PERCEPTIONS OF THE LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN-NEW CONSTRUCTION (LEED-NC) GREEN BUILDING CERTIFICATION SYSTEM AMONG LEED ACCREDITED PROFESSIONALS

By

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by

Matthew W. Cox
To those committed to improving the sustainability of the United States
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The traditional built environment practices within the United States have been devastating to the health of the environment for over a century. Decaying inner cities, congested freeways, rising natural-resource prices, and an overall decrease in quality of life have increased the desire for change. The answer to society’s problems, historically, has been through the invention of technologies. To sustain the future of the U.S., one of the major focuses should be on improving the application of building technologies. However, the major green building initiative, the United States Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED) certification system, has recently been labeled as a troubled success. The environmentally based structure of LEED lacks financial and social components that are potentially deterring the U.S. construction industry from adopting the system. Therefore, this thesis presents the perspectives of LEED Accredited Professionals with regard to financial, organizational, and environmental opportunities. A comprehensive survey of
LEED AP’s from Georgia and Florida was conducted, resulting in an analysis of 37 completed surveys. Many of the recently published concerns of LEED were tested and analyzed in this study including profitability, collaboration, and environmental impact issues.
Chapter 1
Introduction

1.1 U.S. Built Environment History

Prior to the industrial revolution in the United States the dynamics of the construction industry were much different. An agrarian economy dominated the landscape of our country. The sparsely developed population built their homes and places of employment with local timber. Electricity did not exist and water was only accessible in minute quantities. Ventilation was used to cool buildings and fireplaces were used for heating. Streets were primarily dirt but larger cities had cobblestone streets. As the industrial revolution within the U.S materialized, so did the built environment and construction industry.

In the early eighteen-hundreds the invention and use of the coal-powered steam engine made the distribution of labor and building materials more feasible. Cities expanded primarily around waterways or railroads since labor and materials were more accessible. Concrete, steel, and brick were becoming the preferred building materials due to the elements of fire resistance and availability. Improved manufacturing and construction technologies drove the nation’s western expansion and economic prosperity dating back to the mid-nineteenth century.

In the late eighteen-hundreds and early nineteen-hundreds water, gas, and electrical infrastructure began to support higher population densities in both urban and rural areas. However, the size of cities became limited by the increasing distance of travel from the economic centers that were accessible primarily by trains or street cars.
This capacity of the built environment changed with the addition of technological inventions and designs such as the elevator, skyscraper, and automobile. This also increased the amount of materials and energy needed to sustain these booming cities within the United States.

The Great Depression in the 1930’s, however, led to an overall economic decline in the nation. One of the major components of The New Deal, in 1937, was a $112 million dollar government backed investment in new construction that would create employment, expedite the shipment of materials, and create confidence in the utility field. The U.S. government depended on the construction industry to jump-start the nation’s economy.

As a result of the manufacturing boom of the Post WWII era, a large middle class developed within the U.S. who wanted grandiose automobiles and spacious suburban estates. The Eisenhower Interstate System was implemented to promote the deployment of troops nationally and in turn established the development practice now known as urban sprawl. The threat of nuclear holocaust among U.S. cities was also a driving reason to spread out populations as much as possible. The political and economic policies of the period further entrenched the nation’s traditional built environment practices that result in the wasteful consumption of vast amounts of material, land, and energy. The trends continued until the oil crisis of the 1970’s ignited economic, environmental and social drivers for change. The government responded to the need to sustain our quality of life by addressing various energy, environmental, and social issues. More power plants were built during the 70’s. Environmental and growth management legislation were established to regulate pollution and urban sprawl.
By the 1980’s the Industrial Age migrated across the pacific while the Information Age was emerging within the U.S. Computers and the internet took us out of a recession and into several years of economic prosperity throughout the late 90’s. One of the major industries that did not adopt the new information technologies quickly was the construction industry though some of the larger organizations did. As economies around the world became globalized through information technologies, countries in the far-east such as China and India became increasingly industrialized and populated. Now China and India are consuming increasing amounts of building materials and energy in order to support the expansion of various infrastructure projects. The growth of middle-class citizens in those countries is already beginning to rise. As a result, the demand for natural resources at the global level is predicted to continue to increase substantially over several decades. Since the Earth has a finite supply of natural resources available, the costs of materials, land, and energy will increase in proportion to demand.

1.2 U.S. Movement Towards Sustainable Development

The realization that we can not sustain the traditional built environment practices within the U.S. for much longer due to: escalating costs of natural resources, the degrading natural environment, and an overall decline in our quality of life has lead to the U.S. participation in the sustainable development movement.

In 1987, Gro Harlem Brundtland, then Prime Minister of Norway, chaired the World Commission on Environment and Development, which resulted in the currently accepted definition of sustainable development, being development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This was a major political turning point globally that reaffirmed that socio-economic development and environmental protection were intimately linked, and that By
policies should reflect this relationship. Five years later the Rio Conference or Earth Summit was the largest-ever meeting of heads of state and government who focused on climate change, conservation of forests, and biological diversity. In 2002, the World Summit on Sustainable Development in Johannesburg continued to carry out the existing promises and commitments of previous agendas. These conferences politically got countries from around the globe to develop sustainable initiatives. However, no politically driven sustainable development initiative would be successful if it did not radically increase resource efficiency through business and industry.

1.3 U.S. Construction Industry’s Present Impact

The amount of construction put in place in 2002 within the United States was over a trillion dollars. This is more than 10% of the Gross Domestic Product (GDP) of the U.S. The construction industry along with the built environment is estimated to be growing annually by around 8% a year.

These estimates provide clear evidence of the current magnitude of the financial impact the construction industry has on the nation. However, as one of the traditionally largest GDP producers, the construction industry is also one of the largest natural resource consumers. Many experts state that more than or equal to 50% of U.S. energy consumption is directly or indirectly related to buildings and their construction. In addition, it is believed that buildings consume one-quarter of the global wood harvest, one-sixth of its fresh water, and two-fifths of material and energy flows.

The financial and environmental aspects of the construction industry are results of its organizational structure. The level of fragmentation within the industry is unmatched when compared to any other industry. Players from various disciplines and markets with different rule regimes coordinate in a decentralized manner. This institutional structure
has defined the traditional criteria within the industry: performance, quality, and costs. This forces businesses to concentrate on achieving the largest short-term profit possible that meets the minimal performance and quality requirements allowed by law. How can we improve the performance and quality standards of the U.S. construction industry?

1.4 U.S. Movement Towards Sustainable Construction

It should not be surprising that one of the major subsets of sustainable development is sustainable construction. According to Kibert (2005), sustainable construction addresses the role of the built environment in contributing to the overarching vision of sustainability. As a major focus of sustainable construction, green buildings increase energy-efficiency, water conservation, indoor-air quality, and ecological conservation. Kibert (2004) stated, to achieve sustainable construction the traditional criteria of building materials, such as performance, cost, and quality, must be replaced with sustainable criteria including resource depletion, environmental degradation, and a healthy environment. Though green building practices have been increasing for years within the U.S. there was no consensus of what a green building consisted of among the industry.

The requirements of a sustainable construction program within a developed country, such as the United States, include increased awareness, production guidelines, and cost-savings. The major green building initiative is the United States Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED)

1.5 U.S. Green Building System

LEED is a voluntary consensus-based certification system and how-to guide for professionals pursuing sustainable construction. The USGBC was formed in 1993 as a coalition of industry leaders from a variety of professions to promote buildings that are environmentally responsible, profitable and healthy. As the major product of the
USGBC, LEED provides a complete framework for assessing building performance and meeting sustainability goals. LEED-NC 1.0 was piloted in 1999 and version 2.0 publicly launched in March 2000. Since then other LEED products such as existing building operations, commercial interiors projects, core & shell projects, homes, and neighborhood development have emerged. Professionals from various disciplines can become LEED Accredited by passing an exam on the aspects and processes of the LEED system. This knowledge is useful during the documentation and review periods of a LEED project. As the main concentration of this research, it is important to understand the costs, environmental concentration, and structure of the LEED certification system.

