

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/284186948>

Can sustainable buildings cost the same as conventional buildings?

Conference Paper · June 2009

CITATION

1

READS

194

3 authors:



Ana Jacomit

8 PUBLICATIONS 40 CITATIONS

[SEE PROFILE](#)



Vanessa Gomes Silva

University of Campinas

104 PUBLICATIONS 309 CITATIONS

[SEE PROFILE](#)



Ariovaldo Denis Granja

University of Campinas

99 PUBLICATIONS 321 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Green Building Tecnologias Verdes | CPFL [View project](#)



Construction Management Research Laboratory (LAGERCON) [View project](#)

CAN SUSTAINABLE BUILDINGS COST THE SAME AS CONVENTIONAL BUILDINGS?

Ana Mitsuko JACOMIT¹
Vanessa Gomes da SILVA²
Ariovaldo Denis GRANJA³



- ¹ Construction Management and Technology Research Group (GTE), Department of Architecture and Construction (DAC), School of Civil Engineering, Architecture and Urban Design (FEC), University of Campinas(UNICAMP), Campinas, Brazil, anamjacomit@gmail.com
- ² Department of Architecture and Construction (DAC), School of Civil Engineering, Architecture and Urban Design (FEC), University of Campinas (UNICAMP), Campinas, Brazil, vangomes@fec.unicamp.br
- ³ Construction Management and Technology Research Group (GTE), Department of Architecture and Construction (DAC), School of Civil Engineering, Architecture and Urban Design (FEC), University of Campinas (UNICAMP), Campinas, Brazil, adgranja@fec.unicamp.br

Keywords: sustainable buildings, green buildings, cost management, target costing

Abstract

There is a broad consensus both with regard to the general attributes that constitute greenness and the subjectivity of the concept of ideal building. It is not detectable when it comes to weighting of green attributes that would allow for an universally accepted way to compare diverse green attributes. There is also a widespread perception that sustainable buildings cost more to be built. However, if the green attributes are integrated into design at early stages and proactively value-managed, the authors submit in this paper that it is possible to achieve minimum or null green premium. Based on data from available cost reports, this study aims to identify the determining factors to allow a green project not to exceed its reference budget (without sustainable features). LEED™ is adopted herein as a common basis for comparison, because all cost reports analyzed refer to data collected in the American context and explicitly refer to this rating system. The most usual analysis of economic feasibility for implementation of a given LEED point or a certain LEED certification level is based on an isolated, point-by-point basis. That means that *costs are always added* to a reference budget. Though it is indeed the most practical approach, to consider cost efforts in isolation is presumed to be flawed. Target costing, a value engineering-based strategic approach for development of new products, is therefore envisioned as a potential alternative to ensure that sustainable buildings cost at least the same as conventional buildings.

1. Introduction

Despite the modern green building movement is little over a decade old, the term sustainable or green architecture as a modern, integrated design philosophy is far more recent. Also, even though the broad consensus with regard to the general “greenness” attributes and the subjectivity of the concept of an ideal building, it is not detectable when it comes to weighting of green attributes that would allow for an universally accepted way to compare diverse green attributes. Some examples are improved human health, reduced water pollution and reduced deforesting. Because of the wide range of “green” attributes considered, no single scientific denominator exists, and weighting reflects best judgment

rather than scientific determination (Kats 2003a). A number of building environmental assessment methods has been developed since the early 90's. Among them¹:

- The British Research Establishment Environmental Assessment Method (BREEAM), launched in 1990;
- Canada's Building Environmental Performance Assessment Criteria (BEPAC), began in 1994 (this system was never fully implemented due to its complexity);
- The Hong Kong Building Environmental Assessment Method (HK-BEAM);
- Leadership in Environmental and Energy Design (LEED™) Green Building Rating System started to be developed by the US Green Building Council (established in 1993) in 1994. At the time of writing, the current version of the LEED™ standard was 2.2, published in October 2005 (USGBC 2005);
- CASBEE, the Japanese approach, based on the eco-efficiency concept;
- Green Stars, developed in Australia and now also used in New Zealand and South Africa, as a combination of the strongest features found in LEED™ and BREEAM.

LEED™ is adopted herein as a common basis for comparison, because all cost reports analyzed (Kats 2003a and 2003b; Matthiessen and Morris 2004 and 2007; BNIM Architects 2002) refer to data collected in the U.S. context and explicitly refer to this rating system.

