A Benefit-Cost Analysis of the Texas Commission on Environmental Quality's Digital Imaging Project

by

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Abstract

This study accomplishes three things. First, it provides a detailed discussion on benefit-cost analysis and how it is used in the decision making process. Second, it provides background information on digital imaging technology and discusses its current uses. Finally, it applies the technique of benefit-cost analysis to privatization of the Texas Commission on Environmental Quality's (TCEQ) digital imaging project to determine if it is cost beneficial. A discussion of the scholarly literature defines the benefits and costs associated with a project and offers uses for a benefit-cost analysis. The conceptual framework links the benefits and costs of a digital imaging project to the existing literature. The operationalization of the benefit and cost variables are identified, showing how each is measured. Finally, the decision criteria of present value and net present value are used to determine the viability of the project. The results of the benefit-cost analysis of the TCEQ digital imaging project finds that it is economically viable at two discount rates. A sound benefit-cost analysis can help decision makers evaluate choices and assure the chosen project will provide the best return on investment. The findings of this study show TCEQ administrators and others considering similar projects that digital imaging is a good investment.

About the Author

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Chapter One: Introduction

Introduction

Benefit-cost analysis is a tool that can be used in both the public and private sectors when making decisions involving monetary resources. In the public sector, a sound benefit-cost analysis can be used to determine priorities and ensure that tax dollars are spent efficiently and in the best interest of the public (Ascott 2006, 2). It also helps decision makers evaluate choices while allocating scarce resources. When public funding becomes scarce, a benefit-cost analysis takes on more importance and helps assure the project will provide the best return on investment.

With limited resources, the government is challenged to find ways to cut back and control expenditures. As indicated by Shields (1992, 1) "techniques of privatization are advocated as means to control government spending." In hopes of creating efficiencies in its financial document handling process, the Texas Commission on Environmental Quality (TCEQ) entered into an imaging contract with a private entity. A formal benefit-cost analysis of this project will assist TCEQ administrators in making a more informed decision pertaining to the future of contracting these services.

Research Purpose

This study will accomplish three things. First, the study will provide a detailed discussion on benefit-cost analysis and how this type of analysis is used in the decision making process. Second, the study will provide background information on digital

imaging technology and discuss this type of technology's current uses. Finally, the study will apply the technique of benefit-cost analysis to privatization of the TCEQ's digital imaging project to determine if it is cost beneficial.

The results from a thorough benefit-cost analysis will provide a clear picture as to whether a project is worthwhile. Such an analysis may determine that this project is not viable, as did Elizabeth Ascott's analysis of the Wonder World Drive overpass. However, as stated in her conclusion, a benefit-cost analysis "can be used as a model to improve the decision making policy [with which] makers are faced" (Ascott 2006, 3). Whether or not the TCEQ's digital imaging project is viable, a formal analysis will equip administrators with the information needed to make sound decisions pertaining to the project's continuance.

Chapter two reviews the scholarly literature on benefit-cost analysis. The literature defines benefits and costs, discusses the uses of benefit-cost analysis, reviews the appropriate discount rate, and identifies decision criteria used in performing a benefit-cost analysis. Additionally, this literature review will provide a foundation for conducting a benefit-cost analysis of the TCEQ digital imaging project.

Chapter three provides a discussion on digital imaging technology and its current uses. The chapter will also provide background and historical information pertaining to the contractual relationship between the TCEQ and Neubus, Inc. The organization and mission of each entity will be discussed, and the progression of the public-private partnership will be revealed.

Chapter four will describe the methodology used to operationalize the benefits and costs identified in the conceptual framework to determine if the TCEQ digital

imaging project is cost beneficial. This chapter will discuss how each benefit and cost is measured. A final section will describe the discount rate and decision criterion used in the benefit-cost analysis for this study.

Chapter five will present the results of the analysis and chapter six will conclude the analysis and review the research. Chapter six also will support recommendations that the TCEQ and similar agencies conduct future benefit-cost analyses when considering privatizing services.

Chapter Two: Literature Review

Introduction

This chapter reviews the scholarly literature on benefit-cost analysis. The literature defines benefits and costs, discusses the uses of benefit-cost analysis, reviews the appropriate discount rate, and identifies decision criteria used in performing a benefit-cost analysis. This literature review will provide a foundation for conducting a benefit-cost analysis of the Texas Commission on Environmental Quality's (TCEQ) digital imaging project.

Defining Benefit-Cost Analysis

Benefit-cost analysis is a tool that can be used in both the public and private sectors when making decisions involving monetary resources. In the public sector, a sound benefit-cost analysis can be used to determine priorities and ensure that tax dollars are spent efficiently and in the best interest of the public (Ascott 2006, 2). With limited resources, the government is challenged to find ways to cut back and control expenditures. The available projects and programs that local governments could spend its limited revenues on always exceed the available revenues. "If optimum use is to be made of these limited revenues, local government must spend them in ways that are socially profitable, generating the most benefits for the community relative to the costs incurred" (Galambos and Schreiber 2006, 62). A benefit-cost analysis can help decision makers evaluate choices while allocating scarce resources. When public funding

becomes scarce, a benefit-cost analysis takes on more importance and helps assure the project will provide the best return on investment.

Eva Galambos and Arthur Schreiber (1978, 62-63) have identified four steps for a successful benefit-cost analysis as outlined below:

1. Identify the cost and benefits of the project
2. Measure the costs and benefits in dollars
3. Consider the costs and benefits over the life of the project
4. Determine if the project's social benefits justify the expenditures

According to Christopher McKenna (1980, 129), there are five elements that must be considered when working through these four steps. They include objectives, alternatives, benefits and costs, a model and a criterion.

In applying the first of these elements to a state agency's digital imaging project, determining if the project is a good investment for the agency is the objective. As for McKenna's second element, there is only one alternative to consider in this case. If a Texas state agency wishes to procure digital imaging services, it only has the option of using a vendor that has been awarded a contract by the Texas State Council on Competitive Government (CCG). If a Texas state agency finds that the vendor cannot provide services to their satisfaction, the only option the agency has is to complete the services in-house. In other words, another vendor cannot be sought to provide the services, as outlined in Appendix A.

The third element suggests that benefits and costs must be identified and measured, using a formula in which the difference between the net present value of benefits and the net present value of costs yields a positive net present value for a project.

The remaining two elements should be applied when consideration and calculation is made concerning the difference in value between current and future dollars, which is discussed more fully later in this chapter.

Challenges and Weaknesses in Benefit-Cost Analysis

Analysts can find difficulties in performing a benefit-cost analysis, as discussed by Darlene Berghammer:

> It is not always a totally objective procedure that can guarantee an evaluation free of error. Identifying the benefits and measuring them in dollars is the most difficult part of benefit-cost analysis. Choosing different discount rates to compute the present value of net social benefits can drastically affect the outcome of an analysis. Placing a dollar value on benefits can be very subjective. Inflation and other intangible items make placing dollar amounts on future and present value difficult. When many of the important benefits are intangible, benefit-cost analysis is probably not worthwhile (Berghammer 1996, 10).

It is not always possible, or efficient, to quantify intangible benefits and costs. However, as Berghammer points out, "When many of the important benefits are intangible, benefit-cost analysis is probably not worthwhile" (1996, 10). It is important for the analyst to give every effort to quantify, by placing monetary value or some other value, on the variables in the analysis. The analyst should "reasonably measure significant preferences, to acknowledge preferences not measured, and to consider whether or not unmeasured preferences are likely to contradict the benefit-cost analysis test" (Zerbe 2008-06, 17). Otherwise, the decision to accept or reject the project may have to rely on subjective information.

One question that is often raised in connection with benefit-cost analysis is how scientific is it? In an attempt to answer this question, Brent notes the following points:

1. The subject is no more or less scientific than any policy area of economics, such as international or labour economics. The strengths and weaknesses are those of welfare economics itself.

2. One needs to use CBA for some government decisions because it is too administratively costly to hold an election every time a public decision needs to be made.

3. Providing the objectives are the same for all projects, and measured in a consistent fashion, there is no necessary bias by using CBA. For example, if environmental factors are considered to be important for one project decision, they must be considered to be important for all project decisions. This guards against a policy-maker bringing in special factors that raise the net benefits only for those particular projects that are personally preferred by the policy-maker (Brent 2006, 7).

An additional weakness identified in benefit-cost analysis is the use of inappropriate discount rates. "Analysts need a theoretically appropriate number more than ever because the federal government and many state governments now mandate the use of cost-benefit analysis for major physical and social investments" (Zerbe 2008, 287). "Evidence abounds that the quality of governmental cost-benefit analysis varies widely, and that a major reason for this variability is lack of consistency in the use of the social discount rate" (Zerbe 2008, 287). Use of different discount rates by different agencies can skew the assessment of projects. A project can be rejected or accepted depending on which agency performed the analysis.

Identifying Benefits and Costs

Public administrators must be good stewards of the public funding and the interest of those they serve. Therefore, administrators should be responsible for identifying the

benefits and costs of a project under consideration. Benefits are usually defined solely in terms of the change in individual well-being that the policy induces, and costs are generally measured in terms of the monetary costs of resources required to implement the project (Kornhauser, 2000). Individual well-being is understood as the satisfaction of subjective preferences thus comparison of costs and benefits requires that the benefit-cost analyst measure subjective benefits in monetary terms (Kornhauser, 2000). It is important to "measure all variables in terms of dollars so you are not comparing apples to oranges" (Galambos & Schreiber 1978, 62). There are different types of project benefits and costs: direct, indirect and intangible. Each should be considered when identifying all of the benefits and costs.

