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COST JUSTIFICATIONS FOR INVESTING IN LEED PROJECTS

Anthony Sparkling

Dr. Benedict Ilozor, Mentor

ABSTRACT

Sustainability, or “green” building, has been examined across disciplines and continues to be at the forefront of global organizations’ and governments’ commitment to promote energy and environmental stewardship. As it relates to construction, this term has been defined and developed by the United States Green Building Council (USGBC). This Green Building certification body has developed a green building rating system for building construction, referred to as LEED (Leadership in Energy and Environmental Design). The practice of constructing building facilities that meet LEED certification standards implies the overall goal of “meeting our building needs of today without compromising the ability of future generations to meet their needs” (WCED, 1987). The objective of this study is to determine key cost justifications informing the pursuit of LEED certification, and to ascertain the level of satisfaction of owners as to the value of LEED. The study comprises 30 LEED-certified buildings that are owner occupied, and a survey to determine which cost justifications associated with LEED construction participants favored.

INTRODUCTION AND BACKGROUND

Sustainability has been examined across many disciplines and continues to be at the forefront of many global organizations’ and governments’ commitment to promote energy and environmental stewardship (Roper and Beard, 2006; Presley, Meade, and Sarkis, 2007; Miller, Spivey, and Florance, 2008; Presley and Meade, 2010). As it relates to construction, this term

has been thoroughly defined and developed by the USGBC. The practice of constructing building facilities that meet LEED certification standards implies the overall goal of “meeting our building needs of today without compromising the ability of future generations to meet their needs” (WCED, 1987).

The system identified as LEED has become the standard applied toward sustainable buildings and green design in the U.S. (Matthiessen and Morris, 2004). According to the USGBC (2011), buildings receiving LEED certification are designed to have lower operating costs and increased asset value, reduced waste, healthier environments for occupants and reduced noxious gas emissions; they qualify for tax incentives and exhibit the building owners’ commitment to environmental stewardship and social responsibility. LEED’s building design and construction rating systems assign points to buildings’ sustainable qualities based upon site selection (SS), water efficiency (WE), energy and atmosphere (EA), materials and resources (MR), indoor environmental quality (IEQ), innovation in design (ID) and regional priority (RP). These compiled ratings determine the level of certification a specific construction project receives. Certification levels are certified *silver*, *gold* and *platinum* respectively, and increase with the extent of sustainable efforts implemented within the project (USGBC 2011). The objective of this study is to determine key cost justifications informing the pursuit of LEED certification, and to ascertain satisfaction of owners as to the value of LEED.

Tangible cost justifications

Cost is one major consideration owners face when deciding to implement ‘green’ building strategies into construction projects, according to Kats (2003) and Nalewaik (2009). Cost justifications have been empirically measured relative to *quantitative* parameters of

sustainable construction, yet few studies provide sufficient data relating to the *qualitative* characteristics favored by owners (Kats, 2006; Langdon, 2007; Singh, 2009; Lavy and Fernandez-Solis, 2009). A study involving LEED accredited professionals (LEED AP) performed by Lavy and Fernandez-Solis (2009) found complexity and cost as major considerations in pursuing LEED credits. The perceptions from this survey are weighted heavily in favor of LEEP AP, with only 6% of respondents comprised of owners, developers, and facility managers. The literature reviewed questions on whether owners are steered toward LEED credits that are easier to obtain, or to ensure the desired level of LEED certification is achieved (Langdon, 2004; Lavy and Fernandez-Solis et al., 2009).

Savings justifications for sustainable design

Rationalizations made for cost incurred from green building are typically perceived as tangible or intangible (Presley, Meade, and Sarkis et al., 2007; Nalewaik and Venters, 2009; Singh, 2009). Tangible benefits are easily identified in the various studies that provide cost/benefit models specifically focused on such benefits as energy and water consumption (Kats, 2010; USGBC-Chicago Chapter, 2009; GSA, 2008, Langdon et al., 2007). The results presented from these approaches revolve around tangible elements such as anticipated return-on-investment (ROI), net present value (NPV), life-cycle cost (LCC) and initial cost increases. A recent study conducted by Kats et al. (2010) concludes that green buildings' ROI is six years. Furthermore, when other intangible benefits are included, the financial investment can double. Investing in green buildings is simply justified by owners and operators as financial savings; conversely, savings relating to environment, health, and culture hold against conventional measures (Morton, Bretschneider, Coley, and Kershaw, 2010; Miller, Spivey, and Florance et al.,

2008; Roper and Beard et al., 2006). An assessment ascertaining the benefits inherent in green building placing greater emphasis on the qualitative attributes favored by the participants has not yet been attempted. This study can help to determine if sustainability goals are masked by purely financial cost justifications.