The LEED system includes additional soft and hard costs. The hard costs are associated with the additional materials or systems that are required to meet many of the points within LEED. This may include additional sky lightening, waterless urinals, advanced HVAC systems, or rainwater collection systems. The soft costs associated with a LEED project are required for certification. These include costs for energy modeling, commissioning, USGBC membership (recommended politically), project registration, and documentation. Schendler and Udall (2005) agreed that advanced design and coordination involved in LEED normally raises the cost of a project by 1-5 percent.

The environmental aspects of LEED make up the vast majority of the point structure. The categories include: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. The last category is dedicated to innovation points. The vast majority of the LEED structure is weighted on purely energy and the environmental, which explains where the product/system name comes from.
The organizational structure of LEED is fairly complex. It is made up of a point-system consisting of a total of 69 possible points in six categories. The levels of certification available include: certified, silver, gold, and platinum. As mentioned previously, projects must be registered in order to apply for any certification level. Participants are encouraged to become members of the USGBC. Once the prerequisites of a project are met through energy modeling, commissioning, and preliminary documentation the remaining points pursued should be identified and administered closely. With the completion of construction and documentation the project gets reviewed by the USGBC. If certain points do not get approved then applicants must make corrections before reapplying or seek a lower certification level than originally anticipated.

1.6 Problem Statement

The problem is that the adoption rate of LEED by the U.S. Construction Industry is extremely poor. LEED is not even close to being mainstreamed within the United States. Primarily, it is only the super dedicated, politically-motivated, wealthy, or public sector that are pursuing LEED certification. LEED is struggling. If LEED stagnates it will fail, ultimately setting back the already deficient sustainable development movement within the United States. This paper, therefore, is in response to the recent call-to-arms within the green building community to reform LEED and mainstream sustainable built environment practices within the American construction industry. The recent demand for LEED reform has prompted the following questions.

- How do we get more people and companies to adopt LEED?
- What are the weakest links in the LEED system?
Who has experienced LEED first-hand to provide feedback and suggest solutions?

In a rough analysis, the three components of sustainable development were applied to LEED, consisting of environmental, economic, and social elements. Since LEED-NC is the original product of the now expanded system it was used for analysis in this research. A quick glance of LEED-NC categories and point structure clearly illustrated that there were almost no economic or financial aspects weighted into the existing system. This makes the bottom-line of business and industry extremely difficult to achieve. In addition, the environmental aspects of LEED were not proven to be the most effective environmental-impact reduction methods. Why would anyone invest time or resources into a system that has not been proven? The final issue that preliminarily analyses raised was an even larger absence of social elements in the system. However, since this research focused primarily on business solutions rather than consumer concerns, the social aspects of the SD model were portrayed instead in an organizational context of the construction industry. A concept diagram of this study is provided in Figure 1-1.
Figure 1-1: Concept diagram of study illustrating sustainable components within an organizational context.
1.7 Research Objectives

The purpose of this study is to gauge the perspectives of LEED Accredited Professionals regarding the financial, organizational, and environmental barriers to the LEED certification system. Based on the results of a survey addressing the barriers to mainstreaming LEED, recommendations and conclusions were developed that will encourage effective modification of future LEED versions. The specifics of the survey covered a broad range of published problems impacting the adoption rate of the LEED system.

This research was conducted in order to create a better understanding of the barriers that restrict the adoption of the LEED system within the U.S. construction industry. Specifically, this research covered financial, organizational, and environmental problems. Various questions on the cost-efficiency of LEED certification were asked. The concept of Life-Cycle Costing was addressed regarding use and value. The demand for green tax reform and other financial incentives for sustainable construction practices were discussed. The use of ecological economics in LEED projects were included in the data collection instrument. Life-Cycle Assessment issues was raised, including whether it should be used in future LEED versions. Professional collaboration factors of project success, environmental impact and profitability were questioned. The demand for a more integrated web-based LEED protocol was also raised.

1.8 Limitations

The findings of this study are in many ways open to interpretation, as much of the data is based on the opinions of the individuals surveyed. Although this study was conducted in a scientific manner, there are additional limitations that also must be mentioned:
1. Subjectivity of topic- Data obtained in this study represents the perceptions of the respondents. Some results were difficult to quantify.

2. Limited range of sample-Surveys were sent only to LEED AP’s in Florida and Georgia because they were the two largest concentrations of LEED AP’s in the region the graduate research was being conducted.

3. Limited size of sample- The results were based on a relatively small portion of LEED AP’s and an even smaller portion of the overall construction industry. A more extensive sample might produce varying results.

4. Limited scope of topic- LEED-NC was mainly used in this research though other new and more reformed versions that address the barriers mentioned in this study were emerging from the USGBC.

In overview, the introduction provided an extensive historical background of the traditional built environment practices within the United States. In addition, the sustainable development and construction movement in relation to the U.S. construction industry was discussed. The recently published critiques of the LEED system were then discussed in the problem statement. Finally, the research objectives and limitations were described to address the elements of this study. In the next chapter, a review of literature was conducted on issues relating to sustainable construction and LEED.
CHAPTER 2
LITERATURE REVIEW

2.1 Sustainable Construction

The emerging concept of sustainable construction has been captured and applied in various recent studies. As mentioned in the previously, sustainable construction is a subset of sustainable development. According to Kibert (2005), the term sustainable construction most comprehensively addresses the ecological, social, and economic issues of a building in the context of its community. The following articles will elaborate on the meaning and ways to achieve sustainable construction.

Sustainable construction can be better achieved by replacing the traditional criteria of the built environment with sustainable criteria consisting of resource depletion, environmental degradation, and a healthy environment (Kibert, 2005). The traditional criteria create a linear process; sustainable criteria are cyclical. Kibert (1994) proposed six principles of sustainable construction that consist of financial, environmental and organizational elements.

2.1.1 Principles of Sustainable Construction

Apply Life Cycle Analysis (LCA) and True Costs (Economics) is the primary principle that addresses environmental and financial concerns of sustainable construction, listed in Table 2-1. Theoretically, LCA closes the material loop by determining the environmental impacts of a material, product, or even a whole building in combination with a cost/benefit analysis over its entire life cycle. It is a comprehensive approach that examines all impacts of material selection decisions, rather than simply it’s performance
in the building (Kibert, 2005). LCA can be broken down into two major components. The first is life cycle assessment (LCA) which is the measures a materials or systems environmental impact over the life span of the item. Life cycle costing (LCC) is the other component used that models the cost associated with the financial benefits or cost-savings the material/system produces of the life span.

Table 2-1: Principles of sustainable construction

<table>
<thead>
<tr>
<th>PRINCIPLES OF SUSTAINABLE CONSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Minimize resource consumption (Conserve)</td>
</tr>
<tr>
<td>2. Maximize resource reuse (Reuse)</td>
</tr>
<tr>
<td>3. Use renewable or recyclable resources (Renew/Recycle)</td>
</tr>
<tr>
<td>4. Protect the natural environment (Protect Nature)</td>
</tr>
<tr>
<td>5. Create a healthy, non-toxic environment (Non-Toxics)</td>
</tr>
<tr>
<td>6. Apply Life Cycle Cost Analysis and True Costs (Economics)</td>
</tr>
<tr>
<td>6. Pursue quality in creating the built environment (Quality)</td>
</tr>
</tbody>
</table>

The principles of sustainable construction are primarily concerned with natural resource efficiency. Since economies and societies exist within an environment it should not be surprising that so many sustainable construction and development principles focus on the environment. Principles one through five focus on primarily environmental issues.

The final principle of SC, proposed by Kibert (1994), touches on organizational aspects of industry and consumers, to pursue quality in creating the built environment (Quality). This quality is listed as a second number six because it is actually a traditional criterion of the built environment and was not an additional sustainable principle. However, it is included because it is being viewed with a new sense and importance attached to it (Kibert, 2004). In sustainable construction it is critical that the design excellence of a building is valued by the end-users. If it is not then the resources used to create the structure will be wasted by disuse, disrepair, and disorder within the built
environment. Integrated design by all professions and parties involved in the product must be achieved to truly achieve theories behind sustainable construction.

### 2.1.2 Drivers for Change within the U.S. Construction Industry

The perspectives of the building industry towards sustainable construction initiatives within the United States are captured by Augenbroe and Pearce (1998). The momentum of new initiatives, methodological framework, and drivers for change within the construction industry are discussed.