Project Benefits

The benefits of a project include the increases or gains in goods or services generated during the life of the project. "Benefits in the comprehensive sense include all outputs of the process or consequences of an alternative" (McKenna 1980, 142). The benefits can be derived directly or indirectly. Direct benefits can be easier to quantify than indirect benefits. For example, cost savings for reduced labor are easier to quantify than the value of knowledge received from learning a new skill. In the case of the TCEQ imaging project, the benefits are outlined in Table 2.2.

Direct Benefits

Direct benefits are those directly generated by the life of the project. "A direct benefit is a measurable saving that flows from a particular course of action" (Blum,

Damsgaard, and Sullivan 1980, 139). In the case of a health insurance program, a direct benefit would be "the prevention of serious loss of income to individuals stricken with a major illness" (Blum, Damsgaard, and Sullivan 1980, 139). Direct benefits from digital imaging services might include the reduction in storage costs for paper and other hard documents. Additionally, labor costs may be reduced for staff involved in handling such documents. A direct benefit also may result from decreased labor costs associated with immediate access for inquiry. Efficiencies created by agencies can result in funds being re-allocated to a more needed cause. For example, a digital imaging project may reduce the responsibilities of a position, thereby allowing the reallocation of that position to a more pressing need.

Indirect Benefits

Indirect benefits are those that are not directly associated with a project but can be of great importance to administrators. "An indirect benefit would be secondary effects felt by an individual" (Blum, Damsgaard, and Sullivan 1980, 139). Benefits, particularly indirect and intangible ones, are not always easily reduced to monetary terms. "Consequently, providing fiscal measurements for these types of benefits has been criticized as a subjective, largely unverifiable process" (Blum, Damsgaard, and Sullivan 1980, 139). An example of an indirect benefit associated with a digital imaging project is the reduced environmental impact resulting from decreased paper usage. Although the environmental impact can not be measured, it should be a consideration in determining the worthiness of a project, particularly a project being considered by an agency charged with protecting environmental resources.

Privatization of digital imaging also can have an indirect benefit for agency employees and staff from other government entities' (e.g., Environmental Protection Agency and the Texas State Auditors Office) ability to access the electronic images (TCEQ 2007, 14). This ability allows individuals to retrieve the information they need at their convenience, thereby reducing dependence on a select few staff members. For a state agency, a misplaced or lost document pertaining to cost recovery can translate into less money that can be retrieved by the agency. Cost recovery refers to efforts by the state to seek reimbursement for site remediation expenses incurred by the state for which a responsible party has been identified. Responsible parties can include individuals and businesses that create hazardous waste sites resulting in clean up costs paid by the government.

It should be noted that each cost recovery case is different, and aspects of each case can lead to the determination of differing levels of activity to pursue cost recovery. The TCEQ maintains cost recovery vouchers for thirty years as a record of costs incurred by the agency to clean up waste sites. Cost recovery vouchers document the amount of time and money spent by TCEQ employees in remediation efforts. The cost to the agency can be over $100,000 per site, and cost recovery vouchers are necessary in recouping the funds. Digital imaging services can prevent the loss of documents needed to recover costs by providing the imaged document online.

Project Costs

Project costs are those that are directly related to the project's development and maintenance. These costs include initial costs, recurring costs and maintenance costs.

Initial costs include research, planning, developing, testing, and training (McKenna 1980, 134). Recurring costs include personnel, education, rental of space, equipment, maintenance, insurance and other costs necessary in the during the course of a project (Ascott 2006, 13). Maintenance costs are ongoing and are associated with "routine, preventive and major maintenance" (McKenna 1980, 134).

A digital imaging project will involve all of these costs. Initial costs may include working with staff to determine their needs and developing a plan for meeting those needs. There may be training required for staff involved in the process and in accessing the digital images. Recurring costs may include staff's time dedicated to the project and administrative overhead.

Direct Costs

Direct costs are those associated with building a project or purchasing services including operation and maintenance costs. A digital imaging project may incur these types of expenses for daily imaging, maintenance and database storage services over the life of the project. According to Mikesell (2007, 269), expenses should be accounted for on an annual basis. It is important to include all of the expenses, as indicated by Shields (1992, 6); "administrative costs of determining procedures, and awarding, negotiating, and monitoring contracts are often overlooked." The initial cost of a project is one of several direct costs that must be included in the benefit-cost analysis. Direct costs associated with the TCEQ digital imaging project include the cost of scanning the documents and storing the electronic images. Additional costs may include time and labor by staff to sort and ship documents to the contractor for imaging. After the

documents are imaged, they are returned to the agency to be shredded. Before the documents are shredded, additional time and labor may occur from performing quality review of the images.

Indirect Costs

Indirect costs include the costs of goods and services that government entities must consider when developing or implementing a project. Indirect costs are not considered in the official accounting records of a project but should be taken into consideration by the analysts to determine their effect (Tanous 2007, 19).

During the process of a benefit-cost analysis, monetary values may be assigned to less tangible costs which could contribute to partial or total project failure. For example, when governments use the analysis to decide whether to introduce business regulation, build a new road or offer a new drug on a healthcare plan, values must be placed on human lives and the environment (Frank 2000, 922). Placing values on things such as human lives and the environment can cause controversy. The benefit-cost principle suggests, for example, that a guardrail should be installed on a dangerous stretch of mountain road if the monetary cost of doing so is less than the monetary value of the injuries, deaths, and property damage thus prevented (Frank 2000, 913).

Measuring Benefits and Costs

After the benefits and costs have been identified, they must be quantified. Quantifying them may be difficult to do, especially for the indirect costs and benefits.

According to Diana Fuguitt and Shanton Wilcox (1999, 173), the following three principles should be applied when measuring intangible variables:

1. Use monetary units to value as many benefits and costs as possible
2. Quantify in physical units those that cannot be assigned a monetary value
3. Identify and qualitatively describe those that elude any type of quantification

Markovits (1984, 1169) argues that benefit-cost analysts "tend to undervalue decision consequences that are difficult to monetize or, worse yet, use this technique to mask the real value choices that underlie judicial, administrative, or legislative decisions." Opponents of this type of analysis argue that flaws in the technique occur during the measurement of costs and benefits, particularly when measuring intangible benefits (Markovits 1984, 1169; Gupta 1994, 336). Although it is difficult to quantify intangible costs and benefits, it is important to consider them when making decisions on potential projects. In measuring the variables, it is important also to consider the time value of money.

Discount Rate and Time

"Given a choice, individuals would prefer to have a unit of benefits today rather than in the future" (Brent 2006, 10). This could be because individuals may not live to experience the future benefits but more likely "is the fact that interest may be earned on the current unit. By the time the future arrives, the cumulated interest will mean that there will be more than one future unit to enjoy" (Brent 2006, 10). It is necessary to discount future benefits and costs in order to calculate net present value (discussed later under sub-heading Net Present Value). Discounting reflects the time value of money.

The higher the discount rate, the lower the present value of future cash flows. For typical investments, with costs concentrated in early periods and benefits following in later periods, raising the discount rate tends to reduce the net present value (U.S. OMB 2008, 7).

Public v. Private Rates

Many scholars disagree on which rate to use in discounting future benefits and costs. Some believe that the private rate should be used, even in public sector considerations. William Davisson (1964, 155) suggests that the market rate, i.e. private rate, should be used and David Newberry (1990, 235) agrees by stating that the private rate is the "appropriate rate of discount to use in selecting public investment." Paul Grout (2002, 2), on the other hand, disagrees and suggests using the social discount rate, which is the rate that citizens receive on savings. He argues that the social rate is appropriate because "the public sector can pool risks" and that "failure to do so will suggest that private provision is less efficient than public since the present value of private provision will be overestimated relative to public."

As the need to reduce government spending increases, partnerships between public and private entities are becoming more common. "With these partnerships, the public entity agrees on a long-term contract with a private partner to supply a specific service for the government. The private partner will design, build, partially own, and run the physical assets required for the delivery of the service" (Tanous 2007, 24). When determining an appropriate discount rate in these situations, the social rate is generally used.

Current Discount Rates

Although three federal government agencies implement discounting for capital expenditures, the Office of Management and Budget (OMB) determines the current discount rate for most federal executive agencies. Circular A4 of the OMB was revised in September 2003 to reflect the current rates that should be used in consideration for new proposals. "The 3% interest rate is the rate relative to private savings and the 7% rate is relative to capital formulation and/or displacement, i.e., as the gross return on capital" (Ascott 2006, 20). These interest rates are still in effect as of April 1, 2009 (OMB 2003, Circular A4).

Choosing a Discount Rate and Time

The discount rate and time for a project must be included in a benefit-cost analysis to determine the future benefits and costs of the project. Both should be converted or discounted to present value for comparison, since most public projects create a flow of cost returns over several years (Mikesell 2007, 272).

When selecting an appropriate discount rate, an analyst should consider the type of project and the number of years that are being analyzed. Varying rates should be used to assess the present value of future benefits and costs (McKenna 1980, 135). "Future benefits are worth less than present benefits, which reduce[s] the monetary value of future benefits" (Ascott 2006, 16). Public and private entities generally use varying discount rates in accordance with the project being financed as well as the amount of time that benefits and costs are projected to occur (Tanous 2007, 22). Public administrators should choose a discount rate that is consistent with all of the potential projects being

considered, and differing rates should not be applied to undesirable projects (Tanous 2007, 26). The formula which applies the discount rate is discussed later in this chapter under the sub-heading Present Value.

An appropriate time horizon must also be determined to prevent skewed results from the benefit-cost analysis. In choosing a time horizon, "the useful life of the project should be carefully selected to ensure that the benefits and costs of the project have been exhausted and are not overestimated" (Tanous 2007, 27). The length and viability of a project can vary considerably. "Ideally, the time horizon should include the entire time period over which policy benefits and costs occur" (Fuguitt and Wilcox 1999, 133). In the case of an ongoing or renewable project, such as a digital imaging project, the length of the contract period would be an appropriate time horizon. If a time period is shortened, the net present value of a project is likely to be lowered, reducing the future benefit stream. On the other hand, if the time period is lengthened, the benefits will increase and the results of the analysis can be skewed.

