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Beyond Sustainability: The Contractor's Role in Regenerative System Design

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Abstract
Current business models employ the concept of the triple bottom line to integrate three aspects of sustainability into the organizational process: economic growth, environmental protection and social equity. This concept is evolving toward a regenerative design approach that promotes a triple "top" line, moving accountability to the beginning of the design process by assigning value to a variety of economic, environmental and social factors. There is an increasingly important need for proactive participation from the construction community in this new generation of sustainability efforts. Otherwise, there will be a widening gap between design and construction, in which the contractor role in sustainability is marginalized, relegated to merely minimizing end-of-project impacts rather than adding value and innovation throughout the project. This paper examines the triple top line in the context of construction projects and identifies opportunities for construction professionals to play a collaborative role in developing the next generation of regenerative facilities.

Sustainability and the triple bottom line

Business leaders today are beginning to incorporate the idea of sustainability into their corporate culture by measuring performance against three concerns: economic growth, environmental protection and social equity. These three concerns comprise what is referred to as the triple bottom line. In the realm of the built environment, the theme of the triple bottom line is expressed through a wide range of design and construction approaches, sometimes interchangeably referred to as sustainable, green, or high performance.

A design approach focused solely on the bottom line tends to emphasize resource efficiency measures or initiatives that meet the triple bottom line by minimizing the impacts of the project. This strategy for managing negative effects establishes an agenda for sustainability built on being "less bad" and is often a measure of the degree to which a company has minimized a liability (McDonough and Braungart 2002). To date, this has been the objective when design professionals encourage contractor involvement in sustainable building projects.

Previous studies identify a number of ways in which construction input during the design process assists in achieving sustainability goals for building processes, materials, and quality (Pulaski et al. 2006, Riley et al. 2003). Commonly identified areas of contractor expertise include estimating, procurement and constructability review services during preconstruction, and assisting with construction waste and indoor air quality management planning. Contractor participation on this level, while contributing to the sustainability goals for the project, does so using an economically focused, triple bottom line perspective aimed at maximizing efficiency by reducing field labor costs and material waste. The perceived challenge is to somehow manage the inefficiencies and additional expenses related to the iterative design process, higher construction standards, additional site

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precautions, and new materials requirements of sustainable building projects. Adherence to this approach can obscure opportunities to pursue innovation and create value in the design process.

Regenerative design and the triple top line

Current rating systems for high performance or green building projects award points for relative efficiency improvements in the use of energy, water and materials resources. From the standpoint of the end use of the project, the constructability review provides the greatest opportunity for the constructor to add value by identifying synergies and improvements to project performance and quality. Yet, all design improvements remain focused on the final product and the end user. As such, the construction process itself, which includes the human resource of construction labor crews, and the environmental and social impacts on the surrounding community during construction are largely unrecognized.

A new design perspective is to create a *triple top line* strategy: a project experience that enhances the well being of the end users, construction workers, and the surrounding community, while at the same time, generating economic value for all the contractual parties. This is in contrast to the manner in which many projects are managed when the focus is solely on the end user, failing to imagine or anticipate complaints from the community, a fine from the regulatory agency, or perhaps something more severe, such as the recent collapse of a pedestrian walkway next to a construction site in San Diego. The triple top line approach moves accountability for these impacts to the beginning of the design process by assigning value to a variety of economic, environmental and social factors. The goal is not to try to balance competing interests but to optimize and maximize value in all three areas through intelligent design.

Triple top line thinking shifts the design approach from compliance to commitment or sustainable to regenerative. Whereas the sustainable design approach only slows the rate of destruction, design practices not only need to do no harm, they must initiate regenerative processes to replace the degeneration resulting from past practices. A regenerative system is one that goes beyond maintaining a certain level to actually produce more: more profit, a healthier environment, and a better quality of life for the people involved (Patelski and Poling 2008). Regenerative design is the proposed design approach that best reflects the thinking that will shape the next phase of development within the field of sustainable design (Mang 2001).

Within the context of construction projects, the concepts of regenerative design and the triple top line raise new questions that are seldom considered during the design process:

- Is the contractor positioned to provide a service rather than supply a commodity? (economic – social)
- Do the selected materials, tools and equipment employ a sustainable supply chain? (economic – social)
- Does each contractual relationship within the project organization support innovation and collaboration to achieve the project goals? (economic – social)
- Does the project/community interface provide a safe, secure and educational opportunity for the public to experience the building process? (social)
- Does the project value and contribute to the health and safety of the construction worker as well as the end user? (social-environmental)
- Does the timing of the project take advantage of optimum weather and site conditions? (environmental - social)
- Does the project mimic the functions of nature to preserve or restore ecologic processes? (environmental)
- Do the construction methods and selected equipment make efficient use of resources? (environmental – economic)
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- Are there opportunities to provide incentives to subcontractors for meeting or exceeding sustainability goals? (economic – environmental)
- Is the concept of sustainability promoted throughout all branches and levels of the project organization? (all)

Typical construction practice would be to view these questions and immediately consider only how they are going to impact the project's bottom line. However, these questions should not be viewed as imposing costly restrictions, but as raising opportunities to identify economically viable ways to add social and environmental value. The parenthetical items for each question identify where in the regenerative model (discussed below) they occur.

