion of the screen. The menu bar offers five executable command groups, namely File, Scenarios, Reports, Database, and Help. Several commands organized within these groups and their corresponding descriptions are summarized in Figure 23 below. The Menu Screen's data and capture are shown in Figure 24 and Figure 25.

Figure 23

Menu Screen Organization

Menu	Descriptions
File	
New	Execute *New* (project) procedure command. (Start program with a blank database file.)
Open	Execute *Open* (an existing project) procedure command. (Start program with an existing database file.)
Exit	Execute *Exit* procedure command. (Unload program, and exit to windows)
Scenarios **	
Costs	
Land Acquisition Costs	Execute *Land Cost* assumption screen.
Hard Costs	Execute *Hard Cost* assumption screen.
Soft Costs	Execute *Soft Cost* assumption screen.
Operations	
Building Areas	Execute *Building Area* assumption screen.
Income	Execute *Income Projection* assumption screen.
Vacancy	Execute *Vacancy Projection* assumption screen.
Operating Expenses	Execute *Operating Expense* assumption screen.
Financing	
Permanent Financing	Execute *Permanent Financing* assumption screen.
Construcdtion Financing	Execute *Construction Financing* assumption screen.
Private Money Mortgage	Execute *Private Money Mortgage* assumption screen.
Reports **	
Compare Scenarios	Execute *Variable Selection* screen.
Print Scenario	Execute *Print Scenario* procedure command. (Print current scenario summary sheet)
Database **	
Copy Database	Execute *Copy Database* procedure command. (copy the raw database file for manual analysis)
Help	
DSSVenture Help	Execute *Help* screen.
About	Execute *About* screen.

Note**: These menus can be accessed only after a database file is created or selected.

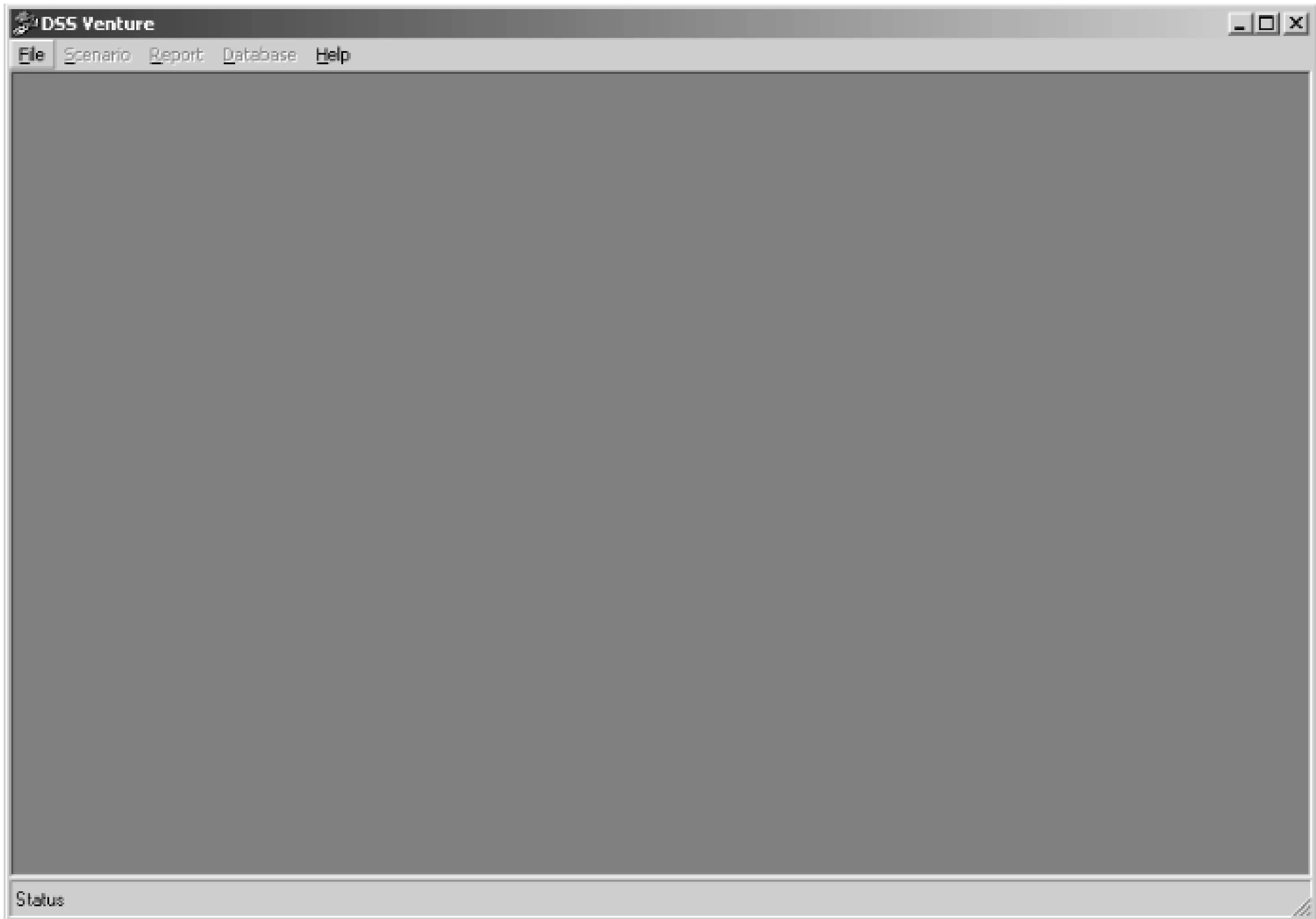
Figure 24

Menu Screen's Data

Forward Screen Linkages:	*New* [analysis] Dialog Box *Open* [an existing analysis] Dialog Box *Land Cost* Assumption Screen *Hard Cost* Assumption Screen *Soft Cost* Assumption Screen *Building Area* Assumption Screen Operating *Income* Assumption Screen *Vacancy* Assumption Screen *Operating Expense* Assumption Screen *Private Money Mortgage Financing* Assumption Screen *Construction Financing* Assumption Screen *Permanent Financing* Assumption Screen *Scenario Selections* Screen Copy Database Dialog Box *Help* Screen *About* Screen	
Backward Screen Linkages:	n/a	
Logic Models:	n/a	
Data Models:	n/a	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	n/a	n/a

Figure 25

Menu Screen Capture



Land Cost Assumption Screen

The Land Cost Assumption Screen is the first component assumption interface discussed in the *Cost* component category. The screen's data and capture are presented in Figure 26 and Figure 27. This component assumption screen can be executed by a command button⑳ located on the right of the Total Land Acquisition Cost output field on Development-Venture Scenario screen. Otherwise, this screen can be activated by a menu command as listed in Figure 23 (Menu Screen Organization).

This screen, as well as every component assumption interface, loads with a modal attribute to prevent syntax errors caused by variable conflicts. Therefore, access to any program objects below the screen is prohibited (except the menu bar) until this screen completely unloads. When this screen loads, a corresponding component assumption shown in Development-Venture Scenario screen is called up as a current record.

Variable input fields on this screen include a Land Cost ($net), a Building Cost ($net), and an Other Cost/Adjustment ($net). Calculations in the proforma produce a total land acquisition cost output that will be subsequently relayed back to a corresponding output field on the screen. It must be noted that calculations in *LDEVOne* proforma and data presentation/record in *DSSVenture* program are always connected. When a variable input is changed, the new value will be automatically applied in every related scenario throughout the analysis. Sensitivity of the variable can be instantly noticed.

Figure 26

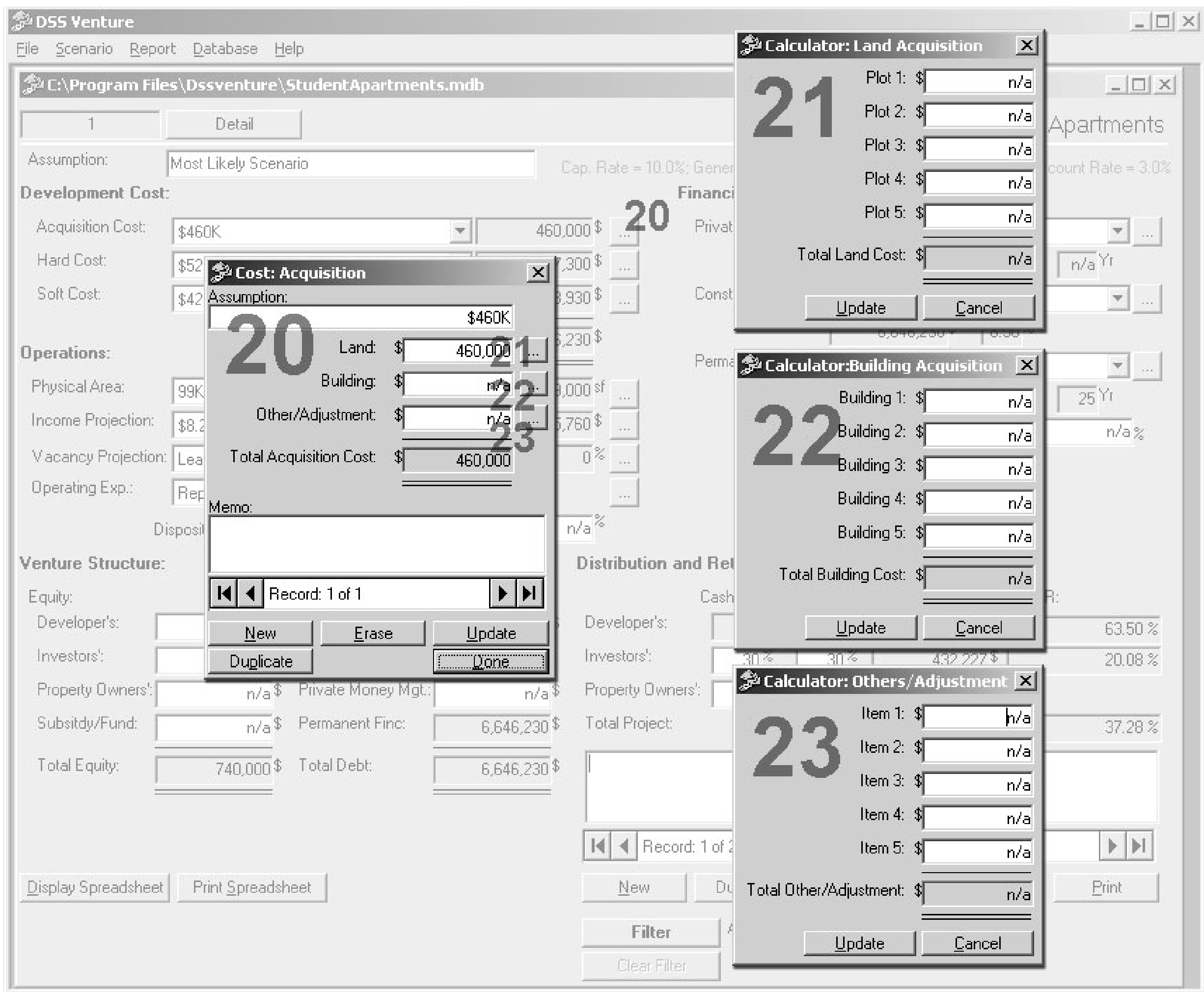
Land Cost Assumption Screen's Data

Forward Screen Linkages:	*Calculator: Land Acquisition* Screen *Calculator: Building Acquisition* Screen *Calculator: Other/Adjustment* Screen	
Backward Screen Linkages:	*Development-Venture Scenario* Screen	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Land: ($)	Summary / Land Cost: ($)
	Building: ($)	Summary / Building Cost: ($)
	Other/Adjustment: ($)	Summary / Other Cost/Adjustment: ($)
	Total Land Acquisition Cost: ($)	Summary / Total Land Acquisition Cost: ($)

Note: Grey Title indicates an output field.

Figure 27

Land Cost Assumption Screen Captures



On the right of the three input fields, there are columns of buttons programmed to facilitate data input process by using Calculation Assistant Feature. These three buttons execute three calculation assistant interfaces, namely Calculator: Land Acquisition screen㉑, Calculator: Building Acquisition screen㉒, and Calculator: Others/Adjustment screen㉓. Each calculator screen provides an appropriate automation and computation for complicated projects with multiple land plots, existing structures, and cost adjustment items respectively. On every calculator assistant screen, an *Update* command button is programmed to relay an output generated in the screen to a corresponding input field in the main screen. The *Update* button also unloads the form.

Finally, the land cost and all other assumption screens include a database organization feature, which is described in Appendix G.

Hard Cost Assumption Screen

Hard Cost Assumption Screen is one of component assumption interfaces included in the *DSSVenture* program. The screen's data and capture are presented in Figure 28 and Figure 29. This screen is executed by two means of a command button㉔ located on the right of the Total Hard Cost output field in Development-Venture Scenario screen, and a menu command presented earlier in Figure 23 (page 229). The screen's modal attribute, the linkage to the *LDEVOne* proforma, and the database organization feature remain similar to the Development-Venture Scenario screen not only for this interface, but also for the entire component assumption screens.

Variable input fields on this screen include a Construction/Improvement Cost ($/SF), and an Other Cost/Adjustment ($net). Clicking on the command button㉕ on the right of the Other Cost/Adjustment input field activates the screen's calculation assistant feature. Total hard cost output field dynamically links to the total hard cost cell in *LDEVOne*.

Figure 28

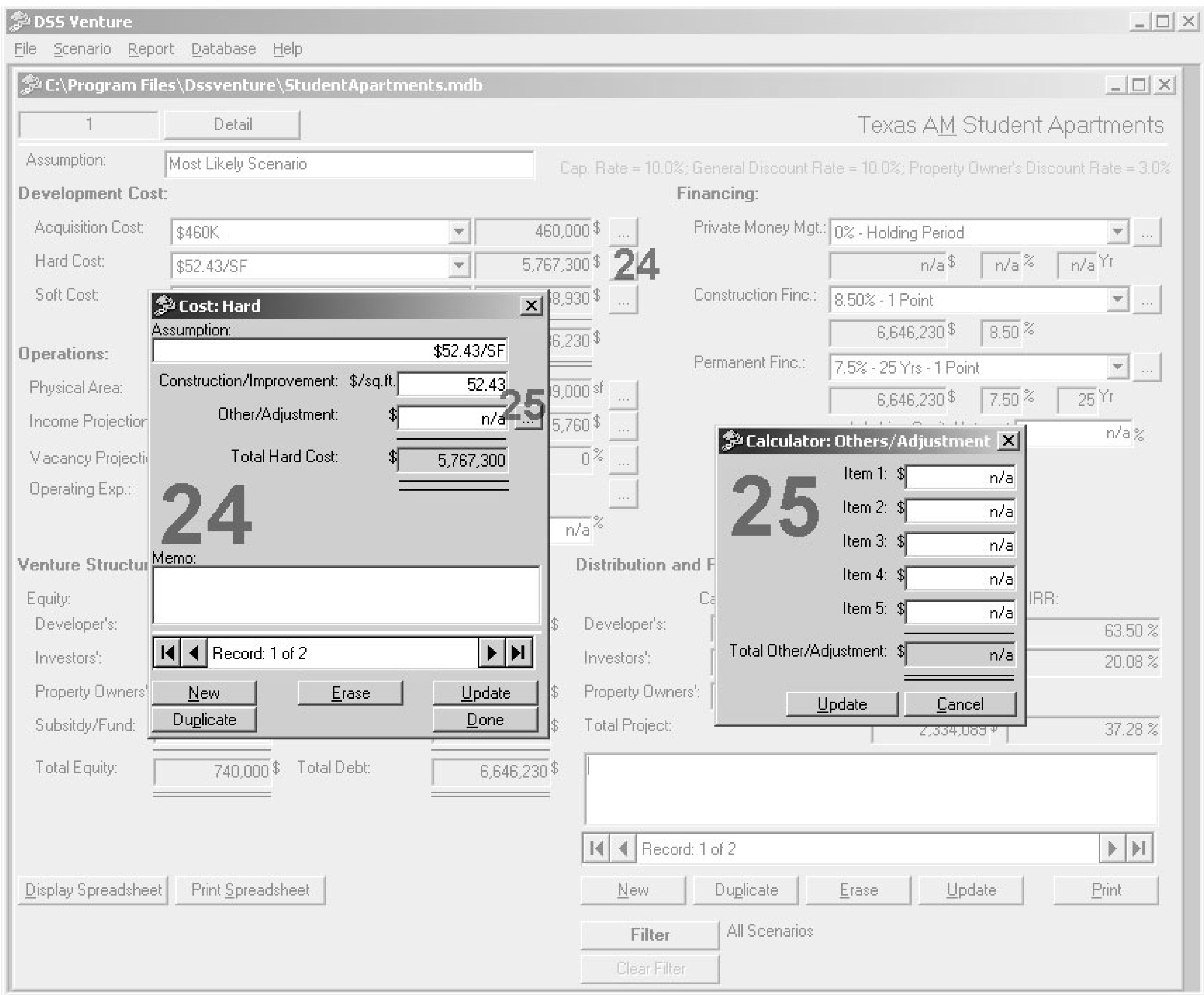
Hard Cost Assumption Screen's Data

Forward Screen Linkages:	*Calculator: Other/Adjustment* Screen	
Backward Screen Linkages:	*Development-Venture Scenario* Screen	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Construction/Improvement: ($/SF)	Summary / Construction/Improvement Cost: ($/SF)
	Other/Adjustment: ($)	Summary / Other Cost/Adjustment: ($)
	Total Hard Cost: ($)	Summary / Total Hard Cost: ($)

Note: Grey Title indicates an output field.

Figure 29

Hard Cost Assumption Screen Capture



Soft Cost Assumption Screen

The Soft Cost Assumption Screen's data and capture are presented in Figure 30 and Figure 31. Similar to previous screens discussed, this screen can be executed by using a command button㉖ on the right of total soft cost output field in Development-Venture Scenario screen, or a menu command presented in Figure 23 (page 229).

As illustrated in Figure 31, this screen's variable input fields include a Soft Cost ($net), an Other Cost/Adjustment ($net), and a Development Fee (% to development cost). Two command buttons located next to soft cost㉗, and other cost/adjustment ㉘ fields are programmed to execute soft cost and adjustment calculator interfaces. A Construction Loan Fee Allowance, a Permanent Loan Fee Allowance, and a Total Soft Cost output fields directly connect values from corresponding cells in *LDEVOne*.