The demand for sustainable construction initiatives has emerged within the construction industry because of increasing natural resource cost, degrading environments, and an overall loss in quality of life within America. According to Augenbroe and Pearce (1998), a variety of initiatives have been put into place to begin the change toward increased sustainability, some people have begun to realize that these initiatives are not sufficient to bring about the change that is needed. Some national U.S. sustainable initiatives include LEED, Buildings for the 21st Century, and Energy Star. LEED more comprehensive in scope but the other two have more certified projects/participants.

In the wide context of sustainable construction a methodological framework is useful to identify, position, and measure the opportunities for improvement and priorities for change. Augenbroe and Pearce (1998) concluded, a methodological framework expresses that in different life cycle phases of a building, different actors are dealing with the designed or built artifact, each of them within distinct system boundaries, while responsible for different sustainability aspects. To achieve sustainability it is critical to find the phases, actors, and system boundaries that have the greatest impact on sustaining
the built environment. In addition, it is important that sustainable task and objectives are coordinated seamlessly across system boundaries and levels by all actors involved.

As the focus of the study, various drivers for change were identified and included in a survey sent out to over 800 green building professionals from various disciplines (Augenbroe & Pearce, 1998). They were asked to rank the drivers for change by importance to sustainable construction, progress between now and 2010, and priorities for achieving sustainable construction. The results of the on-going survey illustrated that education and environmental factors such as energy conservation measures, land use regulations, waste reduction, and resource conservation strategies ranked highly across the board. In addition, better ways to measure and account for costs and re-engineering the design process, ranked closely behind the education and environmental factors. In the immediate progress of sustainable construction category, the product certification ranked highly. However, product certification ranked extremely low in overall importance and as a long-term priority. A summary of the results concludes that financial and organizational drivers are only secondary to education and environmental drivers. What is somewhat surprising is that green building professionals ranked product certification as one of the least important factors and priorities to achieving sustainable construction.
Table 2-2: Average ranking of 15 drivers, 1 being greatest importance

### Sustainable Drivers for Change in the U.S. Construction Industry

<table>
<thead>
<tr>
<th>Sustainable Drivers</th>
<th>Overall Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land use regulations and urban planning policies</td>
<td>1.7</td>
</tr>
<tr>
<td>Energy conservation measures</td>
<td>2.0</td>
</tr>
<tr>
<td>Education and training</td>
<td>3.0</td>
</tr>
<tr>
<td>Resource conservation strategies</td>
<td>5.7</td>
</tr>
<tr>
<td>Indoor environmental quality</td>
<td>5.7</td>
</tr>
<tr>
<td>Environmental-friendly energy technologies</td>
<td>6.3</td>
</tr>
<tr>
<td>Waster reduction measures</td>
<td>6.7</td>
</tr>
<tr>
<td>Better ways to measure and account for costs</td>
<td>9.0</td>
</tr>
<tr>
<td>Re-engineering the design process</td>
<td>9.3</td>
</tr>
<tr>
<td>Adoption of performance-based standards</td>
<td>10.0</td>
</tr>
<tr>
<td>Product innovation and/or certification (LEED)</td>
<td>10.0</td>
</tr>
<tr>
<td>New kinds of partnerships and project stakeholders</td>
<td>11.0</td>
</tr>
<tr>
<td>Adoption of incentive programs</td>
<td>12.7</td>
</tr>
<tr>
<td>Recognition of buildings as productivity assets</td>
<td>12.7</td>
</tr>
<tr>
<td>Proactive role of materials manufacturers</td>
<td>13.0</td>
</tr>
</tbody>
</table>

#### 2.1.3 A Socio-Technical Perspective

Many sustainable construction studies have focused on environmental technologies that will produce more resource efficiency within the built environment. However, Rohracher (2001) believes the major barrier to sustainable construction is the challenge of the socially interactive process of designing, constructing and using buildings. If a lack of interaction and collaboration occurs between actors then true sustainability will not occur since there will be missed opportunities that negatively affect the end users desire to maintain the property. The implementation of more sophisticated technologies required in green building demand the actors to increasingly reorient and co-operate across the various system boundaries, levels, and processes. It is extremely difficult to accomplish this since the construction industry is fragmented, market-driven, and regulatory in nature. According to Rohracher (2001), the focus of social studies of
technology on the intentional strategies of actors and simultaneously on the role of the institutional and organizational framework in the design and diffusion of technologies should provide useful insights to better analyze the barriers and perspectives for the development and dissemination of sustainable buildings. The perspectives of actors involved, type of present collaboration and communication structures will help finds ways to achieve a better integration of actors and technical system requirements.

2.1.4 Organizational Barriers

In a similar study, Van Bueren and Priemus (2002) state that the failed breakthrough of sustainable construction is not because of technical factors but institutional factors that influence the decisionmaking of actors regarding whether or not to pursue sustainable practices. The definition of sustainable construction is reformulated by Van Bueren and Priemus (2002) as the design, development, construction, and management of real estate such that the negative environmental effects of the construction, restructuring, and management of the built environment are reduced as far as possible. This definition illustrates that sustainable construction is a broad concept that requires collaborative and coordinated decisionmaking from all actors involved from designers to end users. The institutional context consists of formal, planned institutions such as (state) organizations and regulations, and more informal, evolved institutions characterized by ground rules; institutions as interaction patterns that structure, but do not determine, behavior, and define the space within which actors act, select problems and solutions, and set priorities (Van Bueren & Priemus, 2002).

To illustrate this, picture each player in the construction industry as a separate box. The relationships or interactions between the players are represented by arrows between the boxes. Some examples of these players/relationships include: urban planner -
landowner, landowner-developer, developer-contractor, contractor-property manager, and property manager -end users. Rarely is there a director or coordinator to these relationships and interactions. Van Bueren and Priemus (2002) state that in a specific project this institutional setting allows for cost-efficient decisionmaking processes with outcomes that meet the minimum requires quality standards and from a sustainability point of view the lack of coordination between the various decisions contributed to many missed opportunities.

To give an example of the consequences of segregated decision-making in sustainable construction various types of gaps that institutional structure can cause will be described. The first gap is between location development and building project development. This is evident in many of the new urbanism type development around the country. An urban planning consultant working with the governmental land-regulatory department and developer will create a development with a sustainable layout that includes mixed-use town centers, varying single family home densities, public transportation access, and open spaces. This increases the desirability of the community by creating favorable environmental conditions that end users can enjoy for years. However, almost no builders within these sustainable communities have capitalized off the established environmental gains by constructing green or high performance buildings. The sustainability of these communities is half of what it could be because of a lack of collaboration.

Another gap caused by institutional barriers is one between construction and management/resident. Each player makes decisions based on their agendas and bottom line. According to Van Bueren and Priemus (2002), the contractor wants to produce a
product that meets legal requirements and that satisfies the demands of the principle
customer, drawing as much as possible on present knowledge and expertise. A property
manager or resident may want a more energy efficient building that will provide cost-
savings through lower utility bills over time. In a reversed scenario a resident may not
make use of advanced green building systems because of a lack of knowledge or
environmental concern.

The underlying reason for the lack of collaboration in sustainable construction
initiatives like the examples mentioned above is because of an asymmetric distribution of
pluses and minuses relating to sustainable costs/benefit. For example, the owner is
usually fixated on investment decisions related to the development or financing costs of a
building, and much less on the long-term management and user costs. In market prices,
typically, environmental costs are not usually internalized in the price formation. In labor
and material markets, labor (income tax) is taxed more heavily than are raw materials
even though sustainable construction measures often require more labor and less raw
materials. The most practical way to eliminate the collaboration and asymmetric costs
issues would be to create a centralized decisionmaking process that would be in the hands
of only a few individuals. This could be achieved through an integrated company such as
a design-build-operate-transfer procedure.

2.2 LEED

2.2.1 “LEED Is Broken . . . Let’s Fix It”

This article by Schendler and Udall (2005) created controversy within national
green building circles. Prior to mentioning problems within the article, however, the
successes of LEED such as the creation of a consensus-based green rating system of
industry professionals where one did not exist before and the national buzz regarding
sustainable awareness the USGBC created through public relation efforts were recognized. Despite the success of LEED, the number of certified projects was less than one-tenth of a percent when compared to the other sustainable initiative programs within the U.S (Schendler & Udall, 2005). The problems of LEED consist of culmination of financial, environmental, and organizational issues.