Decision Criterion

When choosing a criterion for a project analysis, analysts may select from a variety of methods. The most common methods include the Pareto Criterion, present value, net present value, benefit-cost ratio, and pay-back period (Tanous 2007, 31). Each of these methods may be implemented in a benefit-cost analysis to improve the decision making process and later to evaluate an actual project such as the TCEQ digital imaging project.

Pareto Criterion

The Pareto Criterion states that a project is economically feasible if at least one person is better off while no one is worse off. There are few projects that can satisfy this requirement. "Cost-benefit analysis is concerned with achieving economic efficiency in the use of resources, regardless of who derives the benefits and who bears the costs" (Galambos and Schreiber 1978, 73). A benefit-cost analysis cannot consider the fairness of the cost distribution.

Present Value

The present value (PV) formula is the basic formula for the time value of money and is widely used in business and economics to compare cash flows at different times. It is used in conjunction with a benefit-cost ratio since it takes into consideration both the time and value of money. A project's present value is determined by using the annual net capital flow (the annual benefits minus annual expenditures), the discount rate, and the useful life of the project (in number of years) in a formula, as reflected in Figure 2.1 (Mikesell 2007, 262-263).

Figure 2.1: *Present Value Annuity Formula*

$$PV = \frac{S}{r}\left[1 - \left(\frac{1}{1+r}\right)^{n}\right]$$

S=Annual net flow r=Discount rate N=Number of years

In some cases, the benefits and costs of a project may change throughout the life of the project, and additional formulas are needed to compute the present value (Fuguitt and Wilcox 1999, 45). These formulas are reflected in Figure 2.2.

Figure 2.2: *Present Value of Benefits and Costs Formulas*

$$PVB = \sum_{i=1}^{T} \frac{B_i}{(1+r)^i}$$

$$PVC = C + \sum_{i=1}^{T} \frac{C_i}{(1+r)^i}$$

B_i = *Benefits in Year* $_i$
C_i = *Costs in Year* $_i$
T = *Final Year of Project*
r = *Discount Rate*
C = *Initial Cost*

The difference between the net present benefits (NPB) and the net present costs (NPC) represents the net present value (NPV) of a project (Fuguitt and Wilcox 1999, 45). When considering a project in which there are no alternatives, the best criterion will be to find a positive NPV. "A positive NPV figure means that the project is producing more benefits in present value terms than the current costs and so there is a positive contribution left over" (Brent 2006, 11). Table 2.1 reflects the appropriate decision criterion for policy types, as suggested by Diana Fuguitt and Shanton Wilcox (1999, 91). Figure 2.3 reflects the formula used to calculate the overall NPV. Formulas for calculating the NPV for benefits and costs are reflected in Figure 2.4. "In the year in

which the initial expenditure is made, the exponent will be set at zero (this is because the cost is already at present value) and increase to represent each year of the project" (Ascott 2006, 23).

Table 2.1: *Appropriate Decision Criterion for Policy Types*

Alternatives	Criterion
1. One Policy: Implement?	NPV > 0
2. Mutually exclusive policies: Choose one	Maximum NPV
3. Several Policies: Choose a subset	
a. Dependent policies	
i. No budget constraints	Find possible combinations, maximum NPV
ii. Budget constraints	Find affordable combinations, maximum NPV
b. Independent policies	
i. No budget constraints	All policies with NPV > 0
ii. Budget constraints	Find affordable combinations, maximum NPV; rank by B/C for supplementary information

Figure 2.3: *Net Present Value Calculation*

NPV=PVB-PVC

Figure 2.4: *Net Present Value Calculations of Benefits and Costs*

$$PVB = B + \frac{B_1}{(1+r)^1} + \frac{B_2}{(1+r)^2} + \frac{B_3}{(1+r)^3} + \ldots \frac{B_n}{(1+r)^T}$$

$$PVC = C + \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \ldots \frac{C_n}{(1+r)^T}$$

Benefit-Cost Ratio

A benefit-cost ratio (BCR) is used when comparing projects of dissimilar size. The ratio enables analysts to compare alternative projects. The BCR is not influenced by the size of the investment (McKenna 1980, 148). As Figure 2.5 shows, the BCR is found by dividing the present value of the benefits (PVB) by the present value of the costs (PVC). If the ratio exceeds one, the project is sound; if it is below one, the opposite is true (Galambos and Schreiber 1978, 70). When alternative projects are being considered, the one with the highest BCR is determined to be the best project.

Figure 2.5: *Benefit-Cost Ratio Calculation*

$$BCR = \frac{PVB}{PVC}$$

Pay Back Period

The pay back period (PBP) is used to determine the number of years it would take to recover the capital costs of a project (Mikesell 2007, 274). However, it should have the least amount of influence in the decision criterion, as it does not account for time or value of money. As Figure 2.6 shows, the PBP is found by dividing the initial capital outlay (ICO), or project costs, by the annual net flow (S). The annual capital flow is a yield of annual benefits minus annual expenditures.

Figure 2.6: *Pay Back Period Calculation*

$$PBP = \frac{ICO}{S}$$

Conceptual Framework

The conceptual framework for this study outlines the variables involved in performing a benefit-cost analysis and links them to existing scholarly literature. The variables include the direct and indirect benefits and costs of the project. The appropriate discount rates are also identified through existing literature. Table 2.2 contains the conceptual framework table that will be used to guide this analysis.

Table 2.2: *Conceptual Framework Table*

CONCEPTUAL FRAMEWORK	
Research Purpose: To perform a Benefit-Cost Analysis of the Texas Commission on Environmental Quality's Digital Imaging Project.	
BENEFITS:	**SCHOLARLY SUPPORT:**
Direct Benefits:	
• Reduction in document storage costs • Time savings in handling documents • Reduction in paper costs • Reduction in copier equipment repair and maintenance costs • Reallocation of a full time position	Berghammer (1996), Davisson (1964), Galambos and Schreiber (1977), Kornhauser (2000), Tanous (2007), Texas Commission on Environmental Quality (2006)
COSTS:	**SCHOLARLY SUPPORT:**
Direct Costs:	
• Project costs • Maintenance costs	Frank (2000), Galambos and Schreiber (1977), Kornhauser (2000), McKenna (1980), Mikesell (2007), Shields (1992), Tanous (2007), Texas Commission on Environmental Quality (2006)
DISCOUNT RATE:	**SCHOLARLY SUPPORT:**
Social: 3% Private: 7%	Ascott (2006), Frank (2000), Grout (2002), McKenna (1980), Mikesell (2007), Newberry (1990), Tanous (2007), U.S. OMB (2008), Zerbe (2008)

Chapter Summary

The results from a thorough benefit-cost analysis will provide information that can be used in determining whether a project is worthwhile. Analysis of the TCEQ's digital imaging project may determine that it is not viable, as did Elizabeth Ascott's (2006, 3) analysis of the Wonder World Drive overpass. However, as she stated, a benefit-cost analysis "can be used as a model to improve the decision making policy makers are faced with" (Ascott 2006, 3). Whether or not a project is found viable, a formal analysis will equip administrators with the information needed to make sound decisions pertaining to its continuance.

Chapter Three: Setting

Introduction

The focus of this research is to conduct a benefit-cost analysis on the Texas Commission on Environmental Quality's (TCEQ) digital imaging project with Neubus, Inc. With limited resources, the government is challenged with finding ways to cut back and control expenditures. In hopes of creating efficiencies in its financial document handling process, the TCEQ has contracted digital imaging services with Neubus, Inc., a private organization. Although the relationship is fairly new, the agency is seeing savings in time, labor, and document storage costs. This chapter provides background information on digital imaging technology and discusses this type of technology's current uses. Chapter three also provides background and historical information pertaining to the public-private organization relationship between the TCEQ and Neubus, Inc.

Digital Imaging

Microfilm and Microfiche

While the medical and science fields have long benefited from the various imaging products (i.e., x-rays, magnetic resonance imaging, ultrasounds), the industrial world is benefiting from one in particular, microfilm or microfiche. The only difference between the two is their shapes. Microfilm is a roll of film and Microfiche is a 3" x 5" or 4" x 6" card. Although invented in 1839 by John Dancer, the use of microfilm in the commercial world began with a New York banker in the 1920s. The banker used

microfilm to make a record of checks that were returned to depositors or forwarded to other banks (Borck 1985, 241).

Recent technology allows documents and information to be scanned onto film. There are several benefits to this technology. First, and most importantly, the film will last longer than paper documents. As long as the film is stored according to suggested standards, "microfilm has a life expectancy of more than 500 years" (Chace 1991, 186). Second, it takes up much less space, which reduces storage and associated costs. The new 'Ultrafiche' technology can store up to 3,300 pages on the same microfiche card (Borck 1985, 242). Film is an appropriate technology for the storage of vital records, as it is durable, low cost, and requires little storage space.

Although many issues are resolved with the use of microfilm and microfiche, one major problem seems to remain. Low temperatures are needed for storing, and if the readers are located outside of the storage areas, a conditioning period is required to allow gradual warming of cold films before they are read. Rapid transfer from a cold to a warm space can cause damage by causing water condensation to form on the surface of the films (Fox 1996, 221).

This problem has motivated innovators to develop state of the art equipment and processes. There is now the capability to scan documents directly into an electronic imaging system. No longer is there a need for storing microfilm in temperature controlled settings or time necessary for gradual warming of the film (Fox 1996, 223).

