Accounting for human behavior, local conditions and organizational constraints in humanitarian development models

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Abstract   The current trend in foreign aid is toward small-scale sustainable development projects in partnership with defined communities. However, these projects are subject to the influences of self-interested human behavior, poorly defined community structures and resources and organizational constraints that can prevent full realization of development models. Under these constraints, attempting participatory community development models to the exclusion of other techniques may not be the most effective way to achieve positive change. Instead, development agencies should consider adopting other proven elements of development in combination with the spirit of community development to achieve a positive impact within the community and organizational structures and ensure account-ability for success. A small-scale attempted, sustainable development case study in Rwanda is reviewed, as well as a new concept for larger scale development integrating 'carbon credits'. Additionally, a development accreditation organization is proposed to ensure additional accountability in this field.

Keywords   Sustainable development · Rwanda · Carbon credits · EWB-USA · Capacity building · Case study

1 Introduction

Modern humanitarian development models generally advocate community participatory development. This means aid workers are taught to leave bias at the door and work with local residents and respected community leaders to facilitate discussions and grassroots

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implementations of appropriate technologies and microenterprises. They are intended to slowly but surely address a community's public health and welfare challenges 'sustainably'. This works by addressing the needs of the current generation without compromising the needs of subsequent generations through Sustainable Community Development (SCD).

Because of both community and organizational constraints, combined with short- and long-term individual and community interests, the full scope of SCD models is not realized in many programs and projects. Falling short of the models' intentions can lead to program failure.

Instead of setting programs up for failure by forced adherence to community development models that may not be appropriate in the given circumstances, it may be appropriate to include the application of facets of other proven development techniques. These may call for national or international business interests, specialization and public policy development, allowing for the implementation of tangible capacity building. Considerations that must be addressed rather than ignored include local community economic, labor and skill resources, the extent of community identity, development organizational constraints and interests and individual self interest, which can hijack any well-intentioned program. The challenge is not to avoid any tenant of first world development experience, but rather to ensure that both the grassroots and international efforts are properly vetted to be in tune with the communities' challenges and that there is direct accountability for the success (or failure) of the programs.

2 Development review

2.1 Development heritage

About $2.3 trillion dollars have been spent over the past 50 years on international development (Easterly 2006), and yet there is, at the very least, a lack of overwhelming evidence that foreign aid has contributed to growth in developing countries (Easterly 2003).

Prior to the current models of grassroots development efforts, development focused on top–down programs targeting large populations. Large-scale infrastructure programs were installed at significant cost and frequently very quickly failed. Often the proximate causes of failure were corruption, lack of motivation, lack of operation and maintenance funding, lack of appropriate training or a perception both on the part of critics and recipients that there was a lack of need or want for the technologies (Barton et al. 1997) and the perception or reality that the recipient communities were not included in the development process is cited more often than other causes as the reason for failure.

This understanding is echoed by many modern development advocates, in statements such as, "at the core of that failure has been the attempt to deliver solutions from the outside—usually in the form of installing hardware—to communities who have had no involvement in, or ownership of, the process … The result is a total collapse of understanding between provider and recipient, and, ultimately, the community's refusal to use, pay for and maintain the service," (WASH 2004).

2.2 Modern development models

Participatory Community Development models, such as those presented in "The Wealth of Communities" (Smith et al. 1994), "Listening" by the Water Supply and Sanitation

Collaborative Council (WASH 2004), "The Village Earth Model" (CSVBD 2005), "Our People, Our Resources" (Barton et al. 1997), and "The Field Guide to Appropriate Technology" (Hazeltine and Bull 2003) arose within the past two decades in response to generally perceived failures on the part of the previous models. The portfolio of modern development models strongly advocates grassroots effort. However, implementers of these community participatory development models are often forced to short cut the advocated long-term commitments in favor of abbreviated interactions that result in a few hours of community meetings instead of a decade-long commitment as intended.