Long-term value of sustainable design

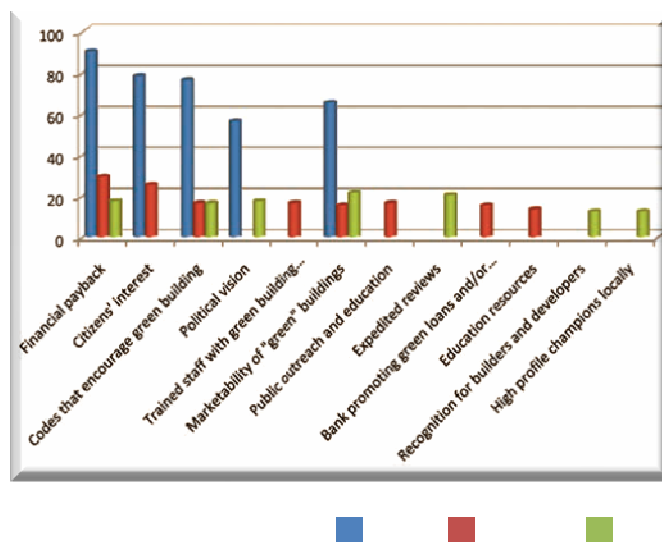
The long-term value associated with sustainable construction evaluates the NPV of the building using modeling predictions. Models are based on LCC, defined by Kats et al. (2010) as savings from energy and water use, and less apparent attributes such as job creation and worker productivity. LCC modeling uses economic impacts, differing from a life-cycle analysis (LCA) or life-cycle cost assessment (LCCA), which assess the ecological, social, cultural, and economically sustainable enhancements designed into the building construction goals (Kohler and Moffatt, 2003). According to Singh et al. (2009) and Sarja (2002), the LCCA includes the reuse, recycling and disposal of the investment. The latter model is less frequently used to justify sustainable construction due to the increased cost (Kohler and Moffatt et al., 2003). Common to these studies is the contention that other factors such as occupant health, productivity, and job creation are not reliable for measuring the long-term value associated with sustainable building resulting from the assumptions involved (Kats et al., 2010; Singh et al., 2009).

Studies quantitatively measuring green building cost

Abundant analyses associated with LEED-certified buildings' performance have been completed and documented by the USGBC. The results point to numerous outcomes beneficial

to building owners and occupants. Even so, the validity of these studies has been criticized, citing bias in data sampling, insufficient data, and overgeneralization (Scofield, 2009; Singh et al., 2009). The analysis performed by Scofield et al. (2009) determined that larger LEED buildings (>50,000 gross sf) fail to provide cost justifications sufficient to energy use, yet they represent 50% of the total gross square foot in the U.S. building stock. The cost/benefit dilemma becomes exacerbated as buildings increase in size and in prospects for operating inefficiencies.

Studies have been completed evaluating the adoption of LEED credits by operations managers, city and public works planners, building developers, and owners, yet perceptions from these studies reveal little post-occupancy satisfaction information (BSU Office of Sustainability and the Public Policy Center et al., 2010; Furphy, 2010; Muthulingham, 2009). The participants in a Boise State University study were asked several questions regarding green building practices, specifically LEED certification standards. To wit: (1) What overall factors encourage green building? (2) What incentives or information encourage the adoption of green building? (3) What are specific barriers to the adoption of green building practices? (4) What tools or support would encourage you to adopt green building practices? (5) Are there other things that might impact your adoption of green building practices?



City County Local

Figure 1. Top Five Incentives for Green Building by Location

Source: ([http://www.boisestate.edu/sustain/documents/GreenBuilding\[1\].pdf](http://www.boisestate.edu/sustain/documents/GreenBuilding[1].pdf))

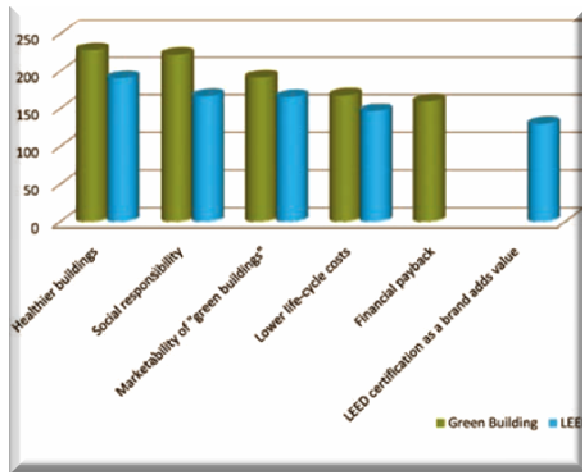


Figure 2. Top Five Incentives by Construction Industry Professionals

Source: ([http://www.boisestate.edu/sustain/documents/GreenBuilding\[1\].pdf](http://www.boisestate.edu/sustain/documents/GreenBuilding[1].pdf))

