SEED CERTIFICATION:
A framework for addressing triple bottom line sustainability

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ABSTRACT: There is a dire need for building design that effectively addresses triple bottom line sustainability through engaging social, economic, and environmental issues. This paper presents the principles of Social Economic Environmental Design (SEED) Certification as a framework for how communities and individuals can partner to achieve contextually specific, triple bottom line design interventions. To illustrate the qualitative and quantitative characteristics of a SEED certified project, this paper describes the Maa-Bara aquaponics project in Kenya, which is a 2013 SEED award winner. The project's holistic approach provides valuable lessons to the building industry where there is potential for passive and low energy architectural design to take on an expanded role and address community empowerment through consideration of materials, knowledge sharing, and income generation. If sustainable design for a renewable future is to be a shared societal goal and imperative, then certifications such as SEED will help projects not only consider innovations in environmental performance, but also in long-term, culturally appropriate, and community based design thinking that initiates social and economic change.
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INTRODUCTION
The word, "sustainability," now permeates the discipline of architecture though its meaning and impact are not always rigorously defined. In response to climate change and increased environmental awareness, architects are becoming more fluent in lowering the carbon impact of our buildings. While many projects demonstrate innovations for improved energy performance, few projects effectively incorporate social and economic advancements in conjunction with their rigorously pursued environmental targets. This paper describes the need and value of a certification system developed for architects, industrial designers, landscape architects, communication designers, and urban designers to address sustainability's triple bottom line of social, economic, and environmental impact. With the goal to use design and the design process to address a more comprehensive scope of contextually critical issues, the Social Economic Environmental Design (SEED) Certification adds values to projects by not only preventing empty claims to be "green" or "sustainable" but helps to ensure that projects achieve sustained positive impact in the communities in which they are located. This paper draws upon a SEED award winning project to demonstrate how systems thinking coupled with technological innovation can successfully address triple bottom line sustainability.

DEFINING THE TRIPLE BOTTOM LINE
While values associated with sustainability are not unique to this generation, it was not until the United Nations defined sustainability in its 1987 Brundtland Report that the term, "sustainability," began to permeate development conversations and practices. The report defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [1]. The United Nations continued to develop its definition of sustainable development and explicit mention of social, economic, and environmental components of the concept were defined in its Johannesburg Declaration on Sustainable Development at the World Summit on Sustainable Development in 2002 [2]. As the importance and prevalence of the word grew in the development sector, John Elkington brought the conversation into the business sector and is credited with coining the term, "triple bottom line," to encompass social, economic, and environmental components to sustainability in his book, *Cannibals with Forks: the Triple Bottom Line of 21st Century Business* [3]. Today, interest in triple bottom line accounting is growing in government, for-profit, and also non-profit sectors [4].

A triple bottom line approach to sustainability is interdisciplinary in nature and requires a holistic approach to any proposed change. One of the leaders of the theory of systems thinking in the context of business management is Peter Senge, who writes, "Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static 'snapshots'" [5]. It is important to understand big-picture relationships when designing interventions to have systemic impact. Paul Bloom and Gregory Dees, both thought leaders in social entrepreneurship, discuss the importance of thinking about the different players and environmental conditions that shape ecosystems as an analogy to the rich web of political, economic, physical, and cultural environments that surround new innovations [6]. The ecosystem analogy is also powerful because ecosystems have nutrient cycles in which waste is part of a circular flow of energy within the system. This idea has permeated economics and led to a transition from a linear model of economics to the concept of a circular economy, defined by the Ellen MacArthur Foundation as "an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models" [7]. Intertwined into all of these ideas is that efficiency alone will not address problems, but rather innovations must embrace their multi-layered context to have meaningful impact and change

Building design professionals are typically conversant about building systems, but it is rarer for them to engage in the larger socio-economic systems in which buildings play a part. However, there have been several high profile pioneering building design professionals who address triple bottom line sustainability in their projects and discourse. The architect, William McDonough, is known for his collaboration with Michael Braungart to describe the cradle-to-cradle processes that can lead to sustained abundance rather than our current wasteful designs [8]. Alisdair McGregor, a principal and engineer at Arup, writes of the limits of thinking about efficiency as the solution to climate change and argues that projects must find the optimal balance of environmental, economic, and social components [9]. Meanwhile, the dominant rating system associated with sustainable buildings is the Leadership in Energy and Environmental Design (LEED) Certification, in which the primary emphasis is on the environmental performance of the building itself. While LEED has succeeded in penetrating the market, raised awareness about efficiency in building performance, and helped bring about a culture of evaluation, it falls short with regards to community engagement and triple bottom line sustainability.