The key component of every modern community participatory development model is the identification and inclusion of every stakeholder in the community. This is often accomplished by identifying village or town boundaries, or through existing or newly created community leadership organizations. A sense of community is a postulate of these models and looks for preexisting conditions such as when, "everyone could be counted on to come together and share resources during times of difficulty," (Smith et al. 1994). The models also demand near-universal participation by the defined community members, "participatory involvement by *everyone* in the village is vital," (CSVBD 2005). Once these communities are identified and structured toward development, the models presume a better chance of success than previous attempts, wherein the community members, often untrained subsistence farmers, direct the development of their own communities.

However, small-scale projects can fail just as easily as the historic large-scale development projects (Zaidi 1999; Gibson et al. 2005). A large portion of small-scale development projects fail for the same reasons as the large-scale programs did—(1) they fail to address all critical facets of operational success, (2) there is little or no accountability for the success on the part of the communities, countries, or aid organizations both on the organizational and individual level and (3) they do not account for self-interested human behavior across the structures.

This paper accepts participatory community development as a viable method. Instead of critiquing this baseline method, the intent here is to identify implementation challenges and potential alternatives.

2.3 Models of development in industrialized countries

A water treatment system in the United States does not exist in isolation. Water treatment systems are only successful because we have had many trained engineers, technicians and tax revenues to pay for their installation and maintenance (MWH 2005). These individuals are held accountable for their work. These are components that were missing in previous development models. There are many challenges the developed world faces, and there are arguments to be made that the developed world lifestyle is not sustainable on an economic, resource or energy level. However, there are also many elements of qualified success that most developed world citizens appreciate. Most citizens in the developed world, like the United States, have easy access to clean, safe drinking water, affordable energy, safe food supplies and safe housing. While there is certainly poverty in the developed world, and our energy sources are neither clean nor without cost to other populations, in general the vast majority of citizens can afford and appreciate the benefits of development.

At a typical university in the United States, it is challenging to take students and turn them into innovative engineers in 4 years. And even a group of intelligent professors and students may have a hard time turning on a LCD projector for a lecture and need to call in the IT technician. Most development advocates have little knowledge themselves of how to farm a field, and they encounter difficulty in training a farmer to act as a technician and

community mediator. Most development workers' societies are based instead on specialization and leadership. While local residents certainly are experts in their community, they cannot be expected to become experts in several other fields simultaneously on top of their own responsibilities, without additional compensation.

3 Constraints to sustainable development

3.1 Human behavior

When well-intentioned academics and development workers sit together in classrooms and conference rooms discussing sustainable community development, they are doing so with the luxury and privilege of safe food and water and good lighting and heating, none of which many of those people had anything to do with ensuring beyond payment for the service. Further, most of us are not well aware of the implications of receiving these resources on the environment or other communities. And yet, these discussions tend to revolve around advocating small-scale community participatory development that emphasizes community members identifying and solving their critical public health challenges on their own, with only minimal facilitation and resources being offered by the development advocates.

Counterproductive human behavior is common around the world. In the developing world, the consequences of common behaviors are much more severe. In Rwanda, for example, most residents have been well taught the dangers of contaminated drinking water and poor sanitation. Many of these residents understand appropriate technology and hygienic interventions. However, after these interventions, the adoption rate is very low, which is shocking to many in the developed world (who are often drinking bottled water). Again, the conclusion is that the people have not been empowered enough by the development programs. Any argument that an average citizen just simply does not choose to spend even a modest (but not negligible) amount of time and money on treating water, and instead chooses to run the risk of getting sick, is unspeakable in the idealistic model.

In the developed and the developing world, human behavior is similar. Instead of fighting against it, development models should account for it and acknowledge that most people are self-interested, demand immediate return on their investment, and at best, are only in a position to help their neighbor when their own conditions are taken care of. Additionally, even the most well-intentioned community members should not be expected to serve as farmers, technicians, mediators, engineers and business entrepreneurs without the resources provided to properly educate and compensate these individuals.

3.2 Local conditions

Sustainable Community Development models universally call for grassroots actions that involve all the members of a community. All the stakeholders are expected to participate, and programs are intended to be developed through ultra-democratic mediation. Community leaders are identified by the population as a whole and are expected to speak with the community's best interests in mind. When programs are implemented, the community members are expected to participate in the labor and costs associated, as they are the owners and motivators of the programs.