Figure 1. illustrates the incentives that city, county, and local governments in the Pacific Northwest region of the U.S. perceive to be most advantageous in pursuit of green building practices. Figure 2. presents perceptions from construction industry professionals and developers regarding green building and LEED certification incentives. These charts reveal contrasting information on the perceived incentives for investing in green building. Construction industry professionals place greater emphasis on healthier buildings and social responsibility, and economic factors are least important. Conversely, cost considerations are highly esteemed by professionals.

Findings from the studies completed by Furphy et al. (2010) and Muthulingham et al. (2009) conclude that the adoption of voluntary standards and sustainable practices such as LEED is based on factors such as the depth of adoption standards by industry professionals and by the broader community. Other factors include voluntary adoption to increase community image and

organizational sustainability goals and practices. These factors offer perceptions from the operations' management perspective; moreover, Furphy et al. (2010) and Presley, Meade, and Sarkis et al. (2007) explain that organizational philosophy plays an important role in deciding to pursue sustainable practices.

Intangible cost justifications

Sustainable construction practices involve strategies to mitigate negative impacts on the environment, provide increased performance in *occupant well being, productivity* and *social value*. Implementation of these measures requires a holistic approach to sustainable design and construction, including reviewing corporate goals (Presley and Meade, 2010; Muthulingham et al., 2009; Presley, Meade, and Sarkis et al., 2007; Roper and Beard et al., 2006). Another rationalization for sustainable construction practice is to provide for waste mitigation, which presents organizations with opportunities to continue with environmental considerations through the entire construction, operation, recycling, and disposal processes.

Environmental impacts and waste mitigation strategies

Mitigating environmental impacts and waste in construction is a major consideration for green building. Studies indicate that these goals are based on many factors, including emission reduction, materials and resource use, and waste reduction. These studies focus on qualitative features as justification assessment tools and benchmarks, and attempt to provide direction to project stakeholders in performing life-cycle assessments for green buildings (Tatari and Kucukvar, 2011; Presley and Meade et al., 2010; Mer'eb, 2008; Presley, Meade and Sarkis et al., 2007).

Energy strategies implemented in sustainable construction and design desire to increase on-site renewable energy sources using features such as ground source heat pumps (GSHP), solar photovoltaic (PV) arrays, and electrochromic glazing (Kats et al., 2010). Reduced energy consumption in buildings equates to lower emissions in nitrogen oxide (NO), sulfur dioxide (SO₂), carbon dioxide (CO₂), and coarse particulate matter (PM₁₀). These and other pollutants have contributed to smog, acid rain, global warming, and increased illnesses (Kats et al., 2003 and 2010; Mer'eb, 2008; Vallero and Brasier, 2008).

The areas of building and material re-use include the use of reclaimed materials in new construction projects. Other strategies such as rapidly renewable material and recycled content are introduced when applying the LEED-certification process during design development. This portion of the sustainable construction design process aims to limit the construction waste sent to landfills and promote greater use of recycling programs. According to the USGBC et al. (2009), developing waste management policies and recycling programs can contribute significantly to reducing greenhouse gases. This presents the opportunity to include intangible qualities inherent within sustainable buildings into the decision process for project stakeholders.

Research suggests that LCCA modeling tools and scoring systems attempt to predict the impact a buildings' life cycle has on the environment, including embodied energy. Life-cycle assessment modeling tools such as Building for Environmental and Economic Sustainability (BEES), tracks products through the entire manufacturing process, from raw materials extraction to the ultimate disposal of the product (Tatari and Kucukvar et al., 2011; Presley and Meade et al., 2010; Bribian, Capilla, and Uson, 2010, Mer'eb et al., 2008; Presley, Meade and Sarkis et al., 2007; Kohler and Moffatt et al., 2003). These assessments are completed during the conceptual and design phases of construction.

