Leveraging Information Technology, Social Entrepreneurship, and Global Collaboration for Just Sustainable Development

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Abstract

Currently, those working for a sustainable development in a vast array of contexts all over the world are often duplicating efforts. In an era where a rapid transition towards sustainability is needed, such wasted effort is no longer tolerable. This paper will discuss current work to overcome this challenge by creating an Open Sustainability Network (OSN) that links relevant individuals, programs, courses, projects, and organizations aimed at just sustainable development. The paper will build an understanding of, and collaboration between, relevant online tools. The paper concludes that the OSN can: 1) develop partnerships with sites with online tools to alleviate some of the technological overhead; 2) help inform entrepreneurs and expanding businesses about the challenges and opportunities presented in social entrepreneurship; and 3) benefit service learning implementation by acting as a repository for appropriate technologies, systems, and policies, while also acting as a clearinghouse for international and local collaborations.

Introduction

In an age where roughly half the global population lives on less than $2 a day, nearly a billion people in the world lack access to improved water sources (i.e., safe drinking water and basic sanitation), and more than 30,000 children under the age of five die each day from preventable causes, the need for sustainable development is evident (United Nations Development Programme 2001). Historically, the definition of sustainable development has generally encapsulated some version of the Brundtland Commission's concept: "development that meets the needs and aspirations of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987, 43). As the need for integrating social justice into the development picture increases, more refined concepts such as just sustainability or "the egalitarian conception of sustainable development" (Jacobs 1999, 32) generate an improved definition of sustainable development as "the need to ensure a better quality of life for all, now and into the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems" (Agyeman, et al. 2003, 5). This new form of sustainable development prioritizes justice and equity, while maintaining the importance of the environment and the global life support system.

The clarion call for just sustainable development is being taken up all over the world by individuals, non-profit organizations, community groups, schools, businesses, governments, and other organizations. These groups are developing appropriate technologies, small businesses, and products to aid the creation of a just sustainable world. Unfortunately, these groups are often duplicating efforts and struggling with problems long solved by those from another community, often speaking a different language and located on another continent. In the face of global climate destabilization and mass poverty, the rapid transition towards just sustainability is needed, and wasted effort is no longer tolerable.

This paper will discuss current efforts to overcome this challenge by creating an Open Sustainability Network (OSN) that links relevant individuals, programs, courses, projects, and organizations aimed at just sustainable

development. The creation of the OSN represents a merging of interests of a great number of diverse stakeholders working towards a just, sustainable world including but not limited to: individuals, local communities, open source appropriate technology (OSAT) developers, non-profit organizations, governments, businesses, entrepreneurs, and universities. The paper will build an understanding of, and collaboration between, relevant online tools. The paper is meant to bridge disciplines to connect and learn from relevant appropriate technology initiatives, social entrepreneurship, business and product development, and service learning to help scale up for more effective impact in teaching, research, and practice.