However, in some communities this ideal can be difficult to realize. While there are many small villages in the world with some disposable income and time, there are also many more regions where the local residents exist in extreme poverty, without enough food to eat, or money for clothing or medicine. Additionally, there are places where defined communities are not obvious. Instead, there is rural sprawl. In these circumstances, it is often difficult to identify a discrete population to participate in the development models or find leaders that truly speak for the population. In these circumstances of extreme poverty and poorly defined communities, it may be difficult for aid organizations to identify the most appropriate use of their limited resources or find leaders who can put aside their own interests.

3.3 Organizational constraints

Sustainable development and appropriate technology models often call for simple and easily understood and maintained technologies that are adopted by community leaders with population acquiescence. Development advocates are supposed to provide selected tools and technologies for consideration and avoid passing judgment on the outcome. However, bias and judgment exist at all levels of this interaction, by the same individuals who espouse open-mindedness. Firstly, there is an assumption that development is required. Secondly, there is an assumption that only simple or clean technologies are appropriate for the communities, and therefore those technologies are presented for consideration. Should a community demand a dirty generator over a photovoltaic power system, many development organizations would balk, regardless of how much fossil fuel energy those first world visitors have used in their lifetimes.

Development organizations, advocating sustainable community development, are often not able to examine their own motivations. While most organizations have at heart sincere altruism and humanitarian motivation, the structures that are established around these motivations can sometimes be in conflict with true development ideals (Gibson et al. 2005). A few examples:

– Humanitarian nonprofit organizations are largely funded by charity grants or donations. These donations are competitive and are awarded often based on the best story provided for the number of people impacted, the innovative nature of the development efforts, and the apparent need of the communities. Apparently successful projects breed more funding for new projects. This structure is therefore incompatible with long-term commitment to communities or ventures that would endanger the chances of receiving new funding for bigger and better things. Likewise, a charity will not often support a previously failed project: administrators want to see what's next. Recently, charities and other donor organizations have attempted to rectify some of these problems by demanding adherence to performance metrics, but these metrics can have the same impact—short-term demonstration of impact at the expense of long-term success and accountability.
– Government aid organizations are similarly motivated by demonstrating immediate impact and are under an even greater burden of showing the scale of their impact in the short term, as dictated by political calendars. Additionally, there is such a high turnover within international government organizations that attention paid to long-term projects is deficient (Gibson et al. 2005).
– Volunteer-based organizations are supported almost entirely by the motivations of their volunteer labor force. Volunteers also want to see an immediate return on their efforts

and can be even more self-serving in the amount of short-term impact sought. Trying to sell volunteers on donating their time to painstaking, boring, long-term projects is difficult. And so, there is a shotgun approach of projects around the world, leading to many failed projects. And even when the programs are focused on long-term commitments to communities, the volunteer turnover results in the atrophy of previous projects started and never finished sustainably by the same organizations.

Figure 1 illustrates these potential constraints to sustainable community development that should be acknowledged, including human behavior, local conditions and operational constraints.