Scanning

Scanning reproduces an image from a source and creates an identical digital image for display or processing. Images can be stored electronically and copied to other systems for backup. The electronic imaging system can be programmed according to the user's needs and specifications. Indexing can provide several methods for retrieving a particular document. This feature saves time for the user when performing research. The same benefits that are associated with film also are associated with the electronic imaging system. The need and use for paper is reduced, as the electronic information can be shared and made available to an unlimited number of users. The need for storage space and associated costs is ultimately eliminated.

Many businesses, including government agencies, are beginning to use this type of technology to store and retrieve documents. Texas state agencies have state and federal mandates that require a retention schedule for particular documents. Until recently, these documents were stored as paper or film in state library archives or in off-site storage facilities. Both paper and film require a great amount of space and funds for associated costs. According to the Texas State Library and Archives Commission (TSLAC 2005, 6), "In FY2004, 112 agencies stored 365,376 cubic feet of records, the equivalent of 60,896 five-drawer file cabinets. When laid end to end, the boxes of records would stretch from downtown Austin to the southern edge of San Antonio." In the same time period, library staff converted 36.7 million document pages of microfilm and delivered nearly 30,000 training and consulting hours to state and local government

employees (TSLAC 2005, 6). In FY2004, the cost to store 365,376 cubic feet of documents with the state library was $68,508[1] per month and the cost to convert 36.7 million pages to microfilm was $917,500[2]. These efforts are a tremendous cost to the state and the tax payers, which may be significantly reduced by digital imaging technology.

Although there are several efficiencies created by digital imaging, there also may be issues that need to be addressed when considering utilizing this technology. For example, images will be inaccessible in the event an electronic storage system fails. In this case, the data must be backed up and stored, preferably, offsite from the mainframe. Additionally, the electronic images must be able to be transferred from the current system to another if necessary, or the images won't be accessible if the old system becomes obsolete. In a case such as this, the TCEQ's digital imaging contract with Neubus, Inc. stipulates that the vendor will assist in transferring all images to any other database that is acquired by the TCEQ.

Background of the TCEQ

The history of natural resource protection by the State of Texas is one of gradual evolution from protecting the right of access to natural resources (principally surface water) to a broader role in protecting public health and conserving natural resources for future generations of Texans. Natural resource programs were established in Texas at the turn of the 20th century, motivated initially by concerns over the management of water

[1] Based on TSLAC rate of $0.1875 per cubic foot in FY2004
[2] Based on TSLAC rate of $0.025 per page in FY2004

resources and water rights. In parallel with developments in the rest of the nation and at the federal level, state natural resource efforts broadened at mid-century to include the protection of air and water resources and later to the regulation of hazardous and non-hazardous waste generation.

During the 1990s, the Texas Legislature moved to make natural resource protection more efficient by consolidating programs. This trend culminated in the creation of the Texas Natural Resource Conservation Commission in the fall of 1993, bringing together for the first time regulatory programs for air, water and waste. Sunset legislation passed by the Texas Legislature in 2000 directed that the agency change its name to the Texas Commission on Environmental Quality (TCEQ) on Sept. 1, 2002. The TCEQ has approximately 2,900 employees, sixteen regional offices, and a $522 million operating budget for the 2009 fiscal year. Most of the budget is funded by program fees (88 percent). Federal funds provide 8 percent; state general revenue, including earned federal funds, provides 2 percent; and other sources provide the remaining 2 percent.

The TCEQ is organized into seven offices and twenty-four divisions. The Financial Administration Division (FAD) is one of several divisions included the Office of Administrative Services. The FAD provides financial support for the agency, as indicated in its mission statement on the TCEQ Web site:

> The Financial Administration Division is responsible for managing the agency's financial transactions, ensuring the integrity of its accounting records, and maintaining adequate internal controls to safeguard its financial assets. This division is responsible for payroll and timekeeping, payments to employees and vendors, billing and collection of fees and federal grants,

centralized revenue management, and financial assurance (http://www.tceq.state.tx.us/about/organization/oas.html#1).

The FAD collects revenue and processes payments for the agency, to include employee payroll and travel reimbursement. In hopes of creating efficiencies in its financial document handling process, the TCEQ FAD entered into an imaging contract with Neubus, Inc., a private organization.

Background of Neubus, Inc.

Neubus, Inc. is a private organization that provides document services in conversion services, management services, and targeted agency specific service bundles to include management services in logistics, documents, records, workflow, and information. The organization was founded in 2000 and deployed a document services platform in 2003. Neubus, Inc. was awarded its first state-wide digital imaging services contract with the state of Texas. The vendor provides services to several state agencies and entities including the Health and Human Services Commission, the Department of Transportation, Texas Parks and Wildlife Department, Office of the Attorney General of Texas, and Texas State University San Marcos. Subject matter experts are employed by the organization and include certified document imaging architects, certified project management professionals, Cisco certified network associates, and Java certified programmers.

Neubus, Inc. claims financial stability by triple digit growth in revenues and operating earnings with a solid balance sheet. The organization's revenue exceeds its expenditures, resulting in a positive cash balance. The organization's business controls include corporate self-assessments and strategy, internal audits, and quarterly quality

reviews. Although the business controls are self-monitored by the organization, there is a Contract Administrator, assigned by the state of Texas, to supervise the organization's deliverables to a state agency. The Contract Administrator serves as the point of contact between the Council on Competitive Government (CCG) and Neubus, Inc. The Contract Administrator supervises the technical work, deliverables, reports, payment requests and similar matters. As outlined in Appendix A, if the organization is found to be in default under any provision of a state contract, the state agency may cancel the contract without notice and either re-solicit or award the contract to the next best responsive and responsible respondent. The organization's Web site includes its mission statement:

> Neubus is committed to helping government and education agencies throughout the country operate more efficiently and cost-effectively by offering the most comprehensive set of document and information management services in the market and supporting the full life cycle of creation, dissemination, use and preservation of data, information and knowledge (Neubus, Inc., http://www.neubus.com/index.htm).

Background of Contractual Relationship

In March 2003, the State Council on Competitive Government (CCG) awarded a contract for digital imaging services to Neubus Inc. Subsequently, the organization was awarded a new contract beginning in March 2007. Details of the contract can be found in Appendix A. The current term runs through August 31, 2011, with two one-year renewal options extending the term to August 31, 2013. State agency locations in Travis County that elect to use a vendor for their standard document digital imaging needs must use the umbrella contract. State

agency locations outside of Travis County may voluntarily use this contract; however, Neubus, Inc. may charge a fee for pick-up and delivery of documents. The Texas State Library and Archives Commission (TSLAC) serves as the Contract Administrator.

The Financial Administration Division (FAD) of the TCEQ entered into contract with Neubus, Inc. on April 1, 2005, as allowed by the state's umbrella contract, to image and electronically store cost recovery documents. Details of the TCEQ contract with Neubus, Inc. can be found in Appendix C. Over a period of one year, the TCEQ's needs were assessed and a design for delivery services was developed. The Division has since completed a pilot project to utilize digital imaging services for vouchers and employee time sheets pertaining to cost recovery. As explained in chapter two, cost recovery vouchers document the amount of time and money spent by TCEQ employees in remediation efforts. The cost to the agency can be over $100,000 per site and cost recovery vouchers are necessary in recouping the funds. Cost recovery vouchers and time sheets, dated from 1994 to present, have been imaged and stored in the Electronic Services Delivery (ESD) System. This system is used for viewing the images online. Early efficiencies realized by the project enabled the TCEQ to reallocate one full time position to another area because the position was no longer needed in handling cost recovery documents. The efficiencies realized by the project also initiated the expansion of services. Additional documents have been identified to be imaged and stored electronically with the expectation of the same success attained in the pilot project. A new agreement was made in FY2008, as can be found in Appendix C. In addition to cost recovery documents, all payment vouchers are now being imaged and stored in the ESD System.

Chapter Summary

This chapter provided background and historical information pertaining to the public-private organization relationship between the TCEQ and Neubus, Inc. The contract that was awarded by the state CCG to Neubus, Inc. stipulates that any state government agency in Texas seeking digital imaging services must utilize this vendor until the award period expires on August 31, 2013. The following chapter details the methodology used to measure the benefits and costs of the TCEQ digital imaging project.

Chapter Four: Methodology

Introduction

This chapter will review and describe the methodology used to operationalize the benefits and costs identified in the conceptual framework to determine if the Texas Commission on Environmental Quality (TCEQ) digital imaging project is cost beneficial. This analysis will discuss how each benefit and cost is measured. A final section will describe the discount rate and decision criterion used in the benefit-cost analysis for this study.

Operationalization

The methodology for this research project is a benefit-cost analysis. This type of analysis is a tool that can be used in both the public and private sectors when making decisions involving monetary resources. In the public sector, a sound benefit-cost analysis can be used to determine priorities and ensure that tax dollars are spent efficiently and in the best interest of the public (Ascott 2006, 2). A benefit-cost analysis can help decision makers evaluate choices while allocating scarce resources. The results of this research will demonstrate whether the benefits of the TCEQ's imaging project outweigh the costs.

The data for this study will be acquired from the TCEQ Financial Administration Division (FAD). The TCEQ has been contracting imaging services from Neubus, Inc. for over three years, and the available data will be used to operationalize the benefits and costs of the project. The TCEQ began contracting digital imaging services in FY2005

and the length of the current contract period runs through FY2010. This is allowed by the umbrella contract between the CCG and Neubus, Inc. that runs through FY2011, with two additional years of renewal options. This analysis considers data from September 1, 2004 through August 31, 2010, the contract period between the TCEQ and Neubus, Inc. Data from the TCEQ include budgeted costs of the project, estimated time in handling documents, cost of paper, and salary information of a reallocated full time position. The variables in this research will be converted into monetary values to perform the benefit-cost analysis. Since most of the indirect benefits and costs are immeasurable in monetary terms, indirect benefits and costs are identified and explained in the final analysis of the project. Measurement of the benefits and costs are outlined in Table 4.1.