The OSN can be visualized by the conceptual model shown in Figure 1. This network will comprise three major elements: 1) open source information collaboration, 2) social entrepreneurship, and 3) service learning. Each element is made up of several subcomponents as can be seen in Figure 1 and will be discussed in detail in the following sections. Users, projects, organizations, and journals are found within each element. The OSN establishes symbiotic relationships between the elements, components, and stakeholders working towards a just sustainable world.
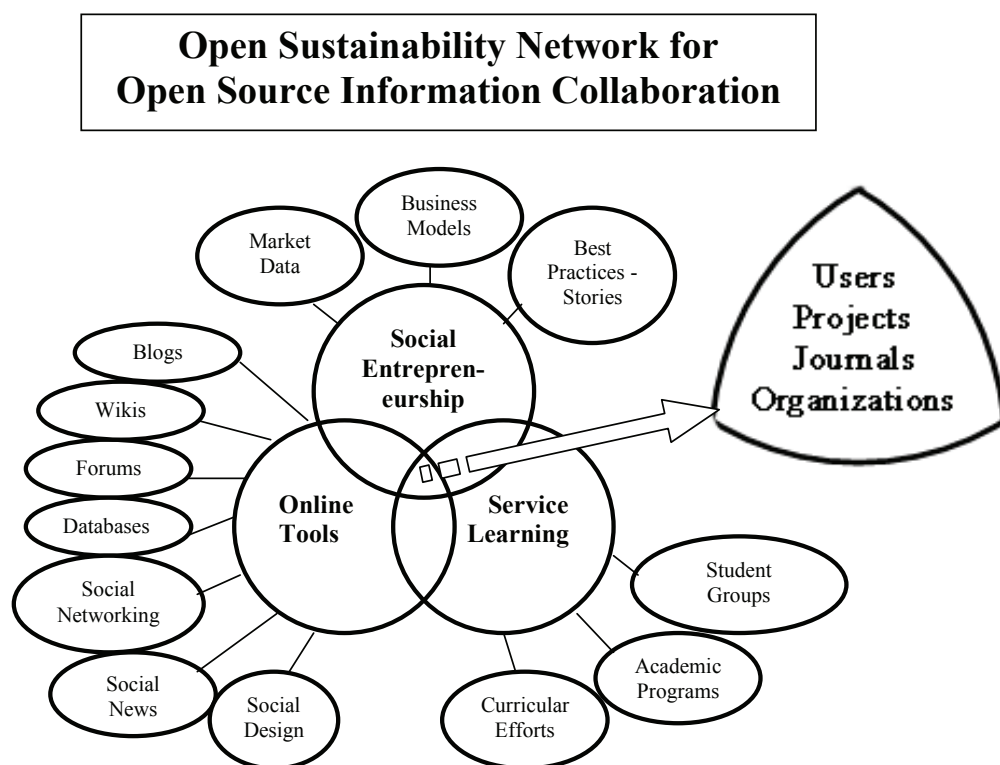
Technological Advances Towards an Open Sustainability Network

The primary goal of the Open Sustainability Network (OSN) is to build a unified collection of relevant online tools and practices to help stakeholders accelerate just sustainable development. The OSN is being synthesized from a number of existing online tools and methods of partnerships between the stakeholders using tools. Here we review the tools, methods of partnerships, and provide a blueprint for creating a unified OSN.

Existing Online Tool Types and Examples

Literally millions of online tools exist, many of which offer methods for addressing sustainable development issues. The ten primary categories of online tool types are shown below, followed by example sites that exemplify each type in the arena of sustainability:

- Blogs: An often updated, sometimes with multiple editors, online diary or journal.
    - Treehugger.com – A blog for news, information, thoughts, website descriptions, product highlights, and essays about sustainability and the environment.
- Wikis: A site that allows users to collectively edit pages.

- Appropedia.org – An open website for users to co-create sustainable solutions, questions, and information. Serves as a resource area for other organizations.
- Forums: An online community of users posting questions, answers, and rants on topics of common interest.
    - Sustainabilityforum.com – An online community for discussing topics regarding sustainability, such as sustainable development, corporate social responsibility, ethical living, and climate change.
- Journals: A periodical publication, dedicated to a specific topic, which contains scholarly manuscripts usually written by students, professors, or experts and reviewed by peers.
    - Ijsle.org – An online journal providing peer/faculty review of original work of students and researchers with a specific focus or implication for service learning in engineering, engineering entrepreneurship in service, or related service learning pedagogy.
- Databases: A collection of information organized in a particular, often searchable, manner.
    - Attra.ncat.org – A website with various online databases of information pertaining to sustainable agriculture and organic farming.
- Social Networking: A site that links users together based on similar interests by providing social tools, such as profiles, chats, and network visualizations.
    - Wiserearth.org – A website to link and empower non-governmental organizations and people for a sustainable world.
- Social News: A website that allows users to submit, vote on, and filter relevant news.
    - Hugg.com – A social news site focusing on global green news.
- Social Design: A online platform for enabling individuals, teams, and communities to co-design by providing tools such as community file storage, online whiteboards, and some social networking.
    - Openarchitecturenetwork.org – A website with tools that allow designers to share, view, and review designs and for teams to collaborate, communicate, and manage projects that aim to improve living conditions through innovative and sustainable design.
- Projects: Any website dedicated to a specific project.
    - Laptop.org – A website dedicated to the One Laptop Per Child initiative focused on producing a $100 laptop with content for the developing world.
- Organizations: Any website representing a particular organization.
    - Villageearth.org – A website of Village Earth, a non-profit organization dedicated to promoting sustainable, community-based development around the world by providing innovative training, consultation, appropriate technology information, and project support services.