LEED™ was developed by the United States Green Building Council (USGBC), a non-profit organization, to rate new and existing commercial, institutional, and high-rise residential buildings according to their environmental attributes and sustainable features. The LEED™ system uses a list of 34 potential performance-based credits that worth up to 69 points, as well as 7 prerequisites, distributed across six categories: Sustainable Sites, Water Efficiency; Energy and Atmosphere; Materials and Resources; Indoor Environmental Quality and Innovation & Design Process. The number of points achieved by the building determines the appropriate level of LEED™ certification². Four levels of LEED™ certification are possible to be achieved, depending on the number of criteria met (Certified – 26-32 points; Silver – 33-38 points; Gold – 39-51 points and Platinum 52-69 points), indicating increased levels of sustainable building practices implementation (USGBC 2005).

The benefits of building green include energy and water savings, reduced waste, improved indoor environmental quality, lower operations and maintenance costs. Furthermore with more natural light and better air quality, green buildings typically also contribute to improved employee and student health, comfort, and productivity. Both Kats reports (Kats 2003a, 2003b) identified an expressive large impact of productivity and health in the life-cycle savings, representing more than 60% of the total benefits related to green buildings. This percentage tends to increase for LEED gold and platinum. It reflects the fact that the direct and indirect cost of employees is far larger than the cost of construction or energy. Consequently, even small changes in productivity and health translate into large financial benefits (Kats 2003a). These reports classify the benefits of building green as "fairly predictable" – can be easily measured - energy, waste, water savings and operation/maintenance) and "relatively uncertain" (not precisely understood - productivity and health benefits).

A large number of ongoing research projects investigate possible correlations between increased productivity and health, and connected sustainable features. These studies vary widely in specific measured correlations and, generally, do not approach specific issues like sick days, health costs, employee turnover and respiratory impacts such as asthma and allergies (Kats 2003a). Nevertheless it is difficult to assess the real productivity and health benefits related to each sustainable feature - or to the sustainable building as a whole - but, clearly, the benefits are significant and not zero (Kats 2003a). But, even if they were, energy savings alone are expected to exceed the average increased cost associated with building green in less than 20 years (Kats 2003a, 2003b).

2. Usual economic feasibility approach for green buildings

There has been a widespread perception that green buildings — though more attractive from environmental and health perspectives — are substantially more costly than conventional design and may not be justified from a cost/benefit perspective (Bartlett and Howard 2000; Kats 2003b). But if it is mandatory that "green" or "sustainable" buildings follow some general directions, as using key resources like energy, water, materials and land more efficiently than buildings that are just built-to-code, these general directions will also represent the main benefits of green buildings.

¹ A complete list and discussion of Building Environmental Assessment Methods are presented Silva (2003), for example.

² A full list of prerequisites and credits is presented by USGBC (2005).

The most usual analysis of economic feasibility for implementation of a given LEED point or a certain LEED certification level is based on an isolated, point-by-point basis. That means that *costs is always added* in comparison to a reference budget, as the point checklist options are explored.

This approach was found in all reports reviewed for this paper. Based on the points either earned or attempted by the analyzed projects, Matthiessen and Morris (2004, 2007) discussed the feasibility of each LEED™ point. The 2004 report (Matthiessen and Morris 2004) analyzed which LEED™ points were targeted by each project studied. Another analysis undertaken with 10 Non-LEED-seeking buildings determined that these buildings could achieve between 15 and 25 LEED™ points without design changes. The same authors also determined that 12 points could be achieved by any building without any design changes and that 18 points could be achieved with a little or no additional costs. In the 2007 study, each prerequisite and point were discussed individually addressing economic and technical feasibility as well as the synergy between credits. The GSA LEED™ Applications Guide (GSA 2005) indicates the cost impacts of each LEED™ point and prerequisite based on a low-cost Gold-rated courthouse model elaborated to the study. This guide also evaluates high design impact credits and synergistic credits for design integration opportunities. In the GSA study (GSA 2005), 2 points were associated with high impact on costs, while 23 points were identified as having zero cost premium (excluding the points that could be acquired following the GSA standards or mandates), 4 had low cost premium; 3 had moderate cost premium and 12 with potentially significant design impacts, and therefore require early consideration and integration by the project team (GSA 2005).