Ebrahim (2005) suggests that accountability in development work must be rethought, to emphasize downward accountability to communities, not just upward accountability to funders. The responsibility for this change lies with both the development agencies and the funders. They must be willing engage in long-term social change and self-examine failures, and not just report short-term success (Ebrahim 2005; Jordan and van Tuijl 2006). Accountability may be achieved through several methods, that include enforcing participation, transparency, evaluation and the redress of complaints, through regulations, politics, contracts and impact on reputation (Brown 2009).
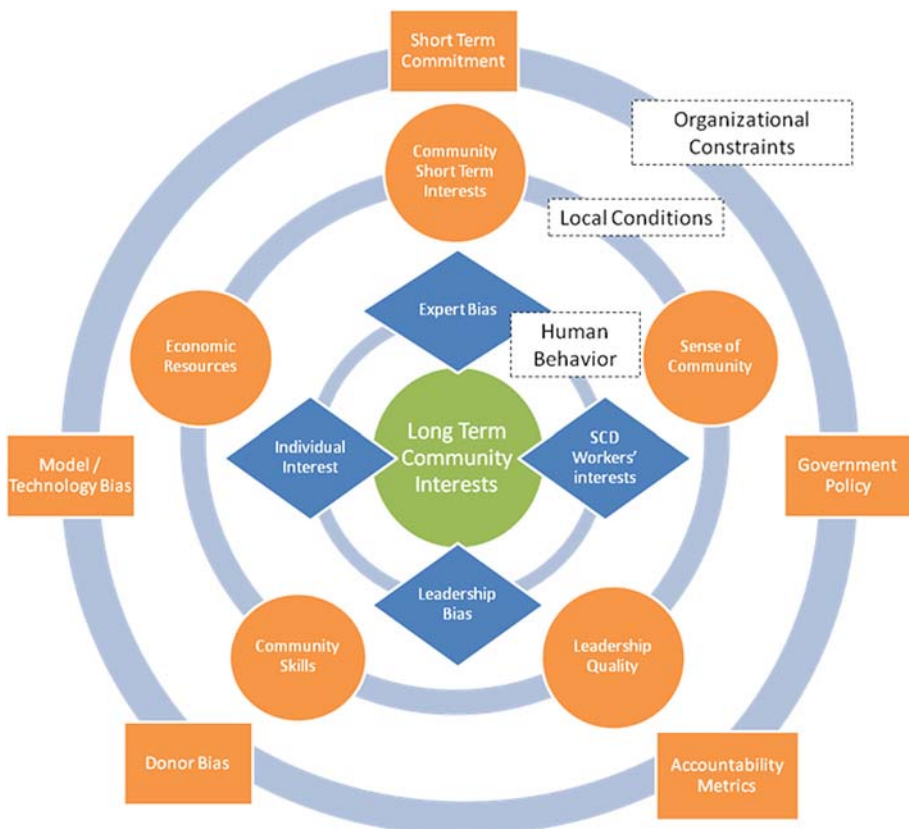

Fig. 1 Conflicting realities of sustainable development models

4 Proposed inclusions to development models—tangible capacity building

The drawbacks identified with discrete sustainable development projects often lead to discussions on 'capacity building', which has been defined as "… the building (or strengthening) of human, institutional and infrastructure capacity to help societies develop secure, stable and sustainable economies, governments and other institutions through mentoring, training, education, physical projects, the infusion of financial and other resources, and most importantly, the motivation and inspiration of people to improve their lives," (Hatch 2007).

Capacity building can be applied on a small scale as well, which we term 'tangible capacity building', via domestic businesses with trained employees, clients and revenue. Clearly a business venture is not easy, but if development institutions focus the same time and effort they focus on discrete projects, the expense will be comparable and the impact potentially much greater. Microenterprises are an excellent tool, but only for a handful of ambitious entrepreneurs and cannot impact as many people as a true enterprise.

However, this melding of business enterprise with humanitarian development is contrary to the models and structure of most organizations for several reasons. While microenterprises are widely promoted, they depend on extraordinary entrepreneurs taking a great risk and invoking a pioneering spirit that works well with the altruistic persona of developers. However, to the idealistic viewpoint, a business enterprise, which involves policy interaction, profit, employees and business suits, can seem tainted. Yet, those same idealists have benefited from a hybrid of capitalization and socialization in their own lives and are not always endowed with much experience with alternative models. Finding extraordinary leaders in communities in the developing world is at least as hard as in the developed world.

Figure 2 illustrates components of tangible capacity building that are necessary to realize accountable and sustainable development projects, including development

Fig. 2 Tangible capacity building for community development

agencies, community participation, policy interaction, capitalization and human capital all addressed together on a program or project basis. The illustration is presented as a series of cogs, each of which is necessary for success and can be identified and held accountable for failure.

5 Attempted sustainable community development case studies

Engineers Without Borders-USA (EWB-USA), a nonprofit humanitarian organization, was founded at the University of Colorado at Boulder in 2001. The primary author of this paper was the volunteer project manager for the case studies presented herein and has responsibility for some of the critical shortcomings of the reviewed project. It is presented here to highlight some difficulties other organizations may be able to avoid and not to criticize any organization, community or individuals.

