Combining Instrumental and Contextual Approaches: Nanotechnology and Sustainable Development

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Hailed as the "foundation of the next industrial revolution,"[1] nanotechnology is reshaping the landscape of technological innovation and creating hope around the world. Some believe that nanotechnology can address the critical needs of developing countries, but others are less optimistic. At one end of the spectrum, scientists predict that, among other accomplishments, nanotechnology can alleviate poverty, provide safe drinking water, and cure diseases. At the other end, skeptics warn that nanotechnology can further widen the gap between the rich and the poor, contributing to an already imbalanced global landscape. What can nanotechnology bring to the 21st century? How and in what ways should it intersect with law, public policy, and the plight of the developing world?

This article argues that the international community can harness nanotechnology to create sustainable development, particularly in the field of water remediation and treatment, but it must learn from its past missteps and adopt a strategy that combines two competing theories: instrumentalism and contextualism. Instrumentalism is the concept that technology is superb and stakeholders can easily transfer it from one application to another. In contrast, contextualism places technology in a socioeconomic context and conditions technological success on the stakeholders' ability to meet local needs.

Part I defines nanotechnology and developing countries in the context of public health. Part II describes instrumental and contextual perspectives and illustrates the importance of combining the two positions. Part III focuses on one case study, water treatment and remediation in Bangladesh. Part IV then suggests how the international community can harness nanotechnology to provide safe drinking water to the world's poor.

Nanotechnology and Sustainable Development

The use of emerging technologies to address critical needs has become increasingly common.[2] With the advent of nanotechnology, scientists are confident about its potential to assist the poor.[3] Unfortunately, despite laudable contributions made thus far, significant challenges remain, particularly in the area of

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global health. Billions of people continue to suffer from illnesses while struggling to meet daily necessities.

Introduction to Nanotechnology

Definitions of nanotechnology vary from one institution to another. In a 2004 report, the Royal Society and the Royal Academy of Engineering introduced a simple definition.[4] Nanotechnologies are "the design, characterization, production, and application of structures, devices and systems by controlling shape and size at nanometer scale."[5] A nanometer is one billionth of a meter.[6] In comparison, a sheet of paper is about 100,000 nanometers thick,[7] and a human hair is 80,000 nanometers wide.[8]

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Nanotechnology is a broad interdisciplinary field, encompassing physical, chemical, biological, electronic, and engineering processes that design and manipulate structures and materials at the nanometer scale. At this scale, new properties develop and materials achieve performance otherwise unattainable at the macroscale. For example, some manufactured nanomaterials conduct heat or electricity better than their macroscale counterparts. Others reflect light better; still others have different magnetic, catalytic, thermal, or imaging properties at the nanoscale.[9] Scientists are using these differences to achieve technological breakthroughs.[10]

Definition of Developing Countries

Statistical indexes such as income per capita, life expectancy, and literacy rate measure the development of a country.[11] Although the United Nations (UN) has not precisely defined "developing countries,"[12] it created the Human Development Index (HDI) to provide some guidance. In essence, the HDI captures a country's average achievements in health, knowledge, and the standard of living.[13] For example, life expectancy at birth measures health, and GDP per capita measures the standard of living.[14]

To be classified as a "least developed country" (LDC), a country must satisfy three criteria: low income, human resource weakness, and economic vulnerability.[15] The UN relies on indicators such as health, nutrition, and stability of agricultural production to make such determinations.[16] Afghanistan, Bangladesh, Cambodia, and Yemen are a few of the countries on a lengthy list of LDCs.[17] In recent years, resolving the LDCs' health issues has become a key feature on the agendas of numerous developed countries.[18]

Confronting Challenges in Global Health

A decade ago, a lack of resources represented a major roadblock to providing for the world's poor. Over the years, both public and private funds have risen extraordinarily.[19] Governments and private donors such as Bill Gates and Warren Buffett have increased spending to fight diseases and other problems ravaging the poor.[20] Despite well-intended policies and charitable contributions, challenges in global health persist.[21] For example, notwithstanding the six billion dollars pledged by the Bill and Melinda Gates Foundation between 1999 and 2006 to battling diseases, which is a sum roughly equal to the budget of the World Health Organization (WHO) for the same period, health care is still lacking in developing countries.[22]

Scholars attributed this inadequacy to several factors. First, instead of tackling public health in general, much of the aid has focused on solving narrow, disease-specific problems.[23] Projects typically have short-term numerical goals, such as increasing the number of people receiving specific drugs or decreasing the number of pregnant women diagnosed with HIV.[24] The projects' short-sightedness contributes little to improving an entire population's general well-being.

