RESEARCH FOR DEVELOPMENT

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When I was a graduate student, I knew wanted to run a research group that focused on technology for developing and emerging markets. I consulted professors from a variety of schools and was most often told that I should do "real" research to get tenure, and only afterwards focus on international development. Their perception was that development-focused engineering did not have any research value and belonged primarily in undergraduate classes.

This mentality is dead wrong. We live in a time of tremendous opportunity to use engineering to positively impact the developing world, where extreme poverty and diminishing natural resources have created some of the most pressing challenges in human history. Engineers have the chance to solve problems that mean life or death to millions if not billions of people. Great technical problems that do not have obvious solutions form a fertile ground for engineering research.

Take for example the Millennium Development Goals, which were set in 2000 during the United Nations Millennium Summit (**www.un.org/millenniumgoals**):

1. **Eradicate extreme poverty and hunger.**
2. **Achieve universal primary education.**
3. **Promote gender equality and empower women.**
4. **Reduce child mortality.**
5. **Improve maternal health.**
6. **Combat HIV/AIDS, malaria, and other diseases.**
7. **Ensure environmental sustainability.**
8. **Develop a global partnership for development.**

View these goals through an engineering lens and you see that achieving Nos. 1, 4, 5, 6, and 7 could certainly include a technological intervention. Most of the other goals could benefit from engineering as well. For example, Khan Academy (**www.khanacademy.org**) offers free, high-quality primary educational material via the web, and the Global Alliance for Clean Cookstoves (**www.cleancookstoves.org**) promotes clean and efficient cooking solutions to improve the respiratory health of women and children. Although significant progress has been made towards achieving the goals, many will not be met by the Summit's 2015 deadline. The Millennium Development Goals, as well as the myriad other technical challenges facing the developing world, should constitute a call to action for scientists and engineers.

ACADEMIC RESEARCH AND INDUSTRY R&D WILL LEAD TO SCIENTIFIC BREAKTHROUGHS AND REVOLUTIONARY TECHNOLOGIES THAT WILL CHANGE THE LIVES OF MILLIONS.

But why is engineering *research* needed when solutions to these problems have existed in the developed world for decades? One reason is cost. Developing and emerging markets demand technologies that perform for a fraction of the price of western equivalents. Medical diagnostics, for example, has seen advances in low-cost equipment. Daktari's (**www.daktaridx.com**) CD4 cell counting system and Diagnostics For All's (**www.dfa.org**) paper-based tests were facilitated by fundamental research: one in microfluidics, the other in patterned paper chemistry.

A second reason is that the dynamics of developing and emerging markets are fundamentally different from those of the developed world. Consumer preferences, government subsidies, distribution and repair networks—all of these stakeholder-driven factors must be accounted for when developing a technology. Existing solutions cannot simply be modified to meet the challenges faced by developing countries. We need Yankee ingenuity, not Yankee adaptability.

In the five years since I was discouraged to pursue development-engineering research, I have been heartened by the changing attitudes toward this field. The shift has been catalyzed by proponents like George Whitesides of Harvard University and Diagnostics For All, who has authored over 1,000 academic papers and has called for more research on frugal technology for developing countries (*The Economist*, Nov. 17, 2011).

Funding for academic research for development has also increased through new programs like USAID's Higher Education Solutions Network (**www.usaid.gov/hesn**) and continued support by established players like the Gates Foundation. This is just the beginning. Academic research and industry R&D will lead to engineering breakthroughs that will change the lives of millions — not only in the developing world, but also worldwide.

To learn more about how you can get involved, I invite you to attend the Forum on Research Related to Developing Countries and Emerging Markets that will be held at the ASME IDETC/CIE conference in Portland, Ore., this August. ME

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