Located in East Africa, Rwanda is a landlocked country that is slightly smaller than Maryland. With a fast-growing population of over 10 million, it is the most densely populated country in Africa. Rwanda is very mountainous and poor with over 90% of the population working as subsistence farmers. The communities of Mugonero and Muramba, located about 4 h apart, have unique development requirements compared to many other developing communities. First, the communities are very densely populated, likely comparable to the conditions observed in nearby Kanama in 1993, where each person was farming less than a seventh of an acre (Diamond 2005). Families live virtually atop one another. Communities and service areas are poorly delimited. Second, western Rwanda's mountainous terrain makes water wells generally impractical. Third, the residents are extremely poor and have very little disposable income or time for water treatment or other technologies. Residents do not share food with their neighbors because most do not have enough food for their own families. This level of poverty is comparable to the pre-genocide conditions, wherein many thousands of people participated in the killings motivated in part by the strain on the environmental resources by the population (Diamond 2005).

When EWB-USA first visited Muramba in March 2004, community leaders introduced the team to their water provisioning challenges. Surface run-off water was harvested for community facilities by a deteriorating network of pipes and shallow collection boxes. In some locations, apparent springs provided some drinking water needs. These water sources were fed to facilities on the opposite hillside. The pipes often leaked or broke, and during the dry season there was not enough water for users. During the two annual rainy seasons, waterborne illness spiked due to contaminants being washed into the unprotected water sources. These conditions are similar across western Rwanda (USAID 2008).

In January 2006, a EWB-USA team assessed these locations for potential water quality projects. During this assessment, the team determined that the water quality around the Muramba Clinic was poor. During interviews and meetings with community leaders and clinic employees, the consensus was that addressing the water quality concerns was appropriate. The community and clinic leaders specifically requested help with the water quality challenges and expressed commitment toward operating and maintaining an installed system.

During this site survey, the team failed to identify that the primary water source for the Muramba Clinic was a spring, as reported by subsequent visitors. Had this determination been made, a spring box may have been a more appropriate solution and was indeed implemented by other EWB-USA groups later. This discovery would not have been difficult, and the failure was essentially due to the volunteers being spread too thin in their

assessment work, with little emphasis on the Clinic assessment at the time and no more extensive follow-up. Instead, the consensus was that water treatment at the point of use was appropriate.

A trade study concluded that family-sized disinfection systems were impractical because of the replacement and maintenance costs, and labor were all outside the means of a typical Rwandan family. Therefore, EWB-USA decided to work with the Muramba Clinic, which would be responsible for maintaining the systems. The Clinic would provide access to residents living nearby. EWB-USA volunteers then developed the BYOW system, consisting of gravity-fed gravel flocculators, rapid sand filters and solar panel powered ultra-violet disinfection systems. The system could be assembled almost entirely in Rwanda out of locally available (at the very least, importable to Kigali) components and could be operated and maintained for a cost and labor burden comparable to family-scale systems. The technical details of the system are described in detail in Gold et al. (2007).

Between January and June 2006, communication between the communities and EWB-USA consisted of reassurances on both sides that the agreement to address the water quality at the clinic was still in place. In May 2006, the Executive Director of EWB-USA travelled to Rwanda on other business and went to Muramba to discuss the potential design options. The community leaders stated that the design and responsibilities outlined were in keeping with the previous discussions and agreements and reaffirmed their support for the project. The EWB-USA team was confident that the development of bacterial decontamination technologies for the Muramba Clinic was appropriate and in keeping with sustainable community development models.

In June 2006, the EWB-USA team arrived in Rwanda with a complete water treatment system in tow. In Muramba, the conditions included a lack of clearly defined leadership, as individuals previously committed to the project were not reliably available during the implementation stage, plus there was a change in the water supply conditions. Six months previous, the clinic did not have any running water and received water from the contaminated spring. By the time of implementation, a water pipeline was up and running, providing much improved quality and quantity supply.