Figure 30

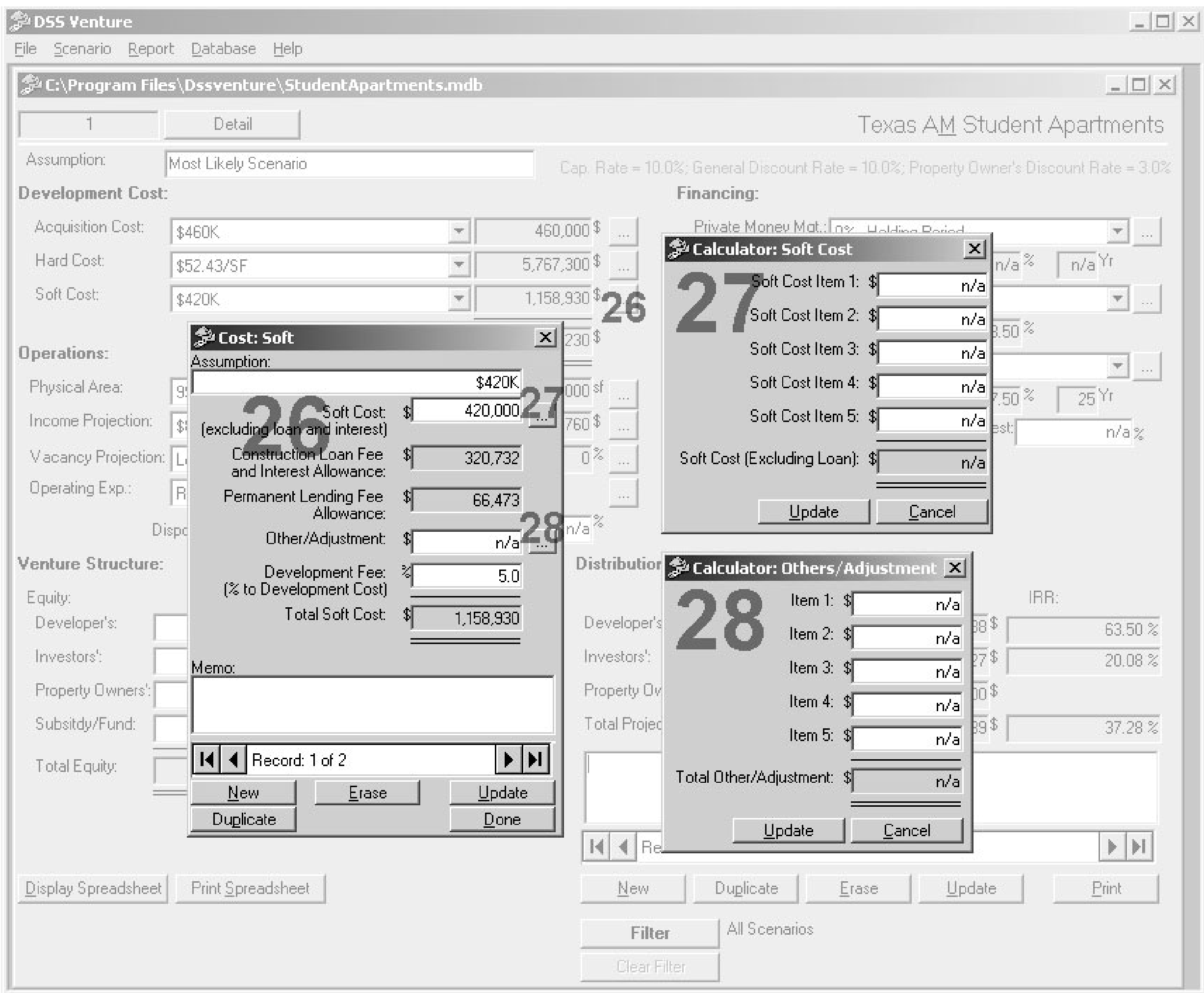
Soft Cost Assumption Screen's Data

Forward Screen Linkages:	*Calculator: Soft Cost* Screen *Calculator: Other/Adjustment* Screen	
Backward Screen Linkages:	*Development-Venture Scenario* Screen	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Soft Cost (excluding loan and interest): ($)	Summary / Soft Cost (excld loan cost): ($)
	Construction Loan Fee and Interest Allowance: ($)	Summary / Const. Loan Fee and Int. Allowance: ($)
	Permanent Loan Fee Allowance: ($)	Summary / Permanent Loan Fee Allowance: ($)
	Other/Adjustment: ($)	Summary / Additional Soft Cost / Adjustment: ($)
	Development Fee (% to development cost)	Summary / Development Fee: ($)
	Total Soft Cost: ($)	Summary / Total Hard Cost: ($)

Note: Grey Title indicates an output field.

Figure 31

Soft Cost Assumption Screen Capture



Building Area Assumption Screen

Building Area Assumption Screen is the first component assumption featured in the *Operation* category. The screen's data and capture can be seen in Figure 32 and Figure 33. Like other component assumption interfaces, this screen can be executed in two ways by using a command button㉙ located on the right of leasable area output field in Development-Venture Scenario screen, or a menu command described earlier in Figure 23 (page 229).

Variable input fields on this screen include a Gross Building Area (SF), a Usable Area (SF), and a Leasable Area (SF). The final leasable area output field is dynamically automated by the LDEVOne proforma. The automated value is used to compute the project's potential gross income, while the gross and the usable areas are used for estimations of respectively construction/improvment cost and operating expenses per building area.

Figure 32

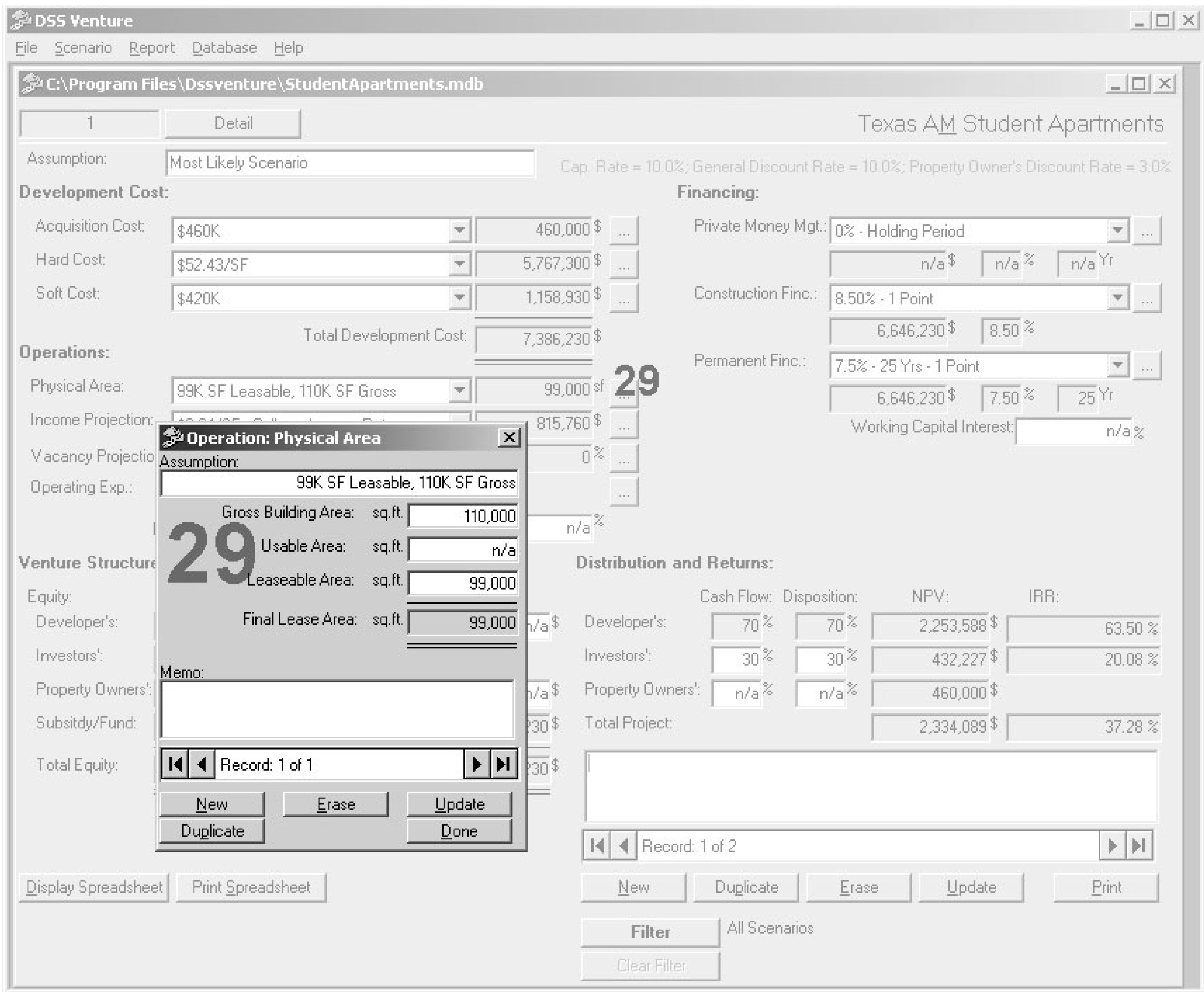
Building Area Assumption Screen's Data

Forward Screen Linkages:	n/a	
Backward Screen Linkages:	*Development-Venture Scenario* Screen	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Gross Building Area: (SF)	Gross Building Area: (SF)
	Usable Area: (SF)	Total Leasable Area: (SF)
	Leasable Area: (SF)	Total Usable Area: (SF)
	Final Leasable Area: (SF)	n/a

Note: Grey Title indicates an output field.

Figure 33

Building Area Assumption Screen Capture



Operating Income Assumption Screen

The Operating Income Assumption Screen is among ten component assumption interfaces equipped in the program. The screen's data and capture are presented in Figure 34 and Figure 35. Like the previous screens, this assumption screen can be executed by using a command button 50 located on the right of potential gross income output field in Development-Venture Scenario, or a menu command presented earlier in Figure 23 (page 229).

Variable input fields on this screen include an Annual Rental Rate ($/SF), an Other Income ($-net), and an Income Growth Rate (%). A command button 51 located on the right of the other income input field is programmed to execute a Calculation Assistant Feature, Other Income Calculator interface. Potential Gross Income output field refers to a value from the corresponding output cell in *LDEVOne*.

Figure 34

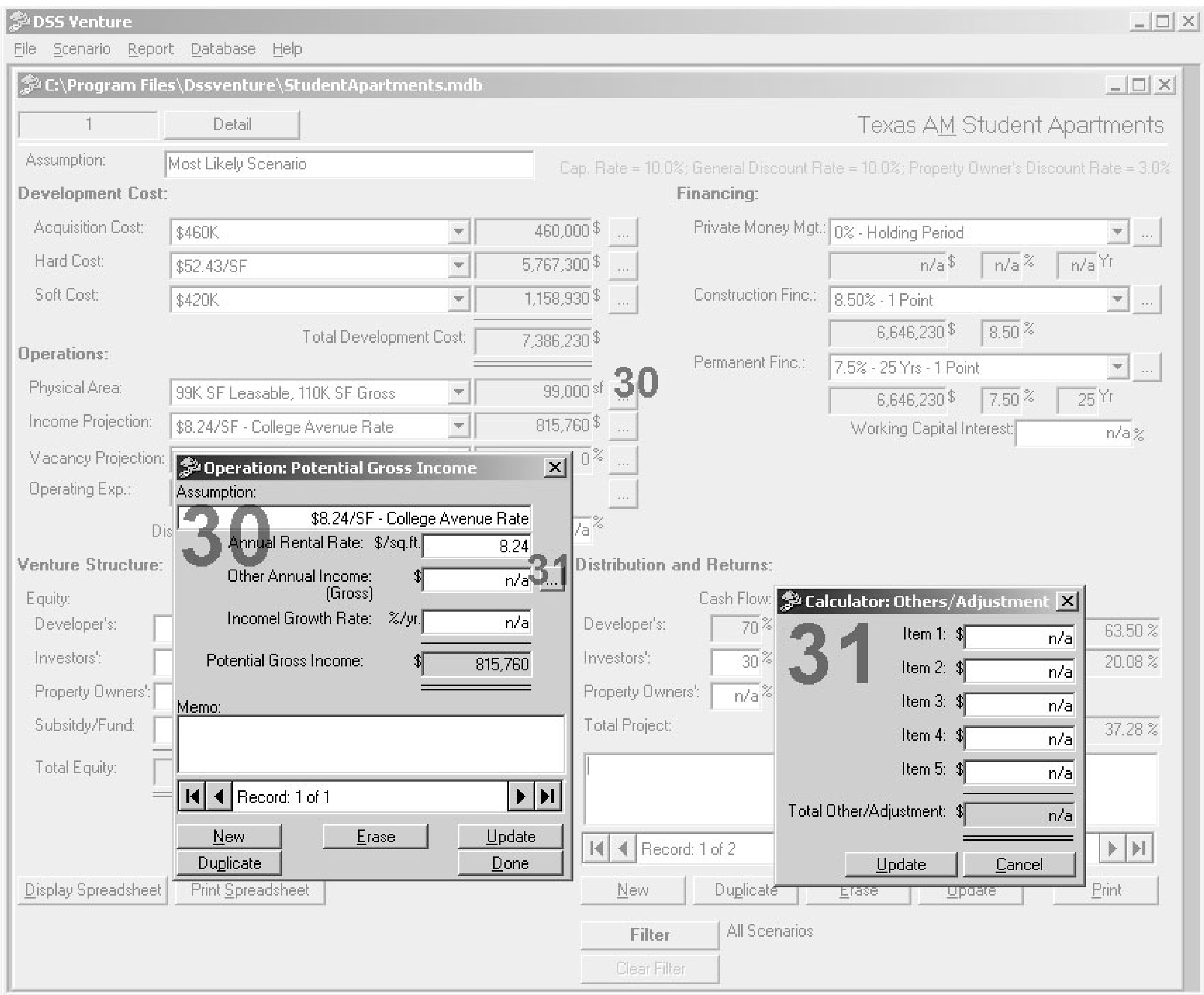
Operating Income Assumption Screen's Data

Forward Screen Linkages:	Calculator: *Other/Adjustment* Screen	
Backward Screen Linkages:	*Development-Venture Scenario* Screen	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Annual Rental Rate: ($/SF)	Summary / Annual Rent (per SF): ($/SF)
	Other Income (Gross): ($)	Summary / Other Annual Income (Gross): ($)
	Income Growth Rate: (%)	Summary / Annual Growth: (%)
	Potential Gross Income: ($)	Summary / Potential Gross Income: ($)

Note: Grey Title indicates an output field.

Figure 35

Operating Income Assumption Screen Capture



Vacancy Assumption Screen

The Vacancy Assumption Screen is another component assumptionl interface incorporated in the *Operation* category. The screen's data and capture are presented in Figure 36 and Figure 37. Similar to other component assumption screens, Vacancy Assumption Screen is executed by using a command button ㉜ on the right of the Stabilized Year Vacancy output field in Development-Venture Scenario, or a menu command presented earlier in Figure 23 (page 229).

Variable input fields on this screen include a First Stabilized Year (operating year), and a series of Annual Vacancy Rates (%), which cover expected vacancy rate of the first to the ninth operating year. Located on the right of each Annual Vacancy Rate input fields is an output field programmed to automate corresponding year's final vacancy rate applied in the scenario in case the inputs are not available. These output fields were programmed to correspond with the output cells in *LDEVOne*'s Cash Flow Schedule worksheet.

Figure 36

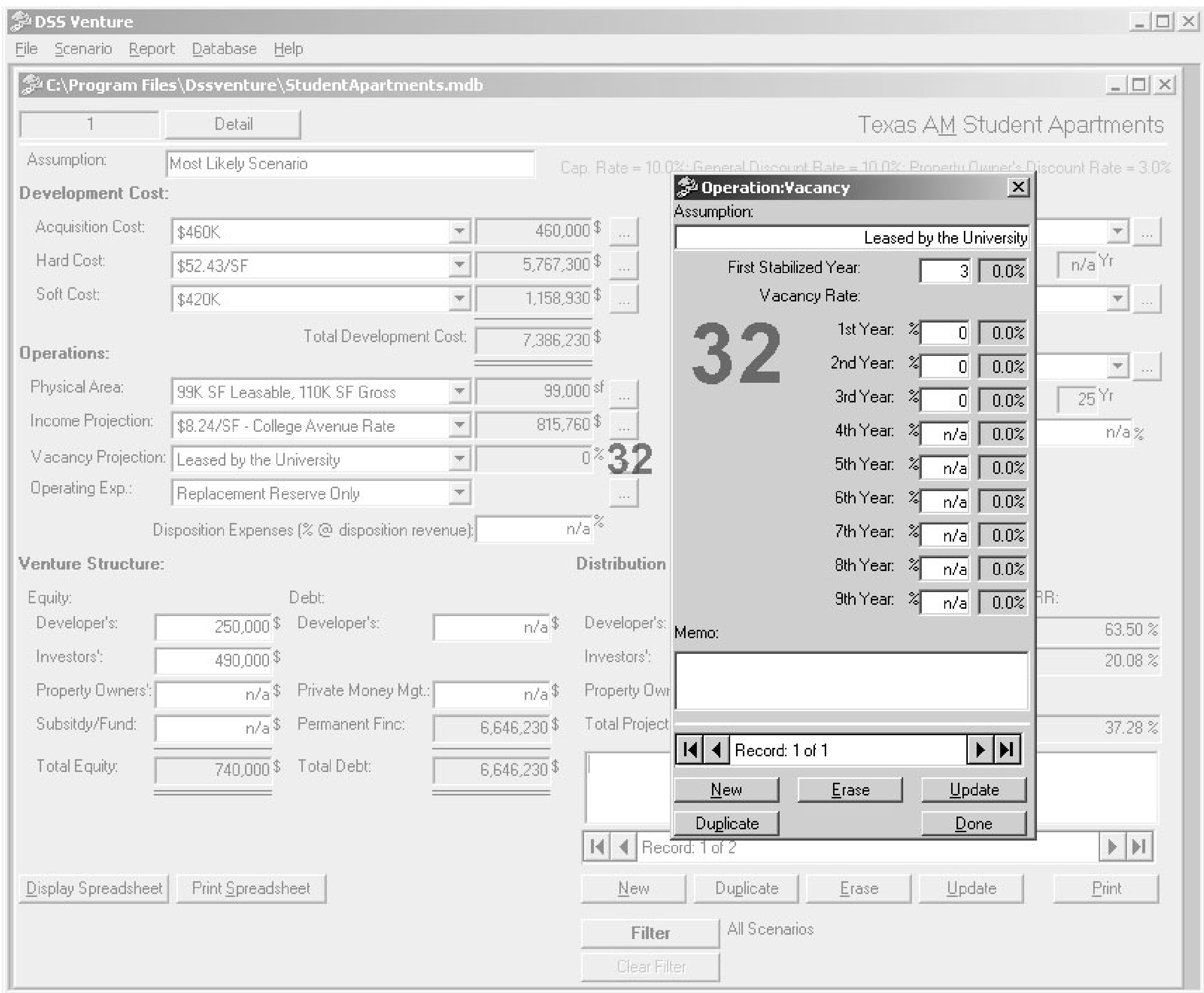
Vacancy Assumption Screen's Data

Forward Screen Linkages:	n/a	
Backward Screen Linkages:	*Development-Venture Scenario* Screen	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	First Stabilized Year:	Summary / Annual Rent (per SF): ($/SF)
	Vacancy Rate: 1st Year: (%)	Cash Flow Schedule / Vacancy Yr 1: (%)
	Vacancy Rate: 1st Year: (%)	n/a
	Vacancy Rate: 2nd Year: (%)	Cash Flow Schedule / Vacancy Yr 2: (%)
	Vacancy Rate: 2nd Year: (%)	n/a
	Vacancy Rate: 3rd Year: (%)	Cash Flow Schedule / Vacancy Yr 3: (%)
	Vacancy Rate: 3rd Year: (%)	n/a
	Vacancy Rate: 4th Year: (%)	Cash Flow Schedule / Vacancy Yr 4: (%)
	Vacancy Rate: 4th Year: (%)	n/a
	Vacancy Rate: 5th Year: (%)	Cash Flow Schedule / Vacancy Yr 5: (%)
	Vacancy Rate: 5th Year: (%)	n/a
	Vacancy Rate: 6th Year: (%)	Cash Flow Schedule / Vacancy Yr 6: (%)
	Vacancy Rate: 6th Year: (%)	n/a
	Vacancy Rate: 7th Year: (%)	Cash Flow Schedule / Vacancy Yr 7: (%)
	Vacancy Rate: 7th Year: (%)	n/a
	Vacancy Rate: 8th Year: (%)	Cash Flow Schedule / Vacancy Yr 8: (%)
	Vacancy Rate: 8th Year: (%)	n/a
	Vacancy Rate: 9th Year: (%)	Cash Flow Schedule / Vacancy Yr 9: (%)
	Vacancy Rate: 9th Year: (%)	n/a

Note: Grey Title indicates an output field.

