A Comparison of Upstream Costs and Downstream Costs in Green Building Systems

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Introduction

Organizations are searching for strategies that best suit their customer's needs and are environmentally sustainable (Nalewaik and Venters, 2009). These strategies can further enhance their communication with customers and their profitability in the long run (Nalewaik and Venters, 2008). To achieve this goal, companies can invest in intelligent building systems and low environmental impact technologies to reduce energy consumption and improve the overall performance of the building (Helgeson and Lippiatt, 2009).

The following research paper investigates the financial justification for choosing "green" or high-performance buildings rather than a conventional building design. The agency partner for this project is Canem Systems Ltd, who has developed a suite of Building Performance Services to deliver optimal solutions to building sustainability challenges. An important component of this practice is the financial justification of "green" solutions. Canem must be able to prove the value of new technologies and integrated design approaches to building owners and operators in order to make their service offering appealing (Nalewaik and Venters, 2009).

As the researcher on this project, I have been asked to provide research support for the lifecycle cost benefit analysis for sustainable buildings. The

research is contained within the topic of bringing an economic justification perspective to the value of green building.

Analyzing the tangible and intangible benefits of building green will further lead this research to investigate the costs and benefits of building green (Nalesaik and Venters, 2008). The research explores how a building "lifecycle" is defined and what the best practices are in the marketplace for constructing buildings that are managed and maintained to their optimal capacity over time (Langdon, 2011). Core metrics for success should be identified and analyzed within a Lifecycle Cost Benefit Analysis (LCBA), which will serve as the outcome of the project and targets financial priorities of building owners, operators and tenants. (Theriault, 2008). The main priority of this research paper will be to find solutions and provide recommendations for the Canem team to aid with the internal process of performing a Life Cycle Cost Benefit Analysis (LCCBA).

According to Canem's standards, the details of the research will focus on three primary components when contemplating the lifecycle costing of a building:

1. **Capital costs:** This component considers all repairs, upgrades, and replacements of systems over the lifecycle of a building.

2. **Operational and behavioral costs**: This component overviews organizational structures, tenant and building owner behaviors over time, and further assists sustainability development based on organizational structures that rule and administer a building.

3. **Energy costs**: This component analyzes the costs of fuel over time and energy savings that can be optimized through lifecycle services and energy management planning.

There are a few lifecycle tools and frameworks available for assessing existing building stock, retrofits and new buildings in order to address and model lifecycle costing for Canem Systems Ltd. There is a wide range of software that is available online to enable strategic planning on energy management. This particular software assesses energy consumption and identifies energy potentials. Further, they help set energy efficiency targets and the best practices to identify projects with the highest return on investment.

As a result this represents the ultimate goal of this research paper as to find solutions for Canem to implement in their strategies for new incentives and technologies toward a successful return on their customer's investments.

Life Cycle Costing and its benefits

According to green building experts, there are numerous examples of how the human performance is critical in any comprehensive cost analysis of commercial green building construction projects (Nalewaik & Venters, 2009). For example, (Nalewaik & Venters, 2009) argue that a credible argument can be made that building green can be justified and tangible economic returns realized for investors. The mistake that some builders make is not doing an accurate and comprehensive cost benefits of building green and then comparing that data with the cost of building with traditional building products. In addition, (Pushpala, 2011) provides intriguing insights in the identification and subsequent evaluation of various proven methods, new technologies and specific tools that can be used effectively and efficiently in the construction of green buildings. Thus, (Pushpala, 2011) argues that if these groundbreaking methods, new technologies and the relevant tools it is possible to build green buildings that are much more efficient and have a much smaller carbon footprint and in turn will generate ongoing cost savings and financial benefits in both the short-term and long term life of the building.