Further studies may expand upon these approaches by monitoring and documenting the post-occupancy satisfaction with LEED-certified buildings over the lifespan of a building, typically defined as 50 years (Bribian, Capilla, and Uson et al., 2010). The embodied energy of building materials is a measure of the energy involved in the entire manufacturing process of a product, including extraction, use, and disposal (Kats et al., 2010; Bribian, Capilla, and Uson et al., 2010). Construction building materials, according to Bribian, Capilla, and Uson et al., account for 50 percent of the embodied energy in a building. Owners and operators have an opportunity to specify building materials with lower amounts of embodied energy.

Occupant well being and performance

Occupant well being and performance associated with green buildings has been purported to improve human health and productivity (USGBC et al., 2011; Kats et al., 2010; Singh et al., 2009; Kats et al., 2006). Improving indoor air quality in schools and offices has been shown to reduce certain health conditions such as asthma, colds and the flu, respiratory problems and headaches. Other areas with increased benefits are teacher retention rates, reduced number of sick days, increased student achievement, and increased worker performance (Kats et al., 2010; Singh et al., 2009; Kats et al., 2006; KEMA, 2003).

Research suggests that occupants' performance and health are affected by indoor air quality, thermal comfort, lighting, and acoustics within a building. Huge cost savings are commonly reported, yet few studies have collected sufficient data to validate this claim (Singh et al., 2009). A study conducted by Singh et al. (2009) shows that investing in LEED certification improves the physical and psychological well being of building occupants, however, it increases the cost of the project. Increased costs are shown to be incremental, even decreasing as markets

adopt green building strategies; yet owners and designers commonly seek LEED credits that are easier to obtain (Lavy and Fernandez-Solis et al., 2009; Singh et al., 2009; Kats et al., 2006).

Green building design using strategies such as LEED-certification also presents challenges with less individual occupant comfort control, noise level increases, and lighting dissatisfaction. Moreover, these design features are less favorable due to open floor plans and increased day-lighting options. Despite these findings, surveys by Leaman and Bordass et al. (2010) and Singh et al. (2009) determined that green buildings retained higher levels of occupant satisfaction with building performance than did their counterparts.

Social value

The social value of green building is based on the triple bottom-line concept to include the environment and economy. Research and assessment tools on social equity and investment made in green buildings lag, according to Hammer (2009). Cost justifications attributed to social return-on-investment are considered less quantitative, as these investments are holistic and provide benefits to the larger community. Social investing in construction considers not only the health and well being of the building occupants, but also the overall impact the project has on the locale and population within a specific area (Hammer et al., 2009). The justification for investing in green building utilizing LEED-certification is premised on transforming the buildings' impact, not only on the environment, occupant well being and performance, but also on the social value for the greater community (USGBC et al., 2011). However, means for justification and research data appear lacking in the decision process for LEED-certification (USGBC et al., 2011; Hammer et al., 2009).

RESEARCH DESIGN AND METHODOLOGY

Our survey seeks to determine the foundation for cost justification that owners favor in deciding to construct green buildings using the LEED certification system. The survey is designed for owners and operators, rather than LEED accredited professionals and public officials (Lavy and Fernandez-Solis et al., 2009; BSU Office of Sustainability and the Public Policy Center et al., 2010). The objective of this study is to determine key cost justifications informing pursuit of LEED certification, and to ascertain the satisfaction of owners as to the value of LEED. An invitation to participate was sent to about 30 LEED-certified projects found on the USGBC (2011) website. The invitation letter sent to respondents included information regarding the purpose, value, and time constraints inherent in participation. The letter also offered information regarding privacy and voluntary participation in this study. A follow-up invitation email contained a link directing participants to the online survey's webpage.

Challenges to completing the study arose from voluntary subject participation. The information gained from the survey instrument only serve as a representation of the study population. Furthermore, data collected are only a sample representation of LEED-certified buildings in Michigan; hence, future studies based on larger data sets may reflex different outcomes. Data collection is ongoing and the conclusions are not final.

CONCLUSION

Research demonstrates that owners and building operators place differing values on the benefits derived from green building practices. The value attributed to green building, or constructing to LEED standards, provides owners and operators tangible economic benefits. Seldom justified benefits, such as social and environmental impacts, are less likely to be included

in their decision-making process. Green building strategies such as waste mitigation, occupant well being and social value provide building owners and operators vast potential benefits, yet are difficult to quantify. Economic savings for building owners and operators, however, are significantly influential in the justification process for investment in green building and LEED-certification.

Our study to determine the key cost justifications for investing in LEED certification is ongoing. Several participants in our study have already noted cost savings associated with energy and water use reduction as incentives to pursue LEED certification. Results from the study will fully present the green building owners' and operators' perspectives for investments in green building strategies and LEED certification.

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