The cost of LEED certification can be unpredictable and potentially unprofitable. False reporting among the industry that LEED projects do not cost more than conventional projects is misleading. The ability to accurately predict and execute LEED project cost is difficult since there usually are unexpected outcomes in any new system or process. If you admit that LEED does add costs it scares many clients away. Schendler and Udall (2005) estimated the soft costs of LEED for a small building will put you in the hole $68,450. These funds could be used to improve the building in other useful ways. Many developers are leery of costs of LEED certification since it is too expensive and time consuming. A growing amount of developers feel it is just as useful to use LEED as just a guideline.

Point mongering is another problem that happens when the design team places more emphasis on acquiring LEED points than adding environmental value to a project. The public relation campaign that the USGBC created with LEED is followed by its users in the decisionmaking process. In the organizational structure of LEED, all points are created equal. This directs LEED participants to pursue the cheapest points possible creating more bang-for-the-buck than environmental capital. Making LEED based on scientific analysis rather than on committee consensus may help the point inequality
issues, according to Scheduler and Udall (2005). Increasing the required amount of specific creates is also suggested.

2.2.2 LEED: Past, Present, and Future

In another article analyzing how LEED was faring after five years, Solomon (2005) provided not only insight to the existing problems of LEED but also explained how they came about and whether they will be resolved. Many of the original developers of LEED were not surprised by the existing problems. When the decision was made to release the first version of LEED many USGBC members knew that it was awkward and incomplete, and many wanted to wait until it could be put on more scientific footing, but more wanted to get something out quickly (Solomon, 2005). The current problems of LEED that are mentioned include bioregional insensitivity and the relatively tenuous connection to life-cycle analysis. The first issue leads to impractical design and also point-mongering. The Life-cycle analysis, or LCA, leads to the scientific discipline of measuring the material resources and energy consumed, and the environmental impact create, by a particular product throughout its life (Solomon, 2005). A greater reduction in environmental impact could result using LCA but LEED’s one-point-per-credit structure does not encourage this more sophisticated method.

Other concerns mentioned accuse LEED of being too bureaucratic. LEED certifiers get bogged down by technical details and loss sight of good design. In competition with LEED, Green Globes, a Web-based sustainable design tool for new commercial construction is being used by many green building professionals as an alternative to the headaches of LEED. Green Globes is an online platform that links to energy-modeling and LCA software tools. However, it does lack the market base and public input that gives LEED its strength.
The future of LEED is promising. The early success of LEED and adoption of it by the public sector overwhelmed the resources the USGBC has to refine and add depth to the original product. Instead, they have focused on getting new products of LEED into the market place such as LEED-EB, LEED-ND, and LEED-H. LEED has already included and improved an online tool that promises to be more user-friendly and cut down on the paperwork. There will be some refinement in the credits themselves in the next LEED version. The USGBC is also planning on increasingly underpinning LEED with LCA-type thinking, although they are searching for the right mix to use since LCA does not focus on local impact issues.

This chapter reviewed some of the more significant publications on sustainable construction and LEED. Existing studies were conducted that led to the conception of this study. In the next chapter a methodology of this research is provided including the development of the survey and the statistical measurements used for analysis.
CHAPTER 3
METHODOLOGY

Literature pertaining to the barriers of sustainable construction is abundant. Recent articles addressing the specific problems of LEED have also been published. However, there is very little data regarding the financial and organizational barriers of sustainable construction initiatives within the United States. This study was conducted to help collaborate and document LEED Accredited Professional’s perspectives on the financial, environmental, and organizational barriers of the LEED green rating system. Ultimately, the goal of this research is to contribute to making the next major version of LEED more accepted among the construction industry. To begin this study, a review of periodicals pertaining to the subjects of sustainability, green building, and LEED was conducted, and internet websites were consulted as well.

A survey was then developed with questions falling into five categories; company information, personal information, financial-organizational perspectives, financial-environmental perspectives and environmental-organizational perspectives. The questionnaire consisted of two types of questions; those that required written answers dealing with general company/personnel information and those that required a respondent to rate his/her level of agreement with the statement on a seven-point Likert scale with a response of 1 indicating total disagreement and 7 indicating total agreement. The number 4 within the Likert scale represented a neutral response to the statement allowing participants to not take a side or state an opinion. After each category heading a space was provided for comment or clarification.
In order to produce an effective survey, it was necessary to refine the survey several times. Numerous articles on LEED were reviewed and analyzed. Each problem or critic of the system was listed according to the environmental and economic components of sustainable development. In addition, organizational components were also listed such as bureaucratic or collaboration issues between professionals. Repetitive issues were consolidated. The problems were then transposed into statements that fell into social-economic, social-environmental, or economic-environmental. Since the statements mainly addressed internal business socialization rather than end-user or consumer topics of sustainability the term social was replaced by organizational to probably convey the focus on the institutional structure of the LEED system and U.S. construction industry. The broad area of economics was narrowed down and restated as financial since profitability was the major area of concentration in this study. Several expert LEED consultants then reviewed the survey drafts and made valuable suggestions and corrections.

This process produced a two-page survey consisting of 18 questions not including the sections relating to company and personal information. It was necessary to include a letter of consent to participate with the survey explaining the privacy protocol and the purpose of the research. The IRB, consent, and survey forms were then submitted to the Institutional Review Board for approval. After receiving authorization (see Appendix A), the survey and letter of consent were electronically mailed to LEED AP’s in the states of Florida and Georgia from the LEED AP directory web pages with instructions for their return via electronic mail or facsimile.

The type of information gathered in each section of the survey is as follows:
1. Company Information: this section request data such as company age, company services, annual volume, percent of volume that is LEED certified, percent of volume increase in LEED projects over the last 2 years, percent volume that is sustainable but not LEED certified, number of employees, number of LEED certified employees, and highest level of LEED certification any experienced project has received. This section provided general information helpful to the assessment of the survey.

2. Personal Information: this section consisted mainly of details pertaining to the individual participant. The profession and position were also asked to establish variances between professions.

3. Organizational - Financial: this section was designed to establish perspectives on how coordination between organizations or individuals affected the profitability of LEED projects.

4. Organizational - Environmental: this section was designed to establish perspectives on how coordination between organizations or individuals affected the environmental impact of LEED projects.

5. Financial - Environmental: this section was designed to establish perspectives on how profitability of a LEED project affected the environmental impact of LEED projects.

Before sending out the surveys, it was necessary to determine the sample size.

With a 95% confidence level, a permissible error of .05, and an estimated sample size was calculated to be 47. A random selection of LEED AP’s from the states of Florida and Georgia was generated. With the assumption that one out of every eight surveys would be completed and returned, 248 surveys were distributed via electronic mail. After the initial survey was sent, a period of 2 weeks was allowed for responses because of thesis deadline dates.

The data sets that the surveys contained were then input into a Microsoft Excel spreadsheet for stratification and analysis. The maximum, minimum, and average responses were calculated. Then the results were further analyzed to select the most appropriate data source to compare to the other answers to find the potential relations and
conclusive insights of the research. Then the average responses of the selected categories were calculated for each question and used for comparison.

This chapter discussed the procedures for developing the survey and data collection methodology, next in Chapter 4 a detailed look into data analyses is presented.
CHAPTER 4

RESULTS

The results of this study were presented in two sections. Section 4.1 reviewed the responses to each survey question; the average, maximum, and minimum responses were also reported unless the question structure calls for percentage distribution breakdown. Where necessary the data results were stratified to provide more useful comparisons.

Section 4.2 analyzed the data based on the services of the company. Where relevant the participant’s profession was substituted in place of company services for statement analyses. This provided insight to the various disciplines perspectives and organizational structures regarding financial and environmental issues.

One element of two questions caused a problem when analyzing the results. In the Type of LEED AP’s question and the Profession of Participant question the choice of Owner was available for selection. Owner was supposed to be classified as a principal investor or equity holder of a development or construction project; however, many participants believed it referred to the ownership of a company.

The other problem in the Results section of this study was because there were only 37 survey responses instead of the 48 needed to have a 95% confidence level for this study, the confidence level was re-calculated using N=37, the new confidence level was 90%.
4.1 Overview

4.1.1 General Background Information

4.1.1.1 Company age

There were 33 responses to this question with 35 years old as the average. The maximum amount reported was 150 years old, and the minimum was 3 years. The largest amount of respondents were from companies 1 to 20 years in age, illustrated in Figure 4-1.