Table 4.1: *Operationalization of the Conceptual Framework Table*

OPERATIONALIZATION OF THE CONCEPTUAL FRAMEWORK	
BENEFITS:	**MEASUREMENT:**
Direct Benefits:	
Reduction in document storage costs	Annual cost of storing documents from FY2005 through FY2010 Project allows electronic images to serve as official records thereby reducing storage for paper documents. TCEQ provides annual costs of storing documents imaged from FY2005 to FY2008. Estimates were made for FY2009 and FY2010 based on the annual amount paid and include a trend of increase in images of 18% .
Time savings in handling documents	Annual cost of handling documents from FY2005 through FY2010 Project allows electronic access to documents thereby reducing time spent by staff in making hard copies. TCEQ provided amount of time spent processing requests prior to contracting imaging services and amount of time spent on imaging related tasks post contracting the services. Amount of time to process a document request x number of requests per year x labor cost per hour = cost of salaries Cost of salaries prior to implementation of project – cost of salaries post implementation of project = time savings
Reduction in paper costs	Annual cost of paper from FY2005 through FY2010 Project allows electronic access to documents thereby reducing need to make hard copies. TCEQ provided cost per page and number of pages used per year prior to contracting imaging services. Amount of paper used in a year x cost of paper = cost savings

OPERATIONALIZATION OF THE CONCEPTUAL FRAMEWORK: CONTINUED	
BENEFITS:	**MEASUREMENT:**
Direct Benefits:	
Reduction in copier equipment maintenance and repair costs	Annual cost of leased copier equipment maintenance and repair for imaged documents from FY2005 through FY2010 Project allows electronic access to documents thereby reducing demand on copier equipment. TCEQ provided maintenance and repair costs per copy and number of copies used per year prior to contracting imaging services. Number of copies made in a year x cost per copy = cost savings
Reallocation of one full time position	Annual savings from salary reduction from FY2005 through FY2010 Efficiencies created by the project allowed the TCEQ to reallocate one full time position to another area. TCEQ provided annual salary to include rate of growth.
COSTS:	**MEASUREMENT:**
Direct Costs:	
Project Costs	Annual cost of project from FY2005 through 2010 The total budgeted cost of the imaging project is approximately $55,000 per year. TCEQ is responsible for 100% of project costs, including the cost of storing electronic images. TCEQ provided invoices showing annual costs for fiscal years 2005 through 2008. Estimations were made for fiscal years 2009 and 2010 based on the monthly amount paid. The estimations take into consideration the consumer price index average growth rate.
Maintenance Costs	Annual cost for maintenance from FY2005 through 2010 The project requires maintenance costs for making changes to the contract if the changes require additional resources by the contractor. TCEQ is responsible for 100% of maintenance costs. TCEQ provided invoices showing annual costs for fiscal years 2005 through 2008. Estimations were made for fiscal years 2009 and 2010 based on the monthly amount paid. The estimations take into consideration the consumer price index average growth rate.
DECISION CRITERIA:	**MEASUREMENT:**
Present Value of Benefits and Costs	Present value of project today in future dollars Present value is derived by using the annual capital flow, which is the annual benefits minus annual costs, in a formula with the discount rate and the useful life of the project in years.
Net Present Value	Net present value of project Net present value is derived from the subtraction of the present value of the benefits and the present value of the costs.
Benefit-Cost Ratio (BCR)	Benefit-cost ratio of project Benefit-cost ratio is derived from dividing the present value of benefits and costs by the initial capital outlay of the project.

Methods of Data Collection

Benefits

Direct Benefits

Conducting document analysis of available data from the TCEQ will allow operationalization of the direct benefits of the imaging project. The project's direct benefits include reduction in document storage costs, time savings in handling documents, and reduction in paper costs. Data for computing these savings will be provided by the TCEQ based on the actual costs for fiscal years 2005 through 2008 and the estimated costs for fiscal years 2009 and 2010.

Reduction in Document Storage Costs

The TCEQ cost recovery documents have a thirty year retention schedule and are stored at the Texas State Library and Archives Commission (TSLAC). The imaging project allows the electronic images to serve as the official records thereby reducing the need for storage space and resulting in a cost savings to the TCEQ. The measurement for this benefit is the annual cost of storing documents from FY2005 through FY2010. There are two factors that must be considered in determining the total amount of savings. First, approximately 725,000 cost recovery copies from ten years prior to 2006 have been imaged and purged, resulting in an annual cost savings of $42.24 ($.01875 per linear foot per month) in storage fees or approximately $1,300 for the life of the retention period. Second, additional savings are being realized by documents imaged beginning in FY2006. Actual savings will be used for fiscal years 2006 through 2008, and estimates

will be made for fiscal years 2009 and 2010. These estimates will include an average increase in images of 18%, as shown as the trend from FY2005 rough FY2008 in Table 5.2 of Chapter five.

In determining the total savings for reduction in document storage costs, the savings resulting from documents imaged prior to FY2006 are added to the actual savings resulting from documents imaged between fiscal years 2006 and 2008 and estimated for fiscal years 2009 and 2010.

Time Savings in Handling Documents

The ability to electronically retrieve and print selected financial documents has increased efficiency in the TCEQ cost recovery billing process. Retrieving, locating, and copying paper documents had been a labor intensive process. Prior to contracting with Neubus, Inc., cost recovery documents were not centrally located, which made access difficult and time consuming. The documents stored at the TSLAC had to be identified by access numbers and requested by telephone. To complete a cost summary request for the TCEQ Remediation Division or for the Environmental Protection Agency, documents for various fiscal years would be needed. Retrieving the documents would require several boxes being requested from the TSLAC, and delivery time could take up to three days. In addition, a considerable amount of time was spent copying the documents and preparing them for return to the TSLAC. Imaging the documents allows immediate access to answer many of various inquiries as well as improving response time. Although a direct benefit of the imaging project is expected in time savings for staff

involved in handling these documents, there is additional labor and time associated with preparing and packaging documents to be imaged.

The measurement for this benefit is the annual cost of handling documents from FY2005 through FY2010. The average amount of time saved is calculated by comparing the time spent by staff before and after contracting digital imaging services. The TCEQ will provide the amount of time spent processing requests prior to contracting imaging services and the amount of time spent on imaging related tasks post contracting the services. The cost of salaries will be determined by calculations involving time to process a document, number of requests per year, and labor cost per hour. The cost of salaries prior to implementation of the project minus the costs of salaries post implementation of project will determine the time savings and is further discussed in Chapter five.

The TCEQ will provide the annual number of requests received for fiscal years 2005 through 2008 and estimations for fiscal years 2009 and 2010. It will also provide the amount of time spent by staff on processing each request prior to the imaging project as well as time spent performing tasks associated with the project since its implementation. The time will be converted to salaries used in the final calculations. Prior to implementation of the project, staff spent approximately 1 hour to process a request consisting of 38 copies. The time included locating, retrieving, copying, and re-filing documents. An annual average of 57,000 copies resulted in 1,500 hours being spent by an Accounting Technician II, at a cost of $14.92 per hour. Post implementation of the project, staff spends 16 hours per week packaging documents and performing quality review of document images. These tasks are performed by a Clerk IV, at a cost of

$13.31 per hour. Salaries spent post implementation of the imaging project will be subtracted from salaries spent prior to implementation. The actual costs for salaries from FY2005 through FY2008 are used in the analysis. Estimations are made for fiscal years 2009 and 2010 and take into consideration that salaries at the TCEQ typically increase 3.4% annually.

Reduction in Paper and Copier Equipment Costs

The imaging project allows TCEQ staff the ability to access electronic images of payment vouchers and other financial documents. Therefore, hard copies of documents are no longer needed, resulting in less paper used and less demand on copier equipment. Both benefits result in a cost savings for the agency. The measurements for these benefits are the annual cost of paper and the annual cost of copier equipment maintenance and repair from FY2005 through FY2010. The savings for reduction in paper costs will be determined by multiplying the number of copies made by the TCEQ's rate of $.01 per copy. The savings for reduction in copier equipment and maintenance costs will be determined by multiplying the number of copies made by the TCEQ's rate of $.10 per copy.

Reallocation of a Full Time Position

The imaging project allowed the TCEQ FAD to reallocate a full time position to another area in the same division because the position was no longer needed in handling cost recovery documents. The measurement for this benefit is the annual savings in salary reductions from FY2006 through FY2010. The position was transferred in

September 2005, thus savings did not result until FY2006. The annual salary and fringe benefits of the position will determine the monetary value of this benefit and is provided by the TCEQ Human Resources Division. The annual salary for the position at the time of transfer was $41,259.24. Salaries at the TCEQ typically increase 3.4% each year and thus will be considered in the calculation.

Costs

Direct Costs

Conducting document analysis of available and existing data from the TCEQ will allow operationalization of the direct costs of the imaging project. The most current data will be used in the analysis. The TCEQ has financial records reflecting actual project and annual maintenance costs for each year of the contractual period.

Project Costs

The TCEQ is responsible for 100% of the project cost and includes the cost of storing electronic images in the Electronic Services Delivery System. The measurement for this cost is the annual cost of the project from FY2005 through FY2010. The TCEQ Financial Administration Division maintains records that reflect the amounts paid to the contractor and will provide invoices for the period FY2005 through FY2008. Estimations will be made for FY2009 and FY2010 and will include the consumer price index average growth rate of 2.82%, provided by the U.S. Department of Labor and found in Appendix B.