Figure 37

Vacancy Assumption Screen Capture



Operating Expense Assumption Screen

Another component assumption interface featuring in the program is the Operating Expense Assumption Screen. The screen's data and capture can be seen in Figure 38 and Figure 39. Like other component assumption interfaces, this screen is executed by using a command button㉝ located on the right of the Operating Expense Component Assumption drop-box in Development-Venture Scenario screen, or a menu command presented earlier in Figure 23 (page 229).

Variable input fields on this screen include an Operating Expense per Collectible Income (% to effective gross income), an Overhead Expense ($net), an Operating Expense per Building Area ($/useable area), a Replacement Reserve (% to net income), an Expense Growth Rate (%), a Developer's Incentive Fee (% to cash flow) and a Developer's Incentive Threshold ($). Three calculation assistant screens can be executed to aid calculations of the Expense per Collectible Income amount㉞, the Overhead Expense amount㉟, and the Expense per Building Area amount㊱.

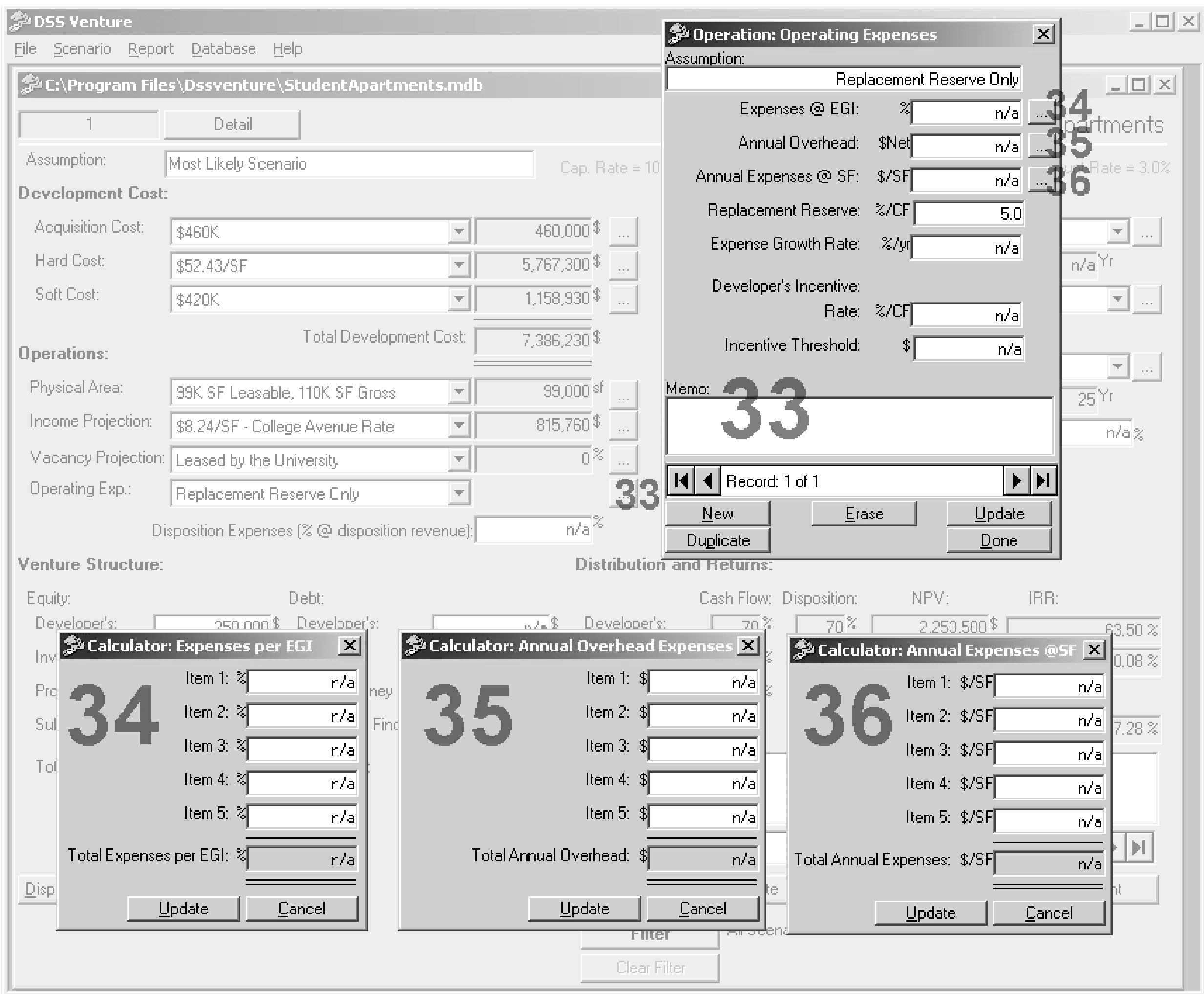
Figure 38

Operating Expense Assumption Screen's Data

Forward Screen Linkages:	*Calculator: Expenses per PGI* Screen *Calculator: Annual Overhead Expenses* Screen *Calculator: Annual Expenses @SF* Screen	
Backward Screen Linkages:	*Development-Venture Scenario* Screen	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Expenses @EGI: (%EGI)	Summary / Expenses per Collectible Income: (%EGI)
	Annual Overhead: ($)	Summary / Annual Overhead: ($)
	Annual Expenses per SF: ($/SF)	Summary / Expenses per Building Area: ($/SF)
	Replacement Reserve: (%CF)	Summary / Annual Replacement Reserve: (%)
	Expense Growth Rate: (%)	Summary / Annual Growth: (%)
	Developer's Incentive Rate: (%CF)	Summary / Fee (%BTCF above threshold): (%CF)
	Incentive Threshold: ($)	Summary / Threshold: ($)

Figure 39

Operating Expense Assumption Screen Capture



Private Money Mortgage Assumption Screen

This screen is the first component assumption interface discussed in the *Financing* category. The screen's data and capture are presented in Figure 40 and Figure 41. The Private Money Mortgage Assumption Screen is executed by using a command button㊲ located on the right of the Private Money Mortgage assumption drop-down selection box in Development-Venture Scenario screen, or a menu command presented earlier in Figure 23 (page 229).

Two variable inputs are essential for an assumption setting. These include an an Interest Rate (%APR), and a Mortgage Term (years). This screen offers two variable output fields that inform the user of the mortgage amount required, and the annual debt service amount estimated for the scenario. These fields dynamically derive values from the corresponding output cells in *LDEVOne*.

Figure 40

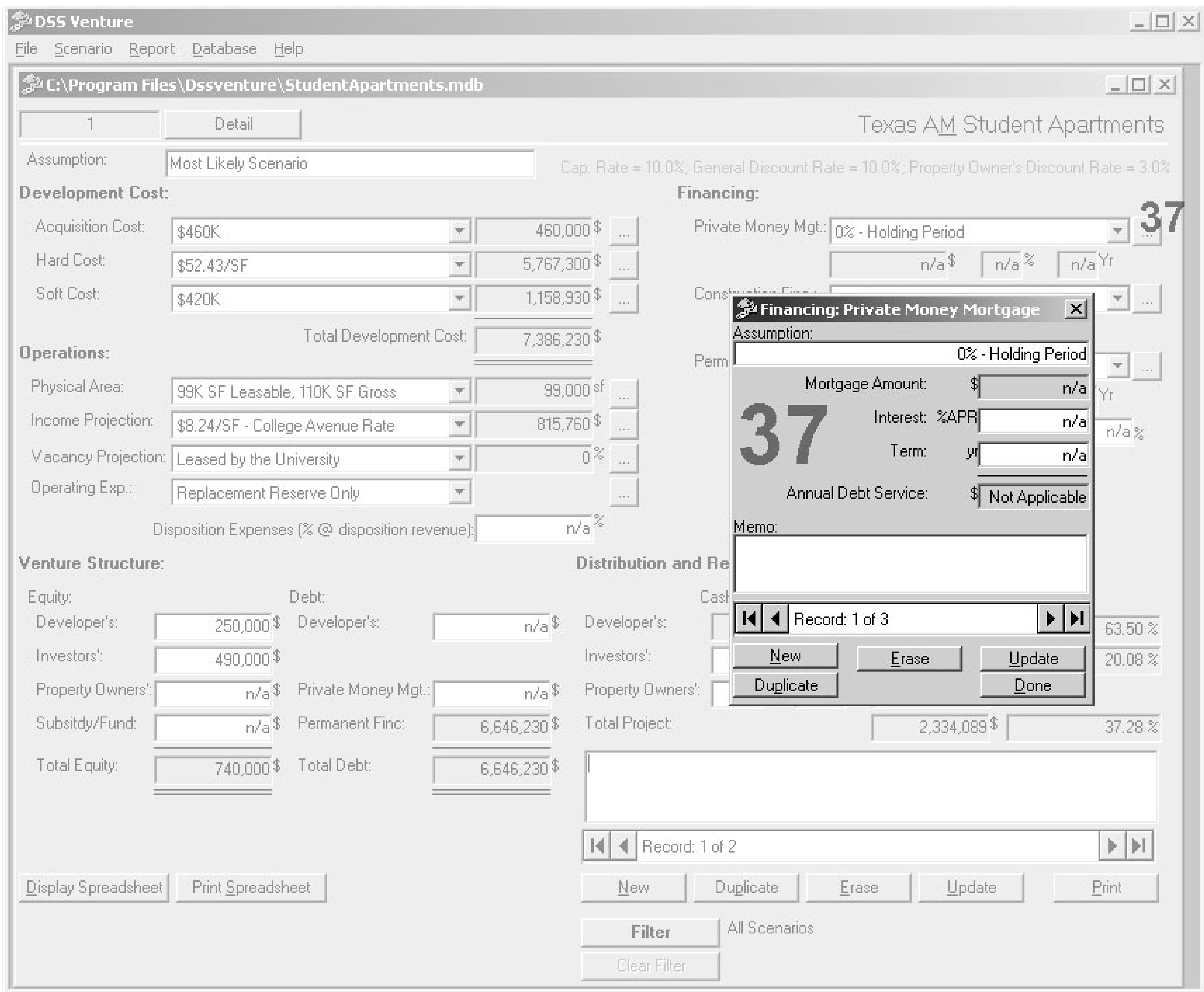
Private Money Mortgage Assumption Screen's Data

Forward Screen Linkages:	n/a	
Backward Screen Linkages:	*Development-Venture Scenario* Screen	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Mortgage Amount: ($)	Summary / Private Money Mortgage (PMM): $
	Interest: (%APR)	Summary / Interest Rate: (%)
	Term: (years)	Summary / Term of Loan: (years)
	Annual Debt Service: ($)	Summary / Annual Debt Service ($)

Note: Grey Title indicates an output field.

Figure 41

Private Money Mortgage Assumption Screen Capture



Construction Financing Assumption Screen

This screen is another component assumption interface discussed in the *Financing* category. The screen's data and capture are presented in Figure 42 and Figure 43. Like other component assumption screens, Construction Financing Assumption Screen can be executed by using a command button ㊳ located on the right of the Construction Financing Assumption selection box in Development-Venture Scenario screen, or a menu command presented in Figure 23 (page 229).

Two variable inputs are critical for a construction financing assumption. These include an Interest Rate (%APR), and a Lending Fee (% to the required financing amount). This screen offers three output fields that inform the user of the potential maximum financing amount suggested by the proforma, the financing amount required for the scenario, and the financing term supplied by the project detail screen. These field's values dynamically refer to the corresponding output cells in *LDEVOne*.

Figure 42

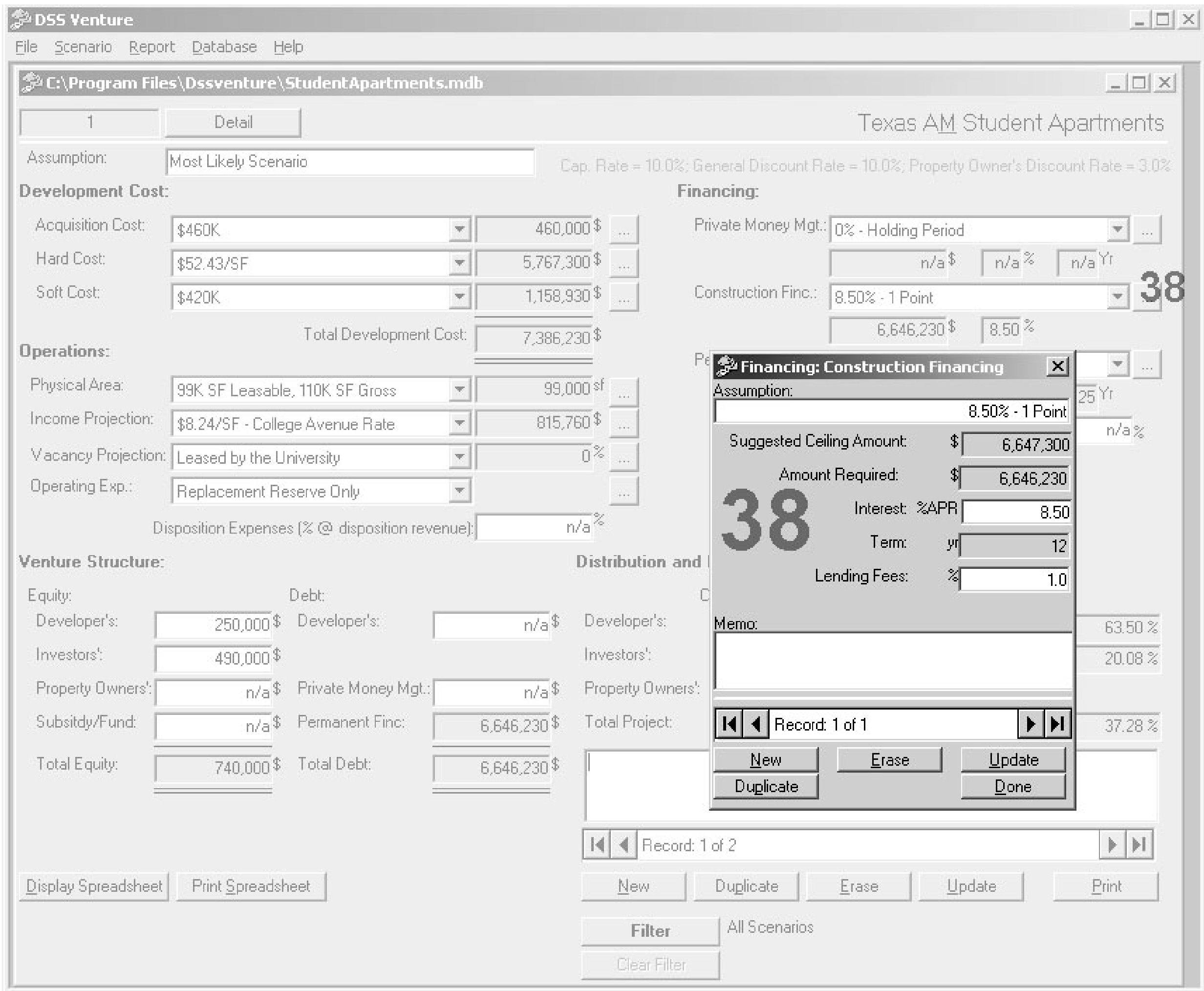
Construction Financing Assumption Screen's Data

Forward Screen Linkages:	n/a	
Backward Screen Linkages:	*Development-Venture Scenario* Screen	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Suggested Ceiling Amount: ($)	Summary / Suggested Maximum Loan Available: ($)
	Amount Required: ($)	Summary / Const. Loan Amount Required: ($)
	Interest: (%)	Summary / Term of Loan (months)
	Term: (months)	Summary / Interest Rate: (%)
	Lending Fee: (%)	Summary / Lender's Fees: (%)

Note: Grey Title indicates an output field.

Figure 43

Construction Financing Assumption Screen Capture



Permanent Financing Assumption Screen

The Permanent Financing Assumption Screen is the final component assumption interface in *DSSVenture*. The screen's data and capture are presented in Figure 44 and Figure 45. Similar to other component assumption screens, Permanent Financing Assumption Screen is called on using a command button㊴ on the right of the Permanent Financing Assumption field in Development-Venture Scenario, or a menu command presented in Figure 23 (page 229).

Six variables are essential inputs for a permanent financing assumption setting. These variables can be divided into two categories, namely preferred financing ratios, and potential financing term. The preferred financing ratios category includes three input variables of a Loan-to-Value Ratio (% to economic value), a Loan-to-Cost Ratio (% to development cost), and a Debt Coverage Ratio. The potential financing term input variables include an Interest Rate (%APR), a Financing Term (years of loan course), and a Lending Fee (% to the required mortgage amount).

This screen offers three output fields, which inform users of the potential maximum mortgage amount suggested by the proforma, the mortgage amount required in the scenario, and the annual debt service estimated for the mortgage. These fields directly refer to the corresponding output values in *LDEVOne*.

