Development Engineering

Are Engineers Making a Difference in the Developing World?

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The concept of an engineering "field" for international development is newly emergent. Yet the act of applying technology to promote development is not new. Indeed, it has been on the minds of scientists, engineers, and policy makers for decades. Has this renewed interest in development work—sparked by movements such as the UN Millennium Development Goals and the recent tsunami in Asia—provided an opportunity for real improvements in the development effort and the conditions in developing nations? How realistic and sustainable can engineers' contributions to such problems be?

Intermediate Technology and International Development: A Brief History

In 1973, E.F. Schumacher published a revolutionary book titled *Small is Beautiful: Economics as if People Mattered*. Ranked by *The London Times Literary Supplement*[1] among the hundred most influential books published since the Second World War, it challenged the way society saw development issues in the Third World. The book contains Schumacher's ideas of appropriate technologies and economies of scale. The plight of impoverished nations, he argued, was brought on by Western industrial development. In areas such as agriculture, for example, their current technologies could not meet the needs of their populations. However, it would not be suitable to simply transplant modern technologies developed by and for industrialized nations such as the United States. Schumacher instead claimed that intermediate technologies would be more appropriate for solving such problems. He saw intermediate technologies as "belonging between the capital-intensive advanced technologies of the 'West,' driven by large scale production and profit, and the traditional subsistence technologies of developing countries." Building on the skills, knowledge, and norms already existing in the developing regions, intermediate technologies seek to equip people to advance their own development.

Figure 1.

These ideas sparked the creation of the Intermediate Technology Development Group (ITDG) by Schumacher and his colleagues. This began the process of researching technologies and equipment that could be used by small-scale farmers and artisans. Widely considered to be the birth of the widespread movement for engineering-for-development, the ITDG has inspired the formation of many similar organizations around the world. To date, countless scientists and engineers have contributed to the development cause.

Additionally, the Intergovernmental Group on Transfer of Technology, part of the United Nations Conference on Trade and Development (UNCTAD), was formed in 1970, followed by the Committee on Transfer of Technology in 1974. They have both helped increase awareness of development-related issues among influential political circles.[2]

Figure 2.

Efforts for the cause of international development are constantly being renewed at local, national, and international levels. Since these original developments decades ago, dozens of charitable, non-profit, non-governmental, and even private organizations have formed with goals aiding the development process. Today, the UN has several committees that seek to address related issues: the United Nations Development Program, the Division for Sustainable Development (of the UN Department of Economic and Social Affairs), and the Science and Technology for Development Network (of the UN Conference on Trade and Development) to name a few. Individual nations also have agencies or departments concerned with international development, such as the United States Agency for International Development (USAID) and the British Department for International Development (DFID).

Most recently, the Millennium Development Goals, set forth by the United Nations in 1990, ambitiously challenged the world to improve the extreme poverty situation around the world by 2015. The specific goals were to eradicate extreme poverty and hunger, achieve universal primary education, promote gender equality and the empowerment of women, reduce child mortality, improve maternal health, combat potentially deadly infectious diseases, ensure environmental sustainability, and develop a Global Partnership for Development.[3] Additionally, the Make Poverty History campaign has come onto the world scene, challenging the major industrialized nations of the world to be more active in poverty alleviation by promoting fair trade, canceling un-payable national debts, and improving the quality of aid.[4]

Does this renewed focus on international and sustainable development reflect real attitude changes? One cannot deny the fact that issues of global development are gaining momentum on the world stage. Universities have also increased focus on the issue. Cambridge University created the Centre for Sustainable Development in the Engineering Department, while MIT has recently launched both academic and non-academic programs promoting development, including the new International Development Initiative. Programs such as the Public Service Center support independent summer fellowships, providing funding for selected students to complete engineering-related community service projects. Other programs, like the IDEAS competition which started in 2001, encourages students to develop their ideas into innovative solutions to that can have a positive impact on the world.[5] Supporting these efforts are a host of student-motivated organizations and professional non-profit organizations raising awareness of development issues, and providing those involved with opportunities to affect positive change.

Engineers' Involvement in Development

These issues have had a direct relevance regarding engineers' involvement in development work. These, and other such efforts to promote international development, may be brought to fruition by the application of appropriate technology. This does not imply that technology is a panacea, but it is nonetheless a significant force in effecting change.