The team, in consultation with the Muramba Clinic leadership, went forward with the installation on the premise that the surrounding community could utilize the system and that when the water quality was poor at the Clinic, the employees would use the system. The installation proceeded with all the hallmarks of appropriate technology implementation, including local laborers from the Muramba Vocational School, installation leadership from the school, training on the operation and maintenance of the system with both the Vocational school teachers and the Clinic and general community meetings to emphasize the ease and importance of using the system. However, the Vocational School students and staff were paid for their labor, as it was made clear to the EWB-USA team that it would not be culturally appropriate to expect skilled laboring in free time for a project not directly impacting those individuals.

As a follow-up, EWB-USA had a Rwandan volunteer visit Muramba to interview the community on use of the system. The Clinic leadership reported that the BYOW system was being used by staff, patients, mothers of newborn babies, teachers, students and other residents and indicated that the system continued to be adopted by an increasing number of residents.

The EWB-USA volunteer who conducted these interviews was directed to seek candid answers to the follow-up questions and to use his own intuition and judgment on the success or failure of the system. The conclusion was that Muramba Clinic counted the BYOW system, "among the remedies it can use in curing diarrhea and some other

diseases, which are caused by the unclean and contaminated water that the people in Muramba drink. This is our community's answer to such diseases, we will continue coordinating the campaign to increase usage of this system."

However, this apparent success was soon determined to be inaccurate. A year later, the EWB-USA team returned to note that the system had fallen into disuse. In spite of repeated statements to the contrary by the community leaders, the conditions of the system led to the conclusion that the system was being underutilized. During this visit, the team refurbished the system and spent much time with further education and training efforts. The community once again assured the team that they would proactively maintain the system. Another year later, in June 2008, the system was once again not being used. Now, efforts are underway to salvage the project. During this time, a spring box was implemented by another team at the Clinic water source, which dramatically improved the water quality. However, the community leadership continued to express support for the BYOW system, even when it was suggested that the system be dismantled.

Throughout this process, the EWB-USA team members, attempted to follow sustainable community development guidelines and good engineering practice. The conditions were assessed by experts; community meetings and leaders provided input into the need to address the water quality conditions; the infrastructure was in place and offered to support the operation and maintenance of the system; vocational school staff and students appeared eager to participate; and the technology implemented, according to many technical experts, was easy to maintain and addressed the critical water quality issue. Instead of creating success, this model resulted in failure.

This failure was due to the realities of the organizational and community constraints and human nature from participants in Rwanda and the United States. The EWB-USA team failed to conduct a thorough enough assessment before implementation, and the community assurances were not backed up by action because there was not an immediate return for the resident investing his or her time in maintaining or operating the system. The Clinic personnel, although well versed in water-borne disease and trained in operating the system, did not do so. From reports, there were both concerns about internal responsibility and motivation to work with the system, as well as atrophy in the education provided. Instead, the Clinic chose to put the burden on the Vocational School, which in turn, after several months, decided that because their staff and students were not directly benefiting from the use of the system, and they were not being paid to operate and maintain it, doing so was not worth their while. The realities of human nature hit headlong against the ideals of development. While all concerned recognized the potential benefits of the system, without direct compensation included in the plan, there was no immediate motivation to ensure continued use. This is a reasonable and understandable response that must be accounted for in future implementations.

Meanwhile, the EWB-USA team assessed, developed, implemented and monitored a second generation BYOW system at the Mugonero Orphanage, a defined community with strong leadership and located a few hours from Muramba. With some improvements, the implementation process was largely the same as that used in Muramba. As in Muramba, the system was requested and assurances were provided that it would be used and maintained. However, a key difference was that the Orphanage was a small, defined and enclosed community under the direct control of a strong leader, in contrast to the Muramba Clinic, where leadership was transient and served a sprawling and poorly defined population.

After installation in September 2007, Victor Monroy, the Guatemalan director of the Mugonero Orphanage, reported to EWB-USA on the usage of their recently installed BYOW system. Mr. Monroy reported, "The Children's Village did not have clean water

available on site for the past 6 years. The only available option to drink pure water was to boil it. That caused to the orphanage very high expenses to purchase big amounts of firewood. Due to the long and relatively complicated process of boiling water, quite often the children decided not to boil the water. Quite often the children suffered from digestive and intestinal problems. Now there is plenty of pure water available to cover all the needs of the orphanage. To boil such an amount of water, we would need to burn mountains of firewood every single day. Now all the children have more than enough pure water to have a healthy and happy life. We are convinced that the health of all our kids will improve considerably through the precious and abundant supply of pure drinking water."