SEED CERTIFICATION

While there is a deep history of public interest and community based design, it wasn't until 2005 that an architect began to facilitate discussions leading to the creation of a certification system that explicitly addresses triple bottom line sustainability in design projects. This architect, Bryan Bell, began to develop the SEED Certification through a series of roundtable sessions at the Harvard Graduate School of Design that gathered architects, designers, and experts in public interest design to discuss how design could address social, economic, and environmental issues in communities [10]. To this end, SEED projects must demonstrate how they embody the five SEED principles [11]:

- SEED Principle 1: Advocate with those who have a limited voice in public life.
- SEED Principle 2: Build structures for inclusion that engage stakeholders and allow communities to make decisions.
- SEED Principle 3: Promote social equality through discourse that reflects a range of values and social identities.
- SEED Principle 4: Generate ideas that grow from place and build local capacity.
- SEED Principle 5: Design to help conserve resources and minimize waste.

The certification process is a two stage process. Part 1 takes place in the early stage of the project and Part 2 occurs after the project has been implemented. In the first part of the SEED certification process, the design team defines its own goals and provides narratives about the critical triple bottom line issues addressed by the project, the anticipated results, method for measuring the results, and plan for engaging community stakeholders. By framing the project goals in relation to community needs, design teams must consider the larger impact of their project and this helps identify and engage stakeholders. Applicants define social, economic, and environmental performance measures that will be later documented in part two of the certification process and are encouraged to use both qualitative and quantitative metrics.

SEED evaluates Part 1 and provides feedback before approving projects to continue to Part 2 of the certification process. Part 2 requires narratives that provide evidence that the performance measures specified in Part 1 were actually met. Performance measures have self-defined benchmarks, which are targets that the team will meet at different stages of the project timeline. These incremental goals are meant to help the team articulate a clear strategy for achieving their goals. While Part 1 of the certification process can occur at an early stage of the project, Part 2 focuses on post-implementation analyses.

The SEED Certification system is relatively new and so far 12 projects have achieved certification. Since the full certification requires verification of performance measures after completion of the project, this number will increase soon as the 125 projects that have started Part 1 of the process are built and implemented. The use of this certification process is growing as it has proven to add value to projects by offering third party review of defined goals, as well as their documented and measured success, while providing recognition to these projects helping to raise awareness within and beyond the design community about successful projects addressing the triple bottom line.

SEED CASE STUDY: MAA-BARA

Maa-Bara is a SEED award winning project and serves as a case study of triple bottom line design. The project demonstrates how a design approach can be shaped by holistic systems thinking through an understanding of a larger set of contextual factors. Maa-Bara is a closed-loop aquaponics system that uses kitchen scraps to grow fish and vegetables. Aquaponics is a fish and vegetable production method which recirculates water and nutrients in a closed-loop system minimizing waste and agricultural inputs. This cycle begins when fish effluent flows from the fish tanks to the hydroponic system where plants uptake the fish effluent as nutrients and flourish. Clean water flows back into the fish tanks and the cycle repeats itself. Before further describing the details of the Maa-Bara aquaponics system, it is first important to understand the community in Kenya in which this project was implemented, as well as the theory of change driving this innovation.

In July 2012, a 1,000 Maa-Bara aquaponics system was deployed with the participation of community members of the Lenya School in a rural fishing community in Kenya. In this elementary and middle school of 589 students, two thirds of students eat only one meal a day and one third is orphaned by HIV/AIDS. Both hunger and school retention are major challenges in this community that suffers from depleted fisheries stocks, poor food security, and few income generating alternatives to fishing, which cause many students drop out of primary school to become fishermen. On the country wide level, 60% of Kenyans are below the poverty line and 80% derive at least part of their livelihoods from agriculture [12]. The Food and Agriculture Organization (FAO) of the UN has identified that fisheries have "the potential to significantly contribute to the national economy through employment creation, foreign exchange earnings, poverty reduction and food security support" [13]. Understanding these larger issued shaped the approach of the Maa-Bara project by broadening the vision from an innovative aquaponics technology of sustainable food production, to one that could promote education by partnering with local schools to provide curriculum and training workshops on construction, operation, and expansion of the system.