Moreover, many global health projects lack methods of assessing efficacy or sustainability.[25] Citizens of developed countries design and manage such projects without implementing exit strategies or safeguards against local governments' dependency.[26] In addition, local citizens have virtually no voice in the decision-making process.[27]

Lastly, the loss of educated workers to developed countries and a lack of visionary leadership reduced the projects' effectiveness.[28] This "brain drain" problem is escalating because developed countries are continuing to attract talented students from around the world to meet the needs of their ailing and aging populations.[29] By 2020, the United States may face a shortage of up to 800,000 nurses and 200,000 doctors.[30] This shortage can reduce the pool of talent necessary to meet health care demands in developing countries.[31] A lack of leadership compounds the problem, leaving many speculating grimly about the future of global health.[32]

With the development of nanotechnology, scholars disagree on whether the international community can use nanotechnology to eradicate poverty. Skeptics doubt that nanotechnology will benefit the poor,[33] but others are confident that it will be the key to addressing critical needs.[34]

Current and Future Applications of Nanotechnology in Public Health

In public health, nanomedicine and nanobiotechnology are promising. Nanomedicine can enhance disease diagnosis, drug delivery, and molecular imaging.[35] Medical products with nanoparticles are already on the market in the United States.[36] For example, many burn centers in North America use wound dressings with nanocrystalline silver that contain antimicrobial properties.[37] Furthermore, nanobiotechnology can provide a systematic approach to drug delivery and enhance both diagnostic and therapeutic techniques.[38] However, many experts consider nanobiotechnology a long-term project requiring strict testing and extensive validation procedures.[39]

A study in 2005 identified and ranked the ten applications of nanotechnology most likely to benefit developing countries.[40] To assess nanotechnology's potential impact, the study compared the top ten applications to the UN Millennium Development Goals.[41] The results reflect a surge of confidence in nanotechnology's ability to help the poor, particularly in public health. Among the ten applications, five are public-health related: water treatment and remediation, disease diagnosis and screening, drug delivery systems, air pollution and remediation, and health monitoring.[42] This article focuses on water treatment and remediation. Despite optimism, debates continue on nanotechnology's impact in practice. Two competing positions emerge as a result of the debate: instrumentalism and contextualism.

Critique of Sustainable Development through Instrumentalism and Contextualism

The role that technologies play in development and poverty alleviation is a hotly contested issue.[43] For example, instrumentalists and contextualists differ on how the international community should harness nanotechnology. The former takes the position that nanotechnology can spur development, but the latter disagrees, warning that it can reinforce inequality.[44]

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Technology as an Artifact

Instrumentalists argue that technology is a neutral artifact that allows the society to transfer it from one context to another.[45] Technology can solve social problems; more importantly, social problems arise because of a lack of technical capabilities.[46] Instrumentalists urge developing countries to embark on nanotechnology development in order to improve their competitiveness and standard of living.[47] Because nanotechnology is an efficient and advanced technology, it will reduce poverty.[48] Fundamentally, competitive enhancement is necessary to drive growth.[49]

Contextualists disagree, arguing that technology is a socially conditioned artifact.[50] Technology embodies social relations, interests, political power, and cultural values.[51] Contextualists emphasize the social context in which a society produces, uses, and adapts to new technology.[52] Because technology is a product of social structures, its use is a function of socioeconomic trends.[53] This means that technology can widen the income gap if poorly managed.[54] Barriers such as profit-driven innovation, privatization of basic knowledge, and concentration of patents in developed countries all hinder growth.[55]

Criticizing instrumentalists' naivety, contextualists contend that increasing a country's competitiveness does not necessarily lead to development.[56] Contextualists point out that inequality in countries such as China and India has increased despite the countries' technological advances.[57] Thus, nanotechnology is unlikely to benefit the poor.[58]