Figure 44

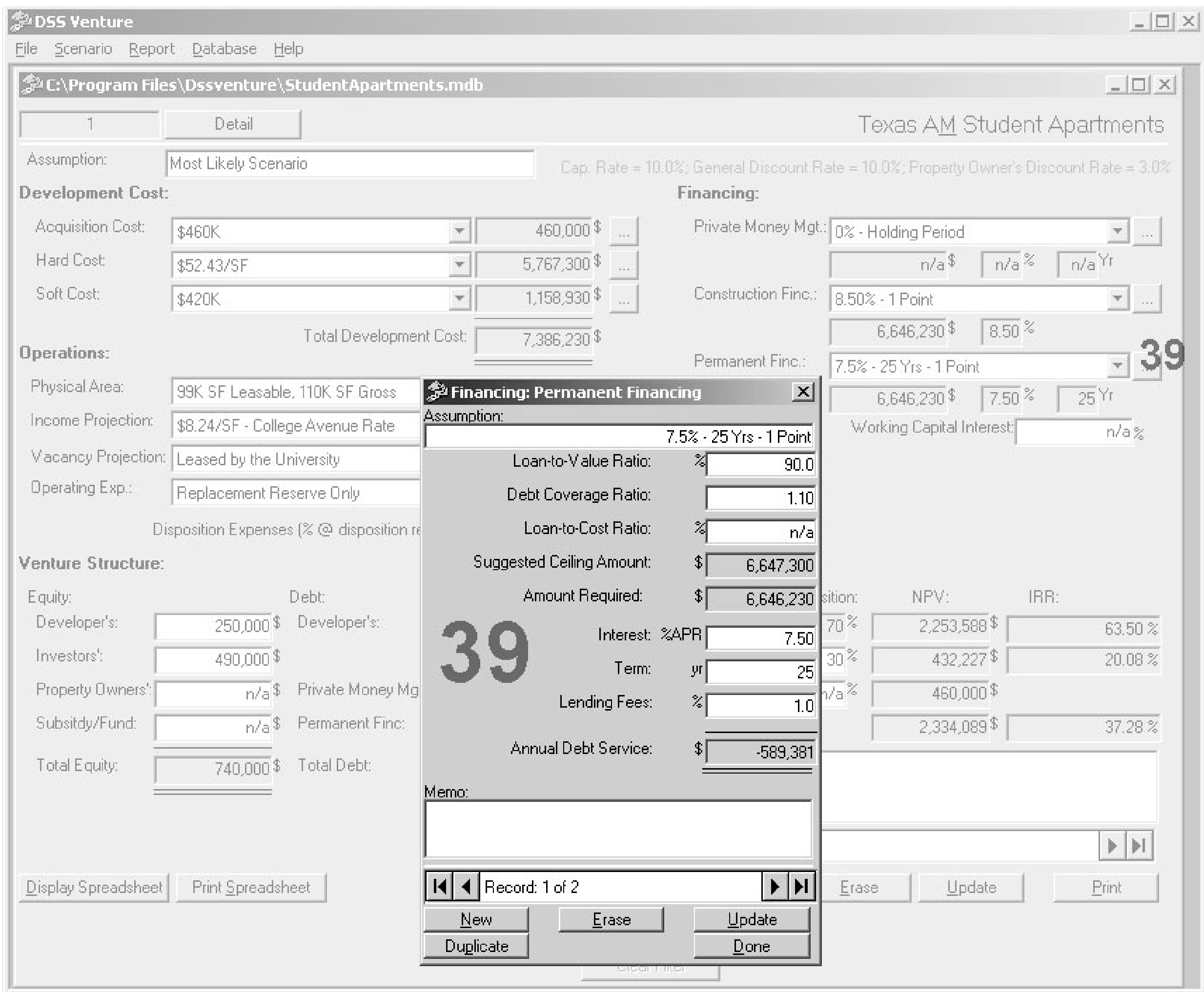
Permanent Financing Assumption Screen's Data

Forward Screen Linkages:	n/a	
Backward Screen Linkages:	*Development-Venture Scenario* Screen	
Logic Models:	LDEVOne	
Data Models:	Manual Inputs / Project Scenario Database	
Variable Connectivity:	**DSSVenture Interface**	**LDEVOne Variables**
	Loan-to-Value Ratio:	Summary / Preferred Loan to Value Ratio
	Debt-Coverage Ratio:	Summary / Preferred Debt Coverage Ratio
	Loan-to-Cost Ratio:	Summary / Preferred Loan to Cost Ratio
	Suggested Ceiling Amount: ($)	Summary / Suggested Maximum Loan Available ($)
	Amount Required: ($)	Summary / Perm. Loan Required ($)
	Interest: (%)	Summary / Interest Rate (%)
	Term: (years)	Summary / Term of Loan (years)
	Lending Fee: (%)	Summary / Lender's Fees (%)
	Annual Debt Service: ($)	Summary / Annual Debt Service ($)

Note: Grey Title indicates an output field.

Figure 45

Permanent Financing Assumption Screen Capture

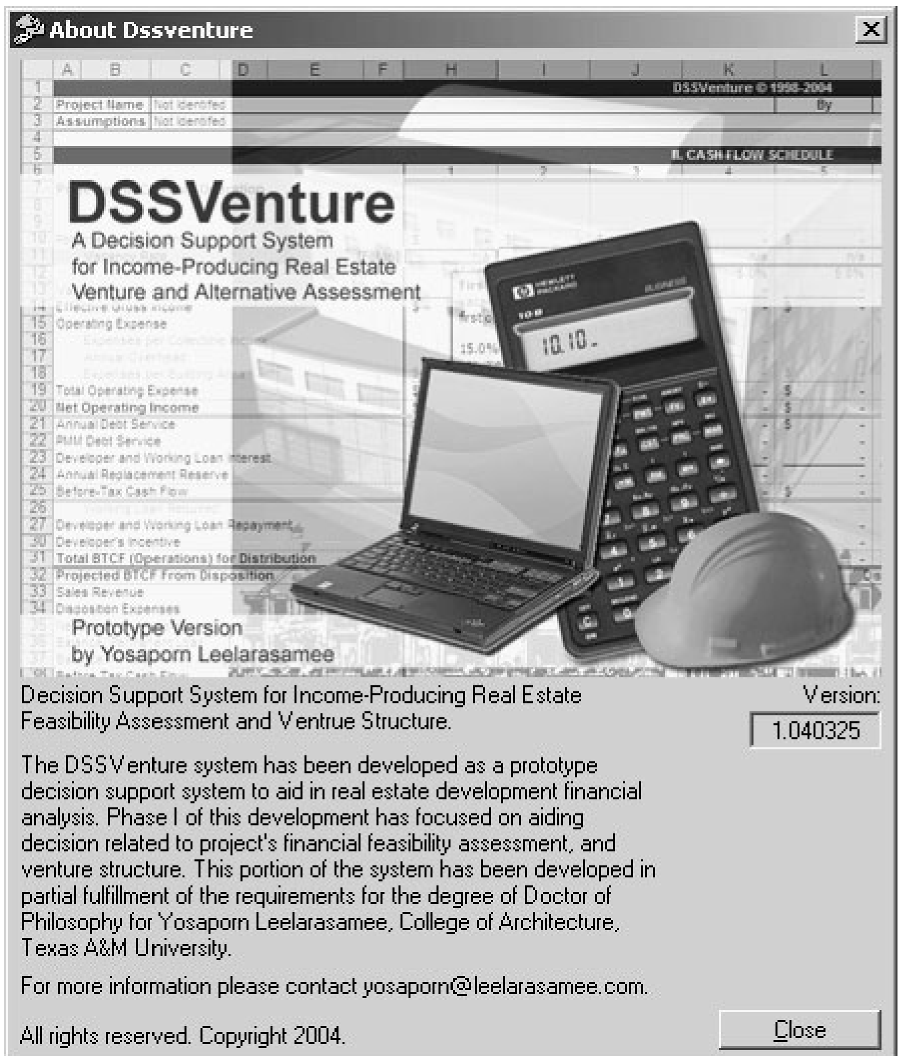


About DSSVenture Information Screen

Located in the help category in the menu bar (in the Menu Screen) is an *About* [DSSVenture] menu command. The command activated About Dssventure Information Screen. With the program's general information to acquaint users with the system, the screen capture is presented in Figure 46 below.

Figure 46

About DSSVenture Information Screen



APPENDIX I

ETTER'S MULTI-YEAR ANALYSIS IN MICROSOFT EXCEL FORMAT

Figure 47

Proformas for Multi Year Analysis in Microsoft Excel

Project Origination	0	1	2	3	4	5	6
Cost of Land	$ 130,680						
Cost of Building	612,080						
Total Cost	$ 742,760						
Mortgage (12%, 25 years	(557,070)						
Initial Equity	$ 185,690						
Before Tax CF: Operations	0	1	2	3	4	5	6
Potential Gross Income		$132,000	$135,960	$140,039	$144,240	$ 148,567	$153,024
Miscellaneous Income		-	-	-	-	-	-
Less Vacancy		(6,600)	(6,798)	(7,002)	(7,212)	(7,428)	(7,651)
Effective Gross Income		$125,400	$129,162	$133,037	$137,028	$ 141,139	$145,373
Less Operating Expenses		(36,000)	(37,080)	(38,192)	(39,338)	(40,518)	(41,734)
Net Operating Income		$ 89,400	$ 92,082	$ 94,844	$ 97,690	$ 100,620	$103,639
Mortgage Payment		$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	
Before Tax Cash Flow from Operations		$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 29,594	
Before Tax CF: Resale	0	1	2	3	4	5	6
Expected Resale Price						$1,036,391	
Less Selling Expenses						(41,456)	
Net Resale Price						$ 994,935	
Less Unpaid Mortgage Balance						(530,528)	
Before Tax Cash Flow from Resale						$ 464,408	
Before Tax CF: Equity	0	1	2	3	4	5	6
Initial Equity	$(185,690)						
Before Tax Cash Flow from Operation:		$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 29,594	
Before Tax Cash Flow fr	-	-	-	-	-	$ 464,408	
Total Cash Flow to Equity	$(185,690)	$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 494,002	

APPENDIX J

ETTER'S MULTI-YEAR ANALYSIS IN LDEVONE.XLT

Figure 48

Proforma for Multi Year Anlaysi in LDEVOne.xlt: Input and Summary Sheet

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Project Name	Etter's Multi-Year Analysis	**By**	Yosaporn	**Date**	Jun 3, 04	**Alternative**	1
Assumption	Data for Model Validation						

I. INPUTS & SUMMARY

COST

Land Cost	$	130,680
Building Cost		n/a
Other Cost / Adjustment		n/a
Total Acquisition Cost	$	**130,680**
Construction and Improvement Cost		n/a
Other Hard Cost / Adjustment		612,080
Total Hard Cost	$	**612,080**
Soft Cost (excld. loan costs)		n/a
Const. Loan Fee and Int. Allowance	$	-
Permanent Loan Fee Allowance	$	-
Additional Soft Cost / Adjustment		n/a
Development Fee		n/a
Total Soft Cost	$	-
Total Development Cost	$	**742,760**

VENTURE STRUCTURE

Equity		
Developer's Investment	$	185,690
Investors' Contribution		n/a
Property for Equity Swap		n/a
Other Subsidy(ies)/Fund(s)		n/a
Total Initial Equity	$	**185,690**
Debt		
Loan from Developer		n/a
Private Money Mortgage (PMM)		n/a
Permanent Loan		557,070
Total Debt	$	**557,070**

OPERATIONS

~~Efficiency Ratio (Leasable/Gross)~~		n/a
Gross Building Area		20,000 SF
Total Leasable Area		20,000 SF
Total Usable Area		20,000 SF
Total Leasable Area (Final)		**20,000**
		by using direct Leasable Area
Annual Rent (per SF)	$	6.60 @SF
Other Annual Income (Gross)	$	-
Potential Gross Income	$	132,000
Annual Growth		3.0%
Vacancy Rate		
Input year-by-year vacancy in 'Cash Flow' Sheet		
Stabilized Year (1-9)		2
Stabilized Year Rate: (2)		5.0%
Operating Expenses (Annually)		
Expenses per Collectible Income		n/a
Annual Overhead	$	36,000
Expenses per Building Area		n/a
Annual Growth		3.0%
Annual Replacement Reserve		n/a
Incentive to Developer (If applicable)		
Fee (%BTCF above threshold)		n/a
Threshold		n/a
Disposition Expenses (% of Sale)		4.0%

FINANCING

Private Money Mortgage (PMM)		
Interest Rate		n/a
Term of Loan		n/a
Annual Debt Service		Not Applicable
Construction Financing		
Suggested Maximum Loan Available	$	701,177
Const. Loan Amount Required	$	557,070
Term of Loan (months)		12 months
Interest Rate		0.00%
Lender's Fees		n/a
Permanent Financing		
Preferred Loan to Value Ratio		n/a
Preferred Debt Coverage Ratio		n/a
Preferred Loan to Cost Ratio		n/a
Suggested Maximum Loan Available	$	701,177
Perm. Loan Required	$	557,070
Term of Loan		25 years
Interest Rate		12.13%
Lender's Fees		n/a
Annual Debt Service	$	(71,026)
Working Loan		
Interest		n/a

OTHER INPUTS

Ground Breaking	n/a
Time for Construction	n/a
First Operating Year	1
Project Holding Period	5 years

The property will be liquidated in 5.

Capitalization Rate	10.00%
General Discount Rate	n/a
Property Owner's Discount Rate	n/a

		Property Owners(s)		Developer	Investor(s)	Total Project
Before Tax	PV at 12.0% discount. (Excld ROE)	$ 130,680	Net Present Value at 12.0% discount	$ 160,131	n/a	$ 160,131
			Internal Rate of Return	28.91%	n/a	28.91%

Sharkawy and Leelarasamee: 1.032911.6

Figure 49

Proforma for Multi Year Anlaysi in LDEVOne.xlt: Cash Flow Schedule Sheet

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Project Name	Etter's Multi-Year Analysis	**By**	Yosaporn	**Date**	Jun 3, 04	**Alternative**	1
Assumptions	Data for Model Validation						

II. CASH FLOW SCHEDULE

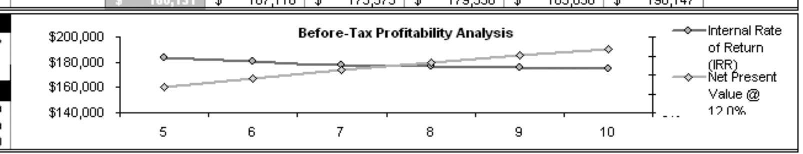
	1	2	3	4	5	6	7	8	9	10	11
Projected BTCF From Operation					Disposition						
Rental Income	132,000	135,960	140,039	144,240	148,567	153,024	157,615	162,343	167,214	172,230	177,397
Other Income	-	-	-	-	-	-	-	-	-	-	-
Potential Gross Income	$ 132,000	$ 135,960	$ 140,039	$ 144,240	$ 148,567	$ 153,024	$ 157,615	$ 162,343	$ 167,214	$ 172,230	$ 177,397
Vacancy Rate [Fill In]	5.0%	5.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.0%	5.0%
	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Vacancy	(6,600)	(6,798)	(7,002)	(7,212)	(7,428)	(7,651)	(7,881)	(8,117)	(8,361)	(8,612)	(8,870)
Effective Gross Income	$ 125,400	$ 129,162	$ 133,037	$ 137,028	$ 141,139	$ 145,373	$ 149,734	$ 154,226	$ 158,853	$ 163,619	$ 168,527
Operating Expense											
Expenses per Collectible Income	-	-	-	-	-	-	-	-	-	-	-
Annual Overhead ($36,000 gross)	(36,000)	(37,080)	(38,192)	(39,338)	(40,518)	(41,734)	(42,986)	(44,275)	(45,604)	(46,972)	(48,381)
Expenses per Building Area	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Operating Expense	$ (36,000)	$ (37,080)	$ (38,192)	$ (39,338)	$ (40,518)	$ (41,734)	$ (42,986)	$ (44,275)	$ (45,604)	$ (46,972)	$ (48,381)
Net Operating Income	$ 89,400	$ 92,082	$ 94,844	$ 97,690	$ 100,620	$ 103,639	$ 106,748	$ 109,951	$ 113,249	$ 116,647	$ 120,146
Annual Debt Service	$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	$ (71,026)	
PMM Debt Service	-	-	-	-	-	-	-	-	-	-	
Developer and Working Loan Interest	-	-	-	-	-	-	-	-	-	-	
Annual Replacement Reserve	-	-	-	-	-	-	-	-	-	-	
Before-Tax Cash Flow	$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 29,594	$ 32,613	$ 35,722	$ 38,924	$ 42,223	$ 45,620	
Working Loan Required	-	-	-	-	-	-	-	-	-	-	
Developer and Working Loan Repayment	-	-	-	-	-	-	-	-	-	-	
Developer's Incentive	-	-	-	-	-	-	-	-	-	-	
Total BTCF (Operations) for Distribution	$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 29,594	$ 32,613	$ 35,722	$ 38,924	$ 42,223	$ 45,620	
Projected BTCF From Disposition					Disposition BTCF, If the development is sold at the end of a given year.						
Sales Revenue					$ 1,036,391						
Disposition Expenses					(41,456)						
Net Disposition Income					$ 994,935						
Balance: Permanent Loan					(533,309)						
Balance: Private Money Mortgage (PMM)					$ -						
Before-Tax Cash Flow					$ 461,627						
Balance: Other Loans					$ -						
Total BTCF (Reversion) for Distribution					$ 461,627						

Before-Tax Cash Flow Summary	1	2	3	4	5	6	7	8	9	10	11
Total Cash Flow	18,374	21,056	23,818	26,663	491,221						
Total Cash Flow for Distribution	$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 491,221						

Distributed Before-Tax Cash Flow Summary	1	2	3	4	5	6	7	8	9	10	11
Investor(s)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Property Owner(s)	$ -	$ -	$ -	$ -	$ -						

Before-Tax Risk Analysis (Total Development)	1	2	3	4	5	6	7	8	9	10	11
Debt Coverage Ratio (DCR)			1.34	1.38	1.42	1.46	1.50	1.55	1.59	1.64	
					Risk Analysis of the investment, if the development is sold at the end of a given year.						
Internal Rate of Return (IRR)					28.91%	26.89%	25.46%	24.40%	23.59%	22.94%	
Net Present Value @ 12.0% Discount					$ 160,131	$ 167,118	$ 173,573	$ 179,538	$ 185,050	$ 190,147	

Project Profitability Analysis			
Disposition at the end of	5	Internal Rate of Return (IRR)	28.91%
		Net Present Value (NPV)	$ 160,131
Investors/Property Owners: Profitability Analysis (Before Tax)			
Investor's(s') Participation	n/a	IRR to Investor(s)	n/a
		NPV to Investor(s)	n/a
Prpty Owner's(s') Participation	n/a	PV to Property Owner(s)	$ 130,680



Sharkawy and Leelarasamee: 1.032911.6

Figure 50

Proforma for Multi Year Anlaysi in LDEVOne.xlt: Venture Summary Sheet

DSSVenture © 1998-2003

Project Name	Etter's Multi-Year Analysis	**By**	Yosaporn	**Date**	Jun 3, 04	**Alternative**	1
Assumptions	Data for Model Validation						

III. VENTURE ANALYSIS

	Capital Budget	1	2	3	4	5	6	7	8	9	10
Development Entity						Disposition					
Total Development Cost	$ (742,760)										
Total Initial Equity	185,690										
Total Debt	$ 557,070										
Distributed Cash Flow		$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 491,221					
Investor(s)											
Total Capital Budget	$ -										
Total Cash Flow		$ -	$ -	$ -	$ -	$ -					
Property Owner(s)											
Property Acquisition Cost	$ 130,680										
Investment	-										
Private Money Mortgage	-										
Total Cash Received at Closing	$ 130,680										
Distributed Cash Flow		$ -	$ -	$ -	$ -	$ -					
Private Money Mortgage		-	-	-	-	-					
Total Cash Flow		$ -	$ -	$ -	$ -	$ -					
Developer											
Investment	$ (185,690)										
Developer's Loan	-										
Development Fee - NET 100.0% of Total Dev Fee	-										
Other Fee(s) and Adjustment(s) - NET	n/a										
Total Capital Budget	$ (185,690)										
Distributed Cash Flow		$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 491,221					
Loan		-	-	-	-	-					
Interest / Repayment		-	-	-	-	-					
Incentive Fees		-	-	-	-	-					
Other Fee(s) and Adjustment(s) - NET		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Cash Flow		$ 18,374	$ 21,056	$ 23,818	$ 26,663	$ 491,221					

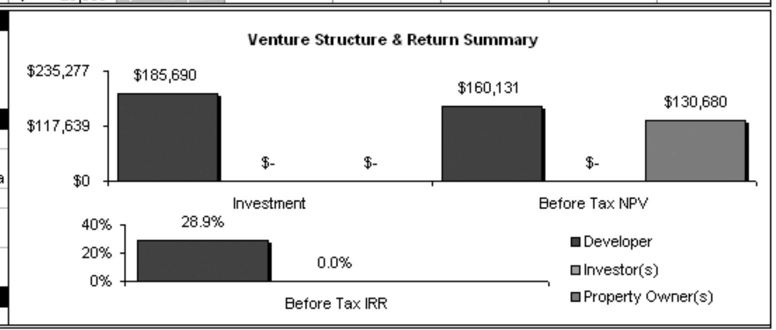
Venture Structure and Return Summary

	Investment	% to Total	% Cash Flow	% Reversion
Developer	$ 185,690	100.00%	100.00%	100.00%
Investor(s)	n/a	n/a	n/a	n/a
Property Owner(s)	n/a	n/a	0.00%	0.00%

Before Tax: Profitability Analysis

Internal Rate of Return	Project	28.91%
	Developer	28.91%
	Investor(s)	n/a
Net Present Value @ 12.0% Discount	Project	$ 160,131
	Developer	$ 160,131
	Investor(s)	n/a
Net Present Value @ 12.0% Discount	Property Owner(s)	$ 130,680

Internal Rate of Return for Property Owner is not available. No property for equity swap.