![Bar chart showing company age](image)

Figure 4-1: Company age in years (N=33)

4.1.1.2 Company services

As shown in Figure 4-2, 35 respondents answered this question. The largest percentage of services provided by a company was Multi-discipline at 37%. Just over 31% provided only Design services. There were 11% Construction and 11% of Other services such as planning and business development.
4.1.1.3 Annual volume

There were 28 respondents with a total average annual volume of $369,835,528. The maximum was $1.8 billion and the minimum was $300,000. As shown in Figure 4-3, the largest amount of respondents were from companies with annual volumes of less than 20 million dollars.
4.1.1.4 Percent of annual volume contributed to LEED

There were 35 respondents with an average of 2.2% of annual volume contributed to LEED. The maximum was 23% and the minimum was 0. The majority of respondents only had between 0 to 1% of their company’s annual volume that contributed to LEED projects, shown in Figure 4-4.

![Figure 4-4: Distribution of annual volume LEED certified (N=35)](image)

4.1.1.5 Percent of annual volume not LEED but green

As shown in Figure 4-5, the number of respondents was 5 and the average was one-third of a percent. The maximum was 2.5% and the minimum was 0.
4.1.1.6 Number of company employees

The number of respondents was 35 and the average was 985 employees. The maximum was 26,000 and the minimum was 3 employees. The majority of respondents were from companies with less than 50 employees, shown in Figure 4-6.
4.1.1.7 Number of LEED Accredited Professionals in company

The number of participants was 36, with an average of 11 LEED AP’s. The maximum was a 100 and the minimum was 2 LEED APs. The majority of companies had five or less LEED AP’s, shown in Figure 4-7.

![Number of Companies by Number of LEED APs](image)

Figure 4-7: Distribution of the number of LEED APs in company (N=36)

4.1.1.8 Types of LEED APs in a company

As shown in Figure 4-8, there were 36 respondents with Architects and Multi-disciplines of LEED APs each consisting of 25%. The next closest was GC’s with 22% and the lowest percentage was Developers and Owners each making up 3%.

![Types of LEED APs in Company](image)

Figure 4-8: Distribution of the types of LEED APs in companies (N=36)
4.1.1.9 Number of LEED certified project based on certification level

As shown in Figure 4-9, there were 36 respondents, with 22 Silver projects completed, 20 Gold, 14 Certified, and only 4 Platinum.

![LEED Certification Levels for years 2000 through 2005](image)

Figure 4-9: Distribution of LEED certified project levels (N=36)

4.1.2 Personnel Background Information

4.1.2.1 Professions of participants

As shown by Figure 4-10, the number of participants was 36, with the highest number being architects followed by engineers. Construction was third then the rest of the professions feel significantly below.

![Survey Responders by Profession](image)
Figure 4-10: Distribution of participant professions (N=36)

4.1.2.2 Participant job titles

As shown by Figure 4-11, the number of responders is 36, and the largest amount of titles is in Project Management. President and VP are equally second in distribution followed last by Other miscellaneous.

![Figure 4-11: Distribution of participant job title (N=36)](image)

4.1.3 Organizational and Financial Perspectives

This section was developed to ascertain the respondent’s perceptions of LEED regarding organizational and financial aspects. They read statements and were asked to rate the degree to which they disagreed or agreed with the statement from one to seven on a Likert scale. One signifies Strongly Disagree, four was a Neutral response, and seven was Strongly Agree. The averages of the ratings were then calculated for ease of comparison and are illustrated in each graph by a dashed black line.

4.1.3.1 Collaboration of costs

All 37 respondents answered this question. The question was established to determine the amount of cost collaboration by professionals. As shown in Figure 4-12,
the average was 4.51, which indicates that respondents tended to Somewhat Agree that they collaborate with professionals on LEED cost issues.

*I collaborate extensively with other professions on cost-related issues pertaining to LEED projects, such as budgeting, scheduling, design, and LCC.*

![Question 1](image)

Figure 4-12: Collaboration of costs (N=37)

### 4.1.3.2 Adequacy of LEED budgets and schedules

The number of responses to this statement was 36. As shown in Figure 4-13, the average of the ratings was 3.83, signifying that respondents were Neutral with this statement.

*The budgets and schedules for LEED projects are just as adequate as for conventional projects.*
Figure 4-13: Adequacy of LEED budgets and schedules (N=36)

4.1.3.3 Collaboration, cost-efficiency, and reduced environmental impact

There were 37 responses to this statement as well. As shown in Figure 4-14, the average response was 5.19, which corresponds to the Somewhat Agree category. The majority of respondents agreed overall that LEED promotes collaboration financially and environmentally.

*The LEED point system promotes collaboration between professions resulting in cost-efficient designs that reduce environment impact.*

Figure 4-14: Collaboration, cost-efficiency, and reduced environmental impact (N=37)
4.1.3.4 Environmental impact reduction and profit

There were 36 responses to this statement. As shown by Figure 4-15, the average response was 3.42, which corresponds to the Somewhat Disagree category. The majority of respondents tend to disagree that environmental impact reduction and profit are not correlated.

*The more environmental impact reduction measures on a LEED project the more profit my company will earn.*

![Question 4](Figure 4-15: Environmental impact reduction and profit (N=36))

4.1.3.5 Authority to Pursue LEED Points by Cost/Benefit

All 37 respondents rated this statement. As shown by Figure 4-16, the overall rating fell into the Somewhat Agree category with an average of 4.59. The majority of respondents agreed that they have the authority to decide what points are pursued based on cost in a LEED project.

*I have the authority to decide what LEED points are pursued based on cost/benefit analysis.*
4.1.3.6 Green taxes and financial incentives

A shown in Figure 4-17, the average rating for this statement was 5.54, which places it in the category of Agree. All 37 respondents rated this statement. The majority of respondents also Strongly Agreed to that the green building advocates should focus on creating more monetary incentives for LEED participation.

*Green Building advocates should focus on creating more tax and financial incentives for LEED projects.*
4.1.4 Organizational and Environmental Perspectives

This section was developed to ascertain the respondent’s perceptions of LEED regarding organizational and environmental aspects. Again, respondents read the statements and were asked to rate the degree to which they disagreed or agreed with the statement from one to seven on a Likert scale. One signifies Strongly Disagree, four is a Neutral response, and seven is Strongly Agree. The averages of the ratings were then calculated for ease of comparison and illustrated in each graph by a dashed line.

4.1.4.1 Level of integrated design

As shown in Figure 4-18, the average rating for this statement was 2.78, which places it in the category of somewhat disagree. The majority of respondents Disagreed with the statement that integrated design does not substantially increase for LEED projects over conventional projects.

*The level of integrated design does not substantially increase for a LEED project compared to a conventional project.*

![Figure 4-18: Level of integrated design (N=37)](image-url)
4.1.4.2 United States Green Building Council (USGBC) receptiveness to feedback

As shown in Figure 4-19, the average rating for this statement was 4.67, which places it in the category of Somewhat Agree. One respondent didn’t reply regarding this question. The majority of respondents were Neutral in opinion whether the USGBC is receptive to feedback. Enough respondents agreed pushing the average just into the Somewhat Agree category.

*The USGBC is receptive to feedback*

![Figure 4-19: USGBC receptiveness to feedback (N=36)](image)

4.1.4.3 Collaboration and certification level

As shown in Figure 4-20, the average rating for this statement was 6.11, which places it in the Agree category. All 37 respondents agreed to varying degrees that collaboration between professions during a LEED project increased the chances of achieving the desired certification level.

*Increased collaboration between professions during a LEED project increase the likelihood of achieving the desired certification level*
4.1.4.4 Collaboration and point mongering

Every respondent rated this statement. As shown by Figure 4-21, the average of all the ratings was 3.97, putting the average response in the Neutral category. The distribution of responses was very balanced to whether collaboration on LEED projects leads to point-mongering rather than good design.

*Collaboration on LEED projects results in LEED point maximizing rather than good design.*
4.1.4.5 Consensus-based rating system

Thirty-six of thirty seven respondents rated this statement. As shown in Figure 4-22, the average of those ratings was 5.31. This average fell into the Somewhat Agree category. No respondents disagreed to any degree to the statement that LEED should remain consensus-based.