This math however does not consider the so-called *synergistic credits*, related to design solutions that allow a project to attend more than one credit. Thus, once achieving that given point, a project can achieve more extra points, without any additional cost impact beyond that resulting from the first given point (Matthiessen and Morris 2007). Though indeed the most practical approach, considering cost efforts in isolation, we submit, is conceptually flawed, as **(1)** design solutions for sustainable building are – or should be – based on system thinking, instead of in isolated and **(2)** synergic effects of a given action, technology or strategy, could have on different points are not deducted from the total sum, inflating the final result (and imagined cost for elevating environmental performance) and even invalidating implementation of certain solutions.

Before answering if "*Can sustainable buildings cost the same as conventional buildings?*", an underlying question must be answered: "*Compared to what?*". According to Morris and Langdon (2007), there are three "methods" to assess how much the sustainable features will cost. The most common one is **(i)** comparing the cost of the green project with the original project budget or the original anticipated cost of the project. These authors pointed out two substantial problems with this approach: it assumes the original budget was adequate in the first place, and it assumes that no other changes or enhancements were going to be made. Nevertheless, this is a widely used methodology and is found in many of the studies of the cost of green projects, like BNIM Architects (2002) and Kats (2003a and 2003b). Another concern with this approach is that projects (being them either pursuing LEED certification or not) very rarely report meeting ends under budget. The range of reported costs, therefore, typically runs from no added cost to *some* added cost, most frequently resulting in positive cost premium. Morris and Langdon (2007) complement that this measure is challenging to use, since it is difficult to assess the reasonability of the original budget, or what other factors may have contributed to a project's budget performance. It is, therefore, the most subjective of the three measures (Matthiessen and Morris, 2007).

A second approach, also used in many green cost analyses, **(ii)** is to look at the cost of individual added green features, comparing the building to its baseline, *i.e.* without the green features. Such approach presents inadequacies (Morris and Langdon 2007), as separately pricing item by item does not consider solutions generated by integrated design and makes virtually impossible to determine their added cost (*e.g.* of improved daylighting through good orientation and space planning). Additionally:

- It tends to return positive values for the green premium because it views most green features as additive to a baseline project (add-on approach);
- It does not reflect design choices and trade-offs that are typically made during the design and construction process and that could make green premium neutral in practice.

A third approach **(iii)** is to compare the cost of a population of green buildings with the cost of similar programs but without green elements. This approach was adopted in the two David Langdon's cost reports (Matthiessen and Morris 2004, 2007). It eliminates some of the subjectivity on deciding what would have been built, or what it should have costed, but the approach adds in the challenges of finding an adequate population of comparable buildings and *deciding whether buildings are truly comparable*, given the significant variations between buildings (Morris and Langdon 2007). It also requires adjusting costs for time and location in order to bring the comparable buildings to a common base. Because of the heavy data demands, this approach is not widely used (Morris and Langdon 2007). Kats (2003a) criticizes this third approach, considering only the first approach meaningful to assess the cost of building green. The report says that attempts to compare the cost of a specific green building – such as a school – with other buildings of similar size and function in a different

locality provide little help in understanding the cost of green design, because the added cost impact of designing green may be very small compared with other building costs such as the cost of land and infrastructure (Kats 2003a).

3. Adopted research approach

This study was basically constituted of a literature review about the costs of sustainable buildings, and proposes a very first rationale of the concept of target costing applied to cost budgeting of green buildings, for which no conclusive study was found in the literature. However, cost reports were identified concerning the comparison between the cost of sustainable buildings and the cost of conventional buildings. The comparison was based on the following concepts:

- Cost of sustainable buildings (green cost) – considered as the cost of the projects which are seeking to achieve some LEED™ certification level;
- Cost of conventional buildings (conventional cost) – defined according to the comparative method adopted. These methods were introduced in section 2.

After defining what was going to be compared for the sake of this study, the costs reports were compared and analyzed. From this analysis, it was identified the shaping “issues” to a building achieve null green premium, *i.e.*: “green cost = conventional cost”. After identifying these issues the target costing approach was introduced as possible means to ensure that a building achieve null green premium. Finally, each issue was commented based on the target costing and sustainable buildings costs reports, aiming to justify and infer the introduction of the target costing approach to cost budgeting purposes of green buildings.