Disposition at the end of 5

Sharkawy and Leelarasamee: 1.032911.6

APPENDIX K

ORIGINAL PEISER AND SCHWANKE'S

MULTIFAMILY HOUSING CASE STUDY

Figure 51

Original Multifamily Case Study: Operating Income and Expenses Summary

		No. of Units	Rent	SF	Total SF	Unit Rent per Month	Total Annual Rent per Year
	Income						
1	A-1 1 Bedroom, 1 Bath	36	$0.72/SF	590 SF	21,240 SF	$ 425	$ 183,514
2	A-2 1 Bedroom, Den, 1 Bath	20	$0.70/SF	741 SF	14,820 SF	519	124,488
3	B-1 2 Bedroom, 2 Bath	24	$0.69/SF	832 SF	19,968 SF	574	165,335
4	B-2 2 Bedroom, 2 Bath	46	$0.68/SF	952 SF	43,792 SF	647	357,343
5	C-1 3 Bedroom, 2 Bath	32	$0.67/SF	1,050 SF	33,600 SF	704	270,144
7	Total Income	158	$0.69/SF		133,420 SF	$ 2,868	$ 1,100,823

		Assumptions	Per Year
10	Gross Rent (from above)		$1,100,823
11	Vacancy	5.00%	(55,041)
13	Adjusted Gross Rent		$1,045,782
14	Miscellaneous Income	25,000	25,000
16	**Total Revenue**	**$8.03/SF**	**$1,070,782**
	Expenses		
	Payroll	**Per Month**	**Per Year**
21	Manager	$ (1,700)	$ (20,400)
22	Assistant Manager/Bookkeeper	(1,100)	(13,200)
23	Maintenance	(1,600)	(19,200)
24	Porter for Grounds	(1,000)	(12,000)
26	Subtotal Payroll	$ (5,400)	$ (64,800)
		Per SF	**Per Year**
28	Payroll Taxes and Insurance	$ (0.10)	$ (12,960)
29	Advertising and Promotion	(0.15)	(20,013)
30	Maintenance and Supplies	(0.40)	(53,368)
31	Administration, Management, Tel.	(0.40)	(53,368)
32	Utilities for Common Area	(0.40)	(53,368)
33	Real Estate Taxes	(0.48)	(64,042)
34	Insurance	(0.24)	(32,021)
34A	Subtotal Expenses per SF	$ (2.17)	$ (289,139)
36	**Total Expenses**	**$ (2.65)**	**(353,939)**
38	**Net Operating Income**		**$ 716,843**

Figure 52

Original Multifamily Case Study: Development Cost Summary

		Assumptions	Cost	Amount	Cost per Building SF	Cost per Unit
	Land	5.13 acres	$2.25/SF	$ 502,791	$ 3.77	$ 3,182
40	Land Carry (12%, 3 Months)			15,084	0.11	95
41	Approval Fees and Startup Costs			35,000	0.26	222
42	Subtotal Land Cost			$ 552,875	$ 4.14	$ 3,499
	Building Construction					
45	Construction		$35.00/SF	$ 4,669,700	$ 35.00	$ 29,555
46	Architecture			20,000	0.15	127
47	Engineering and Appraisal			35,000	0.26	222
48	Furnishing			10,000	0.07	63
49	Marketing			45,000	0.34	285
50	Professional Fees			5,000	0.04	32
51	Subtotal Building Construction Cost			$ 4,784,700	$ 35.86	$ 30,283
	Construction Financing	Rate	Months			
54	Interest on $5,224,387	10.50%	12	$ 365,707	$ 2.74	$ 2,315
55	Miscellaneous			5,000	0.04	32
56	Subtotal Construction Financing Cost			$ 370,707	$ 2.78	$ 2,346
	Financing Transaction Costs					
59	Mortgage Broker	1.00%		$ 52,244	$ 0.39	$ 331
60	Construction Loan Points	1.00%		52,244	0.39	331
61	Permanent Loan Points	1.00%		52,244	0.39	331
62	Attorney Fees	0.50%		26,122	0.20	165
63	Subtotal Construction Loan Points Cost	3.50%		$ 182,854	$ 1.37	$ 1,157
	Insurance, Taxes, and Other		Cost			
66	Title Insurance		$0.22/SF	$ 29,352	$ 0.22	$ 186
67	Liability Insurance			10,000	0.07	63
68	Property Taxes During Construction			10,000	0.07	63
69	Audit Cost			3,000	0.02	19
70	Subtotal Liability Insurance Cost			$ 52,352	$ 0.39	$ 331
72	**Subtotal Land, Building Construction, and Financing**			**$ 5,943,488**	**$ 44.55**	**$ 37,617**
74	Operating Reserve During Lease-Up	(from line 146)		$ 325,989	$ 2.44	$ 2,063
75	Development Fee (@ Hard Costs)	5.00%		239,235	1.79	1,514
76	Contigency (rounded up to nearest $10,000)	3.00%		150,000	1.12	949
78	**Total Project Cost**			**$ 6,658,712**	**$ 49.91**	**$ 42,144**

Figure 53

Original Multifamily Case Study: Other Assumptions

			Cost
81	Total Project Cost		$ 6,658,712
82	Total Capital Cost		$ 6,332,723
83	Operating Reserve	Assumptions	$ 325,989
84	NPV Discount Rate	20.00%	
85	Years of Analysis	7 years	
	Mortgage Input Data		
88	Equity		$ 1,434,325
89	Principal Amount		$ (5,224,387)
90	Interest Rate	10.50%	
91	Term	30 years	
92	Monthly Payment (DCR Approach)	1.25	$ 47,790
93	Annual Payment		$ 573,474
	Annual Cash Flows		
102	Gross Rent		$ 1,100,823
103	Rentable SF		133,420 SF
104	Rent per SF		$8.25/SF
105	Rent Appreication Rate	4.00%	
106	Vacancy Rate	5.00%	
107	Expenses per SF (Year 1)	$2.65/SF	
	Sale Price Data		
115	Capitalization Rate at Sale	9.00%	
118	Sales Commission and Expenses	4.00%	

Figure 54

Original Multifamily Case Study: Mortgage Calculation

	Mortgage Calculation	Year 0	1	2	3	4	5	6	7
	Annual Payment	-	573,474	573,474	573,474	573,474	573,474	573,474	573,474
122	Interest	-	(547,326)	(544,444)	(541,245)	(537,693)	(533,750)	(529,373)	(524,512)
	Remaining Payment	-	26,148	29,030	32,229	35,781	39,724	44,102	48,962
119	Beginning Balance	$ 5,224,387	$5,224,387	$5,198,239	$5,169,209	$5,136,980	$5,101,199	$5,061,475	$ 5,017,373
121	Amortization of Principal	-	(26,148)	(29,030)	(32,229)	(35,781)	(39,724)	(44,102)	(48,962)
120	Ending Balance	$ 5,224,387	$5,198,239	$5,169,209	$5,136,980	$5,101,199	$5,061,475	$5,017,373	$ 4,968,411

Figure 55

Original Multifamily Case Study: Annual Cash Flow

	Revenue	Year 0	1	2	3	4	5	6	7
132	Gross Rent		$1,100,823	$1,144,856	$1,190,651	$1,238,277	$1,287,808	$1,339,320	$ 1,392,893
133	Vacancy Rate		46.69%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
134	Vacancy		(513,974)	(57,243)	(59,533)	(61,914)	(64,390)	(66,966)	(69,645)
135	Adjusted Gross Income		586,849	1,087,613	1,131,118	1,176,363	1,223,417	1,272,354	1,323,248
136	Other Income		$14,576	26,000	27,040	28,122	29,246	30,416	31,633
137	Total Revenue		$ 601,425	$1,113,613	$1,158,158	$1,204,484	$1,252,664	$1,302,770	$ 1,354,881
139	**Operating Expenses**	4.00%	(353,939)	(368,097)	(382,821)	(398,134)	(414,059)	(430,621)	(447,846)
140	Other Expenses		-	-	-	-	-	-	-
141	Total Expenses		(353,939)	(368,097)	(382,821)	(398,134)	(414,059)	(430,621)	(447,846)
143	**Net Operating Income**		$ 247,486	$ 745,517	$ 775,337	$ 806,351	$ 838,605	$ 872,149	$ 907,035
145	Annual Debt Service		(573,474)	(573,474)	(573,474)	(573,474)	(573,474)	(573,474)	(573,474)
146	Operating Reserve During Lease-Up		325,989	-	-	-	-	-	-
147	**Total Before Tax Cash Flow**		$ -	$ 172,042	$ 201,863	$ 232,876	$ 265,130	$ 298,675	$ 333,561

Figure 56

Original Multifamily Case Study: Sale Calculation

		Year							
	Cash from Sale	0	1	2	3	4	5	6	7
163	Sales Price								$10,481,291
164	Commission								(419,252)
165	Adjusted Sales Price								$10,062,040
166	Mortgage Balance								(4,968,411)
167	**Total Cash Flow from Sale before Tax**								$ 5,093,628

Figure 57

Original Multifamily Case Study: Return Cash Flow

		Year							
		0	1	2	3	4	5	6	7
184	Equity	$(1,108,336)	$ (325,989)						
185	Annual Cash Flows	-	-	$ 172,042	$ 201,863	$ 232,876	$ 265,130	$ 298,675	$ 333,561
186	Cash Flow from Sale	-	-	-	-	-	-	-	5,093,628
187	Total Before Tax Cash Flows	$(1,108,336)	$ (325,989)	$ 172,042	$ 201,863	$ 232,876	$ 265,130	$ 298,675	$ 5,427,189
189					**Before Tax Internal Rate of Return**			**28.55%**	
					Net Present Value @ 20 %			**$689,809**	

APPENDIX L

AUTOMATED PEISER AND SCHWANKE'S MULTIFAMILY HOUSING CASE STUDY IN MICROSOFT EXCEL FORMAT

Figure 58

Automated Multifamily Case Study: Operating Income and Expense Summary

	Income	No. of Units	Rent	SF	Total SF	Unit Rent per Month	Total Annual Rent per Year
1	A-1 1 Bedroom, 1 Bath	36	$0.72/SF	590 SF	21,240 SF	$ 425	$ 183,514
2	A-2 1 Bedroom, Den, 1 Bath	20	$0.70/SF	741 SF	14,820 SF	519	124,488
3	B-1 2 Bedroom, 2 Bath	24	$0.69/SF	832 SF	19,968 SF	574	165,335
4	B-2 2 Bedroom, 2 Bath	46	$0.68/SF	952 SF	43,792 SF	647	357,343
5	C-1 3 Bedroom, 2 Bath	32	$0.67/SF	1,050 SF	33,600 SF	704	270,144
7	Total Income	158	$0.69/SF		133,420 SF	$ 2,868	$ 1,100,823
						Per Year	
10	Gross Rent (from above)	Assumptions				$1,100,823	
11	Vacancy	5.00%				(55,041)	
13	Adjusted Gross Rent					$1,045,782	
14	Miscellaneous Income	25,000				25,000	
16	**Total Revenue**	**$8.03/SF**				**$1,070,782**	
	Expenses						
	Payroll	Per Month				Per Year	
21	Manager	$ (1,700)				$ (20,400)	
22	Assistant Manager/Bookkeeper	(1,100)				(13,200)	
23	Maintenance	(1,600)				(19,200)	
24	Porter for Grounds	(1,000)				(12,000)	
26	Subtotal Payroll	$ (5,400)				$ (64,800)	
		Per SF				Per Year	
28	Payroll Taxes and Insurance	$ (0.10)				$ (12,960)	
29	Advertising and Promotion	(0.15)				(20,013)	
30	Maintenance and Supplies	(0.40)				(53,368)	
31	Administration, Management, Tel.	(0.40)				(53,368)	
32	Utilities for Common Area	(0.40)				(53,368)	
33	Real Estate Taxes	(0.48)				(64,042)	
34	Insurance	(0.24)				(32,021)	
34A	Subtotal Expenses per SF	$ (2.17)				$ (289,139)	
36	**Total Expenses**	**$ (2.65)**				**(353,939)**	
38	**Net Operating Income**					**$ 716,843**	

Figure 59

Automated Multifamily Case Study: Development Cost Summary

		Assumptions	Cost	Amount	Cost per Building SF	Cost per Unit
	Land	5.13 acres	$2.25/SF	$ 502,791	$ 3.77	$ 3,182
40	Land Carry (12%, 3 Months)			15,084	0.11	95
41	Approval Fees and Startup Costs			35,000	0.26	222
42	Subtotal Land Cost			$ 552,875	$ 4.14	$ 3,499
	Building Construction					
45	Construction		$35.00/SF	$ 4,669,700	$ 35.00	$ 29,555
46	Architecture			20,000	0.15	127
47	Engineering and Appraisal			35,000	0.26	222
48	Furnishing			10,000	0.07	63
49	Marketing			45,000	0.34	285
50	Professional Fees			5,000	0.04	32
51	Subtotal Building Construction Cost			$ 4,784,700	$ 35.86	$ 30,283
	Construction Financing	Rate	Months			
54	Interest on $5,224,387	10.50%	12	$ 365,707	$ 2.74	$ 2,315
55	Miscellaneous			5,000	0.04	32
56	Subtotal Construction Financing Cost			$ 370,707	$ 2.78	$ 2,346
	Financing Transaction Costs					
59	Mortgage Broker	1.00%		$ 52,244	$ 0.39	$ 331
60	Construction Loan Points	1.00%		52,244	0.39	331
61	Permanent Loan Points	1.00%		52,244	0.39	331
62	Attorney Fees	0.50%		26,122	0.20	165
63	Subtotal Construction Loan Points Cost	3.50%		$ 182,854	$ 1.37	$ 1,157
	Insurance, Taxes, and Other		Cost			
66	Title Insurance		$0.22/SF	$ 29,352	$ 0.22	$ 186
67	Liability Insurance			10,000	0.07	63
68	Property Taxes During Construction			10,000	0.07	63
69	Audit Cost			3,000	0.02	19
70	Subtotal Liability Insurance Cost			$ 52,352	$ 0.39	$ 331
72	**Subtotal Land, Building Construction, and Financing**			**$ 5,943,488**	**$ 44.55**	**$ 37,617**
74	Operating Reserve During Lease-Up	(from line 146)		$ 315,565	$ 2.37	$ 1,997
75	Development Fee (@ Hard Costs)	5.00%		239,235	1.79	1,514
76	Contigency (rounded up to nearest $10,000)	3.00%		150,000	1.12	949
78	**Total Project Cost**			**$ 6,648,288**	**$ 49.83**	**$ 42,078**

Figure 60

Automated Multifamily Case Study: Other Assumptions

81	Total Project Cost		$ 6,648,288
82	Total Capital Cost		$ 6,332,723
83	Operating Reserve	**Assumptions**	$ 315,565
84	NPV Discount Rate	20.00%	
85	Years of Analysis	7 years	
	Mortgage Input Data		
88	Equity		$ 1,423,901
89	Principal Amount		$ (5,224,387)
90	Interest Rate	10.50%	
91	Term	30 years	
92	Monthly Payment (DCR Approach)	1.25	$ 47,790
93	Annual Payment		$ 573,474
	Annual Cash Flows		
102	Gross Rent		$ 1,100,823
103	Rentable SF		133,420 SF
104	Rent per SF		$8.25/SF
105	Rent Appreication Rate	4.00%	
106	Vacancy Rate	5.00%	
107	Expenses per SF (Year 1)	$2.65/SF	
	Sale Price Data		
115	Capitalization Rate at Sale	9.00%	
118	Sales Commission and Expenses	4.00%	

Figure 61

Automated Multifamily Case Study: Mortgage Calculation

		Year							
	Mortgage Calculation	0	1	2	3	4	5	6	7
	Annual Payment	-	573,474	573,474	573,474	573,474	573,474	573,474	573,474
122	Interest	-	(547,326)	(544,444)	(541,245)	(537,693)	(533,750)	(529,373)	(524,512)
	Remaining Payment	-	26,148	29,030	32,229	35,781	39,724	44,102	48,962
119	Beginning Balance	$ 5,224,387	$ 5,224,387	$ 5,198,239	$ 5,169,209	$ 5,136,980	$ 5,101,199	$ 5,061,475	$ 5,017,373
121	Amortization of Principal	-	(26,148)	(29,030)	(32,229)	(35,781)	(39,724)	(44,102)	(48,962)
120	Ending Balance	$ 5,224,387	$ 5,198,239	$ 5,169,209	$ 5,136,980	$ 5,101,199	$ 5,061,475	$ 5,017,373	$ 4,968,411

Figure 62

Automated Multifamily Case Study: Annual Cash Flow

		Year							
	Revenue	0	1	2	3	4	5	6	7
132	Gross Rent		$1,100,823	$1,144,856	$1,190,651	$1,238,277	$1,287,808	$1,339,320	$ 1,392,893
133	Vacancy Rate		46.69%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
134	Vacancy		(513,974)	(57,243)	(59,533)	(61,914)	(64,390)	(66,966)	(69,645)
135	Adjusted Gross Income		586,849	1,087,613	1,131,118	1,176,363	1,223,417	1,272,354	1,323,248
136	Other Income		$25,000	26,000	27,040	28,122	29,246	30,416	31,633
137	Total Revenue		$ 611,849	$1,113,613	$1,158,158	$1,204,484	$1,252,664	$1,302,770	$ 1,354,881
139	**Operating Expenses**	4.00%	(353,939)	(368,097)	(382,821)	(398,134)	(414,059)	(430,621)	(447,846)
140	Other Expenses		-	-	-	-	-	-	-
141	Total Expenses		(353,939)	(368,097)	(382,821)	(398,134)	(414,059)	(430,621)	(447,846)
143	**Net Operating Income**		$ 257,910	$ 745,517	$ 775,337	$ 806,351	$ 838,605	$ 872,149	$ 907,035
145	Annual Debt Service		(573,474)	(573,474)	(573,474)	(573,474)	(573,474)	(573,474)	(573,474)
146	Operating Reserve During Lease-Up		315,565	-	-	-	-	-	-
147	**Total Before Tax Cash Flow**		$ -	$ 172,042	$ 201,863	$ 232,876	$ 265,130	$ 298,675	$ 333,561

Figure 63

Automated Multifamily Case Study: Sale Calculation

		Year							
	Cash from Sale	0	1	2	3	4	5	6	7
163	Sales Price								$10,481,291
164	Commission								(419,252)
165	Adjusted Sales Price								$10,062,040
166	Mortgage Balance								(4,968,411)
167	**Total Cash Flow from Sale before Tax**								$ 5,093,628

Figure 64

Automated Multifamily Case Study: Return Calculation

		Year							
		0	1	2	3	4	5	6	7
184	Equity	$(1,108,336)	$ (315,565)						
185	Annual Cash Flows	-	-	$ 172,042	$ 201,863	$ 232,876	$ 265,130	$ 298,675	$ 333,561
186	Cash Flow from Sale	-	-	-	-	-	-	-	5,093,628
187	Total Before Tax Cash Flows	$(1,108,336)	$ (315,565)	$ 172,042	$ 201,863	$ 232,876	$ 265,130	$ 298,675	$ 5,427,189
189					**Before Tax Internal Rate of Return**			**28.68%**	
					Net Present Value @ 20 %			**$698,495**	

APPENDIX M

PEISER AND SCHWANKE'S MULTIFAMILY HOUSING CASE STUDY IN LDEVONE.XLT

Figure 65

Multifamily Case Study in LDEVOne.xlt: Input and Summary Sheet

DSSVenture © 1998-2003							
Project Name	Peiser and Schawanhe's Multifamily Case	**By**	Y Leelarasamee	**Date**	Apr 13, 04	**Alternative**	1
Assumption	Data for model validation.						