Maintenance Costs

The project requires a maintenance cost for making changes to the contract's Statement of Work (SOW) if such changes require additional resources by the contractor. On several occasions during the evaluation period, a change to the SOW has been needed. For example, in FY2008, the TCEQ requested the additional service of re-stapling financial documents after they were imaged, resulting in an additional cost. The measurement for this cost is the annual cost of maintenance from FY2005 through FY2010. The costs for fiscal years 2005 through 2008 are included in the same invoices that will be reviewed in determining the project costs, as discussed earlier. Estimations will be made for FY2009 and FY2010 and will include the consumer price index average growth rate of 2.82%.

Discount Rate

The discount rate used in this benefit-cost analysis is critical to the results. Varying rates should be used to assess the present value of future benefits and costs (McKenna 1980, 135). Public and private entities generally use varying discount rates in accordance with the project being financed and the amount of time that benefits and costs are projected to occur (Tanous 2007, 22). The OMB determines the current discount rate for most federal executive agencies. Circular A4 of the OMB was revised in September 2003 to reflect the current rates that should be used in consideration of any new proposal. The rates reflected in Circular A4 are still in effect as of April 1, 2009 (Appendix B). Since the TCEQ imaging project is a public-private partnership, this analysis will be evaluated using the OMB's rates of 3% and 7% to examine the differences in the results.

Decision Criterion

After the benefit and cost variables have been measured in monetary terms, they can be analyzed using the appropriate decision criterion. The primary decision criterion will be the net present value (NPV). If the project is beneficial for the TCEQ and the economic benefits outweigh the costs, the NPV will be positive. The PV and NPV calculations take into account both the time and value of money, thus they are the most appropriate criterion to use when conducting a benefit-cost analysis.

The benefit-cost ratio (BCR) is a measure that is not influenced by the size of the investment but compares alternatives of different sizes (McKenna, 1980, 149). The BCR also will be discussed in this research but will not be significantly weighted in the final analysis of the project. If the value of the BCR is calculated to exceed one, then it is a viable project, but if the BCR is fund to below one, then the project is not economically feasible and not recommended since the costs outweigh the benefits.

Human Subjects Protection

The Institutional Review Board (IRB) awarded an exemption (2009H4705) on this research based on Exempt Category of Research listed at 45 CFR, Part 46, Sec. 101(b): Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

This research will conduct a benefit-cost analysis of a state agency's digital imaging project. The project will only involve collecting and evaluating current public

data to determine if benefits and costs savings are being realized. There will not be any human subjects involved.

Chapter Summary

This chapter described the methods that will be used to operationalize the benefits and costs to determine if the TCEQ digital imaging project is cost beneficial. The discount rate and decision criterion used in this analysis was also discussed. Whether or not the project is found viable, a formal analysis will equip administrators with the information needed to make sound decisions pertaining to its continuance.

Chapter Five: Results

Introduction

This chapter presents the results of the benefit-cost analysis performed on the TCEQ digital imaging project. As discussed in the Literature Review Chapter, variable discount rates were applied. Since the Texas Commission on Environmental Quality (TCEQ) digital imaging project is a public-private partnership, the OMB's suggested rates of 3% and 7% are used to examine the differences in the results. Results of calculations measuring the benefits and costs of the project were derived from the formulas presented in Figures 2.1 – 2.6 of the Literature Review Chapter.

As allowed by the state's umbrella contract, the TCEQ began contracting digital imaging services in FY2005 and the length of the current contract period runs through FY2010. Therefore, this analysis considers data from September 1, 2004 through August 31, 2010. The outcome of each present value of the benefits and costs is presented and discussed. The net present value is determined and the benefit-cost ratio of the project is shown. These calculations are used to determine the project's viability for the TCEQ.

Benefits

Direct Benefits

Benefits that are a direct result of the digital imaging project include variables such as reduction in document storage costs, time savings in handling documents, reduction in paper costs, reduction in copier equipment maintenance and repair costs, and

reallocation of a full time position. The calculated results of each will be discussed consecutively.

Present Value of Reduction in Document Storage Costs

The TCEQ cost recovery documents have a 30 year retention schedule and were stored at the Texas State Library and Archives Commission (TSLAC) prior to contracting digital imaging services. The project allows the electronic images to serve as the official records thereby reducing the need for storing paper documents, resulting in a cost savings to the TCEQ. In determining the amount of savings, two factors must be calculated and added together. For the first factor, approximately 725,000 cost recovery copies from years prior to 2006 have been imaged and purged. In expectation of imaging, documents were retrieved from the TSLAC in September 2004, resulting in savings beginning in FY2005. 725,000 copies equates to 18.75 linear feet (38,667 pages = 1 linear foot) and the TSLAC charges $0.1875 per linear foot per month, which results in an annual savings of $42.24 ($3.52 per month x 12 months). The rate has remained the same from FY2005 through FY2008 and, according to the TSLAC, will not change during the years included in this analysis. Therefore, the annual savings of $42.24 will be used to determine this factor in the analysis, as shown in Table 5.1, and included in the total savings presented later in this section.

Table 5.1: *PV of Reduction in Storage Costs for Documents Imaged Prior to FY2006*

FY	Actual and Estimated Savings	PV @ 3%	PV @ 7%	n
2005	$42.24	$42.24	$42.24	1
2006	42.24	39.82	36.89	2
2007	42.24	38.66	34.48	3
2008	42.24	37.53	32.22	4
2009	42.24	36.44	30.12	5
2010	42.24	35.38	28.15	6
Total: 2005 to 2010		**$230.05**	**$204.10**	

The second factor in determining the savings in reduction of storage costs is the amount being saved by imaging additional documents each year beginning in FY2006. For fiscal years 2006 through 2008, the actual amount of savings is obtained. In year 2006, a total of 319,526 images were made which converts to 8.26 linear feet of paper that will no longer be stored. At the TSLAC rate of $0.1875 per linear foot per month, this results in a cost savings of $18.60 ($1.55 per month x 12 months). As previously mentioned, the rate charged by the TSLAC has not changed and will remain the same during the years being analyzed. In FY2007, a total of 384,972 images were made which converts to 9.96 linear feet of paper and results in a cost savings of $22.44. In FY2008, a total of 449,284 images were made converting to 11.62 linear feet of paper and resulting in a cost savings of $26.16 ($2.18 per month x 12 months). Based on the number of images made from FY2005 through FY2008, there is an approximate increase of 18% in images made each year. The increase will be included in the calculations of estimates made for fiscal years 2009 and 2010. Table 5.2 shows the amounts being saved by imaging additional documents beginning in FY2006 and will be included in the total savings presented later in this section.

Table 5.2: *PV of Reduction in Storage Costs for Documents Imaged Beginning in FY2006*

FY	Actual and Estimated Savings	PV @ 3%	PV @ 7%	n
2005	$0.00	$0.00	$0.00	1
2006	18.60	17.53	16.25	2
2007	22.44	20.54	18.32	3
2008	26.16	23.24	19.96	4
2009	30.84	26.60	21.99	5
2010	36.36	30.45	24.23	6
Total: 2005 to 2010		**$118.36**	**$100.74**	

In determining the total savings for reduction in document storage costs, the savings resulting from documents imaged prior to FY2006 are added to the savings resulting from documents imaged between fiscal years 2006 and 2008 and estimated for fiscal years 2009 and 2010. Table 5.3 shows the present value of the cost savings from reduction in document storage. Although the savings appear minimal, cost recovery documents have a thirty year retention period. The savings are considerably higher when the life of the retention period is taken into consideration. The estimated present value for reduction in document storage costs is $348.42 at 3% and $304.84 at 7%. Projected reduction in document storage costs is $43.58 more at a discount rate of 3% than at the 7% rate.

Table 5.3: *PV of Reduction in Document Storage Costs*

FY	Actual and Estimated Savings	PV @ 3%	PV @ 7%	n
2005	$42.24	$42.24	$42.24	1
2006	60.84	57.35	53.14	2
2007	64.68	59.19	52.80	3
2008	68.40	60.77	52.18	4
2009	73.08	63.04	52.11	5
2010	78.60	65.83	52.37	6
Total: 2005 to 2010		**$348.42**	**$304.84**	

Present Value of Time Savings in Handling Documents

Prior to contracting digital imaging services, TCEQ Financial Administration Division (FAD) staff was required to retrieve, locate, and copy paper documents. Although the digital imaging project reduced the labor and time associated with these tasks, there is additional labor and time associated with preparing and packaging documents to be imaged. An average amount of time saved is calculated by comparing the time spent by staff before and after contracting digital imaging services.

The TCEQ cannot provide actual numbers of copies made, as these data are not typically maintained. However, based on sporadic tracking for several months in FY2004 and FY2005, an average number of 57,000 copies were determined to be made per year prior to the digital imaging project. Staff involved in retrieving and making copies documented the number of copies made from December 2003 through March 2004 and from September 2004 through January 2005. The requests are typically made by internal customers (e.g. TCEQ Budget Analysts and Administrative Assistants), and the number of full time positions is not expected to rise in the next few years. Staff spends approximately 1 hour to process a request consisting of 38 copies. The time

includes locating, retrieving, copying, and re-filing documents. An annual average of 57,000 copies resulted in 1,500 hours being spent by an Accounting Technician II. Time savings for handling documents did not occur during the first year of imaging because electronic images were not available until approximately twelve months after the implementation of the project. In FY2006, the position was funded at $31,344.96 (or $15.37 per hour) at a cost of $23,055.00. In FY2007, the position was funded at $31,971.96 (or $15.67 per hour) at a cost of $23,505.00. In FY2008, the position was vacated and refilled at $29,145.96 (or $14.29 per hour) at a cost of $21,435.00. In absence of actual data, the trend for copy requests cannot be applied to fiscal years 2009 and 2010, thus the average number of documents will be used. Salaries at the TCEQ usually increase 3.4% each year, and this increase will be used in estimations for fiscal years 2009 and 2010. Table 5.4 shows the present value of salaries spent handling documents prior to the imaging project and will be used in the total time savings discussed further in this section.