4. Can sustainable buildings cost the same as conventional buildings?

Clearly there can be no single, across-the-board answer to this question. While there seems to be consensus on the environmental and social benefits of green building, there is no consensus on financial benefits. The general perception, due to the lack of accurate and thorough financial and economic information, is that the introduction of sustainable construction practices will increase costs and reduce profit (Kats 2003a). Indeed, sustainable buildings generally incur a green premium above the costs of standard construction, but, they also provide an array of financial and environmental benefits that conventional buildings do not (Kats 2003a). These benefits, such as energy savings, should be looked at through a life cycle cost methodology, not just evaluated in terms of upfront or initial costs.

In their pioneer study “Building for sustainability”, BNIM Architects (2002) released the Sustainability Matrix and Sustainability Report, developed to consider environmental goals for the new office facility for the David and Lucille Packard Foundation. The matrix summarized the important issues regarding sustainability issues, indicating, for each LEED™ certification level, for example the plan, energy consumption, pollution for building operation, construction costs and life cycle costs. The study’s main findings can be seen in Table 1.

From a life cycle savings standpoint, savings resulting from investment in sustainable design and construction dramatically exceed any additional upfront costs as shown by the Sustainability Matrix (BNIM Architects 2002) and the “Costs and Financial Benefits of Green Buildings Reports” (Kats 2003a, 2003b). These last cost reports reviewed and analyzed 33 individual LEED™ registered projects from across the United States, completed between 1995 and 2004. These projects were chosen because relatively robust cost data for both actual green design and conventional design was available for the same building. The main findings, as shown in Table 1, were that the average premium for the green buildings analyzed was slightly less than 2% (or \$3-5/ ft² in California), substantially lower than is commonly perceived, with some buildings reporting no added cost; and that this increase in upfront costs would, on average, result in life cycle savings of 20% of total construction costs – more than ten times the initial investment (Kats 2003a, 2003b). The majority of the additional cost is due to the increased architectural and engineering design time necessary to integrate sustainable building practices into projects (Kats 2003a, 2003b).

The cost of incorporating sustainable design elements will also depend on a wide range of factors, including building type, project location, local climate, site conditions, the stage that green attributes get incorporated into the design process, and the familiarity of the project team with sustainable design (Morris and Langdon, 2007). Despite expectations that building green would get less expensive over time for gradual increase in experience and number of green buildings, data analyzed by the Kats (2003a and 2003b) did not evidence such trend (Figure 1).

Table 1 Comparison between some available cost reports.

	Sustainability Matrix (BNIM Architects 2002)	Costs and Financial Benefits of Green Buildings Report (Kats 2003a, 2003b)	David Langdon Cost Report (Matthiessen and Morris 2004)	David Langdon Cost Report (Matthiessen and Morris 2007)
Method	(i) compare the cost of green project with the original budget	(i) compare the cost of green project with the original budget	(iii) compare the cost of a population of green buildings with the cost of similar programs without green elements	
Number of buildings analyzed	One 90,000 ft ² \$10 million building	33 LEED TM registered projects	138 – 93 non-LEED TM -seeking (NL) and 45 LEED-seeking (L) buildings	221 – 138 non-LEED TM -seeking (NL) and 83 LEED-seeking (L) buildings
Kind of buildings	1 office facility	25 offices and 8 schools	52 academic buildings; 49 laboratories; 37 libraries	60 academic buildings; 70 laboratories; 57 libraries, 18 community centers, 17 ambulatories
Sustainability parameters	LEED TM Certified (C) LEED TM Silver (S) LEED TM Gold (G) LEED TM Platinum (P) "Living building"	LEED TM Certified (C) LEED TM Silver (S) LEED TM Gold (G) LEED TM Platinum (P)	Non-LEED TM -seeking buildings (NL) LEED TM -seeking buildings (L)	
Green premium	(C) 1% (S) 13% (G) 15% (P) 21%	(C) 0.66% (S) 2.11% (G) 1.82% (P) 6.50% Average 1.84% (or \$3-5/ft ² in California) Obs.: some buildings reported no added cost	0% - The authors concluded that as L costs fell into the wide range of NL costs of similar program type, it is possible to conclude that there is no significant variation between them	
Life-cycle Savings	30-year NPV (% LCC): C 14% S 13% G 18% P 19% 60-year NPV: C 30% S 42% G 56% P 62%	20-year NPV: C and S - \$48.87/ft ² G and P - \$67.31/ft ²	Not expressed in numbers	
Critiques	- Just one building analyzed; - Uncertainty to generalize to other buildings	- Tendency to show green premiums always positive; - Difficult to assess the reasonability of the original budget or what factors may have changed the budget	- Budgets of NL could be set with sustainability in mind; - Holistic analysis, it does not point out conclusive numbers	
Anomalies	- LCC savings (30-year NPV) for Silver certification (13%) slightly lower than for the first level of certification (14%)	- Green premium for Gold buildings (6 buildings 1.82%) slightly lower than Silver buildings (18 buildings 2.11%); - Green premium for silver buildings did not follow the cost trend (did not drop with time)		- Incoherence in the number of buildings analyzed: Total - 221 (informed) or 222 (sum) L - 83 (informed) or 86 (sum) NL – 138 (informed) or 136 (sum)
Notes			- Parallel analysis of the percentage of projects that tried to achieve each point; - Costs normalized for time and location; - Green premium determination not used in the final analysis	- Parallel analysis: Point by point feasibility; - Costs normalized for time and location; - Green premium determination not used in the final analysis