I. INPUTS & SUMMARY

COST		**OPERATIONS**		**FINANCING**	
Land Cost	$ 552,875	~~Efficiency Ratio (Leasable/Gross)~~	n/a	Private Money Mortgage (PMM)	
Building Cost	n/a	Gross Building Area	133,420 SF	Interest Rate	n/a
Other Cost / Adjustment	n/a	Total Leasable Area	133,420 SF	Term of Loan	n/a
Total Acquisition Cost	$ 552,875	Total Usable Area	133,420 SF	Annual Debt Service	Not Applicable
Construction and Improvement Cost	$ 35.00 SF	Total Leasable Area (Final)	133,420	Construction Financing	
Other Hard Cost / Adjustment	n/a	by using direct Leasable Area		Suggested Maximum Loan Available	$ 5,224,387
Total Hard Cost	$ 4,669,700			Const. Loan Amount Required	$ 5,224,387
Soft Cost (excld. loan costs)	$ 172,352	Annual Rent (per SF)	$ 8.25 @SF	Term of Loan (months)	12 months
Const. Loan Fee and Int. Allowance	$ 417,951	Other Annual Income (Gross)	$ 25,000	Interest Rate	10.50%
Permanent Loan Fee Allowance	$ 130,610	Potential Gross Income	$ 1,125,823	Lender's Fees	1.00%
Additional Soft Cost / Adjustment	150,000	Annual Growth	4.0%	Permanent Financing	
Development Fee	3.9%	Vacancy Rate		Preferred Loan to Value Ratio	65.59%
Total Soft Cost	$ 1,110,148	Input year-by-year vacancy in 'Cash Flow' Sheet		Preferred Debt Coverage Ratio	n/a
Total Development Cost	$ 6,332,723	Stabilized Year (1-9)	2	Preferred Loan to Cost Ratio	n/a
		Stabilized Year Rate: (2)	4.9%	Suggested Maximum Loan Available	$ 5,224,387
				Perm. Loan Required	$ 5,224,387
				Term of Loan	30 years
VENTURE STRUCTURE		Operating Expenses (Annually)		Interest Rate	10.50%
Equity		Expenses per Collectible Income	n/a	Lender's Fees	2.50%
Developer's Investment	$ 1,108,336	Annual Overhead	$ 64,800	Annual Debt Service	$ (573,474)
Investors' Contribution	n/a	Expenses per Building Area	$ 2.17 @SF	Working Loan	
Property for Equity Swap	n/a	Annual Growth	4.0%	Interest	n/a
Other Subsidy(ies)/Fund(s)	n/a	Annual Replacement Reserve	n/a		
Total Initial Equity	$ 1,108,336				
Debt		Incentive to Developer (If applicable)		**OTHER INPUTS**	
Loan from Developer	n/a	Fee (%BTCF above threshold)	n/a	Ground Breaking	n/a
Private Money Mortgage (PMM)	n/a	Threshold	n/a	Time for Construction	12 months
Permanent Loan	5,224,387			First Operating Year	1
Total Debt	$ 5,224,387	Disposition Expenses (% of Sale)	4.0%	Project Holding Period	7 years
				The property will be liquidated in 7.	
				Capitalization Rate	9.00%
				General Discount Rate	20.00%
				Property Owner's Discount Rate	n/a

		Property Owners(s)		Developer	Investor(s)	Total Project
Before Tax	PV at 20.0% discount. (Excld ROE)	$ 552,875	Net Present Value at 20.0% discount	$ 698,495	n/a	$ 758,935
			Internal Rate of Return	28.68%	n/a	29.96%

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Figure 66

Multifamily Case Study in LDEVOne.xlt: Cash Flow Schedule Sheet

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Project Name	Peiser and Schawanhe's Multifamily Case	**By**	Y Leelarasamee	**Date**	Apr 13, 04	**Alternative**	1
Assumptions	Data for model validation.						

II. CASH FLOW SCHEDULE

	1	2	3	4	5	6	7	8	9	10	11
Projected BTCF From Operation							Disposition				
Rental Income	1,100,823	1,144,856	1,190,651	1,238,277	1,287,808	1,339,320	1,392,893	1,448,608	1,506,553	1,566,815	1,629,487
Other Income	25,000	26,000	27,040	28,122	29,246	30,416	31,633	32,898	34,214	35,583	37,006
Potential Gross Income	$ 1,125,823	$ 1,170,856	$ 1,217,691	$ 1,266,398	$ 1,317,054	$ 1,369,736	$ 1,424,526	$ 1,481,507	$ 1,540,767	$ 1,602,398	$ 1,666,494
Vacancy Rate [Fill In]	45.7%	4.9%	4.9%	n/a	n/a	n/a	n/a	n/a	n/a	4.9%	4.9%
	45.7%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%
Vacancy	(513,974)	(57,243)	(59,533)	(61,914)	(64,390)	(66,966)	(69,645)	(72,430)	(75,328)	(78,341)	(81,474)
Effective Gross Income	$ 611,849	$ 1,113,613	$ 1,158,158	$ 1,204,484	$ 1,252,664	$ 1,302,770	$ 1,354,881	$ 1,409,076	$ 1,465,439	$ 1,524,057	$ 1,585,019
Operating Expense											
Expenses per Collectible Income	-	-	-	-	-	-	-	-	-	-	-
Annual Overhead ($64,800 gross)	(64,800)	(67,392)	(70,088)	(72,891)	(75,807)	(78,839)	(81,993)	(85,272)	(88,683)	(92,231)	(95,920)
Expenses per Building ($2.17 @SF)	$ (289,139)	$ (300,705)	$ (312,733)	$ (325,243)	$ (338,252)	$ (351,782)	$ (365,854)	$ (380,488)	$ (395,707)	$ (411,536)	$ (427,997)
Total Operating Expense	$ (353,939)	$ (368,097)	$ (382,821)	$ (398,134)	$ (414,059)	$ (430,621)	$ (447,846)	$ (465,760)	$ (484,391)	$ (503,766)	$ (523,917)
Net Operating Income	$ 257,910	$ 745,517	$ 775,337	$ 806,351	$ 838,605	$ 872,149	$ 907,035	$ 943,316	$ 981,049	$ 1,020,291	$ 1,061,102
Annual Debt Service	$ (573,474)	$ (573,474)	$ (573,474)	$ (573,474)	$ (573,474)	$ (573,474)	$ (573,474)	$ (573,474)	$ (573,474)	$ (573,474)	
PMM Debt Service	-	-	-	-	-	-	-	-	-	-	
Developer and Working Loan Interest	-	-	-	-	-	-	-	-	-	-	
Annual Replacement Reserve	-	-	-	-	-	-	-	-	-	-	
Before-Tax Cash Flow	$ (315,565)	$ 172,042	$ 201,863	$ 232,876	$ 265,130	$ 298,675	$ 333,561	$ 369,842	$ 407,575	$ 446,817	
Working Loan Required	315,565	-	-	-	-	-	-	-	-	-	
Developer and Working Loan Repayment	-	(172,042)	(143,522)	-	-	-	-	-	-	-	
Developer's Incentive	-	-	-	-	-	-	-	-	-	-	
Total BTCF (Operations) for Distribution	$ -	$ -	$ 58,340	$ 232,876	$ 265,130	$ 298,675	$ 333,561	$ 369,842	$ 407,575	$ 446,817	
Projected BTCF From Disposition					Disposition BTCF, If the development is sold at the end of a given year.						
Sales Revenue							$ 10,481,291				
Disposition Expenses							(419,252)				
Net Disposition Income							$ 10,062,040				
Balance: Permanent Loan							(4,968,411)				
Balance: Private Money Mortgage (PMM)							$ -				
Before-Tax Cash Flow							$ 5,093,628				
Balance: Other Loans							$ -				
Total BTCF (Reversion) for Distribution							$ 5,093,628				
Before-Tax Cash Flow Summary	1	2	3	4	5	6	7	8	9	10	11
Total Cash Flow	(315,565)	172,042	201,863	232,876	265,130	298,675	5,427,189				
Total Cash Flow for Distribution	$ -	$ -	$ 58,340	$ 232,876	$ 265,130	$ 298,675	$ 5,427,189				
Distributed Before-Tax Cash Flow Summary	1	2	3	4	5	6	7	8	9	10	11
Investor(s)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Property Owner(s)	$ -	$ -	$ -	$ -	$ -	$ -	$ -				
Before-Tax Risk Analysis (Total Development)	1	2	3	4	5	6	7	8	9	10	11
Debt Coverage Ratio (DCR)			1.35	1.41	1.46	1.52	1.58	1.64	1.71	1.78	
					Risk Analysis of the investment, if the development is sold at the end of a given year.						
Internal Rate of Return (IRR)					34.76%	31.93%	29.96%	28.51%	27.40%	26.52%	
Net Present Value @ 20.0% Discount					$ 848,823	$ 804,149	$ 758,935	$ 714,272	$ 670,938	$ 629,473	

Project Profitability Analysis

Disposition at the end of	7	Internal Rate of Return (IRR)	29.96%
		Net Present Value (NPV)	$ 758,935

Investors/Property Owners: Profitability Analysis (Before Tax)

Investor's(s') Participation	n/a	IRR to Investor(s)	n/a
		NPV to Investor(s)	n/a
Prpty Owner's(s') Participation	n/a	PV to Property Owner(s)	$ 552,875

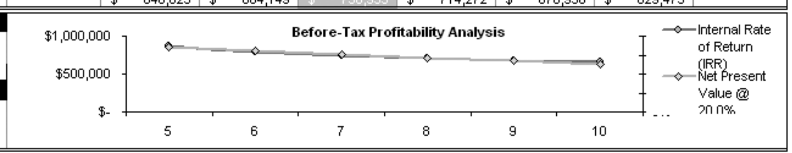

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Figure 67

Multifamily Case Study in LDEVOne.xlt: Venture Summary Sheet

DSSVenture © 1998-2003

Project Name	Peiser and Schawanhe's Multifamily Case	**By**	Y Leelarasamee	**Date**	Apr 13, 04	**Alternative**	1
Assumptions	Data for model validation.						

III. VENTURE ANALYSIS

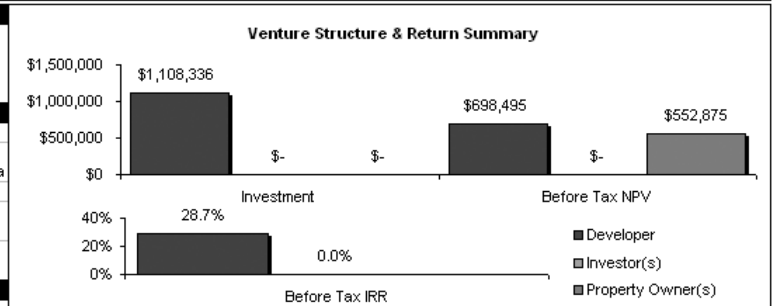
Development Entity	Capital Budget	1	2	3	4	5	6	7	8	9	10
Total Development Cost	$ (6,332,723)							Disposition			
Total Initial Equity	1,108,336										
Total Debt	$ 5,224,387										
Distributed Cash Flow		$ -	$ -	$ 58,340	$ 232,876	$ 265,130	$ 298,675	$ 5,427,189			
Investor(s)											
Total Capital Budget	$ -										
Total Cash Flow		$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Property Owner(s)											
Property Acquisition Cost	$ 552,875										
Investment	-										
Private Money Mortgage	-										
Total Cash Received at Closing	$ 552,875										
Distributed Cash Flow		$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Private Money Mortgage		-	-	-	-	-	-	-			
Total Cash Flow		$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Developer											
Investment	$ (1,108,336)										
Developer's Loan	-										
Development Fee - NET 0.0% of Total Dev Fee	-										
Other Fee(s) and Adjustment(s) - NET	n/a										
Total Capital Budget	$ (1,108,336)										
Distributed Cash Flow		$ -	$ -	$ 58,340	$ 232,876	$ 265,130	$ 298,675	$ 5,427,189			
Loan		(315,565)	-	-	-	-	-	-			
Interest / Repayment		-	172,042	143,522	-	-	-	-			
Incentive Fees		-	-	-	-	-	-	-			
Other Fee(s) and Adjustment(s) - NET		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Cash Flow		$ (315,565)	$ 172,042	$ 201,863	$ 232,876	$ 265,130	$ 298,675	$ 5,427,189			

Venture Structure and Return Summary

		Investment	% to Total	% Cash Flow	% Reversion
Developer		$ 1,108,336	100.00%	100.00%	100.00%
Investor(s)		n/a	n/a	n/a	n/a
Property Owner(s)		n/a	n/a	0.00%	0.00%
Before Tax: Profitability Analysis					
Internal Rate of Return	Project				29.96%
	Developer				28.68%
	Investor(s)				n/a
Net Present Value @ 20.0% Discount	Project				$ 758,935
	Developer				$ 698,495
	Investor(s)				n/a
Net Present Value @ 20.0% Discount	Property Owner(s)				$ 552,875

Internal Rate of Return for Property Owner is not available. No property for equity swap.

Disposition at the end of 7



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APPENDIX N

VALIDATION OF INTERFACES' DATA INTERCHANGES

Figure 68

Data-Interchange Verification between DSSVenture Interfaces and LDEVOne's Variables: Cost Category Screens

Variables	DSSVenture Interfaces		LDEVOne.xlt	
	Input	Output	Input	Output
Land Acquisition Costs				
Land	$552,875		$552,875	
Building	10,000		10,000	
Other/Adjustment	20,000		20,000	
Total Land Acquisition Cost		$582,875		$582,875
Hard Costs				
Construction/Improvement	$ 35.00 @SF		$ 35.00 @SF	
Other/Adjustment	$1,000		$1,000	
Total Hard Cost		$4,670,700		$4,670,700
Soft Costs				
Soft Costs Excluding Loan and Interest	$172,352		$172,352	
Construction Loan Fees and Interest Allowance		255,377		255,377
Permanent Loan Fees Allowance		111,519		111,519
Other/Adjustment	150,000		150,000	
Development Fee (% to Development Cost)	3.9%		3.9%	
Total Soft Costs		$921,018		$921,018
Total Development Cost		**$6,174,593**		**$6,174,593**

Figure 69

Data-Interchange Verification between DSSVenture Interfaces and LDEVOne's Variables: Operation Category Screens

Variables	DSSVenture Interfaces		LDEVOne.xlt	
	Input	Output	Input	Output
Building Areas				
Gross Building Area	133,420		133,420	
Useable Area	132,400		132,400	
Leaseable Area	133,000		133,000	
Final Leaseable Area		133,000		133,000
Incomes				
Annual Rent (per SF)	$ 8.25 @SF		$ 8.25 @SF	
Other Annual Income	$25,000		$25,000	
Potential Gross Income		$1,122,250		$1,122,250
Annual Growth	4.0%		4.0%	
Vacancy				
First Stabilized Year	3	3	3	3
1st Year	12.0%	12.0%	12.0%	12.0%
2nd Year	7.0%	7.0%	7.0%	7.0%
3rd Year	4.9%	4.9%	4.9%	4.9%
4th Year	n/a	4.9%	n/a	4.9%
6th Year	n/a	4.9%	n/a	4.9%
7th Year	n/a	4.9%	n/a	4.9%
8th Year	n/a	4.9%	n/a	4.9%
9th Year	n/a	4.9%	n/a	4.9%
Operating Expenses				
Expenses @ Collectible Income	3.0% @EGI		3.0% @EGI	
Annual Overhead	$34,800		$34,800	
Annual Expenses @ SF	$ 2.17 @SF		$ 2.17 @SF	
Replacement Reserve	5.0% @EGI		5.0% @EGI	
Annual Growth	4.0%		4.0%	
Developer's Incentive Rate	10.0% @BTCF		10.0% @BTCF	
Incentive Threshold	$100,000		$100,000	

Figure 70

Data-Interchange Verification between DSSVenture Interfaces and LDEVOne's Variables: Financing Category Screens

Variables	DSSVenture Interfaces		LDEVOne.xlt	
	Input	Output	Input	Output
Private Money Mortgage				
Mortgage Amount		$400,000		$400,000
Interest	2.0%		2.0%	
Term	3 years		3 years	
Annual Debt Service		($138,702)		($138,702)
Construction Financing				
Suggested Ceiling Amount		$4,460,742		$4,460,742
Amount Required		$4,454,593		$4,454,593
Interest	10.5%		10.5%	
Term		12		12
Lending Fee	1.0%		1.0%	
Permanent Financing				
Loan-to-Value Ratio	65.6%		65.6%	
Debt-Coverage Ratio	1.20		1.20	
Loan-to-Cost Ratio	80.0%		80.0%	
Suggested Ceiling Amount		$4,460,742		$4,460,742
Amount Required		$4,454,593		$4,454,593
Interest	10.5%		10.5%	
Term	30 years		30 years	
Lending Fee	2.5%		2.5%	
Annual Debt Service		($488,975)		($488,975)

Figure 71

Data-Interchange Verification between DSSVenture Interfaces and LDEVOne's Variables: Project Detail Screen