*LEED should continue to be a consensus-based rating system*

![Figure 4-22: Consensus-based rating system (N=36)](image)

4.1.4.6 Improved web-based protocol / customer service

There were a total of 35 responses to this statement. With an average rating of 5.11, respondents Somewhat Agreed. Figure 4-23 shows that the majority were either Neutral or in agreement with the statement that LEED needs to improve internet usage and customer service.

*LEED needs an improved interactive web-based protocol to improve customer support.*
4.1.5 Financial and Environmental Perspectives

This section was developed to determine the respondent’s perceptions of LEED regarding financial and environmental aspects. The Respondents read statements and were asked to rate the degree to which they disagreed or agreed with the statement from one to seven on a Likert scale. One signified Strongly Disagree, four was a Neutral response, and seven was Strongly Agree. The averages of the ratings were then calculated for ease of analysis and illustrated in each graph by a dashed line.

4.1.5.1 Cost-efficiency and certification level

All respondents replied to this statement. As Figure 4–24 illustrates, the average rating was 4.59, which fell into the Somewhat Agree category. The majority of the responses were Neutral or agreed to this statement.

The more cost-efficient a LEED project’s budget and design are, the more likely that the desired certification level will be achieved.
4.1.5.2 Future of Life-Cycle Assessments (LCA) and Life-Cycle Costing (LCC) methods

Thirty-five of thirty-seven respondents rated this statement. Figure 4-25 shows that the average rating of responses was 4.71, which states a Somewhat Agreement to whether LCA and LCC methods should be used in LEED.

*LCA and LCC methods should be included in the future LEED 3.0 version.*

The average of this question is 4.71.
4.1.5.3 Rationale to pursue LEED

All 37 respondents rated this statement. In Figure 4-26, the average is 4.22, which fell into the Neutral category. There was a balanced distribution of opinions in the corresponding degrees of disagreement and agreement.

The major consideration whether to pursue LEED Certification is based on cost/benefit analysis relative to environmental impact.

Figure 4-26: Rationale to pursue LEED (N=37)

4.1.5.4 Ecological economics

All 37 respondents rated this statement as well. Figure 4-27 illustrates that the average response was 5.76, which fell into the Agree category. The majority agreed to this statement that they considered environmentally pertinent aspects of a project.

I consider the value of environmentally pertinent aspects of a project (ex. Natural ecosystems, green space, wetlands...)

4.1.5.5 Soft cost of LEED value

Only 34 of the 37 respondents rated this statement. In Figure 4-28, the average rating was 3.79, making for an overall Neutral response to whether soft cost of LEED could be better used in LCC and LCA analyses. The bell-shaped distribution illustrated a balance of opinions.

*The (soft) costs of LEED certification, such as commissioning, energy modeling, and documentation, could be better invested in LCC and LCA analyses.*
4.1.5.6 Profitability of LEED projects

The final question that was asked received ratings by all respondents. As Figure 4-29 illustrates, the average distribution was 3.59, which fell into the Neutral category as well. There were slightly more disagreement responses overall.

*LEED projects are more profitable for my company than conventional projects.*

![Figure 4-29: Profitability of LEED projects (N=37)]

4.2 Analysis

This section examines the perspectives of LEED AP’s by Company Services. Company services were condensed into four aspects: Design, Construction, Other, and Multi-Discipline services. Design services consist of Architects or Engineers. The Other category of professional service companies consist of a culmination of developers, consultants, financial lenders, investors, and educators. The Multi Discipline category consists of any companies that had more than one professional service internally available to their clients. An example of this would be a design-build firm. Another example would be a company that finances, designs, builds, and operates a project. Distributing the responses by company services provided additional insight to the
organizational and social agendas relating to both environmental and financial factors of sustainable construction and LEED. First, the company service data was compared to the background information within the survey. Then the company service application was applied to a scatter plot chart to illustrate the correlations and differences of the perspectives regarding the eighteen statements. The averages of the responses closely followed the Multi-discipline and Design companies’ opinions since they were by far the largest groups of respondents of the survey.

4.2.1 Background

4.2.1.1 Company age in years

The average age of Design service companies was less than 30 years old. Construction companies were the youngest at an average of 19 years. Surprisingly the Multi-disciplines and Other companies were older.

![Company Average Age vs Services](image)

Figure 4-30 Company service vs. company age

4.2.1.2 Annual volume

As Figure 4-31 illustrates Multi-discipline serviced companies had an exponential amount of annual volume over all other companies. However, Design and Construction
had averages of less than 5 million. This data may be skewed because of an unusually high volume by a specific survey participant.

![Annual Vol $ by Services](image1)

**Figure 4-31: Company services vs. annual volume (N=28)**

4.2.1.3 LEED volume

As Figure 4-32 shows, the average percents of breakdown by company services and LEED % of Annual Volume. Multi Discipline and Design companies vary at 17% and 45%.

![LEEDs % vs Services](image2)

**Figure 4-32: Company services vs. LEED percent of annual volume**
4.2.1.4 Number of LEED APs

The comparison between number of LEED APs and company structure revealed that Multi and Design firms were above Construction and Other service companies in the number of LEED AP’s.

Figure 4-33: Company services vs. number of LEED APs

4.2.1.5 Number of LEED certified projects

In Figure 4-34, the quantity of LEED certified projects by company services was illustrated. Design was the highest with 22 projects experienced; Multi was close behind with 21 projects. Other service company averaged around 16 while Construction was extremely low at 1 LEED AP.
4.2.2 Organizational and Financial Perspectives

The following perspective questions were analyzed through scatter plot graphs to insightfully illustrate the correlations between financial viewpoints versus company organizational structures. In many of the scenarios the Construction and Design companies had opposite concerns and opinions. In addition the Other classification of company services included planners, business development manager, and manufacturers gave typically optimistic responses.

4.2.2.1 Collaboration of costs by company services

The responses to this question illustrated that Design companies collaborated the least with Other professions while Multidiscipline companies the most. If Multi companies have various types of professionals working under one roof then it could be easier for them to collaborate.
I collaborate extensively with other professions on cost-related issues pertaining to LEED projects, such as budgeting, scheduling, design, and LCC.

Figure 4-35: Distribution of company services and collaboration of costs by company services

4.2.2.2 Adequacy of LEED budgets and schedules by company services

In this question responses were significantly different. Construction companies disagreed the most and Design companies disagreed to a lesser extent. Multi and Other companies were very agreeable with the statement. The possible reasoning behind the responses may have been because contractors and designers had much more exposure and liability with regards to budgeting and time restraints than Other service companies in the industry.
The budgets and schedules for LEED projects are just as adequate as for conventional projects

4.2.2.3 Collaboration, cost-efficiency, and reduced environmental impact by company services

In question 3, there were also a variety of responses based on company services. Construction disagreed again while Design companies thought LEED collaboration did work. Design professionals collaborated the least but they said that LEED promotes collaboration. Designers can steer the cost and environmental impact since they make decisions early on in the chain. Contractors must work within the design professional’s lines with a profit margin and with environmental requirements. It is interesting that Other companies truly believe LEED was cost-efficient and environmentally friendly. The company types that fell into this category were developers, planners, and educators.
4.2.2.4 Environmental impact reduction and profit by company services

In Figure 4-37, the distribution was wide. Multi discipline companies stated that there was no relation between profit and environmental impact reduction. Construction professionals though fairly Neutral in perspectives stated a slight agreement with the statement.
4.2.2.5 Authority to pursue LEED points by cost/benefit by company services

This question was designed to determine who had the greatest impact or say in cost/benefit analyses on LEED projects. As no surprise Design professionals were early in the decision-making chain. Contractors and Multi companies were Neutral while Other service companies Slightly Disagreed.
4.2.2.6 Green taxes and financial incentives by company services

Figure 4-39: Distribution of company services and green taxes and financial incentives by company services

In Figure 4-39, the distribution showed that contractors Strongly Agreed to the demand for more financial incentives. This may indicate that contractors have had difficulty turning a profit on these technologically advanced buildings. This may be because of the tax system that taxes labor more than materials. Other causes may be because sustainable suppliers and subcontractors were not affordable or available in the marketplace.