However, in a further analysis of location broke down data, authors verified a drop in green design cost over the last few years. The trend of declining costs associated with increased understanding and practice in green building construction has been experienced in Pennsylvania, Portland and Seattle. Portland's three reported and completed LEED™ Silver buildings were finished in 1995, 1997, and 2000. They incurred cost premiums of 2%, 1% and 0% respectively (Kats 2003b). Figure 1 also includes anomaly reported costs. Although, generally, cost levels increase when performance level requirements increase, there are cost levels records of LEED™ Gold buildings inferior to costs reported for Silver buildings (Kats 2003a, 2003b).

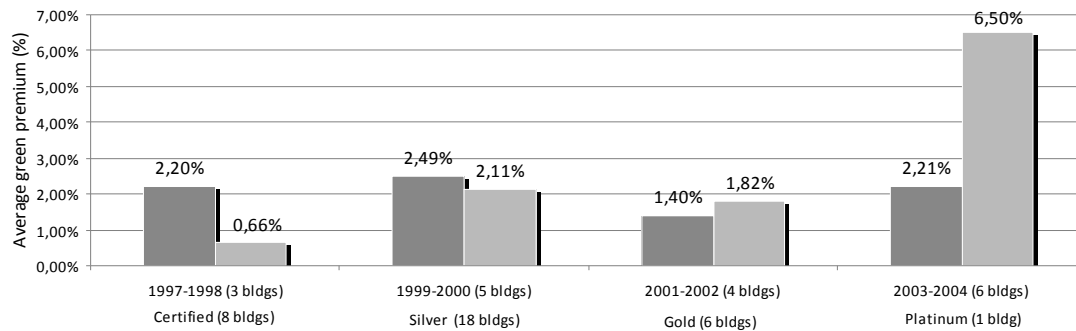


Figure 1 Average green premium for office and school buildings vs. date of completion (dark-colored columns, silver buildings only) and Average green premium vs. green certification level (light-colored columns) found by Kats (2003a).

Although Matthiessen and Morris (2004, 2007) adopted a different methodology for costs comparisons in their reports – and compared construction costs of buildings where LEED™ certification was a primary goal to similar buildings where LEED™ was not considered during design – they achieved similar results to Kats (2003a, 2003b). They concluded that there is no significant difference in average initial costs for green buildings as compared to regular, similar buildings. Many project teams are building green buildings with little or no added cost, and with budgets within the cost range of non-green buildings with similar programs.

The wide variation in cost per square foot across buildings, even without taking sustainable design into account, certainly contributed to the lack of statistically significant differences between the LEED™-seeking and non-LEED™ buildings. The overall conclusion pointed out by these reports was that *comparing the average cost per square foot for one set of buildings to another does not provide any meaningful data for any individual project to assess what – if any – cost impact there might be for incorporating LEED™ and sustainable design.* Although it is likely that, in some of those cases, budgets of non-LEED™ buildings were set with sustainability in mind – making the finding for those projects less meaningful – it became clear that the most successful ones were those which had clear goals established from the start, and which integrated the sustainable elements into the project at an early stage (Matthiessen and Morris 2004; Morris and Langdon 2007). Projects that viewed the elements as added scope, tended to experience the greatest budget difficulties (Matthiessen and Morris 2004). More details about Matthiessen and Morris (2004, 2007) reports are presented in Table 1.