Implementing the triple top line using the regenerative model

The key to discovering and realizing opportunities for adding value using a triple top line approach lies not only in early involvement by the constructor, but in alignment of the entire project team with triple top line values.

Pulaski et al (2006) make a compelling case for the urgent implementation of project management practices to strengthen integration between design and construction disciplines and manage sustainable design knowledge of green building projects.

Current management systems such as the balanced scorecard align well with triple bottom line models. The balanced scorecard is a strategic planning, management and communications system in which the work people do is aligned with an organization's or project's vision and strategy, in order to align strategic objectives with resources (Rohm 2008). The scorecard system includes a strategy map, to show how value is created for members (owner, A/E/C partners, end user, construction workers, community), strategic objectives to describe what needs to be accomplished to produce value, what performance measures will be used to measure progress against targets, and what strategic initiatives have been identified to make strategy actionable and operational.

The balanced scorecard, when applied to the triple bottom line, provides a framework for defining the strategy, matching it with resources, determining how it will be assessed, and communicating it to all stakeholders. It identifies who has accountability for implementation, and suggests ways to recognize and reward performance. However, the balance scorecard suggests a zero sum approach to limit liabilities of competing perspectives rather than maximizing value.

Implementing triple top line thinking also requires a champion and action by the management team. An adaptation of McDonough's fractal triangle provides an appropriate framework for shifting sustainable design-construction integration from a balancing (bottom line) to a maximizing (top line) approach. This approach provides a framework for regenerative design-construction planning.

When planning a project, the team moves around the triangle investigating the value creation potential for each category; economic, social, and environmental. The goal is to maximize value of the entire system instead of minimizing liabilities through tradeoff. As illustrated on the model, the boundaries between primary perspectives provide value adding opportunities generally not considered in triple bottom line approaches. Figure 1 illustrates the fractal triangle model.

Eisenberg and Reed (2003) describe regenerative design as being place-based. It requires an understanding of how activities need to be aligned with the characteristics of the place in which they are occurring. Connection to the place or project ultimately requires a sense of ownership by all parties and a cascade of the regenerative process to all individuals.

The potential impact of contractor involvement using the triple top line approach is illustrated in the following three examples: cost savings from construction waste management (economic growth), regenerative features for conveyance of stormwater runoff (environmental protection), and improving the availability of a skilled construction workforce (social equity).

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Disposition of waste materials

At Greenbuild 2007, speakers presented a case study illustrating the savings realized from the reuse of concrete from demolition (Boecker et. al 2007). The Portola Valley Town Center project in northern California required disposition of 3,040 tons of demolished CMU block. After demolition, 2,470 tons of rubble was designated for

