

CAPACITY BUILDING – ENGINEERS FOR DEVELOPING COUNTRIES

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Abstract

The global persistence of warfare, aggression, oppression and political unrest testify to the growing vulnerability and impatience of those who live in conditions of extreme poverty. A larger injection of aid is needed to help stabilize the poorest countries: projects that promise only long-term results are inadequate responses to immediate needs. But in order to insure that this aid is not wasted, the population of these countries must be prepared to act in partnership with the donor nations in monitoring funds distribution and assessing their impact on the economic welfare of their countries.

This paper argues two points. First, foreign aid in the US and other developed countries must be raised to a minimum of .7% of the combined GDP of the developed countries. Second, 10% of that foreign aid must be earmarked for higher learning in engineering and technology in order to increase economic development and its concomitant result, alleviation of poverty. With an adequately educated and trained indigenous workforce to help implement foreign assistance, chances are increased for sustainable improvement in the living standards of the people.

Introduction

“Give a man a fish; you have fed him for today. Teach a man to fish; and you have fed him for a lifetime.” (Anon.)

“It is good fishing in troubled waters.” (Anon.)

Developing countries need to be taught how to fish, rather than continually having fish

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provided to them by the developed world. And the time is ripe for those lessons to be taught to indigenous people who can most quickly and effectively wield the lines and lures, because they and their people are hungry and impatient.

Technical capability is needed for developing countries to engage effectively in the global economy. In addition, technical capability is needed to assure the effective utilization of international assistance sent to developing countries. A well-educated technical workforce pool must be in place before technology-based multinational companies will be attracted to make investments in production facilities and other areas. The day is past when such companies would simply introduce expatriates from developed countries to attempt such operations. Current political and economic realities require that a population of well-educated and trained indigenous people be available to sustain technically based industrial operations.

A technical workforce pool should also be specifically educated and prepared to engage in entrepreneurial startup efforts that meet local needs. Well-educated engineers and scientists in developing countries will find appropriate ways to extend R&D results to marketable products and services responsive to local needs – to their personal economic benefits as well as to the economic benefit of their countries. Further development of such entrepreneurial startups can lead to products and services that profitably extend to regional markets, and eventually global markets.

Indigenous science and technology capacity is also needed in developing countries to assure that international aid funds sent there are utilized effectively and efficiently – both for initial project implementation and for long term operation and maintenance. Too often in the past, major projects in developing countries have failed to meet desired and designed objectives because there is not a local base of technically qualified people to assist in implementation in ways that are compatible with the local culture and environment.

Thus it is clear that developing countries need their own indigenous technological expertise. They cannot afford to buy it from developed countries, and even when technical expertise from developed countries is provided by external funding it is often ineffective in appropriately responding to local needs and constraints. Capacity building of technical expertise in developing countries is key to enhancing their ability to become economically self-sufficient.

What is needed

The Secretary General of the United Nations, Kofi Annan, has used the acronym WEHAB to describe the areas in which aid must be provided to developing countries in order to build self-sufficiency: water and sanitation, energy, health, agricultural productivity, and

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biodiversity and ecosystem management. Engineering and science are key in each of these areas – and an indigenous capacity in these technical fields must be developed to assure that foreign aid funding is used effectively and efficiently.

Education is key to capacity building. While aid to developing countries must include significant funding for K-12 education, university level education, and continuing education in the fields of engineering and science are most urgently need. It is recommended that support for indigenous technical capacity building be included in each aid project in a developing country. Universities and other educational agencies need to be built, re-equipped, and sustained, along with their faculties; graduates need continuing education to maintain their technical expertise; incentives must be provided to convince young people to remain in their homelands and invest in their collective future.

In discussions of higher learning needs in developing countries one problem that is often neglected is the instability of universities and research institutions. Universities in some parts of the world where education is most needed are too often rocked by political unrest sufficient to disrupt all teaching and research functions. An essential component of capacity building is to ensure the continuing functions of higher learning and research even through economic, social and political upheavals. Institutions of higher learning must be supported as a source of solutions to a nation's problems, not endured as a source of additional problems and uncertainty.

In addition to capacity building and the provision of foreign aid in developing countries, developed countries must make political and economic decisions that allow emerging market countries to trade effectively in the global marketplace. It is inappropriate and inefficient for a developed country to build trade barriers against imports from emerging countries, and/or to subsidize its own economic sectors to undercut the supplying of appropriate products from developing countries, both of which have happened recently in the US and France.