As the various methods of analysis showed, there is no 'one size fits all' answer to the question of the cost of incorporating green features in buildings (BNIM Architects 2002; Kats 2003a and 2003b; Matthiessen and Morris 2004 and 2007). It is possible to conclude though that many projects can achieve sustainable design within their initial budget, or upon small supplemental funding. In general, significant additional funding was identified only for specific, high embodied technology features, such as photovoltaic systems (Matthiessen and Morris 2007).

5. Determining factors for targeting null green premium

As it was pointed out before, there is a number of factors that influence both feasibility and cost as well as barriers to overcome before proceeding with development of sustainable projects. Having assessed all these issues, it is necessary to define the sustainability goals. Generally, the sustainability goals are established based on the chosen level of certification of a given rating method. Once sustainability goals have been defined, including which points are going to be targeted, it is essential to incorporate the sustainable goals into the design. But which possibilities to explore in order to do it without over spending?

One of the fundamental answers is through design process integration. Reed (2004) highlights that even though the purpose of LEED™ rating system is to present the assessed issues as a grouped system; it actually grades a client and design team's willingness to reduce impact in these broad areas. The author also stresses that there is a danger that users think that LEED helps create sustainable buildings, while what it actually does is to help people create buildings that have some features that lead toward a sustainable future. LEED - and other rating systems - should better be understood as a set of training wheels to help people move to higher levels of systems thinking, that would ultimately lead to more sustainable building. In fact, one can't really do a sustainable building cost effectively without a reasonable level of integrated systems thinking. Moving towards sustainability means to move towards more complex system awareness. This way of approaching problems helps to address and make use of many more issues and systems than typically addressed when working within a conventional framework. Sustainable design requires a different mindset or mental model, able to look at systems in a more complex way, which looks beyond the physical elements of the building to also encompass the invisible connections between the elements that need to be understood. This system view requires a collaborative approach. Projects that achieved the high environmental goals they originally set out to achieve within budget have done so not because of adding technology and products to the building, but because they had the willingness to focus on the environmental issues as essential to the success of the design. The environmental concerns were not secondary, nor were they dominant. They were just an integral part of the design (Reed 2004).

Another possibility, as proposed in this paper, may be through a strategic concept for new product development called target costing. Target costing was developed over the last 30 years by Japanese car manufacture companies, in particular by Toyota and Nissan, from the principles of the American value engineering (Monden 1995, Nicolini et al. 2000). Together with value engineering, they are considered cornerstones of Japanese cost management programs, but had not received as much attention in the West until recently (Cooper, 1997). Nowadays, target costing is applied worldwide in different industries, and some abstracted models are already available in the construction industry (Monden 1995, Nicolini et al. 2000, Ballard, 2006, Robert and Granja, 2006). Target costing aims to ensure that the resultant cost from a composition of required characteristics of a product does not go beyond a certain target (or allowable) cost determined by the maximum sale price that the market is willing to pay for the product, after ensuring the company's profits (Monden 1995). A framework summarizing the main steps in a product development system applying target costing can be seen elsewhere (Jacomit et al., 2007).

From the previous examination of the cited cost reports, it was also possible to identify aspects that remount to a value engineering approach and thus also represent the key features for the target costing approach, such as: determination of the value for the client; integrated design process; cost/design breakdown; life-cycle costing; features incorporated at early stages; multi-disciplinary teams; workshops; design/cost trade-offs; supply chain integration; and special contracting.

In the present paper, authors' major intent is to provoke further exploration of the target costing approach to change the established mindset of designers, market and further stakeholders. We submit that sustainable buildings do not necessarily demand additional supplemental funding to be built. The proposed framework includes establishing the target cost as the cost determined by the original budget (assessed for the previous design without green features) and applying value engineering to reduce the green premium to zero, *i.e.*, making the costs of a sustainable building equals its budgeted baseline cost, without green attributes. This framework is already in further conceptual development by the authors.

6. Conclusions

This study analyzed some available cost and benefits reports aiming to evaluate if sustainable buildings can cost the same as conventional buildings and to identify the determining issues to a green design approach not exceeding its originally budget baseline. Holistic consideration of these issues remount to a value engineering approach and thus also represent the key features for the target costing approach.