The Maa-Bara system installed in Lenya is a 1,000-liter low-tech, low-cost demonstration of the technology and it was made from 100% locally sourced materials. This system took a few days to construct and requires two hours of maintenance per day. The closed loop aquaponics system has six components to the cycle shown in the figure below.

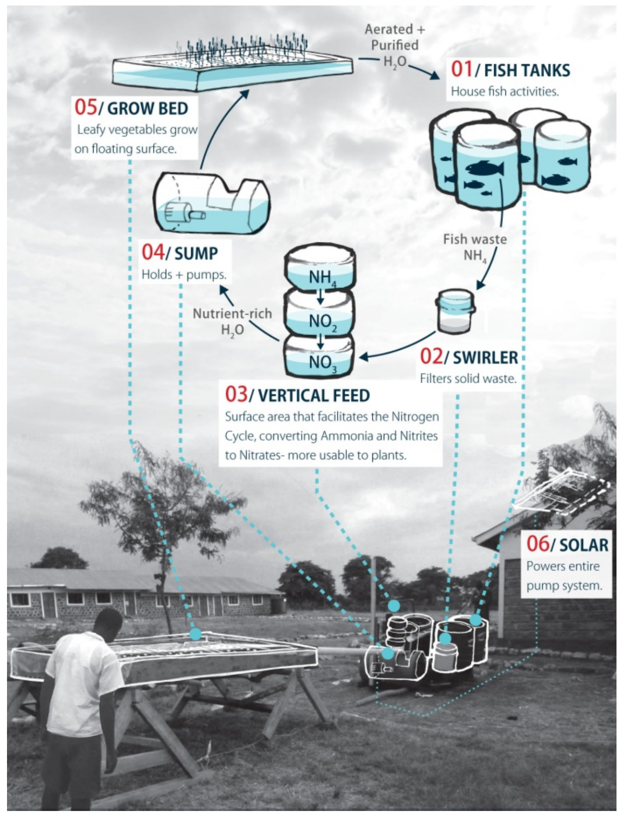

Figure 1: Basic system components prove tilapia waste can support vegetable growth.

Tilapia fish live in fish tanks where they reproduce after three months and are fed with kitchen scraps. The fish waste from these tanks accumulates in the swirler, which filters the solid waste and sends it into the vertical feed, in which it the larger surface area facilitates the nitrogen cycle that converts the sate into nitrates more usable to plants. The nutrient rich water then goes into a small holding tank that can pump the nutrient rich water into a growing bed where vegetables such as kale can be harvested on a floating surface. This process aerates and purifies the water in the grow bed, which then goes back into the fish tanks. A solar panel provides the small amount of energy needed to power the pumps in this system that uses tilapia waste to support vegetable growth and provide easy, on-going fish farming.

Conservative outputs from this system are that it will produce 250 pounds of fish and 160 heads of kale per year. If the volume of this system were scaled up to 5,678-liters, this could generate approximately 1,050 fish and 4,200 vegetables per year, which is enough to provide a five-person family with 3 fish and 12 vegetables per day and the opportunity to sell excess fish and vegetables as a source of supplemental income.

The Maa-Bara project started with stakeholder meetings with members from the Maa-Bara team and members from the school community in Lenya. These meetings helped the design team understand the contextual lifecycles of the community by gaining an understanding of the daily sequence of activities in the community, as well as the social, economic, and environmental landscapes of the community. When the Maa-Bara installation process began, students were involved in preparing the site for the installation of the aquaponics system, which was built in collaboration between a Maa-Bara machinist and a local builder. When the construction was complete, Maa-Bara trained students in how to maintain the system and taught the basic principles around how the system works. The success of the aquaponics system is not simply its ability to produce food, but also its design as a system that generates income, addresses food security, keeps kids in school, increases employment, converts waste to food, enables empowerment, and builds a youth culture of agriculture innovation.