Update of the agenda of world needs

The World Summit on Sustainable Development¹, held in Johannesburg in August-September 2002, has provided an updated perspective on the needs of the world's developing areas. It reaffirmed sustainable development as a central element of the international agenda, as had been stated in Rio 10 years earlier, and gave new impetus to global action to fight poverty and to protect the environment. It identified safe drinking water and basic sanitation as key needs in developing countries, as well as access to energy and the sustainable use of natural resources while protecting the environment. It listed responsible corporate development as necessary to lead to the economic growth that can lead to poverty reduction.

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The authors of this paper interpret these pronouncements as a call for international aid that is focused on capacity building in the developing countries – that is, building a base of technologically educated skilled workers who can effectively utilize foreign aid to build and maintain necessary infrastructure which can support economic developments leading to growth. It is our judgment that earlier foreign aid projects in such countries that did not first build a local cadre of educated and trained people to carry them out and keep them operating have had less than desirable results.

One caveat that must be mentioned in any discussion of foreign aid to build developing countries to economic strength: endemic corruption must be identified and systematically weeded out. In far too many instances, corrupt governments and/or private individuals and enterprises have siphoned off massive amounts of foreign aid money, defeating the efforts of international agencies to assist developing countries. If those gaping sinks for funds cannot be closed – by effective government policies and actions in the developing countries – no amount of international aid will achieve the desired results of economic growth and self-sufficiency.

The Gender Imperative

“Teach a woman to fish, and you have fed a family for a lifetime.” (Anon.)

Women must be given priority in education efforts at all levels to assure long-term societal development. No nation can afford to write off one-half of its population in the interest of conforming to long-standing cultural norms, however well meaning or god-given they are proclaimed to be. In order to jump start economic recovery in the poorest countries, women are the key, because they play a dual role. They can raise the living standards of their immediate families, and they can also create an environment in which both female and male children will have a better chance for improving themselves through education and thus effect far-reaching changes in their societies.

Enhancement of engineering education

Developing countries need world-class engineering educators in order to mount effective engineering education programs at their local universities. Today the typical pattern is for bright young talent in developing countries interested in engineering education to complete programs of study through an undergraduate degree in their home countries, then to go abroad to North America or Western Europe for doctoral study. Sufficient financial aid, in the form of fellowships from international agencies or assistantships at the universities where graduate level study is undertaken, is typically available today. It is important to assure that doctoral graduates from institutions in developed countries do return to their home countries to take up faculty careers.

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When fresh engineering doctoral graduates from universities in developed countries return to their developing countries to take up university faculty careers, they need startup funding for laboratory equipment, computers and communications, and curriculum development. Such funding should be a priority for international aid agencies committed to local capacity building.

Curriculum development for engineering education programs in developing countries should be informed and guided by the state-of-the-art of engineering education in developed countries – but tailored to local needs and constraints. Considerations such as the amount and type of mathematics and science to be included, technical specialties to be offered, broadening subjects to be covered, etc. are important².

Engineering faculty members in developing countries need the opportunity to interact with engineering educators elsewhere for professional development. Funds need to be provided for at least periodic travel to professional conferences in developed countries or at the international level. Mechanisms for technical updating – such as sabbatical periods abroad and participation in periodic technical conferences in developed countries – must also be provided to engineering faculty members in developing countries. In addition, electronic mechanisms – such as electronic conferences, digital libraries, etc. – must be made available³.

Economic development needs

“Give a man a fish: you have fed him for today. Teach a man to fish; and you have fed him for a lifetime. Teach a man to sell fish and he eats steak.” (Anon.)

Beyond the building of a well-educated workforce base, developing countries need assistance in moving ideas from conception to economic viability. Industry incubators, where R&D results or other intellectual seeds can be developed to economically viable products and services, are one effective mechanism. Startup funding for entrepreneurial individuals and teams is another key ingredient on the road to self-sufficiency. Training in small business development – intellectual property rights, finance, management, marketing, international trade, etc. – in another key ingredient. External funding for such activities can be very effective and efficient foreign aid, leading to more self-sufficiency for developing countries.

Funding needed

It has been estimated by the Center for International Development at Harvard University that approximately \$ 50-billion per year will be needed to effectively address the several need areas represented in WEHAB⁴. This amount is approximately 0.4% of the combined gross domestic product of the developed countries of the world. To address all aid needs,

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it is estimated that approximately 0.7% of the combined GDPs of developed countries would be required.