Table 5.4: *PV of Salaries Spent Handling Documents Prior to Implementation*

FY	Estimated Salaries	PV @ 3%	PV @ 7%	n
2005	$0.00	$0.00	$0.00	1
2006	23,055.00	21,731.55	20,137.13	2
2007	23,505.00	21,510.40	19,187.08	3
2008	21,435.00	19,044.72	16,352.66	4
2009	22,163.79	19,118.68	15,802.48	5
2010	22,917.36	19,192.93	15,270.80	6
Total: 2005 to 2010		**$100,598.28**	**$86,750.15**	

In determining the time savings in handling documents, the time and labor associated with preparing documents to be imaged since the project began (September 1,

2004) must be taken into consideration. The level of responsibilities in handling documents decreased after the imaging project was implemented. Therefore a lower level classification, with less salary, was needed in handling documents. According to the TCEQ, a Clerk IV spends approximately sixteen hours per week packaging documents and performing quality review of the images. In FY2005, the position was funded at $27,144.00 (or $13.31 per hour), costing $11,073.92[3] for the performance of this function. In FY2006, the position was funded at $27,958.32 (or $13.71 per hour), at a cost of $11,406.72[4]. In FY2007, the position was vacated and refilled at $24,231.96 (or $11.88 per hour), at a cost of $9,884.16[5]. In FY2008, the position was funded at $24,831.96 (or $12.17 per hour), at a cost of $10,125.44[6]. Salaries at the TCEQ typically increase 3.4% each year and thus will be used in estimations for fiscal years 2009 and 2010. Table 5.5 shows the present value of salaries spent handling documents post implementation of the imaging project and will be used in the total time savings discussed further in this section.

Table 5.5: *PV of Salaries Spent Handling Documents Post Implementation*

FY	Estimated Salaries	PV @ 3%	PV @ 7%	n
2005	$11,073.92	$11,073.92	$11,073.92	1
2006	11,406.72	10,751.93	9,963.07	2
2007	9,884.16	9,045.41	8,068.42	3
2008	10,125.44	8,996.32	7,724.65	4
2009	10,469.70	9,031.26	7,464.75	5
2010	10,825.67	9,066.33	7,213.60	6
Total: 2005 to 2010		**$57,965.16**	**$51,508.41**	

[3] Hourly salary x 16 hours per week x 52 weeks = Annual cost of $11,073.92
[4] Hourly salary x 16 hours per week x 52 weeks = Annual cost of $11,406.72
[5] Hourly salary x 16 hours per week x 52 weeks = Annual cost of $9,884.16
[6] Hourly salary x 16 hours per week x 52 weeks = Annual cost of $10,125.44

The time savings in handling documents is calculated by subtracting the salaries spent post implementation of the imaging contract from those spent prior to the implementation. Salaries were spent in FY2005 performing this function but no savings resulted until FY2006, thus resulting in a negative amount for FY2005. Table 5.6 shows the present value of the time savings in handling documents. The estimated present value for time savings in handling documents is $42,633.12 at 3% and $35,241.74 at 7%. Projected savings in time associated with handling documents is $7,391.38 more at a discount rate of 3% than at the 7% rate.

Table 5.6: *PV of Time Savings in Handling Documents*

FY	Estimated Savings	PV @ 3%	PV @ 7%	n
2005	- $11,073.92	- $11,073.92	-$11,073.92	1
2006	11,648.28	10,979.62	10,174.06	2
2007	13,620.84	12,465.00	11,118.66	3
2008	11,309.56	10,048.40	8,628.01	4
2009	11,694.09	10,087.42	8,337.72	5
2010	12,091.69	10,126.60	8,057.20	6
Total: 2005 to 2010		**$42,633.12**	**$35,241.74**	

Present Value of Reduction in Paper Costs

The imaging project allows TCEQ staff the ability to access electronic images of payment vouchers and other financial documents. Therefore, hard copies of documents are no longer needed, resulting in less paper. Although all payment processing vouchers are currently being imaged, copies of only those requested were being made prior to the imaging project. The TCEQ does not typically maintain the actual number of copies made for a particular task so an average was provided based on sporadic tracking for several months in FY2004 and FY2005. An average number of 57,000 copies were

determined to be made per year prior to the digital imaging project. In absence of actual data, the trend for copy requests cannot be applied, thus the average number of documents will be used. As of April 1, 2009, the Agency's rate for paper is $3.57 per ream of 500 sheets (or $.01 per sheet). The rate has remained the same from FY2005 through FY2008 and, according to the TCEQ, will not change during the years included in this analysis. For this study's purpose, an average cost will be determined for each of the years analyzed based on the consistent number of copies made and the constant rate per sheet. Reduction in paper costs did not occur during the first year of imaging because electronic images were not available until approximately twelve months after the implementation of the project. Table 5.7 shows the present value of the savings by reduction in paper usage. The estimated present value is $2,534.40 at 3% and $2,184.22 at 7%. Projected savings is $350.18 more at a discount rate of 3% than at the 7% rate.

Table 5.7: *PV of Reduction in Paper Costs*

FY	Estimated Savings	PV @ 3%	PV @ 7%	n
2005	$0.00	$0.00	$0.00	1
2006	570.00	537.28	497.86	2
2007	570.00	521.63	465.29	3
2008	570.00	506.44	434.85	4
2009	570.00	491.69	406.40	5
2010	570.00	477.37	379.82	6
Total: 2005 to 2010		**$2,534.40**	**$2,184.22**	

Present Value of Reduction in Copier Equipment Maintenance and Repair Costs

The reduction of necessary copies results in less demand on copier equipment. The TCEQ cannot provide actual numbers of copies made, as these data are not typically maintained. As previously discussed, an average number of 57,000 copies were

determined to be made per year prior to the digital imaging project. In absence of actual data, the trend for copy requests cannot be applied, thus the average number of documents will be used. The TCEQ has determined a standard print charge of $.10 per page that includes maintenance and repair costs. The rate has remained the same from FY2005 through FY2008 and, according to the TCEQ, will not change during the years included in this analysis. For this study's purpose, an average cost will be determined for each of the years analyzed based on the consistent number of copies made and the constant rate per sheet. Reduction in copier equipment costs did not occur during the first year of imaging because electronic images were not available until approximately twelve months after the implementation of the project. Table 5.8 shows the present value of the savings by reduction in copier equipment maintenance and repair costs. The estimated present value is $25,344.01 at 3% and $21,842.17 at 7%. Projected savings is $3,501.84 more at a discount rate of 3% than at the 7% rate.

Table 5.8: *PV of Reduction in Copier Equipment Costs*

FY	Estimated Savings	PV @ 3%	PV @ 7%	n
2005	$0.00	$0.00	$0.00	1
2006	5,700.00	5,372.80	4,978.60	2
2007	5,700.00	5,216.31	4,652.90	3
2008	5,700.00	5,064.38	4,348.50	4
2009	5,700.00	4,916.87	4,064.02	5
2010	5,700.00	4,773.66	3,798.15	6
Total: 2005 to 2010		**$25,344.01**	**$21,842.17**	

Reallocation of a Full Time Position

The imaging project allowed the TCEQ FAD to reallocate a full time position to another area in the same division because it was no longer needed in handling cost

recovery documents. The position was transferred in September 2005, thus savings do not result until FY2006. The annual salary for the position at the time of transfer was $41,259.24. As previously stated, salaries at the TCEQ typically increase 3.4% each year and thus have been considered in these calculations. Table 5.9 shows the present value of the reallocation of a full time position. The estimated present value is $203,050.98 at 3% and $182,955.12 at 7%. Projected savings is $20,095.87 more at a discount rate of 3% than at the 7% rate.

Table 5.9: *PV of Reallocation of a Full Time Position*

FY	Actual and Estimated Savings	PV @ 3%	PV @ 7%	n
2005	$0.00	$0.00	$0.00	1
2006	41,259.24	41,259.24	41,259.24	2
2007	42,662.05	40,213.08	37,262.69	3
2008	44,112.56	40,369.25	36,008.99	4
2009	45,612.39	40,526.02	34,797.47	5
2010	47,163.21	40,683.40	33,626.72	6
Total: 2005 to 2010		**$203,050.98**	**$182,955.12**	

Present Value of Total Benefits

The total value of benefits is found by adding together the reduction in document storage costs, time savings in handling documents, the reduction in paper costs, the reduction in maintenance and repair costs associated with copier equipment, and the reallocation of a full time position. Totals of each benefit are outlined in Table 5.10 and show the present value differences when varying discount rates are applied. The total present value of benefits is $273,910.93 at 3% and $242,528.09 at 7%. The total benefits of the TCEQ digital imaging project are $31,382.34 more at a discount rate of 3% than at the 7% rate.

Table 5.10: *Present Value of Benefits*

Present Value: Benefits	PV @ 3%	PV @ 7%
Reduction in Document Storage Costs	$348.42	$304.84
Time Savings in Handling Documents	42,633.12	35,241.74
Reduction in Paper Costs	2,534.40	2,184.22
Reduction in Copier Equipment Maintenance and Repair Costs	25,344.01	21,842.17
Reallocation of a Full Time Position	203,050.98	182,955.12
Total PV of Benefits	**$273,910.93**	**$242,528.09**

Costs

Direct Costs

Costs that are a direct result of the digital imaging project include variables such as project and maintenance costs. The calculated results of each will be discussed consecutively.