Variables	DSSVenture Interfaces		LDEVOne.xlt	
	Input	Output	Input	Output
Capitalization Rate	9.0%		9.0%	
Discount Rates				
General	15.0%		15.0%	
Property Owner	10.0%		10.0%	
Ground Breaking Year	2005		2005	
Time for Construction	12		12	
First Operating Year		2006		2006
Project Holding Period	7		7	

Figure 72

Data-Interchange Verification between DSSVenture Interfaces and LDEVOne's Variables: Development-Venture Scenario Screen

Variables	DSSVenture Interfaces		LDEVOne.xlt	
	Input	Output	Input	Output
Disposition Expenses				
Disposition Expenses	0.0%		0.0%	
Financing				
Working Capital Interest	3.0%		3.0%	
Venture Structure				
Equity				
Developer's	$250,000		$250,000	
Investor's	$1,000,000		$1,000,000	
Property Owner's	$50,000		$50,000	
Subsidy/Fund	$10,000		$10,000	
Total Equity		$1,310,000		$1,310,000
Debt				
Developer's	$10,000		$10,000	
Private Money Mortgage	$400,000		$400,000	
Permanent Financing		$4,454,593		$4,454,593
Total Debt		$4,864,593		$4,864,593
Distribution and Returns				
Cash Flow				
Developer's		42.0%		42.0%
Investor's	55.0%		55.0%	
Property Owner's	3.0%		3.0%	
Disposition				
Developer's		31.0%		31.0%
Investor's	65.0%		65.0%	
Property Owner's	4.0%		4.0%	
Net Present Value (NPV)				
Developer's		$967,556		$967,556
Investor's		$820,537		$820,537
Property Owner's		$626,117		$626,117
Total Project		$1,586,918		$1,586,918
Internal Rate of Return (IRR)				
Developer's		41.31%		41.31%
Investor's		25.81%		25.81%
Total Project		29.75%		29.75%

Figure 73

Data-Interchange Validation: Development-Venture Scenario Screen

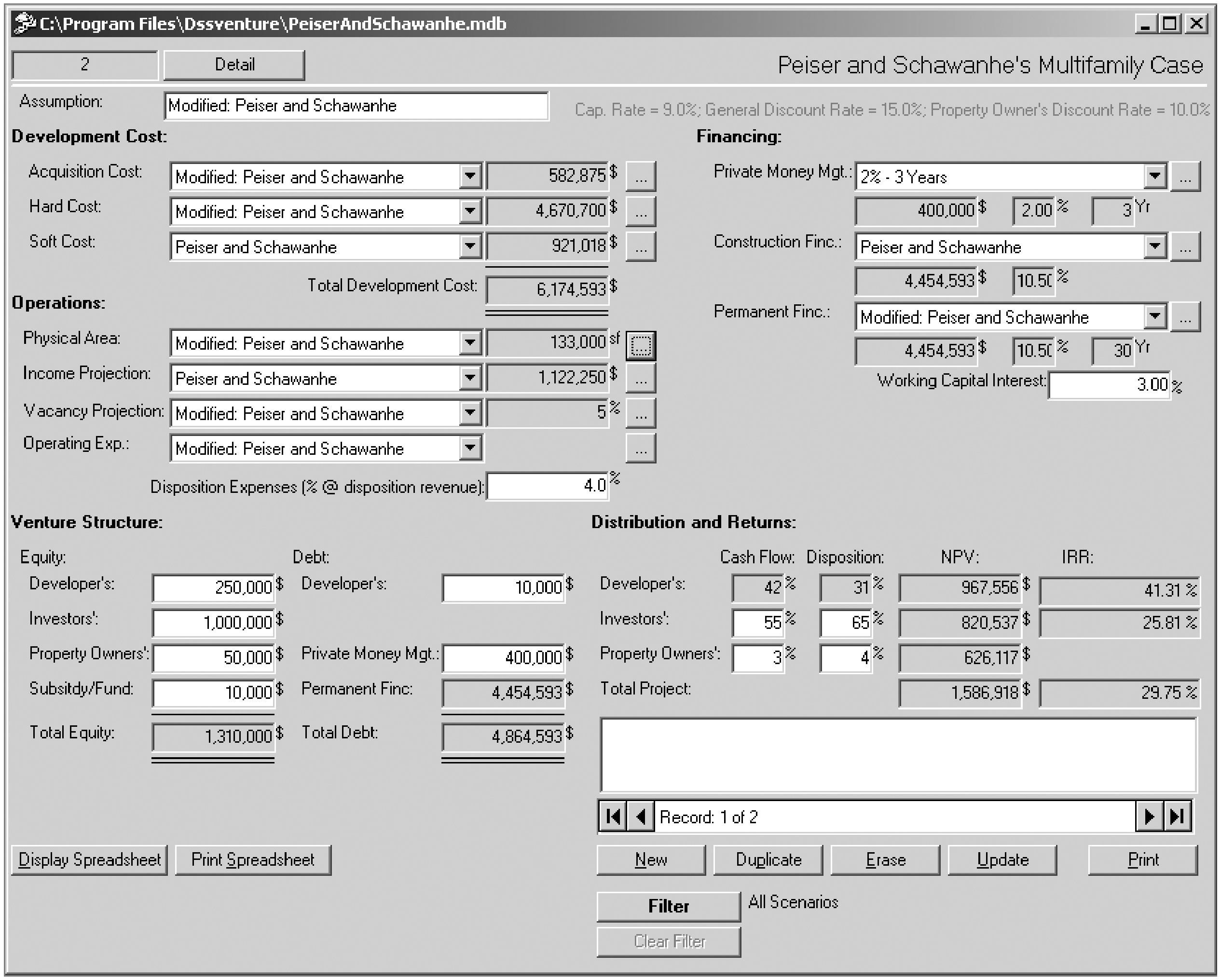

Figure 74

Data-Interchange Validation: Project Detail Screen

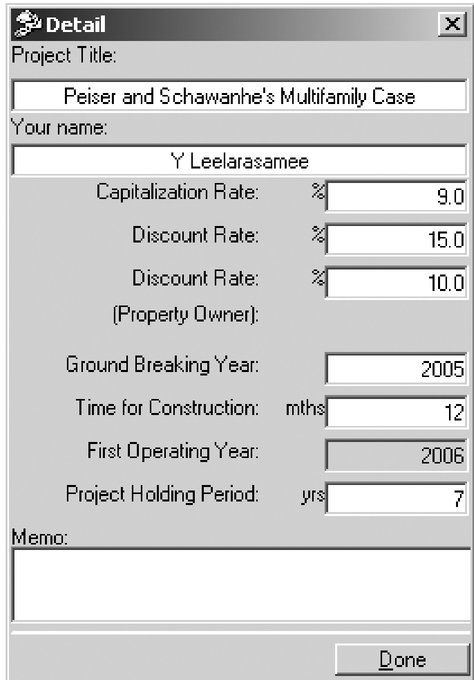

Figure 75

Data-Interchange Validation: Land Cost Assumption Screen

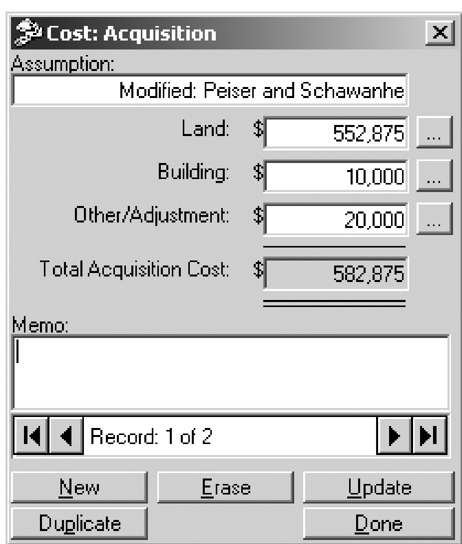

Figure 76

Data-Interchange Validation: Hard Cost Assumption Screen

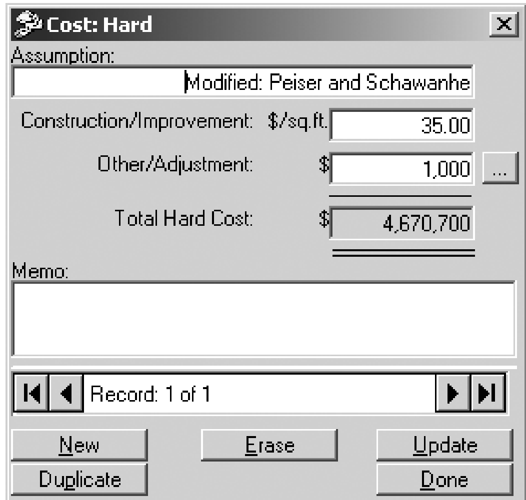

Figure 77

Data-Interchange Validation: Soft Cost Assumption Screen

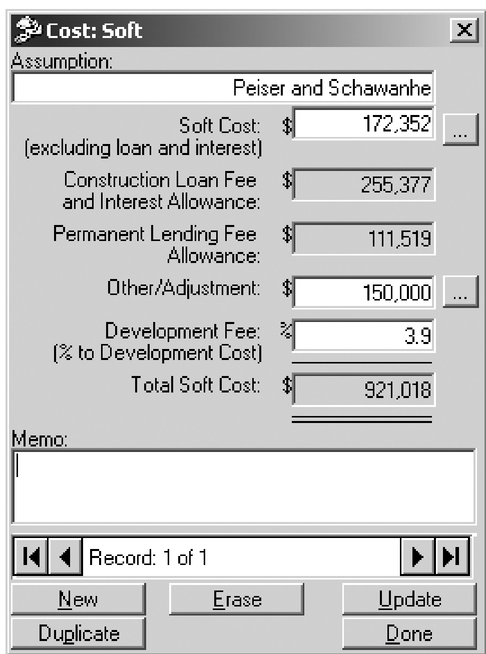

Figure 78

Data-Interchange Validation: Building Area Assumption Screen

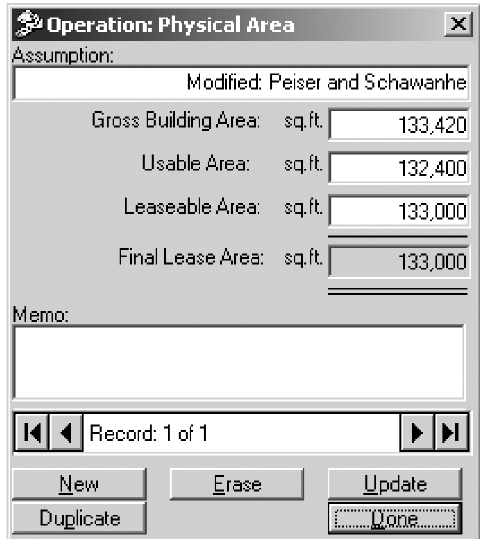

Figure 79

Data-Interchange Validation: Operating Income Assumption Screen

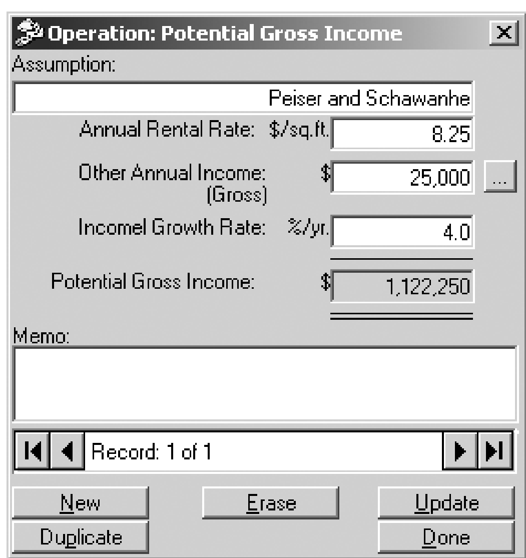

Figure 80

Data-Interchange Validation: Vacancy Assumption Screen

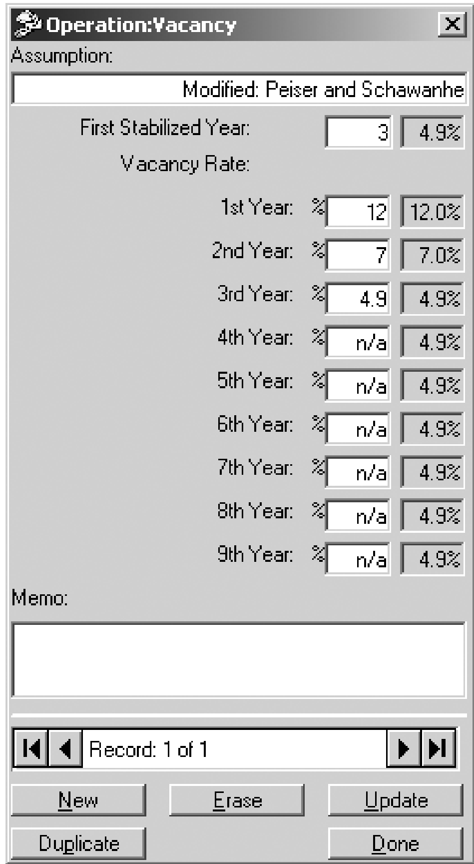

Figure 81

Data-Interchange Validation: Operating Expense Assumption Screen

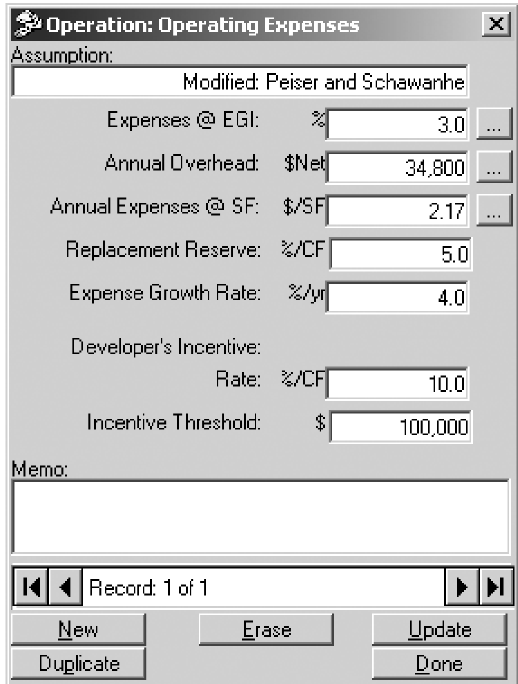

Figure 82

Data-Interchange Validation: Private Money Mortgage Assumption Screen

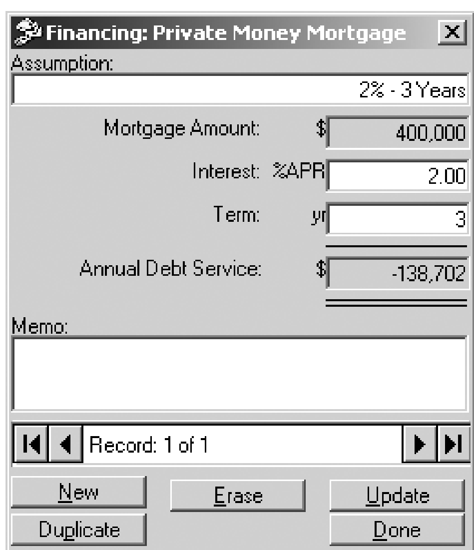

Figure 83

Data-Interchange Validation: Construction Financing Assumption Screen

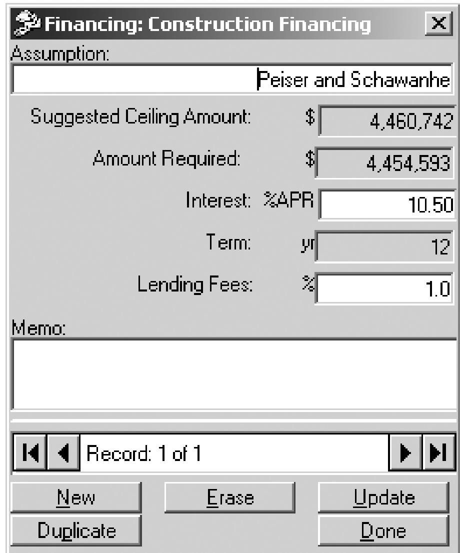

Figure 84

Data-Interchange Validation: Permanent Financing Assumption Screen

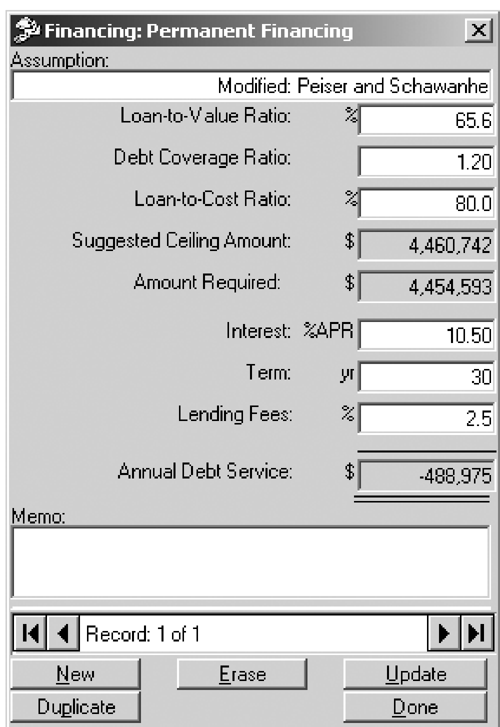

Figure 85

Data-Interchange Validation: LDEVOne.xlt – Input and Summary Sheet

DSSVenture © 1998-2003							
Project Name	Peiser and Schawanhe's Multifamily Case	**By**	Y Leelarasamee	**Date**	Apr 13, 04	**Alternative**	2
Assumption	Modified: Peiser and Schawanhe						