Moreover, David Gottfeied the founder of the USGBC that was the first green building council that is now firmly established and maintained in over

eighty countries and is internationally recognized as the developer of the LEED green building evaluation system that has been used in the evaluation of how green buildings are for over fifteen years. He has a lot of hands-on experience in building green buildings both large and small and the LEED green building evaluation system is internationally recognized by governments, builders and architects and is a highly sought after certification for the environmentally conscious public (Abraham et al., 1996). In addition, (Abraham et al., 1996) argues that utilizing the life-cycle cost benefit analysis is an appropriate project specific formula that will be able to provide both builders and investors with all of the financial information about the economic viability of building a green building and then comparing the costs and benefits of building a non-green building. A key point that emerges from (Abraham, et al, 1996) is that the life-cycle cost benefit analysis is the gold standard when it comes to evaluating the economic viability of green building. The fact that the life-cycle cost benefit analysis is legitimized by David Gottfeied the founder of the LEED green building rating system provides credible legitimacy and relevancy of this particular mode of analysis.

While (Helgeson & Lippiatt, 2009) provides an in-depth analysis of specific analytical tools and related metrics that are essential tools that work in

conjunction with financial investments that are put into sustainable green buildings by both the building owners and the subsequent stakeholders. A key finding that (Helgeson & Lippiatt, 2009) make is that building green has proven and will continue to prove that building green is cost effective. Although, both authors caution that some of the evidence used to support claims about the economic viability of building green is not always credible and able to stand up to rigorous analysis. Thus, (Helgeson & Lippiatt, 2009) have developed several useful tools that will facilitate a more accurate assessment of the short-term and long-term economic performance of green buildings by specifically focusing on the environmental assessments such as the LEED green building certification system.

Theriault (2008) who is a facility management consultant provides a comprehensive review of the initial front end initial costs of building green and then compares these costs with initial costs of building a non-green building. As well, (Theriault, 2008) makes a key finding that the upfront cost of a building in actuality is only fifteen percent of the complete cost of a life-cycle of a building. In addition, (Theriault, 2008) claims that a common miscalculation made by building owners is that they do not take into account the eighty five percent cost of the building and because of this oversight the subsequent life-cycle of the

building in question substantially increases. According to Theriault (2008) what building owners should do instead is to invest their capital on the front end or initial cost of building green and by doing so they will reduce the total cost of a particular life-cycle building. Thus, this is an important point that will have to be considered by Canem Systems Ltd in the investigation of the financial justification for utilizing "green" buildings rather than a conventional building design.

A common theme that emerges from the scholarly research is that if the life-cycle cost analysis is going to be utilized, it has to be done so correctly or its findings will be of no benefit to the builders and the stakeholders. According to (Catalli & Nielsen, 2010) it is very important that the LEED is useful in clearly and concisely identifying green buildings and more importantly, the level of their carbon footprint and impact on the environment. Further, (Catalli & Nielsen, 2010) argue those factors such as ongoing productivity, full retention, valuation and a full understanding of the potential of the risks are critical factors that must be fully understood and appreciated such as in Canem's case in which they are to provide the building owners with a Life Cycle Cost Benefit Analysis in determining the full and complete cost of building ownership.

According to (Buys, et al., 2011) a common mistake that building owners make is that they often miscalculate or even underestimate Life Cycle Cost Benefit Analysis (LCCBA) because they are only focusing on getting an immediate financial return and mistakenly undervaluing the long-term and cost-savings of front-end or initial expenditures and energy efficient investments that will be realized for the life of the green building. Once again, it is clear that some building developers and stakeholders are not fully familiarized with Life Cycle Cost Benefit Analysis and this can undermine its true value in providing a complete financial analysis of a green building and in comparing it with a traditional non-green building. It would seem that there have been cases when the LCCBA was used incorrectly and did not provide an accurate assessment of the economic viability for choosing to build a green building that has a much smaller carbon footprint than the carbon footprint of a traditional building. Thus, I would argue that the misapplication of a LCCBA would have just as adverse an effect as choosing not to use it at all.