There are other types of informational websites and subcategories, such as Content Management Systems (CMS), social bookmarking, link repositories, galleries, podcasts, vlogs (video blogging), etc. While each of these different tools offers its own set of applications and constraints, they can work together synergistically to impart greater impact. Most sites do implement various tools. For example, blogs have forums, social design sites have link repositories, projects have wikis, organizations have blogs, wikis, social news, etc. These mixed implementations often meet with varying degrees of success, as many organizations do not have the resources to maintain all of their different tools. For example, Leonardo Energy, a website delivering a range of virtual libraries relating to electrical energy, recently instituted a virtual reality 3D Energy Forum, which both in attendance and quality of articles is significantly less developed than their prior work (2007). An opportunity thus exists to develop partnerships with other sites to alleviate some of the technological overhead, while leveraging each site's strengths and memberships to greater effect positive change in the burgeoning sustainability field. The OSN will be the ultimate embodiment of this concept by networking all relevant individuals, programs, courses, projects, and organizations aimed at just sustainable development.

Existing Online Tool Partnerships
Many partnerships of online tools for appropriate technology currently exist. The following list depicts some of the types of partnerships that have already evolved in Appropedia.org, a rapidly expanding wiki site for

collaborative solutions in sustainability, poverty reduction, and international development, which can serve as one of the pillars of the OSN.

- The Hexayurt project is housed on Appropedia and the project maintains its own domain (http://hexayurt.com/) as a landing page.
- Wikigreen.org, a wiki for green living, merged completely into Appropedia.
- Village Earth merged their appropriate technology wiki into Appropedia (Village Earth 2007).
- Engineers Without Borders (EWB) – Australia is using Appropedia as their resource area. (EWB 2007).
- Issuepedia.org and Appropedia are partnering to send political discourse content to Issuepedia and project development content to Appropedia.
- Appropedia and Openarchitecturenetwork.org (OAN) currently partner through interlinking, and are discussing a partnership with OAN specializing in collaborative sustainable architecture design and Appropedia specializing in building and maintaining the resources area. Nabuur.org, the global neighbor network that links people around the world who need and can provide assistance, is discussing a similar arrangement with Appropedia.
- Clarion University and other universities are also using Appropedia as a project development area for courses in science. This use as a service-learning tool will be discussed in more detail below.

Along with the many already existing partnerships lie many more possibilities. These possible partnerships must be identified across a wide spectrum of online tool types, and can be implemented in the following ways.

Methods of Partnerships

Complementing the many partnership opportunities are the many methods of partnering. A key to sustainable development is greater collaboration and partnering among key entities working to make a difference through giving voice to the individual stakeholders. The scale and scope of change required to create a just sustainable world are unlikely to be brought about by any single organization, no matter how large or well resourced (Sustainable Development eLearning Network 2004). Partnership opportunities come with their own unique sets of criteria, and constraints and partnership methods span a spectrum of solution variables and agreements. This partnership method spectrum can be bracketed on the side of minimum engagement by simple interlinking and on the side of maximum engagement by site convergence.

Interlinking consists of partnering sites posting links to each other in relevant places on their sites. Interlinking assumes the least risk and time commitment of the proposed methods of partnership. It can result in visitors being brought away from one of the partnering sites, without much incentive to return. Interlinking partnerships can be bolstered by using Really Simple Syndication (RSS) to keep each of the partner sites current.

Cross posting, or content duplication, consists of duplicating relevant content on each partner site. Cross posting can be automated or manual, does not encourage visitors to leave a specific site, and can be implemented with interlinking. Duplicate content is generally frowned upon by search engines, but this technical barrier can be overcome. While cross posting is a low cost solution, it can split the pool of commenters, leaving different conversations about the content on each partner site.

Specialization is an engagement-heavy option for partnering. In specialization, each partner focuses on what they do best and farms out the other parts to other partners. Specialization takes considerable planning to reach consensus on procedures and to determine which areas each partner will take on, but can ultimately result in allowing each partner to focus more energy less broadly. Specialization takes trust, as each partner now relies on the other partner(s) for their completeness. Specialization can utilize a common login among partner sites and, unlike cross posting, conversations will take place collectively in their relevant place.

Convergence is the most heavily engaged option for partnering, combing relevant partners into one larger partner. This option allows for completely pooled resources, but comes with many risks and compromises, such as combining vision and mission across partner sites.

Many other solutions exist along this spectrum. Partnerships and partnership methods should be carefully considered, but the nature of online collaboration does allow for some added flexibility and safety. Sites may

maintain their own branding, user base, newsletter, etc., while engaging in various partnerships and partnership methods.