A year later, in August 2008, the EWB-USA team assessed the conditions and response of the system. It was reported and observed that the students now refuse to drink any water that does not come from the water treatment system, and the system was observed to be well maintained and even improved since the initial installation.

While it is well known that water accessibility places a greater role than water quality in changing user behavior (White et al. 1972), it is not anticipated to be the driving factor behind the differences in this case study, as the accessibility situations are similar, if not more favorable in Muramba. In both Muramba and Mugonero, the source water is collected at least 400 m from the homes of the targeted users down a steep slope. In Muramba, the source water is closer to the user homes and water treatment system than in Mugonero. Residents in both locations are accustomed to the chore of carrying water from the source to their homes. In both cases, the water treatment systems are situated near the homes of the targeted users, generally less than 100 m away.

This case study reviews two communities with similar conditions, two similar installations and two dramatically different results. However, the reasons for the failed system versus the successful system were not discernable prior to installation using the abbreviated sustainable community development models alone. In the end, the sustainability hinged on extraordinary leadership in a defined community, which in itself is not a sustainable solution for humanitarian development.

One potential lesson learned in these two case studies is an evaluation of the appropriateness of attempting to exclusively follow sustainable participatory community development models under such constraints. The constraints identified were:

1. Lack of a clearly defined community. Rural Rwanda is dense subsistence farming sprawl. It is not easy or obvious to identify what the community boundaries are. Meanwhile, community development models presuppose a sense of well-defined community, accountability and universal participation.
2. Extreme poverty. Most rural residents are farming barely enough to survive, and most people cannot afford to share their food, time or money for community concerns. These conditions contributed to a genocide in 1994 and are in conflict with sustainable development assumptions that people can share resources.
3. Development agency structures. Many aid organizations have a high level of turnover of ambitious but limited experience employees and volunteers, and the structures surround discrete projects and limited accountability.

Since 2000, the Government of Rwanda has engaged in implementing their "Decentralization Policy" that encourages the local population's participation in policy activities that affect their lives. This key element of social accountability is designed to "re-build lost ties of the community" after the genocide and recognizes that conflict and poverty are closely interrelated. In the water sector, responsibilities have been decentralized to district level, where 65% of districts have water master plans. Local water committees known as

"regie" have been formed to coordinate local water distribution, location of pipes, wells, tax levels and exemptions. The significant cost and complexity of installation remain the responsibility of the national authorities. This decentralization effort has met with mixed success—some local committees are considered ineffective because of the level of poverty and the general opinion that water should be a free resource. A recent study suggested that more local technical training may be effective, but only if monthly salaries are provided to the trainees (GoR 2006).

Given these constraints to applying community-based sustainable development, it is important to be willing to adjust programs in similar environments to these weaknesses, which may involve the inclusion of other development methods.

6 Hybrid of SCD with large-scale impact concept review

In 2007, The Manna Energy Foundation, a United States based nonprofit organization found in 2005, was reorganized in 2007 to combine the water treatment experience of Engineers Without Borders-USA in Rwanda with a change at the United Nations Clean Development Mechanism (or CDM, established under the Kyoto Protocol). The lead author of this paper is a founding principle in Manna, which is designed to redress some of the previous challenges experienced in Rwanda.

Previously, the CDM issued "Carbon Emission Reductions (CERs)" (or carbon credits, each representing as a metric ton of carbon dioxide captured or suppressed from emission) for demonstration of the reduction of actual greenhouse gas emissions. Africa and other developing regions of the world were left literally in the dark and out of the market, as made obvious by an image of the Earth as seen from space at night, Fig. 3, which shows that Africa and other developing areas of the world have minimal emissions. In mid-2007, the Executive Board of the UN CDM allowed for the concept of "suppression of demand" whereby project proponents could demonstrate a demand for energy that was not currently being met, due to resource availability or poverty, then install alternative energy efficient technologies that provide the same level of service that is demanded and claim CERs on the energy demand suppressed for the operation and maintenance of the systems.