Clearly, it is vital for prospective building owners to have a thorough and complete financial understanding of the amount of financial resources a green building will have both at the initial stage and in the long-term during the life of the building. Since there is significant cost savings in terms of green buildings

consuming less fossil fuels and several other efficiencies that will provide tangible financial benefits for both the building owner and the stakeholders. Although, (Pollin & Garrett-Peltier, 2009) point out that there are other external factors that building owners need to consider prior to their commitment to build a green building. They argue that it is vital to take into account factors such as economic recessions and high rates of unemployment that could reduce the number of people that want to invest in green buildings (Pollin & Garrett-Peltier, 2009). Thus, building owners may not want to invest in a green building unless it can generate a significant return on their investment in the shortest amount of time as possible. Also, in a time of economic uncertainty that may tend to diminish the pool of capital that normally would be available to undertake the construction of green buildings. As well, (Pollin & Garrett-Peltier, 2009) provide valuable insights about what factors make green buildings a viable investment to discerning investors and Canem could use this information when analyzing their respective life cycle cost analysis program.

Further scholarly research on the validity of the LCCA is provided by Professor Norris (2001) who provides insights about the useful information that can be taken from the LCCA. The theme that emerges from Norris's research reinforces the importance of taking into account both economic viability and

environmental performance in two specific areas: in the building process itself and in the product design stage. As well, (Norris, 2001) attaches a great deal of importance to the marketing of the green building and this information may be useful to Canem as it calculates the initial costs of high performance buildings and the subsequent marketing campaign. Therefore, (Norris, 2001) argues that the LCCA is a useful tool if all of the information entered into is correct and that its findings are validated and communicated clearly and concisely. Since a misinterpretation of the LCCA would result in decisions being made based on the faulty interpretation of the findings and that benefits no one.

While (Fuller, 2010) who is an economist and an expert in benefit-cost analysis claims that the LCCA is a useful tool to accurately assess the actual costs associated with the building and maintaining of buildings. The research and findings of studies done by (Fuller, 2001) confirm the validity of the LCCA as long as it is done correctly. Thus, this particular scholar provides several case studies to reveal that LCCA can be utilized in a way that provides useful and insightful information for a builder or investor who is considering investing their money in a green building or a traditional building. Thus, it is essential that the LCCA can be useful because of the viable solutions that it may offer to prospective builders and investors in both green buildings and traditional

buildings. Hence, this research has shown that the LCCA is an effective tool if it is used properly and if it is given the opportunity to prove its worth for Canem Systems and for this particular project.

As long as Canem Systems advises the client about exactly what the Life Cycle Cost Benefit Analysis is and stress how it can be utilized as a credible tool in order to determine whether or not it is economically viable to proceed with incorporating a green system or a conventional trend. The research that I have undertaken has a common theme that weaves through all of the scholarly research and that is the LCCBA can be a useful tool if it is presented and its findings explained by a person who has the knowledge and expertise to make informed opinions from the financial data that has been collected. As has happened several times the LCCBA has been used incorrectly or its insights have not been fully utilized in some instances. However, in the vast majority of cases when the LCCBA was used correctly and its findings communicated clearly and concisely to building developers, building owners and other stakeholders, it proves to be invaluable.

Recommended Software and Tools

There are software to be considered when applying LCCA which is useful for Canem when applying it to certain projects. I would suggest MARS by Whitestone research as a useful component relevant to this research. However this is a costly program which can be replaced by a free software available online (Whitestone, 2012). BEES is non-premium software available online for variety of organizations to use it as part of their projects to initiate LCCA development along their path toward a sustainable development (BEES, 2012).

The research that I have undertaken for this project, I believe proves conclusively that the LCCBA is a vital opportunity to present the economic viability and long term benefits of building green to an audience that typically wants to know what will be the return on their initial investment and how long will they have to wait to receive that return. However, my research has shown that there is a new type of property investor that is very knowledgeable and acutely aware of the precarious state of the environment. Thus, for this particular clientele I am confident that they will utilize the LCCBA and fully appreciate the economic viability of building green both in the short-term and in the long term. Hence, it is elucidated that the demand to build green will continue to increase

as people's concern for the environment continues to increase and it is the building developer who targets these particular people will most likely garner the greatest economic rewards. The final point to take from this report is that the LCCA is the most practical and efficient way for Canem Systems Ltd. to investigate the financial viability of choosing to go green or high-performance buildings rather than opt for a conventional building design.

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