The innovation of Maa-Bara is greater than the engineering of the low cost, low tech aquaponics system as it engaged the Lenya community in developing a holistic approach to addressing its social, economic, and environmental issues. Socially, the project partners with schools to provide education about how to build an aquaponics system, encourages school retention through alleviating the pressure for kids to work as fishermen, alleviates hunger by improving food security, and fosters entrepreneurship. Economically, the system provides a means for an empowered and employed community that grows their own food for subsistence and profit using locally available and affordable materials, provides financial stability through predictable food production, and stimulates economic development by providing the aquaponics knowledge to scale up the system to create new enterprises and jobs. Environmentally, the system is designed to use small amounts of electricity that can be powered off-grid through a solar panel, does not produce excess waste, and uses less water than a traditional aquaculture system irrigation system of growing vegetables in the ground. This holistic, systems based approach to design fosters a renewable future through developing a closed-loop technology that is deeply embedded in social, economic, and environmental strategies aimed to have a sustained, positive impact in the community.

CONCLUSION

What does architecture stand to learn from an aquaponics system? What does design in developed countries stand to learn from developing countries? Maa-Bara shows the power of interdisciplinary collaboration, recycling waste streams, localizing benefits, and locally sourcing materials in a project that promotes entrepreneurship, innovation, and resilience. Architects should consider holistic ways in which buildings can propagate larger-scale change in the community served by the building. The SEED Certification system provides a framework for designers to apply this thinking throughout the design process. Examples of how SEED certified buildings have achieved this include training people in construction trades, creating local jobs, incorporating knowledge sharing about project technologies, remediating brownfields, using energy as efficiently as possible, and reusing waste to foster cradle to cradle material flows. SEED Certification provides a roadmap for addressing the triple bottom line through design, requires accountability by requiring proof that performance measures have been met after project implementation, and creates a repository of exemplary projects.

Architects must not simply ask who they build for, but also what building is for and consider the systemic change that buildings can catalyse in communities. It is only when buildings seriously engage the triple bottom line through systems thinking that design projects can improve the quality of neighbourhoods and the quality of life of their inhabitants. The latest building technologies suggest that buildings can be part of an energy producing system, which is incredibly important in the face of climate change though only a part of what building design has to offer in terms of sustainability. Social and economic strategies can help catalyse change that leads to community empowerment, which leads to a deeper, more systemic renewable future than standalone renewable energy technology. If sustainable design for a renewable future is to be a shared societal goal and imperative, then projects must consider the synthesis of contextually specific approaches to environmental, social, and economic strategies to effectively address triple bottom line sustainability and improve our communities.

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REFERENCES

1. United Nation's World Commission on Environment and Development, (1987). Our Common Future: Report of the World Commission on Environment and Development. [Online] Available: www.un-documents.net/wced-ocf.htm [Accessed 12 May 2013].

2. World Summit on Sustainable Development, (2002). Johannesburg Declaration on Sustainable Development. [online] Available: http://www.unescap.org/esd/environment/rio20/pages/Download/johannesburgdeclaration.pdf [Accessed 12 May 2013].

3. Elkington, J., (1997). Cannibals with forks: The triple bottom line of 21st century business, Capstone, Oxford.

4. Hammer, J., (2008). Development that adds up: Accounting for the social bottom line of triple bottom line investment, Social Equity and Opportunity Forum of Portland State University. [Online] Available: http://www.pdx.edu/sites/www.pdx.edu.cupa/files/SBL%20Briefing%20Paper.pdf [Accessed 12 May 2013].

5. Senge, P., (1990). The fifth discipline: The art and practice of the learning organization, Doubleday/Currency, New York.

6. Bloom, P. and J. Dees, (2008). Cultivate your ecosystem. *Stanford Social Innovation Review*, 6(1): p. 47-53.

7. Towards the circular economy, (2012). Ellen MacArthur Foundation. [Online] Available: http://www.ellenmacarthurfoundation.org/business/reports/ce2012: [Accessed 12 May 2013].

8. McDonough, W. and M. Braungart, (2002). Cradle to cradle: Remaking the way we make things, North Point, New York.

9. McGregor, A., C. Roberts, and F. Cousins, (2013). Two degrees: The built environment and our changing climate, Routledge, New York.

10. Bell, B. and K. Wakeford, (2008). Expanding architecture: Design as activism, Metropolis, New York.

11. Social Economic Environmental Design, n.d. [Online] Available: http://seednetwork.org/ [Accessed 12 May 2013].

12. Intro to Kenya, n.d. USAID Kenya. [Online] Available: http://kenya.usaid.gov/intro-kenya [Accessed 12 May 2013].

13.Gitonga, N. and R. Achoki, (2004). Fiscal Reforms for Kenya Fisheries. [Online] Available: http://www.fao.org/docrep/007/y5718e/y5718e04.htm [Accessed 12 May 2013].