Combining all the Pieces—The Open Sustainability Network
The Open Sustainability Network (OSN) will build a unified collection of relevant online tools and practices to help stakeholders build effective programs in appropriate technology and social entrepreneurship. Specifically, the OSN is focused on impacting the training of future innovators and managers who will need to effectively tackle a set of profound global challenges through the creation, commercialization, and institutionalization of sustainable enterprise and clean technologies.

The OSN will operate with an "open" modality. Utilizing an open modality means that the OSN will engage a collaborative process built upon transparency, accountability, and sharing, with a focus on engendering trust, empowerment, and cooperation. As an open network its content will be free, publicly available, and adaptable.

This network will be propelled forward on the waves of 1) open source information collaboration, 2) social entrepreneurship, and 3) service learning.

Social Entrepreneurship for Rapid Sustainable Development

Building on appropriate technology creation and prototyping being developed online via collaborative technology, entrepreneurship offers a unique way to scale up the impact of technology and services. Social entrepreneurship utilizes entrepreneurial principles to organize, create, and manage a venture to solve social problems. Historically, conventional entrepreneurs measured performance in profit and return; social entrepreneurs assess their success in terms of the impact they have on society. Although all entrepreneurial activity ostensibly is for the betterment of society, there are differences in approach and opinion as to the profit motive for social enterprises. For example, should all social enterprises be non-profit? What are "private sector approaches" when you are a non-profit? (CASE 2007). These are easy points to get hung up on, but for the purpose of this paper, we will leave the status broadly defined as an organization that operates under market constraints for its services—thus, if people in a community do not desire a service, the organization would not exist.

Using this basic assumption, we observe that society needs many different support systems to function and grow effectively. These include: educational systems, healthcare, sanitation systems, economic opportunity, food security, and basic infrastructure including shelter and information and communications technology. No one organization will be able to enter into a community and provide all of these services. So, social entrepreneurs are likely to target one sector where they see the most need and develop their business models appropriately.

One easy form of specialization is in technical specialization whereby an entrepreneur tests his or her technology in the market by prototyping and marketing the product until sufficient demand for their service is created. Many organizations have created funding mechanisms for this level of research including the World Bank Development Marketplace, Mondiologo Engineering Challenge, and the National Collegiate Inventors and Innovators Alliance Sustainable Vision Grants. These grants implicitly set the stage for entrepreneurs to test their ideas in the field and effectively create their own markets for products and services through their entrepreneurial actions—without these entrepreneurial actions, social markets would not exist and the social sector would be limited to a small "Corporate Social Responsibility" movement within existing corporations.

This specialization and organizational scale up in "creative" industries of social entrepreneurship has fostered the development of a number of social entrepreneur support systems including Ashoka and the Skoll Foundation. These organizations foster the development of social enterprises by funding entrepreneurs with a social focus and/or providing business support services. These networks have allowed entrepreneurs to share stories internally and externally via conferences, workshops, and symposia. In conjunction with these activities, networks house a wealth of information on the business models currently employed in social ventures.

To add value to their business model information researchers, including those at the World Resources Institute, are attempting to quantify the social sector, specifically at the Base of the economic Pyramid (BoP). When that market data is combined with progressive social funds like those of the Cleantech Venture Network, Acumen Fund, KIVA, and Endeavor, global markets for social enterprise begin to develop (Flannery 2007).

Bringing these two resources together—market data and business model information—allows potential entrepreneurs and existing corporations with their own knowledge and talents to consider social markets and markets at the BoP in their business strategy (Alvarez 2003), thus creating an inclusive form of capitalism by involving poor and underserved society.

Social Entrepreneurship and the Open Sustainability Network

By bringing together stories of entrepreneurial actions and market information that social entrepreneurship is attempting to tap, the OSN can create a valuable resource to help inform new entrepreneurs and expanding businesses about the challenge and opportunities presented in social entrepreneurship (Maxwell 2006). Furthermore, since companies are not in a position to provide all of the social support services themselves, by offering market data to additional companies, the OSN creates incentive for additional players to enter the market, and a portfolio of services can unfold via the potential new partnership opportunities across business sectors.

This portfolio approach will allow individual companies to maintain highly specialized staff and efficient operations, thus achieving the most effective and efficient operations possible. As networks of service providers unfold globally, larger companies and governments will be able to source work to the most highly specialized companies, and communities will have access to the best information possible—a true win-win for the customer and the business.