But developed countries typically currently provide aid funds significantly below these need levels. The United States, for example, currently budgets only 0.1% of its GDP for foreign aid and about 50% of that is earmarked for Israel and Egypt. Under considerable pressure from the world community at the recent United Nations conference in Monterey, Mexico, President Bush promised to raise the US contribution to world foreign aid needs to 0.15% over the next several years. Some countries do much better with foreign aid commitments; Sweden, for example, contributes approximately 1.0% of its GDP to such aid. These comparative figures can be deceptive, of course. The United States has a long tradition of volunteerism and philanthropy benefiting needy countries. This tradition is less familiar and little practiced elsewhere. The immigration laws also permit large numbers of people to come to the US from other countries, establish themselves with paying employment, and send a large portion of their wages home to their native lands. These and other traditions and practices result in large infusions of non-traditional “foreign assistance” provided by the US. So the Federal Government’s foreign aid budget alone cannot be taken as the sole contribution that the US makes to assisting poor countries raise their standards of living through economic development.

Aid flowing from developed to developing countries needs to be increased significantly in order to reach the critical mass that will allow the poorest of the poor countries to move toward self-sufficiency at a pace sufficient to improve the living conditions of people now living. But such aid should be provided in ways that encourage developing countries to build internal capacity, particularly in human capital, to ensure an appropriate path to economic independence and financial stability. Earmarking just 10% of all aid funds for capacity building in engineering and science would bring about a sea change.

Failure of previous aid efforts

In his 2001 book “The Elusive Quest for Growth”, William Easterly⁵ cites the failure of international aid agencies such as the World Bank and the International Monetary Fund in their attempts to stimulate economic growth in poor developing countries. He documents how these agencies, typically led by economists, have tried to use foreign aid, investment in machines, fostering education at the primary and secondary levels, controlling population growth, and giving loans and debt relief conditional on reforms to stimulate the economic growth that would allow these countries to move toward self sufficiency. He further documents, with statistical data from studies by these agencies themselves, that all of these efforts over the past few decades have failed to lead to the desired economic growth. Easterly concludes that these massive and expensive efforts have failed because they did not hit the fundamental human behavioral chord that “people respond to incentives; they do what they get paid to do, and what they don’t get paid to do they don’t

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do”.

While documenting many failures of foreign aid efforts over recent decades, Easterly hold out hope for two areas that can likely lead to the desired economic growth in developing countries that can lead them toward economic self sufficiency – utilization of advanced technologies, and education that leads to high skills in technological areas. He argues that developing countries have much less vested interest in old technologies, and can jump right to the technological frontier – with appropriately focused external aid. Technological change is a powerful force behind economic growth, leading to new goods and new technologies which can be competitive in the global marketplace. When people have the incentive to adopt new technologies, a steady rise in the economy’s potential over time occurs, with a resulting increase in people’s average income.

Easterly describes the efforts of international aid agencies over the past decades in the education area, where the focus of costly programs has been at the primary and secondary levels. The statistics he cites indicate that such programs have not resulted in economic growth for the developing countries in which such education programs have been conducted. He argues that what will work is the education of people to highly skilled levels in technological areas, together with high-tech machinery, adaptation of advanced technologies, and other investments that happen in economies where there are incentives for growth. Government policies must provide the incentives for such education and economic growth, or else bright, educated people from developing countries will migrate to more developed countries in a ‘brain drain’. He cites the highly successful development of the software industry in Bangalore, India as a result of government policy promoting technological development, and a university system producing the needed highly skilled workforce.

The authors of this paper interpret Easterly’s arguments and statistics as support for their premise that investment in high quality engineering education can be a primary turning point on the path to economic growth for a developing country, leading it toward effective participation in the global marketplace and toward self sufficiency.

Conclusions

The developed world must teach developing countries how to fish, rather than just sending fish to them. Science and technology capacity is needed in developing countries in order to allow them to compete in the global economy, and to assure that aid funds are utilized effectively. Aid funds must be directed to high priority areas, such as those identified by the acronym WEHAB, and including education. High quality engineering education is a key ingredient needed by developing countries as they strive to develop their economies to allow effective entry into the global marketplace. International aid funds flowing from developed to developing countries must be increased significantly, with an appropriate

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percentage earmarked for workforce capacity building, particularly in technical areas.

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