Explicit references to target costing implementation in the green buildings context were not identified in the literature. Even in the overall construction industry, this approach was not conclusively proved to be effective yet. Additional research is therefore required to validate and determine the feasibility of this approach, as well as studies about the required conceptual and methodological adaptations of the target costing approach to sustainable buildings.

Financial gains from construction projects endeavors have the most significance when joined together with the process of creation, perception and delivery of value to stakeholders, organizations and communities. However there are anecdotal evidences that the construction sector achieves its results

by counting on uncertainty and waste ingrained in its processes. The target costing approach, ultimately a proactive product development process, is presented in this paper as a possible strategy not only to change construction's agents' mindset, but also a promising concept to be explored in the context of green buildings.

7. References

- Ballard, G.; Pasquire, C. (2005) **Commercial project management**. United Kingdom, 2005.
- Ballard, G. (2006). "Rethinking Project definition in terms of Target Costing". *Proceedings... of the 14th Annual Conference on Lean Construction, Santiago, Chile*.
- BNIM Architects (2002). Building for sustainability: Sustainability Matrix. Sustainability Resources. The David and Lucile Packard Foundation: Los Altos project. Available at www.bnim.com/fmi/xsl/research/packard/index.xsl
- Cooper, R.; Slagmulder, R. (1997). *Target costing and value engineering*. Productivity Press, Portland, 379 p.
- _____ (2005). GSA LEED® Applications Guide. Steven Winter Associates, Inc. (SWA) of Norwalk, Connecticut and Washington, DC. Available at www.wbdg.org
- Jacomit, A. M.; Granja, A. D.; Picchi, F. A. (2007). Target costing research analysis: Reflections for construction industry implementation. *Proceedings... of the 16th Annual Conference on Lean Construction*, Manchester, UK.
- Kats, G. H. (2003a). "The Costs and Financial Benefits of Green Buildings – A Report to California's Sustainable Building Task Force", California, USA. 134 p. Available at <http://www.scribd.com/doc/1790771/Environmental-Protection-Agency-news477>
- Kats, G. H. (2003b). "Green Building Costs and Financial Benefits". Massachusetts Technology Collaborative, Massachusetts, USA. 10p. Available at <http://www.cap-e.com/ewebeditpro/items/O59F3481.pdf>
- _____ (2005). LEED® for New Construction & Major Renovations V. 2.2. The United States Green Building Council (USGBC). Available at <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=220>
- Matthiessen, L. F.; Morris, P. (2004). "Costing green: a comprehensive cost database and budgeting methodology". 27 p. Available at <http://www.davislangdon.com/USA/Research/ResearchFinder/2004-Costing-Green-A-Comprehensive-Cost-Database-and-Budgeting-Methodology/>
- Matthiessen, L. F.; Morris, P. (2007). "Cost of green revisited". David Langdon Management. 25 p. Available at <http://www.davislangdon.com/USA/Research/ResearchFinder/2007-The-Cost-of-Green-Revisited/>
- Monden, Y. (1995). "Target costing and kaizen costing", Productivity press, Portland, Oregon, 373 p.
- Morris, P.; Langdon, D. L. (2007). "What does green really cost". The green issue feature. Available at <http://www.davislangdon.com/USA/Research/ResearchFinder/What-Does-Green-Really-Cost/>
- Nicolini, D.; Tomkins, C.; Holti, R.; Oldman, A.; Smalley, M. (2000). "Can target costing and whole life costing be applied in the construction industry?: evidence from two case studies". *British Journal of Management*, Blackwell Synergy Publishing, London, UK, 11 (4) 303-324.
- Reed, W. Sustainable Design: Moving towards Integrated Design in a Disintegrated World. December 2004. 5pp. Available at <http://www.integrativedesign.net/files/u1/Sustainable.pdf>.
- Robert, G. T.; Granja, A. D. (2006). "Target and Kaizen Costing Implementation in Construction". *Proceedings... of the 14th Annual Conference on Lean Construction, Santiago, Chile*.
- Silva, V. G. da. (2003) "Sustainability assessment of office buildings in Brazil: guidelines and methodological basis". Doctor Thesis. Civ. and Urban Const. Eng., Polytechnic School, University of São Paulo, São Paulo-SP, Brazil, 210 p. (in Portuguese)