The OSN can foster this network of dynamic specialization (Hagel and Brown 2005) by enabling market creators to share their stories, entrepreneurs to share their business models, social networkers to share best practices, and market enablers to share their market data. This collective database will help identify best practices and encourage additional and large scale investment in the social sector—exactly what is needed to quickly scale up social entrepreneurship into social enterprise.

Service Learning and Just Sustainable Development

Despite incredible technical progress and sophisticated market economies, there are no clearly navigated paths to achieving sustainable development. There is, however, a considerable amount of consensus that the most successful approach will involve the previously discussed collaboration between stakeholders and education. The UN believes that education can play a huge role in driving sustainable development and has declared this the "Decade of Education for Sustainable Development" (2005-2014) (UNESCO 2006). More people at all levels must be enabled to develop the values, attitudes, and skills necessary to change behavior in regard to natural resource management and economic development.

Attaining Sustainable Development: Educational Needs

As the UNESCO Report *Education for Sustainability* notes, people are aware of the social and environmental problems we face (2002). For example, our own experience with students enrolled in "sustainability" courses has shown that they are almost always exposed to the concept "sustainable" with regard to "development." They see the concept as applying to something outside themselves, more at the macro level, and do not see it as applying so much to themselves, at the micro level. The word sustainable is increasingly applied to other areas such as sustainable living, sustainable transport, sustainable farming, and sustainable economic growth. Ideally students need to internalize the philosophy of sustainable development and be able to see how the concept can apply at a variety of levels, from the micro (a sustainable chair or pair of shoes) to the macro (a sustainable city or economic system) (Development Education Project 2007).

In the rapidly changing world of the 21st century, many educational structures are still surprisingly 19th century. As any university professor can attest, many young people feel that what education has to offer is not relevant to their lives. In his book, *Sustainable Education*, Stephen Sterling looks at the need for a 'new educational paradigm', and the differences between first, second, and third order change and learning (2001):

> First order change and learning takes place within accepted boundaries; it is adaptive learning that leaves basic values unexamined and unchanged... the stress is on information. By contrast, second order change and learning involves critically reflective learning, when we examine the assumptions that influence first order learning; this is sometimes called 'learning about learning' or 'thinking about our thinking'. At a deeper level still, when third order learning

happens we are able to see things differently. It is creative, and involves a deep awareness of alternative world-views and ways of doing things. It is, as Einstein suggests, a shift of consciousness, and it is this transformative level of learning, both at individual and whole society levels, that radical movement towards sustainability requires.

This shift from second to third order learning is difficult within current educational structures because of the fragmentation of knowledge into disciplines. Third order learning can only come about through in-depth, interdisciplinary education. Teachers who do arrive at such personal and professional transformation need to build a critical mass of colleagues, which can be accomplished by the networking tools in the OSN. Alliances need to be constructed in order to devise effective strategies for engaging teaching institutions in such transformative learning (Development Education Project 2007b). The various needs highlighted above point to where service learning can provide a bridge between academia and community action—in fact, it is what it does best.

Service Learning and Sustainable Development

Service learning is "a teaching method, which combines community service with academic instruction as it focuses on critical, reflective thinking and civic responsibility. Service-learning programs involve students in organized community service that addresses local needs, while developing their academic skills, sense of civic responsibility, and commitment to the community" (Campus Compact 2000, 17). Service learning pedagogy research has been maturing quickly. It is now well established that service learning has a positive impact on students' academic learning and moral development, improves students' ability to apply what they have learned in the "real world," and improves academic outcomes as demonstrated complexity of understanding, problem analysis, critical thinking, and cognitive development (Pearce 2006; 2007). Service learning has demonstrated success in providing a means for the student to integrate technical training with the social and economic aspects of engaging a community in sustainable projects.