4.2.3 Organizational and Environmental Perspectives

In this next section, the organizational and environmental perspectives are examined based on the same criteria of company services. This will continue to show
potential agendas of industry professionals that create barriers to the adoption of green building systems such as LEED.

4.2.3.1 Level of integrated design by company services

[Diagram showing distribution of company services and level of integrated design by company services]

Figure 4-40: Distribution of company services and level of integrated design by company services

Question 7 showed that Construction, Other, and Multi service companies Strongly Disagreed with this statement. Design professionals only Slightly Disagreed. To designers it may not be that much additional trouble to add some level of complexity or efficiency to a building design. However, Contractors have various additional hurdles such as documentation, energy modeling, commissioning and more specialized trade professionals to manage.
4.2.3.2 USGBC Receptiveness to Feedback by company services

As Figure 4-41 shows, Multi service companies Strongly Agreed while contractors and Designers where much more neutral. Multi service companies may have more comprehensive feedback or a well-rounded view which made there critics more useful to the USGBC. However, it also could be the case that they were less aware of specific faults in the system like specialized companies would.
4.2.3.3 Collaboration and certification level by company services

When company services responses were distributed for question 9 there was very little differentiation. Everyone Strongly Agreed that collaboration did increase the chances of achieving the desired certification level on LEED projects. However, not everyone profits the same off LEED projects so the incentives to collaborate will vary between professions. This question was key to this study, but did still not clarify how to increase and balance the distribution of profits in a LEED project.
4.2.3.4 Collaboration and point mongering by company services

The distribution of company services relating to question 10 about point mongering showed that Construction professionals believe point mongering is an issue; while Design professionals Slightly Disagree with the statement. Multidiscipline companies disagreed the most in reference to collaboration and point mongering. This may be because they have been responsible for more decision making aspects or long-term operation of a building. The average overall on this question was Neutral stating that point mongering was an individual opinion.
4.2.3.5 Consensus-based rating system by company services

The company service distribution to question 11 was very narrow in range.

Overall, all professions Agreed that LEED should remain consensus based.
4.2.3.6 Improved web-based protocol / customer service by company services

LEED needs an improved interactive web-based protocol to improve customer support

Once again, in question 12 the distribution of company services was also very narrow. The professions only Slightly Agreed that LEED should improve web-based efforts and customer support. The power of the internet in business applications are typically underutilized, however, in the entrenched construction industry a Slightly Agreed response was significant.

4.2.4 Financial and Environmental Perspectives

The final section within the results section illustrated the financial and environmental perspectives categorized by company services
4.2.4.1 Cost-efficiency and certification level

As Figure 4-46 shows, cost efficiency and certification chances have a correlation. Design professionals were Neutral in response, however, Construction professionals Agreed overall. This may be because budgets and profit margins are thin and challenging to meet with the increased complexities of a LEED project. Usually, Design professionals do not have to worry about whether the project is competed on budget they get the same profit regardless.
4.2.4.2 Future of LCA and LCC methods by company services

This important financial and environmental statement received interesting responses. Construction and Design companies actually were surprisingly both Neutral to the statement. Other service companies and Multi companies agreed more to the statement. LEED is planning on implementing the right balance of LCA and LCC methods in LEED 3.0 version. However, there are concerns that restrict the use of such modeling that Construction and Design professionals may be aware of.
4.2.4.3 Rationale to pursue LEED by company services

The major consideration whether to pursue LEED Certification is based on cost/benefit analysis relative to environmental impact.

As Figure 4-48 illustrates, the responses to this statement were Neutral. Construction and Design professionals once again were Neutral in opinion. Multi service companies Slightly Disagreed while Other service companies Agreed.
4.2.4.4 Ecological economics by company services

![Likert Scale Graph](image)

**Figure 4-49: Distribution of company services and ecological economics by company services**

This statement distribution was slightly boarder in range as shown by Figure 4-49. Construction professionals Slightly Agreed to the economic ecology statement while Multi service companies Strongly Agreed. Design and Other professionals were in-between the two. This may be the reason why Construction professionals are lacking in interest and participation in LEED when compared to other professions. However, many contractors do not deal with ecosystems, green space, or wetland issues. They simply build the building they are hired for. This lack of awareness should be within the industry.
4.2.4.5 Value of LEED soft costs by company services

The (soft) costs of LEED certification, such as commissioning, energy modeling, and documentation, could be better invested in LCC and LCA analyses.

Figure 4-50: Distribution of company services and value of LEED soft costs by company services

This question distribution by company service was the same across the board, shown in Figure 4-50. Every category of company services was Neutral or Slightly Disagreed. This either illustrated that everyone feels soft costs of LEED projects were founded or just that LCC and LCA may not be a better alternative for the money. Either way the Slight Disagreement to the statement shows LEED does do a pretty good job with cost control and environmental impact.
4.2.4.6 Profitability of LEED projects by company services

The bottom line of companies was distributed by the company categories in Figure 4-51. Design and Construction companies both Slightly Disagreed here. Multi service Slightly Disagreed as well while Other service companies actually Agreed to the statement in a slightly above Neutral way.

The analyses of the results of this study illustrated the various perspectives of LEED AP’s regarding the LEED-NC rating system. A summary of this study and recommendations for future study will be provided in the following chapter.
CHAPTER 5
CONCLUSION

5.1 Summary

The results of this study revealed the perspectives of LEED Accredited Professionals regarding the barriers and opportunities of sustainable construction. Though some of the critics of LEED were reinforced by this study, many proved to be exaggerated and unfounded. However, this study directly illustrated many of the overall barriers to sustainable construction that pose a much larger concern for U.S. citizens, industry, and government.

The major weaknesses found with the LEED system were related to financial aspects. The profitability of LEED was asymmetric. Overall, the USGBC goal to transform the market with the introduction of LEED failed. LEED has captured less than one-third of one percent of the industry’s annual volume. However, it has grown exponentially since its inception. It has also produced awareness of cost and environmental design issues, primarily within design and multi-disciplined companies. Contractors do not have as much interest in sustainable construction because they do not profit off complex designs or reduced long-term operating cost of buildings. More end-user demand for LEED projects would produce a monetary driver forcing contractors to adopt more sustainable initiatives.

From an organizational standpoint, the USGBC has done a good job overall with LEED. The survey illustrated that LEED should remain consensus-based. USGBC was slightly above average in feedback receptiveness. The USGBC already had plans to
improve web usage and customer service aspects. Though LEED was a small percentage of the overall annual volume of the construction industry, it was still the dominant and most comprehensive green building system within the U.S. However, it has not been able to simplify the process enough for smaller businesses to implement it.

The environmental aspects covered in this study were mainly tied to other concerns such as financial or organizational. However, the portions relating to the environmental aspects of LEED showed only positive things. All respondents agreed that LEED does promote good environmental design. In addition, this study illustrated that a very high level of professionals valued environmentally pertinent aspects of a project.

A more detailed analysis of the industry professions or disciplines portrayed differences in opinion regarding the financial and organizational barriers to sustainable construction. The majority of LEED AP’s worked for design or multi-disciplined companies. As no surprise, the greatest amount of LEED volume was also reported by these company types. Design professionals coordinated the least, while multi-discipline companies the most. Design professionals responded that the cost-efficiency of a LEED project’s budget and design was less important to accomplishing certification. Overall, design and multi-disciplined companies thought the LEED system was financially profitable and organizationally desirable.

Construction professionals had very different opinions, especially when compared to design professionals. Contractors showed the smallest adoption rate of LEED out of any profession within the industry. They had a lower annual volume of LEED projects and fewer LEED AP’s on average. Why the lack of interest or participation? Builders, typically, make their profit by simplicity of design and materials. On the other hand,
designers, typically, make profit based on the complexity of design and materials. Unless design-build is utilized, contractors have to accept the decisions or judgments of the designers. The added level of documentation and management requirements of a LEED project will place more burden on the contractor profit margin. Construction professionals did not view LEED as financially profitable or organizationally desirable. It was found that different profit agendas hindered collaboration between professions restricting the adoption of sustainable construction practices, such as LEED.