Present Value of Project Costs

The TCEQ is responsible for 100% of the project costs, which includes the cost of storing electronic images in the Electronic Services Delivery System. The actual amount paid in fiscal years 2005 through 2008 is reflected in Table 5. 11. A backlog of documents, dated from 1994 through 2005, was imaged when the project was implemented in FY2005, resulting in an unusually high cost in FY2005. Estimations are made for fiscal years 2009 and 2010. The invoices received for FY2009, dated 9/01/08 through 4/01/09, show an average of $2,251.00 paid per month. With only four months remaining in the fiscal year, it is estimated that the amount paid in FY2009 will be $27,012.00. The amount paid in FY2009 will be used in estimation for FY2010 since the TCEQ does not foresee any changes to the number of documents being imaged during this period of analysis. In addition, the estimation will take into consideration the

consumer price index average growth rate of 2.82%, provided by the U.S. Department of Labor and found in Appendix B. Table 5.11 depicts the present value of the project costs. The estimated present value is $212,353.96 at 3% and $196,429.70 at 7%. Projected cost is $15,924.26 more at a discount rate of 3% than at the 7% rate.

Table 5.11: *Present Value of Project Costs*

FY	Actual and Estimated Costs	PV @ 3%	PV @ 7%	n
2005	$102,762.59	$102,762.59	$102,762.59	1
2006	13,553.05	12,775.05	11,837.76	2
2007	29,910.30	27,372.16	24,415.71	3
2008	25,737.53	22,867.46	19,635.04	4
2009	27,012.00	23,300.79	19,259.18	5
2010	27,792.65	23,275.90	18,519.41	6
Total: 2005 to 2010		**$212,353.96**	**$196,429.70**	

Present Value of Maintenance Costs

The project requires a maintenance cost for making changes to the contract's Statement of Work (SOW) if such changes require additional resources by the contractor. For example, in FY2008, the agency requested the additional service of re-stapling financial documents after they were imaged. Re-stapling the documents ensured that the documents did not get separated from their supporting pages. The SOW was revised to reflect the new procedures and a cost was incurred by the agency.

The actual amount paid in fiscal years 2005 through 2008 is reflected in Table 5.12. Estimations are made for fiscal years 2009 and 2010, based on the average amount paid in the prior four years. In addition, the estimations will take into consideration the consumer price index average growth rate of 2.82%, provided by the U.S. Department of Labor and found in Appendix B. Table 5.12 shows the present value of the maintenance

costs. The estimated present value is $5,409.24 at 3% and $4,656.40 at 7%. Projected cost is $752.84 more at a discount rate of 3% than at the 7% rate.

Table 5.12: *Present Value of Maintenance Costs*

FY	Actual and Estimated Costs	PV @ 3%	PV @ 7%	n
2005	$0.00	$0.00	$0.00	1
2006	1,500.00	1,413.89	1,310.16	2
2007	0.00	0.00	0.00	3
2008	2,500.00	2,221.22	1,907.24	4
2009	1,028.90	887.54	733.59	5
2010	1,058.64	886.59	705.41	6
Total: 2005 to 2010		**$5,409.24**	**$4,656.40**	

Present Value of Costs

The total value of costs is found by adding together the project costs and the maintenance costs. Totals of each cost are outlined in Table 5.13 and show the present value differences when varying discount rates are applied. The total present value of costs is $217,763.20 at 3% and $201,086.10 at 7%. The total present value cost of the TCEQ digital imaging project is $17,429.94 more at 3% than at 7%.

Table 5.13: *Present Value of Costs*

Present Value: Costs	PV @ 3%	PV @ 7%
Project Costs	$212,353.96	$196,429.70
Maintenance Costs	5,409.24	4,656.40
Total PV of Costs	**$217,763.20**	**$201,086.10**

Net Present Value of the TCEQ Digital Imaging Project

This analysis has determined the total present values of the benefits and costs for the TCEQ digital imaging project. The net present value is found by subtracting the total present value of benefits indicated in Table 5.10 from the total present value of costs

indicated in Table 5.13. The net present value formula is shown in Figure 2.3. The net present value of the TCEQ digital imaging project at each discount rate is presented in Table 5.14.

Table 5.14: *Net Present Value*

	NPV= PVB-PVC	**Social Rate: 3%**	**Private Rate: 7%**
Present Value of Benefits		$273,910.93	$242,528.09
Present Value of Costs		217,763.20	201,086.10
Net Present Value		**$56,147.73**	**$41,441.99**

This analysis finds the NPV for the TCEQ digital imaging project to be positive at both the social and private discount rates, with the total benefits outweighing the total costs. The NPV for the imaging project is $56,147.73 at 3% and is $41,441.99 at 7%. According to the results of the NPV, the digital imaging project is economically viable at either discount rate.

Critics may argue that analysts will falsely inflate benefits or that the data used may not be totally accurate. To avoid unbiased results, this analysis used actual numbers and amounts from available data and only made estimations in cases where there was no available data.

Benefit-Cost Ratio of the TCEQ Digital Imaging Project

The benefit-cost ratio (BCR) can be helpful to decision makers when comparing several projects (Tanous 2007, 88). Though the TCEQ digital imaging project is a single-decision model, and no other projects were being evaluated, this ratio provides a result that allows universal comparability not affected by the amount of benefits or costs involved. If the value of the BCR is calculated to exceed one, then it is a viable project, but if the BCR is found to be below one, then the project is not considered economically feasible. As Table 5.15 shows, the ratio for the project is 1.26 at 3% and 1.21 at 7% at 7%. The benefit-cost ratio for this project affirms the results of the NPV. Using the benefit-cost ratio criterion, projects with the highest benefit-cost ratios are chosen unless budget constraints exist (Galambos and Schreiber 1978, 70). This criterion allows analysts to se how the benefit-cost ratios of alternative projects compare to one another. In this analysis, only the digital imaging project was being considered by the Texas Commission on Environmental Quality so choosing the best alternative was not applicable. In this case, there is not a significant difference between the BCR at the social rate and the BCR at the private rate. However, both result in a ratio exceeding one and indicate the project economically feasible at either rate.

Table 5.15: *Benefit-Cost Ratio*

	BCR= PVB/PVC	**Social Rate: 3%**	**Private Rate: 7%**
Present Value Benefits		$273,910.93	$242,528.09
Present Value Costs		217,763.20	201,086.10
BCR		**1.26**	**1.21**

Chapter Summary

This chapter reviewed and discussed the results of the benefit-cost analysis performed on the TCEQ digital imaging project. As discussed in the Literature Review Chapter, variable discount rates were applied. Since the TCEQ digital imaging project is a public-private partnership, the OMB's suggested rates of 3% and 7% were used to examine the differences in the results. At both discount rates, the project's net present value result is positive and the benefit-cost ratio is above one. The digital imaging project is found to be economically viable.

The indirect benefits and costs associated with this project were not discussed or measured in the results chapter but can have an economic or social impact on the community. The indirect benefits include a reduced environmental impact resulting from decreased paper, increased access to documents by other government entities, and a reduction in misplaced and irretrievable documents. The lack of time and available data prevented the inclusion of these variables in the analysis. There were no indirect costs identified or measured in the parameter of this study.

Chapter Six: Conclusion

Introduction

This chapter provides a summary of the benefit-cost analysis performed on the TCEQ digital imaging project. Challenges discovered in completing this analysis are identified and recommendations are made for further research.

Summary

The study accomplished three things. First, it provided a detailed discussion on benefit-cost analysis and how it is used in the decision making process. Chapter two examined the scholarly literature on benefit-cost analysis. The chapter defined the benefits and costs, discussed appropriate discount rates, and identified decision criteria used in performing a benefit-cost analysis.

Second, the study provided background information on digital imaging technology and discussed this type of technology's current uses. Chapter three provided historical information pertaining to the contractual relationship between the Texas Commission on Environmental Quality (TCEQ) and Neubus, Inc. The Agency's needs were discussed, and the driving forces that initiated the public-private partnership were identified.

Finally, the study applied the technique of benefit-cost analysis to privatization of the TCEQ's digital imaging services to determine if the project is cost beneficial. Chapter four reviewed and described the methodology used to operationalize the benefits

and costs identified in the conceptual framework. Each benefit and cost was measured and a final section described the discount rate and decision criterion used in the benefit-cost analysis for this study. The results chapter revealed the net present values, at both the social and private discount rates and indicated that digital imaging is a good economic investment for the TCEQ. Although the difference between the BCR at the social rate and the BCR at the private rate is not significant, both result in a ratio exceeding one and indicate the project economically feasible at either rate.

Challenges and Recommendations

As discussed in prior chapters, several factors can influence the outcome of the benefit-cost analysis. Due to time constraints and unavailable data, this study did not measure indirect benefits and costs. If measured, indirect benefits and costs can affect the net present value of a project and can provide additional information for decision makers.

The public-private partnership between the TCEQ and Neubus, Inc. is fairly new, and the available data for this study were derived from a three year period. Estimations for future years are based on averages of a limited number of years. Confidence in the calculations could be made stronger if the data were available from a longer time period. It could also be made stronger if data were available for all variables measured. In determining time savings in handling documents, reduction in paper costs, and reduction in copier equipment maintenance and repair, estimations had to be calculated using averages. Actual data would provide a sounder benefit-cost analysis.

Critics may argue that analysts who have an interest in the outcome of the study will falsely inflate benefits or that the data used may not be totally accurate. To avoid unbiased results, a third party should perform the benefit-cost analysis. Public entities can refer to these studies or complete their own to ensure a similar project is economically viable for their needs.

Although challenges have been identified, this analysis identifies the benefits and costs associated with a digital imaging project as well as the method for measuring them. This knowledge will help decision makers in considering similar projects and give them the tools needed to evaluate their choices.

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