Notable examples of service learning organizations, curriculum, programs, and journals relevant to the OSN, found at universities across the U.S. include:

Student Organizations:
1. Engineers Without Borders (EWB) (http://www.ewb-usa.org/) and (http://www.ewb-international.org/)

2. Engineering Projects in Community Service (EPICS) (http://epics.ecn.purdue.edu/)

3. Engineers in Community Service (ECOS) (http://ecos.osu.edu/)

4. Engineers for a Sustainable World (ESW) (http://www.esustainableworld.org/)

Curricular Efforts:
1. Engineers in Technical, Humanitarian Opportunities of Service-Learning (ETHOS) at the University of Dayton (http://campus.udayton.edu/~ethos/) and (quickplace.udayton.edu/slate)

2. Service-Learning Integrated throughout the College of Engineering (SLICE) At the University of Massachusetts (http://www.slice.uml.edu/)

3. MIT's D-Lab: Introduction to Development (http://web.mit.edu/servicelearning/index.shtml) and (http://web.mit.edu/d-lab/)

4. Engineering World Health (EWH) at Duke University (http://www.ewh.org/about/index.php)

5. Entrepreneurial Design for Extreme Affordability at Stanford University (http://soe.stanford.edu/publicservice/courses0607.php)

1. Community Service Engineering Certificate Program (Penn State, Michigan Technological) (http://www.d80. mtu.edu/Certificate.html)

2. Master's Degree in Engineering for Developing Communities and Peace Corps (Michigan Technological) (http:// www.cee.mtu.edu/peacecorps/index.html)

3. Engineering for Developing Communities (Colorado University) (http://www.edc-cu.org/index.htm)

4. Institute for Sustainable Technology and Development (Georgia Tech University) (http://www.sustainable.gatech. edu/)

Service Learning Journals:

1. *International Journal for Service Learning in Engineering* (IJSLE) (http://www.ijsle.org)

2. *Journal for Engineering and Sustainable Development* (JESD) (http://www.collegepublishing.us/jesdhome.htm)

3. Among many other service learning journals (http://www.appropedia.org/Category:Service_Learning_Journals)

Attaining Sustainable Development: OSN Service Learning Collaborations
Although the OSN will benefit service-learning implementation by acting as a repository for appropriate technologies, systems, and policies, it will also act as a clearinghouse for collaborations. Collaborative service learning opportunities assist in the training of future leaders, engineers, and entrepreneurs by offering leadership opportunities, civic engagement, real life design experience, and immersion in the political, economic, historical, and sociological contexts of design projects that few other teaching methods allow. Engaging in collaborative team building and team design efforts with geographically dispersed teams is challenging, but reflective of where the field is now, and where it is heading.

The Knowledge Infrastructure Challenge and the Open Source Solution
It has been well established that people across a wide range of contexts (e.g., companies, cities, universities) want an efficient knowledge infrastructure that increases efficiency and eliminates redundancy, yet have been largely unsuccessful in establishing working models. This may indicate that the success of OSN is improbable. Fortunately, however, there has been a true revolution of information technology with the rise of Web 2.0. As open tools have been created that allow anyone to adapt, add, categorize, and learn, a new paradigm has been reached that is far more flexible and powerful than the information infrastructures of the past. An inspiring example of this is the open project Wikipedia, which possesses more than 1,500,000 articles, outnumbering all other encyclopedias of all time (Voss 2005). This knowledge infrastructure is maintained by ~10,000 volunteers that work to ensure that it is accurate, valid (as in peer review), well organized, and easy to use.

Conclusions
It is well established that a rapid transition towards just sustainability is needed. Although numerous online tools have been created to assist just sustainable development, enormous growth in social entrepreneurship is happening all over the world, and service learning is now standard in most of the top institutions for higher learning, these groups are often duplicating efforts. Individuals, non-profit organizations, community groups, schools, businesses, governments, and other organizations struggle with problems long solved by others. There are numerous redundant online tools, poorly systematized knowledge sets, and lost opportunities for collaboration and learning. The Open Sustainability Network provides a solution to these problems. OSN's mission is to build an understanding of, and collaboration between, relevant online tools targeting appropriate technology, social entrepreneurship, and international development. By creating a centralized repository of information for sustainable development, while being closely tied to all of the collaborating organizations and open to all to participate in and use, the following can be realized:

1. Develop partnerships with sites with online tools to alleviate some of the technological overhead, while leveraging each site's strengths and memberships to greater effect positive change in the sustainability field;

2. Help inform new entrepreneurs and expanding businesses about the challenge and opportunities presented in social entrepreneurship, while fostering a network of dynamic specialization by enabling market creators to share their stories, entrepreneurs to share their business models, social networkers to share best practices, and market enablers to share their market data;

3. Benefit service learning implementation by acting as a repository for appropriate technologies, systems, and policies, while also acting as a clearinghouse for international and local collaborations.

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