Overall, LEED is headed in the right direction. Even though LEED is far from being perfect or scientific, its core is strongly supported through the brightest and most experienced industry leaders. The green building community should not be concentrating on trivial environmental measurements or even the profitability of certification systems. The USGBC has already saturated the LEED product line with environmental standards and measurements. Next, in the hierarchy is the societal component that must be addressed. Society’s problems have, historically, been resolved by the invention and implementation of technology. Advanced green building technologies already exist; however, a broad public awareness of the benefits of such technologies does not. More research, education, and training must be achieved at the institutional levels. Universities and other public institutions set the example for industry to follow with regards to technological and social policy. These trends eventually filter down through ranks of consumers and businesses alike establishing the economic supply/demand relationship necessary to mainstream sustainable construction practices within the United States.

5.2 Recommendations for Future Study

This was a relatively small study reviewing responses from a total of 37 participants. A larger sample is recommended in order to get a more accurate picture of
how the construction industry is truly responding to LEED and sustainable construction. A larger sample could also offset some of the responses given by some extremely large companies whose annual volumes and number of employees skewed some of the averages.

The Likert scale proved useful, however, the neutral choice listed produced neutral responses to many questions. A no opinion option listed as 0, then a 5 point Likert scale may be more effective at distinguishing perspectives. Eliminating the neutral or no opinion option altogether may also be a way to force respondents to agree or disagree.

Direct variations of this study include surveying only small businesses on financial, organizational, and environmental issues pertaining to sustainable construction. Another variation of this study would be to survey LEED AP’s on social issues relating to sustainable construction since this study left out those important elements by instead focusing on organizational aspects of the system.

Green certification systems, such as LEED, are not as important or as high of a priority to achieving sustainable construction as other topics. Studies regarding the effectiveness of education and training curriculums on sustainable development practices would be extremely well founded. Research leading to an interactive web-based system that could make the design process cyclical rather than linear would increase the symmetry of profits among industry actors. The advantages of design-build and other multi-disciplined organizations in implementing sustainable construction practices is a fairly untouched topic that also has vigor. Studying end-user awareness and perspectives regarding sustainable construction has an immediate need for research concentration.
APPENDIX A

LETTER OF CONSENT

University of Florida
M. E. Rinker, Sr. School of Building Construction
Powell Center for Construction and Environment

February 20, 2006

Dear LEED Accredited Professional:

Will you please help us with a very important project?

We are conducting a survey to learn more about your perspectives regarding the financial, organizational, and environmental barriers to LEED certification. We value your opinions as a green building professional. Your answers to the attached questionnaire will ultimately contribute to improving future LEED versions.

You are a part of a very small, scientifically selected sample being asked to participate in this study, so your individual reply is extremely important to the accuracy and success of the research. The maximum number of participants recruited for this research is 1000 LEED Accredited Professionals. There will be no monetary compensation for participating in this survey. However, the immediate benefits of participation include the potential to increase your knowledge and provide feedback about LEED problems currently being addressed within green building circles. There are no more than minimal risks to participating in this survey. Your answers, of course, will be kept in strict confidence and no names will be associated with responses. In addition, you have the right to withdraw from the study at any time without consequence.

Would you please take a few minutes now and complete the questionnaire? Please print, complete, and fax the survey to (352) 846-2772 or please type in your answers (not worrying about formatting issues), save, and attach in an email reply back to mwc7805@ufl.edu. Implied consent of your participation will be assumed by the completion and return of the attached survey by facsimile or email.

Your prompt reply will be greatly appreciated. Thank you very much for your help. We hope to hear from you soon.

Sincerely,

Matthew W. Cox
Principal Investigator
/ UF Grad Student

PO Box 115763 - University of Florida - Gainesville, FL 32611-5763
APPENDIX B
SURVEY

Organizational, Financial, and Environmental Analysis of LEED Certification - Survey
Complete & Fax to (312) 848-8772

Background Information - General (Please Print)

Company Age in Years: ________
Company Services (circle all that apply) (Design, Construction, Development, Consultant, Financial, Other(s) )
Annual Volume in 2005: $________
Percent of Annual Volume in 2005 that received some level of LEED certification: _______%
Percent of Annual Volume in 2005 that did not achieve LEED but did achieve some other green certification standard: _______%
What other green building programs besides LEED has your company used in 2005 (circle all that apply): Energy Star, Building for the 21st Century, BEEA, GREEN GLOBE, FGBC Standard, Other ______
Number of Employees: ________
Number of LEED Accredited Professionals in your Company ________
Types of LEED APs in your company (circle all that apply) (Arch., Eng., GC, Owner, Developer, Other(s) )
Number of LEED certified projects completed from 2005-2009 based on certification level: Certified Silver Gold Platinum ________

Background Information - Personal (Please Print)

Profession: (ex. Arch, GC, Owner, Educator, etc....) ________
Title: ________
City: ________
Phone #: ________
Email: ________

Definitions:
Collaborate: Working together; especially in a given individual effort.
Cost-efficient: Economically or effective in relation to its cost.
Life-Cycle Costing (LCC): A cost-benefit analysis for each year of the probable life of a building to justify a measure that may require greater initial capital investment, but pays significantly less operational costs over time.
Life-Cycle Cost Analysis (LCCA): The method of determining the environmental and resource impacts of a material, product, or an entire building over its entire life.

Directions: Please Circle the number which best represents the extent to which you agree with the following statements.

SECTION A: Organizational - Financial

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Somewhat Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
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<td>1. I collaborate effectively with other professionals on cost-related issues pertaining to LEED projects, such as budgeting, scheduling, design, and LCC.</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td>2. The budgets and schedules for LEED projects are just as adequate as for conventional projects.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
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<td>3. The LEED point system promotes collaboration between professionals resulting in cost-efficient designs that reduce environmental impact.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>4. The more environmental impact reduction measures on a LEED project the more profit my company will earn.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. I have the authority to decline what LEED points any project pursuit based on cost/benefit analysis.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td>6. Green building advocates should focus on creating more tax and financial incentives for LEED projects.</td>
<td>1</td>
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<td>3</td>
<td>4</td>
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Comments: ________

74
### Section B: Organizational - Environmental

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<td>The level of integrated-design does not substantially increase for a LEED project compared to a conventional project.</td>
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<td>6</td>
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<td>8</td>
<td>TheUBC is receptive to feedback.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<td>9</td>
<td>Increased collaboration between professionals during a LEED project increases the likelihood of achieving the desired certification level.</td>
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<td>3</td>
<td>4</td>
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<td>6</td>
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<td>10</td>
<td>Collaboration on LEED projects results in LEED point maximizing rather than good design.</td>
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<td>2</td>
<td>3</td>
<td>4</td>
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<td>6</td>
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<td>11</td>
<td>LEED should continue to be a consensus-based rating system.</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<td>12</td>
<td>LEED needs an improved interactive web-based protocol to improve customer support.</td>
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<td>2</td>
<td>3</td>
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**Comments:**

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### Section C: Financial - Environmental

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<th>Somewhat Disagree</th>
<th>Neutral</th>
<th>Somewhat Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
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<td>13</td>
<td>The more cost-efficient a LEED project's budget and design are, the more likely that the desired certification level will be achieved.</td>
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<td>3</td>
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<td>5</td>
<td>6</td>
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<td>14</td>
<td>LCA and LCC methods should be included in the future LEED 3.0 version.</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<td>15</td>
<td>The major consideration whether to pursue LEED Certification is based on cost benefit analysis relative to environmental impact.</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<td>16</td>
<td>I consider the value of environmentally pertinent aspects of a project (e.g., natural ecosystems, green spaces, wetlands...)</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>17</td>
<td>The (soft) costs of LEED certification, such as commissioning, energy modeling, and documentation, could be better incorporated in LCC and LCA analyses.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>18</td>
<td>LEED projects are more profitable for my company than conventional projects.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
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**Comments:**

- Additional Comments:
LIST OF REFERENCES


BIOGRAPHICAL SKETCH

Matthew W. Cox was born in Stuart, Florida, to Russell E. Cox and Karen A. Cox. As a Martin County School District student, he learned about the importance of the environment on annual field trips through the Environmental Studies Center. After graduating from high school in 1999, he attended the Florida State University where he earned his Bachelor of Science in Management degree. The following year he attended the University of Florida where he earned his Master of Science degree from the School of Building Construction. Matthew plans to remain in Florida where he will pursue a career in construction management and sustainable development.