In this flavor of engineering technologies, the task of understanding the "clients" is especially important. Western engineers aiming to devise a technology that can suitably address development issues in other nations must have a grasp of the technological as well as social context of the problems for which they are tackling. In order for a technology to be sustainable in the long term, it must be made of readily available resources and should be manufactured and repaired locally. If something depends on imported parts or special expertise, there is a good chance that once the technology fails, it cannot be repaired and restored. This difficulty arises when engineers, in the U.S. for example, find themselves unable to visit the sites or talk with the locals for whom they are designing the technologies. Before the implementation step is even reached, there are many considerations that must be taken into account. This has been the problem with many attempted projects. Ambitious people bring in what they think to be solutions, without fully understanding local needs and capabilities.

Also, the long-term ramifications of technologies are complex and difficult, if not impossible, to predict. Devices designed to improve efficiency may well send entire segments of the local population into unemployment.

Furthering the problem is the lack of availability of failed project reports. The failure stories need to be reported on just as much as the success stories, to prevent duplicate research and to help people better understand what methods do not work. Along the same vein, project reports cannot inflate their accomplishments, but should realistically depict the situation. This may be more of an issue in this particular field, where there is less of a basis for accountability. Exaggerations can be made about the reaches of a technology far more easily than the can be made about the reaches of a corporate technology. The populations in developing nations using these intermediate technologies often do not have a voice on the world scene, whereas populations using commercial technologies are more vocal—and thus better suited to pointing out false claims of the reaches of technology. Progress will be inhibited until there is better documentation of all development projects.

Beyond the problem of false reporting, technologies that do not live up to their claims cause another problem: disappointment. People in developing populations may become disillu-

sioned with western aid when it so often follows a pattern of not meeting its claims. "The pattern of failed technology transfer projects was world-wide. As a result, the underlying concept of the Vienna conference held that concerted governmental action at both international and national levels was required in order to build up endogenous capacities within developing countries."[6] The United Nations itself realized this harmful cycle, and worked to involve the appropriate people in the process to combat it, including policymakers, engineers, and stakeholders throughout the process.

Where to Go from Here?

How can engineers effectively use their skills to benefit impoverished people, without causing more harm than good? Several methods have been developed to facilitate just this. Participatory Rural Appraisal (PRA)[7] and Participatory Communication for Development[8] are methods that seek to enable people to realize their problems and plan their own development. It brings the stakeholders together with the engineers (or others involved in the process) to ensure better outcomes—solutions to problems that the stakeholders themselves identify as problems, instead of solutions to problems identified by outsiders. Through semi-structured interviews, mapping exercises, discussions, and other activities, this goal is being achieved.

Additionally, numerous committees within the United Nations have published documents citing proper methods for sustainable technology transfer. The problem is one of complexity. "While some generalizations are possible, the specific nature and severity of the challenges [of technology transfer] depend on the prevailing circumstances, varying with the type of technology, its specific application and the characteristics of the technology providers and recipients. Examples of challenges include shortfalls in technology creation and innovation, underperformance in technology sourcing, sub-optimal enabling environments, and insufficient and unverified information. Small and medium enterprises are disproportionately impacted by these challenges."[9] The problem remains that many of the scientists and engineers who have knowledge of the problems and the tools that may help fix these problems are disconnected from the practical means of implementation. By better integrating the technical and political communities, some of these obstacles are being overcome.

This is a field in which students can make remarkable contributions to progress, through identifying problems, developing technological solutions, and implementing these solutions. It was, for example, in MIT's DtM02 Seminar and Design Studio course (now D-Lab) and 2.009 that the Kinkajou Microfilm Projector (designed to assist literacy classes in western Africa) saw some of its development. "To date, more than 100 students from Massachusetts Institute of Technology, Worcester Polytechnic Institute, Cambridge University (UK), and Babson University have contributed to the business planning, design and field testing of a solution since the [Kinkajou Microfilm Projector] project's inception as a DtM design challenge in spring 2002."[10] Through service UROPs[11] and the MIT Public Service Center Summer Fellowship program,[12] students have gained exposure and made contributions to a host of engineering projects—from wheelchairs in western Mexico to solar energy in Lesotho to improved cooking fuel in India.

Conclusions

International development work has come a far way since its formal beginnings decades ago, but it still has a long road ahead. Development workers have increased awareness about the needs of appropriate technology, but sustainable projects are still not necessarily the norm. Opportunities for international development work are increasing, but they are still somewhat limited largely due to funding; development offers the paradoxical situation where the aim of an engineer should be to make themselves obsolete—in terms of project upkeep—to the people for which they are aiming to benefit.

Margaret Meade once said, "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed its the only thing that ever has." Indeed, through technical know-how, persistence, and increased attention to the interests and needs of the stakeholders, engineers can continue to make improvements to the global community and effect change.

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