Fig. 3 The Earth as seen at night from space (Mayhew and Simmon 2000)

Under the Rwanda Renewable Energy Project, Manna will install nearly 500 water treatment plants and biogas generators augmented with high efficiency cookstoves throughout Rwanda, targeting most of the secondary schools, at the direction of the Government of Rwanda. The installations will be awarded (CERs) or carbon credits over a period of 10 years for each installation.

This new model for humanitarian development is unique. Traditional development organizations rely on government, UN or charity grants and have finite funding with specific goals for discrete projects. Even foundations with sustainable endowments fund projects individually, often with little commitment for sustaining the projects a year or 10 years, later. Instead, under this model, economic sustainability and expansion are generated only by the continued use of the installed projects. There is a direct incentive to ensure that the projects are successful, in that these same projects serve to fund further development. No longer is there a disconnect between funding mechanisms and models and public health goals. The Manna Energy Foundation is pioneering this venture, as the first organization ever to attempt to qualify for United Nations carbon credits based on the treatment of water to address public health needs.

Manna, acting similarly to a utility, will install, operate and maintain the installations for a period of at least 10 years. The large-scale systems are tailored for each community with community involvement. They are built, installed, operated and maintained entirely by trained Rwandan personnel; generate revenue for installation, operation, maintenance, replication and profit; address two universally recognized critical public health challenges in Rwanda; and will impact at least a third of a million citizens for a decade. In other words, the Manna model maintains the most successful components of community participatory development, includes successful facets of large scale development and forgoes some of the pitfalls of both.

Meanwhile, at the direction of the Ministry of Education, the monetary savings from the wood offset realized by the improved cookstoves and biogas generators will be put aside for operation and maintenance after the 10 year CER crediting period has expired. This model combines business enterprise with direct government intervention for the benefit of the wider population. The concept is still in the early stages of realization and will certainly encounter significant challenges.

7 Conclusions

The momentum with development historically emphasized large-scale infrastructure in a vacuum of other capacity building requirements. These failures are part of the reason modern development models have such distaste for specialists swooping in and installing huge systems. Development models now advocate almost exclusive community-based participatory development, which requires extraordinary commitment for long periods of time by aid organizations. The models also require defined communities with resources to spare. However, the application of these models often comes up lacking because of the constraints of both the communities, the aid organizations and the individuals involved, and there is little accountability for successes or failures.

Small-scale development efforts can still be as or more successful than they are at the present, without injecting significant increases in resources or effort, if they are willing to acknowledge constraints including human, community and organizational and utilize proven concepts for obtaining synergy between human nature and community interests.

New development models should recognize and utilize bias and constraints on the part of every interested party. Further, the models must be open to using successful facets of development that have been demonstrated around the world, including capitalization, specialization, policy interaction, leadership and direct accountability to achieve tangible capacity building. Good ideas, technologies and efforts alone will not sustain positive change without the financial mechanisms to support those efforts long term.

One potential need in the sustainable development field is an auditing and accreditation organization. While nonprofits and government organizations report statistics such as overhead numbers, cost of materials and number of people impacted per dollar spent, these statistics do not necessarily translate to positive changes in developing communities. Additionally, the humanitarian benefit numbers are predominately self-reported, and the only external auditing generally conducted is financial. There have been several important steps towards accreditation of NGOs. The Philippine Council for NGO Certification is a step in this direction, although it currently emphasizes financial accountability and leaves project success to self-assessment (Jordan and van Tuijl 2006). In the water sector, Water Partners International is deliberately not an implementing organization. Rather, they serve as an intermediary between vetted implementation organizations and funders. Water Partners takes responsibility for evaluating the success of their partner organizations (White 2009).

Just like universities are accredited by an independent organization to verify the quality of their institution, a sustainable development accreditation organization may be appropriate to independently verify development claims, provide feedback to organizations and donors and hold implementers accountable for the resources spent.

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