I. INPUTS & SUMMARY

COST		**OPERATIONS**		**FINANCING**	
Land Cost	$ 552,875	~~Efficiency Ratio (Leasable/Gross)~~	~~n/a~~	Private Money Mortgage (PMM)	$ 400,000
Building Cost	10,000	Gross Building Area	133,420 SF	Interest Rate	2.00%
Other Cost (not to Property Owner)	20,000	Total Leasable Area	133,000 SF	Term of Loan	3 years
Total Acquisition Cost	$ **582,875**	Total Usable Area	132,400 SF	Annual Debt Service	$ (138,702)
Construction and Improvement Cost	$ 35.00 SF	Total Leasable Area (Final)	**133,000**	Construction Financing	
Other Hard Cost / Adjustment	1,000		by using direct Leasable Area	Suggested Maximum Loan Available	$ 4,460,742
Total Hard Cost	$ **4,670,700**			Const. Loan Amount Required	$ 4,454,593
Soft Cost (excld. loan costs)	$ 172,352	Annual Rent (per SF)	$ 8.25 @SF	Term of Loan (months)	12 months
Const. Loan Fee and Int. Allowance	$ 255,377	Other Annual Income (Gross)	$ 25,000	Interest Rate	10.50%
Permanent Loan Fee Allowance	$ 111,519	Potential Gross Income	$ 1,122,250	Lender's Fees	1.00%
Additional Soft Cost / Adjustment	150,000	Annual Growth	4.0%	Permanent Financing	
Development Fee	3.9%	Vacancy Rate		Preferred Loan to Value Ratio	65.60%
Total Soft Cost	$ **921,018**	Input year-by-year vacancy in 'Cash Flow' Sheet		Preferred Debt Coverage Ratio	1.20
Total Development Cost	$ **6,174,593**	Stabilized Year (1-9)	3	Preferred Loan to Cost Ratio	80.00%
		Stabilized Year Rate: (2008)	4.9%	Suggested Maximum Loan Available	$ 4,460,742
				Perm. Loan Required	$ 4,454,593
				Term of Loan	30 years
VENTURE STRUCTURE		Operating Expenses (Annually)		Interest Rate	10.50%
Equity		Expenses per Collectible Income	3.0% @EGI	Lender's Fees	2.50%
Developer's Investment	$ 250,000	Annual Overhead	$ 34,800	Annual Debt Service	$ (488,975)
Investors' Contribution	1,000,000	Expenses per Building Area	$ 2.17 @SF	Development Loan & Working Capital (Developer's)	
Property for Equity Swap	50,000	Annual Growth	4.0%	Interest	3%
Other Subsidy(ies)/Fund(s)	10,000	Annual Replacement Reserve	5.0% @EGI		
Total Initial Equity	$ **1,310,000**				
Debt		Incentive to Developer (If applicable)		**OTHER INPUTS**	
Loan from Developer	$ 10,000	Fee (%BTCF above threshold)	10.0%	Ground Breaking	2005
Private Money Mortgage (PMM)	400,000	Threshold	$ 100,000	Time for Construction	12 months
Permanent Loan	4,454,593			First Operating Year	2006
Total Debt	$ **4,864,593**	Disposition Expenses (% of Sale)	0.0%	Project Holding Period	7 years
Percent Distribution of Returns				The property will be liquidated in 2012.	
Investor(s): Cash Flow	55.0% @BTCF				
Investor(s): Disposition	65.0% @BTCF			Capitalization Rate	9.00%
Property Owner: Cash Flow	3.0% @BTCF			General Discount Rate	15.00%
Property Owner: Disposition	4.0% @BTCF			Property Owner's Discount Rate	10.00%

		Property Owners(s)		Developer	Investor(s)	Total Project
Before Tax	PV at 10.0% discount.	$ 626,117	Net Present Value at 15.0% discount	$ 967,556	$ 820,537	$ 1,586,918
	IRR on Equity only	29.36%	Internal Rate of Return	41.31%	25.81%	29.75%

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Figure 86

Data-Interchange Validation: LDEVOne.xlt – Cash Flow Schedule Sheet

DSSVenture © 1998-2003

Project Name	Peiser and Schawanhe's Multifamily Case	**By**	Y Leelarasamee	**Date**	Apr 13, 04	**Alternative**	2
Assumptions	Modified: Peiser and Schawanhe						

II. CASH FLOW SCHEDULE

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Projected BTCF From Operation							Disposition				
Rental Income	1,097,250	1,141,140	1,186,786	1,234,257	1,283,627	1,334,972	1,388,371	1,443,906	1,501,662	1,561,729	1,624,198
Other Income	25,000	26,000	27,040	28,122	29,246	30,416	31,633	32,898	34,214	35,583	37,006
Potential Gross Income	$ 1,122,250	$ 1,167,140	$ 1,213,826	$ 1,262,379	$ 1,312,874	$ 1,365,389	$ 1,420,004	$ 1,476,804	$ 1,535,877	$ 1,597,312	$ 1,661,204
Vacancy Rate [Fill In]	12.0%	7.0%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%
	12.0%	7.0%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%	4.9%
Vacancy	(134,670)	(81,700)	(59,477)	(61,857)	(64,331)	(66,904)	(69,580)	(72,363)	(75,258)	(78,268)	(81,399)
Effective Gross Income	$ 987,580	$ 1,085,440	$ 1,154,348	$ 1,200,522	$ 1,248,543	$ 1,298,485	$ 1,350,424	$ 1,404,441	$ 1,460,619	$ 1,519,043	$ 1,579,805
Operating Expense											
Expenses per Collectible Income 3.0% @EGI	(29,627)	(32,563)	(34,630)	(36,016)	(37,456)	(38,955)	(40,513)	(42,133)	(43,819)	(45,571)	(47,394)
Annual Overhead ($34,800 gross)	(34,800)	(36,192)	(37,640)	(39,145)	(40,711)	(42,340)	(44,033)	(45,794)	(47,626)	(49,531)	(51,513)
Expenses per Building ($2.17 @SF)	$ (287,308)	$ (298,800)	$ (310,752)	$ (323,182)	$ (336,110)	$ (349,554)	$ (363,536)	$ (378,078)	$ (393,201)	$ (408,929)	$ (425,286)
Total Operating Expense	$ (351,735)	$ (367,556)	$ (383,022)	$ (398,343)	$ (414,277)	$ (430,848)	$ (448,082)	$ (466,005)	$ (484,646)	$ (504,031)	$ (524,193)
Net Operating Income	$ 635,845	$ 717,885	$ 771,326	$ 802,179	$ 834,266	$ 867,636	$ 902,342	$ 938,436	$ 975,973	$ 1,015,012	$ 1,055,612
Annual Debt Service	$ (488,975)	$ (488,975)	$ (488,975)	$ (488,975)	$ (488,975)	$ (488,975)	$ (488,975)	$ (488,975)	$ (488,975)	$ (488,975)	
PMM Debt Service	(138,702)	(138,702)	(138,702)	-	-	-	-	-	-	-	
Developer and Working Loan Interest	(304)	(1,567)	(522)	-	-	-	-	-	-	-	
Annual Replacement Reserve (5% of remaining EGI)	(49,379)	(54,272)	(57,717)	(60,026)	(62,427)	(64,924)	(67,521)	(70,222)	(73,031)	(75,952)	
Before-Tax Cash Flow	$ (41,515)	$ 34,369	$ 85,410	$ 253,178	$ 282,864	$ 313,737	$ 345,846	$ 379,239	$ 413,967	$ 450,085	
Working Loan Required	41,515	-	-	-	-	-	-	-	-	-	
Developer and Working Loan Repayment	-	(34,369)	(17,146)	-	-	-	-	-	-	-	
Developer's Incentive	-	-	-	(15,318)	(18,286)	(21,374)	(24,585)	(27,924)	(31,397)	(35,008)	
Total BTCF (Operations) for Distribution	$ -	$ -	$ 68,263	$ 237,860	$ 264,577	$ 292,364	$ 321,261	$ 351,315	$ 382,570	$ 415,076	
Projected BTCF From Disposition					Disposition BTCF, If the development is sold at the end of a given year.						
Sales Revenue							$ 10,427,063				
Disposition Expenses							-				
Net Disposition Income							$ 10,427,063				
Balance: Permanent Loan							(4,236,335)				
Balance: Private Money Mortgage (PMM)							$ -				
Before-Tax Cash Flow							$ 6,190,728				
Balance: Other Loans							$ -				
Total BTCF (Reversion) for Distribution							$ 6,190,728				
Before-Tax Cash Flow Summary	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total Cash Flow	(41,515)	34,369	85,410	253,178	282,864	313,737	6,536,574				
Total Cash Flow for Distribution	$ -	$ -	$ 68,263	$ 237,860	$ 264,577	$ 292,364	$ 6,511,989				
Distributed Before-Tax Cash Flow Summary	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Investor(s)	$ -	$ -	$ 37,545	$ 130,823	$ 145,518	$ 160,800	$ 4,200,667				
Property Owner(s)	$ -	$ -	$ 2,048	$ 7,136	$ 7,937	$ 8,771	$ 257,267				
Before-Tax Risk Analysis (Total Development)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Debt Coverage Ratio (DCR)			1.58	1.64	1.71	1.77	1.85	1.92	2.00	2.08	
					Risk Analysis of the investment, if the development is sold at the end of a given year.						
Internal Rate of Return (IRR)					35.96%	32.28%	29.75%	27.92%	26.52%	25.43%	
Net Present Value @ 15.0% Discount					$ 1,659,750	$ 1,623,813	$ 1,586,918	$ 1,549,696	$ 1,512,647	$ 1,476,166	

Project Profitability Analysis			
Disposition at the end of	2012	Internal Rate of Return (IRR)	29.75%
		Net Present Value (NPV)	$ 1,586,918
Investors/Property Owners: Profitability Analysis (Before Tax)			
Investor's(s') Participation	$ 1,000,000	IRR to Investor(s)	25.81%
		NPV to Investor(s)	$ 820,537
Prpty Owner's(s') Participation	$ 50,000	PV to Property Owner(s)	$ 626,117

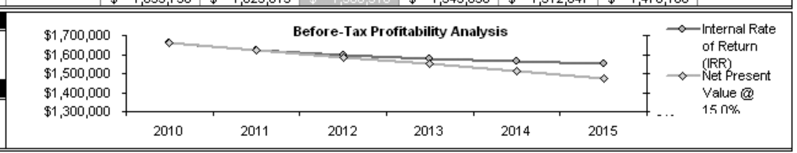

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Figure 87

Data-Interchange Validation: LDEVOne.xlt – Venture Summary Sheet

DSSVenture ©1998-2003							
Project Name	Peiser and Schawanhe's Multifamily Case	**By**	Y Leelarasamee	**Date**	Apr 13, 04	**Alternative**	2
Assumptions	Modified: Peiser and Schawanhe						

III. VENTURE ANALYSIS

Development Entity	Capital Budget	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Development Cost	$ (6,174,593)							Disposition			
Total Initial Equity	1,300,000										
Total Debt	$ 4,864,593										
Distributed Cash Flow		$ -	$ -	$ 68,263	$ 237,860	$ 264,577	$ 292,364	$ 6,511,989			
Investor(s)											
Total Capital Budget	$ (1,000,000)										
Total Cash Flow		$ -	$ -	$ 37,545	$ 130,823	$ 145,518	$ 160,800	$ 4,200,667			
Property Owner(s)											
Property Acquisition Cost	$ 582,875										
Investment	(50,000)										
Private Money Mortgage	(400,000)										
Total Cash Received at Closing	$ 132,875										
Distributed Cash Flow		$ -	$ -	$ 2,048	$ 7,136	$ 7,937	$ 8,771	$ 257,267			
Private Money Mortgage		138,702	138,702	138,702	-	-	-	-			
Total Cash Flow		$ 138,702	$ 138,702	$ 140,750	$ 7,136	$ 7,937	$ 8,771	$ 257,267			
Developer											
Investment	$ (250,000)										
Developer's Loan	(10,000)										
Development Fee - NET n/a	231,770	100%@Dev Fee									
Other Fee(s) and Adjustment(s) - NET	n/a										
Total Take Out (Cash Contribution)	$ (28,230)										
Distributed Cash Flow		$ -	$ -	$ 28,671	$ 99,901	$ 111,122	$ 122,793	$ 2,054,055			
Loan		(41,515)	-	-	-	-	-	-			
Interest / Repayment		304	35,936	17,668	-	-	-	-			
Incentive Fees		-	-	-	15,318	18,286	21,374	24,585			
Other Fee(s) and Adjustment(s) - NET		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Cash Flow	$ (260,000)	$ (41,211)	$ 35,936	$ 46,339	$ 115,219	$ 129,409	$ 144,166	$ 2,078,640			

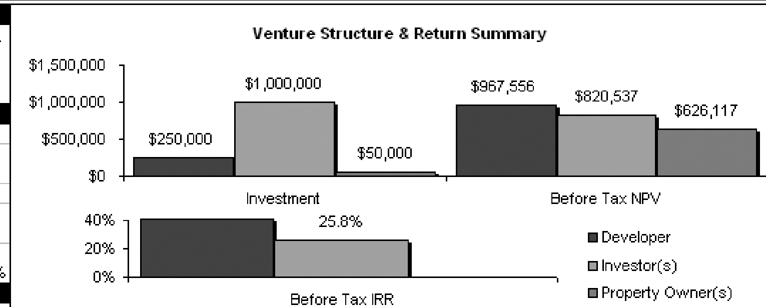
Venture Structure and Return Summary

	Investment	% to Total	% Cash Flow	% Reversion
Developer	$ 250,000	19.23%	42.00%	31.00%
Investor(s)	$ 1,000,000	76.92%	55.00%	65.00%
Property Owner(s)	$ 50,000	3.85%	3.00%	4.00%

Before Tax: Profitability Analysis

Internal Rate of Return	Project	29.75%
	Developer	41.31%
	Investor(s)	25.81%
Net Present Value @ 15.0% Discount	Project	$ 1,586,918
	Developer	$ 967,556
	Investor(s)	$ 820,537
Net Present Value @ 10.0% Discount	Property Owner(s)	$ 626,117
Internal Rate of Return (on equity only)		29.36%

Disposition at the end of 2012



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APPENDIX O

TEST SETUP

Figure 88

Test Setup: Session I – The Introduction

Date:	March 30, 2004
Time:	4:30 PM – 5:45 PM
Locations:	Langford A119
Number of Computers:	36
Number of Computers with DSSVenture Installed:	31
Number of Participants:	24
Number of Submitted Surveys:	n/a

Figure 89

Test Setup Detail: Session II – The Experiment

Date:	April 1, 2004
Time:	4:30 PM – no time limit
Locations:	Langford A119
Number of Computers:	36
Number of Computers with DSSVenture Installed:	31
Number of Participants:	Total: 21 Control: 11 Experiment: 10
Number of Submitted Surveys:	Total: 19 Control: 10 Experiment: 19

Figure 90

Test Setup Detail: Computer Systems

Processors:	Intel® Pentium IV
Speed:	2.0 Gigahertz
Random Access Memory:	512 Megabytes
CD-Rom:	Yes
Keyboard:	101-Key Generic
Mouse:	Optical
Monitor:	15” LCD (1280x1024)
Microsoft Excel®:	Installed – Version 2002
Microsoft Access®:	Installed – Version 2002

APPENDIX P

EVALUATION EXPERIMENT DATA TABLES

Figure 91

Demographic Data

Group	IDSubject	Region of Prior Education	Skill Levels				
			Arch. Design / Planning	Const. Cost Estimating	Financing	Land Economic / Appraisal	Other
Control	153	North America	3	2	2	4	4
	252	Asia	3	4	3	2	3
	291	Asia	3	2	2	2	3
	338	North America	1	2	5	4	0
	649	Asia	2	4	4	2	0
	675	Asia	4	1	2	3	0
	760	North America	5	3	2	4	5
	800	North America	5	2	2	2	0
	834	Asia	5	5	2	2	3
	963	North America	2	3	5	5	0
Experiment	ETM	North America	3	3	4	5	3
	JAF	North America	4	4	2	2	3
	MHJ	Asia	4	2	3	3	3
	PKF	North America	4	5	3	2	0
	REJ	Asia	5	3	3	2	4
	SAH	Asia	2	2	3	4	3
	YEH	Asia	5	3	4	3	2
	ZVX	North America	4	4	4	4	4

Figure 92

The Data Set

Group	Subject ID	Case: Tool	to reach the decision		Recommendations			
					Advance		Fallback	
			Minutes	Alternatives	NPV	IRR	NPV	IRR
Control	153	B: DSSVenture	60	5	$5,124,991	127.2%	$1,591,046	36.0%
		A: DSSVenture	45	8	$5,676,773	412.8%		
	252	A: DSSVenture	15	4	$7,565,357	292.6%	$7,272,849	227.3%
		B: DSSVenture	20	7	$5,839,851	192.8%	$5,602,466	326.7%
	291	B: DSSVenture	70	6	$3,769,337	79.4%	$2,591,038	52.5%
		A: DSSVenture	80	6	$6,209,374	182.9%	$5,591,766	171.0%
	338	B: DSSVenture	90	6	$5,566,665	100.4%	$5,418,099	123.4%
		A: DSSVenture	90	8	$7,361,046	208.0%	$1,020,590	259.4%
	649	A: DSSVenture	120	7	$7,465,721	535.6%	$2,177,543	93.8%
		B: DSSVenture	110	6	$5,595,415	280.3%		
	675	B: DSSVenture	75	5	$5,026,865	702.4%	$1,239,471	25.3%
		A: DSSVenture	90	5	$6,548,890	197.1%		
	760	B: DSSVenture	120	4	$5,607,005	280.0%		
		A: DSSVenture	120	4	$7,459,897	535.0%		
	800	A: DSSVenture	165	5	$1,064,635	1465.0%	$6,944,453	495.9%
		B: DSSVenture	120	4	$5,540,148	191.2%	$5,595,519	98.0%
	834	B: DSSVenture	150	8	$5,505,907	298.0%		
		A: DSSVenture	150	8	$7,453,912	538.6%	$3,830,031	247.0%
	963	A: DSSVenture	45	3	$6,938,504	543.0%	$ 738,218	37.0%
		B: DSSVenture	40	4	$5,612,113	178.0%	$5,495,128	94.0%
Experiment	ETM	A: LDEVOne	135	4	$1,007,861	36.0%	$1,101,644	48.9%
		B: DSSVenture	70	7	$4,500,818	270.0%	$1,310,219	31.0%
	JAF	A: LDEVOne	135	2	$3,600,129	112.3%	$2,502,054	61.6%
		B: DSSVenture	105	8	$5,081,123	130.9%	$5,008,997	137.2%
	MHJ	B: LDEVOne	90	4	$5,510,023	199.9%	$5,300,317	233.5%
		A: DSSVenture	60	7	$2,408,984	118.6%	$2,362,106	186.1%
	PKF	B: LDEVOne	40	4	$7,613,404	444.0%	$7,441,868	426.4%
		A: DSSVenture	30	5	$3,682,551	122.1%	$3,058,650	112.8%
	REJ	A: LDEVOne	90	8	$1,301,824	47.3%	$1,001,844	32.1%
		B: DSSVenture	45	14	$4,322,045	121.4%	$1,282,098	32.8%
	SAH	B: LDEVOne	45	4	$5,209,288	20.0%	$1,592,874	20.0%
		A: DSSVenture	30	8	$2,096,479	20.2%	$1,028,244	20.1%
	YEH	A: LDEVOne	90	2	$1,014,226	25.0%	$1,010,025	25.0%
		B: DSSVenture	90	4	$4,503,522	68.3%	$2,099,890	50.0%
	ZVX	B: LDEVOne	80	2	$2,360,302	110.8%	$1,000,740	25.0%
		A: DSSVenture	60	8	$2,746,700	551.2%	$ 850,368	

Legend: Pre-Test Observation
Post-Test Observation

VITA

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	B.Arch. Faculty of Architecture, Silpakorn University	April 1994
ACADEMIC EXPERIENCE:	**Chulalongkorn University** Department of Housing Development, Faculty of Architecture • Visiting Faculty (2002 – 2003) • Faculty Member (2000 – 2001)	2000 – 2003
	Texas A&M University Department of Landscape Architecture and Urban Planning, College of Architecture • Teaching Assistant (1997 – 2000) • Research Assistant (1996)	1996 – 2000
PROFESSIONAL EXPERIENCE:	**Peeraphatthana Assets Co. Ltd.** Principal	2003 – Present
	Estate Asia Co.Ltd. Vice President for Real Estate (2003) Real Estate Consultant (2001 – 2002)	2001 – 2003
	ISO Group Co. Ltd. Licensed Architect	1994