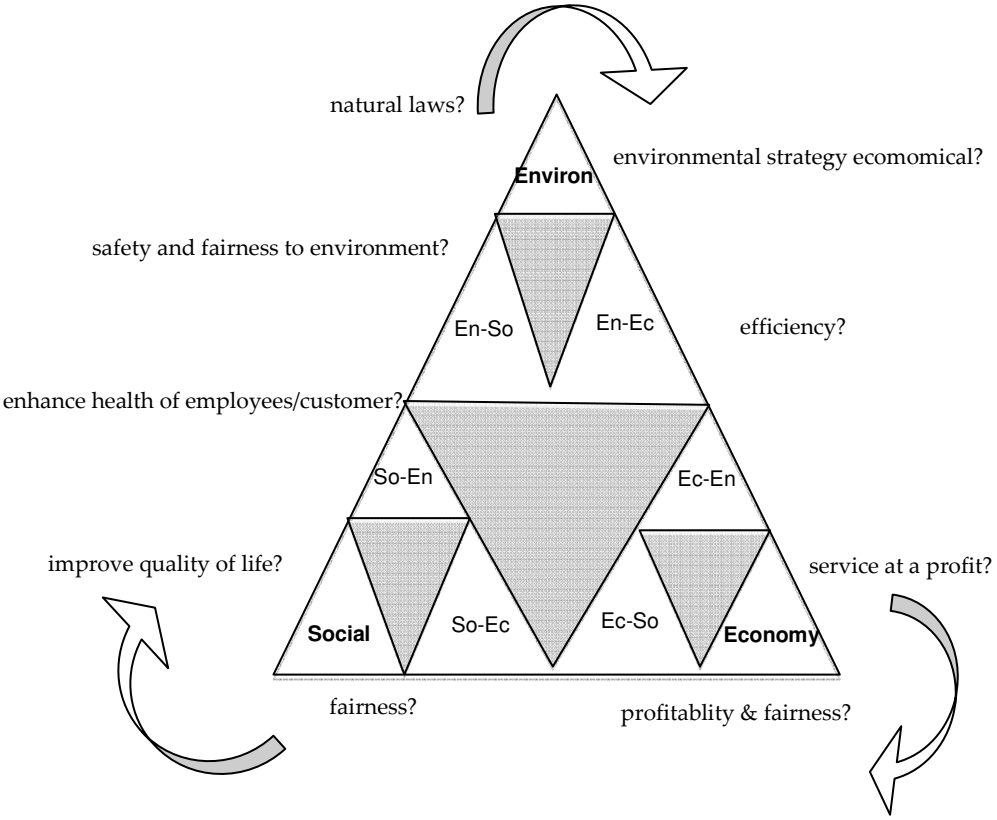

Figure 1. Fractal Triangle – Regenerative Model (adapted from McDonough and Braungart)

recycling and 570 tons was to be landfilled. The triple top line question was: Can the disposition of construction waste materials provide economic and environmental opportunity?

The project team decided to reuse the rubble onsite instead of importing base material for an area that was to be paved. The cost savings and reduced environmental impact realized went far beyond the savings associated with purchase of the base material. The project saved 1,049 gallons of diesel fuel that would have been used to truck the rubble to the recycling center and the landfill, and the base material to the site. Cost savings and reduced environmental impact were also realized by reducing truck use time, truck driver labor, and base material costs.

Regenerative design for stormwater runoff

Two of the goals in sustainable project design are the reduction of the quantity of stormwater runoff from the site, and the improvement of the quality of the runoff. Achievement of these goals generally requires a reduction in the amount of impervious surface area on site, and incorporation of erosion control measures to reduce sediment load in the runoff. The triple top line question is: Does the project mimic the functions of nature to preserve or restore ecologic processes?

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Berg and Underwood (2007) describe a regenerative design for constructing weirs and pools for non-erosive conveyance of stormwater runoff. Rather than adopting a traditional design utilizing pipes and concrete channels to convey runoff from impervious surfaces, the weir and pool system mimics the ecology of the local drainage area, contributes to local micro-habitat, and provides aesthetic value. To be economically viable, this approach requires close contractor involvement during the design phase because of the potential impact on jobsite layout and the site grading plan and sequence.

Regenerating a diminishing workforce

Skilled construction labor is a critical resource that is often taken for granted in facilities planning and design. Seldom are potential shortages in the skilled workforce considered during the design phase of a project, and yet those shortages can and do critically impact a project's schedule and thus its economic bottom line.

The current data underscore the importance of not just sustaining, but regenerating this human resource. According to the Bureau of Labor Statistics (BLS), there were 7,688,900 construction-related jobs in 2006, or 5.1% of the total U.S. employment (BLS 2007). Yet, the average craft professional is now 47 years old, largely because the construction industry is suffering from an image crisis. The labor issue can be even more critical in the sustainable building sector if workers are not available who have specialized training in building commissioning, construction waste management, materials storage and protection, photovoltaics, or other aspects of high performance building.

Construction work has the reputation of being dirty, physically demanding and unsafe. In their report for the National Center for Construction Education and Research (NCCER), Whyte and Greene (2008, p.1), write:

> *"Sons used to follow fathers into trades, yet today parents discourage their sons or daughters from pursuing career opportunities in the industry because of their perception of us."*

The relevant triple top line question is: Does the project value and contribute to the health and safety of the construction worker as well as the end user?

Construction Hazards Prevention through Design (CHPtD) is the process in which construction worker safety is explicitly considered during facility design (Toole and Gambatese 2008). In addition, constructor review during design can address whether design choices made to consider end user health and safety, actually transfer risk from the end user to the construction worker (Armenti 2004). For example, a change in materials or storage requirements may have a potential ergonomic impact associated with material handling. Only by addressing the health and safety of the construction worker when design decisions are made can the industry begin to change its image and not only attract new workers but extend the career length of the existing, skilled labor force. The triple top line approach poses the question about construction worker health and safety. The effect on the economic bottom line is a healthier, safer workforce that is more productive, and is attracted preferentially to a project with the worker's welfare designed in.

Conclusions

McDonough and Braungart make it clear that the triple top line does not obviate the need for triple bottom line accounting. A company cannot achieve sustainability unless it stays in business. But where the triple bottom line focuses on economic concerns, treating environmental and social factors as competing interests requiring compromise, the triple top line strategy recognizes that these factors provide previously unrecognized opportunities to create social and ecological as well as economic value. In this manner, the construction industry becomes a regenerative force in the built environment process.

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