Policy Directions
Instrumentalists and contextualists also disagree on policy goals. To the former, technology itself is flawless and the driver of policy.[59] Instrumental extremists substitute technological policy for social policy and believe in a one-size-fits-all solution that can solve problems across countries despite social, cultural, and ecological differences.[60] Since technology drives development, experts should play a more significant role than the general public in the decision-making process.[61]

On the other hand, contextualists stress the social conditioning of technology and seek a more democratic governance of technology.[62] While developed countries encourage public participation to assess technological development, developing countries rarely engage their citizens.[63] The absence of public participation makes developing countries more vulnerable to the risks of nanotechnology.[64] Thus, contextualists urge policy makers to pursue a multifaceted strategy in nanotechnology decision making, one that takes into account socioeconomic factors such as globalization.[65]

Economic Consequences
Instrumentalists take a deterministic approach, arguing that transferring technology is simple and that benefits of the transfer will materialize mechanically.[66] Ultimately, the linear model of innovation will prevail: innovation will increase competitiveness, which will lead to economic development.[67] Wealth will then trickle down and enrich the society as a whole.[68]

Contextualists embrace a more fatalistic view, arguing that nanotechnology can cause changes in the division of labor and jeopardize employment opportunities.[69] Nanotechnology substitutes can shrink the global demand for raw materials exported from developing countries and widen the income gap.[70] Contextualists also argue that because numerous nanoproducts cater to affluent societies, nanotechnology will not reduce poverty.[71] For example, products such as supercomputers and personalized medicine cannot create sustainable development.[72]

A Case Study: Poisoned Water in Bangladesh

In order to predict nanotechnology's impact on developing countries, it is useful to study how past technologies have performed. The article delves into one specific area, water treatment and remediation, and investigates one particular case, arsenic poisoning in Bangladesh.

Arsenic poisoning in Bangladesh is the largest mass poisoning of any population in history.[73] Studies estimate that, of the 140 million people living in Bangladesh, over 77 million are drinking arsenic-contaminated groundwater.[74] Drinking this water can cause bladder and skin cancer and eventually death.[75] Ironically, the poisoning can be traced back to good-faith efforts to provide safe drinking water.

The surface water in Bangladesh is full of microorganisms that historically caused cholera and typhoid epidemics.[76] In response to the surface water contamination, the United Nations Children's Fund (UNICEF) advocated the installation of tub wells to access presumably safe groundwater.[77] As the main proponent of the project, UNICEF created designs for tub wells and provided materials to the local government.[78] The partnership dug one million tub wells, followed by another three million dug by the villagers.[79]

In the mid-1980s, a growing number of people began to show signs of illnesses.[80] Organizations such as the British Geological Survey (BGS) then conducted studies on groundwater contamination.[81] In 1997, the WHO publicly acknowledged arsenic toxicity.[82] In 1998, the World Bank approved a $32.4 million interest-free loan to create the Bangladesh Arsenic Mitigation and Water Supply Project.[83] In the meantime, millions died from arsenic poisoning.[84]

This historical disaster illustrates that an instrumental approach to solving problems in developing countries is inadequate. The international community cannot transfer one technology from one context to another without taking into account socioeconomic needs. The lack of accountability, coordination among stakeholders, and local participation all contributed to the crisis.

Among many, UNICEF denied culpability, explaining that "at the time, standard procedures for testing the safety of groundwater did not include tests for arsenic [which] had never before been found in the kind of geological formations that exist in Bangladesh."[85] The BGS, which conducted studies on behalf of the Bangladeshi government in the 1980s and 1990s, also failed to monitor arsenic levels.[86] Like UNICEF, the BGS contended that it reasonably believed it did not have to test the groundwater.[87] Despite denials, however, one BGS manager conceded that arsenic had been one of the parameters in the WHO's Drinking Water Guidelines.[88]

Here, the transfer of technology itself was problematic. Contrary to instrumentalists' prediction that injecting technology alone will solve problems, UNICEF's introduction of tub wells failed to improve the plight of the Bangladeshis. UNICEF did nothing other than digging. It did not test the groundwater to ensure its safety, nor did it establish procedures to assess the wells' viability. It also failed to establish the accountability of local government and plan for an emergency. This instrumental process of transferring technology without more proved fatal. What appeared to be a simple "one-technology-fits-all" solution turned into a catastrophe.

Another lesson learned from Bangladesh is that local action, or inaction, can nullify technological benefits even if the transfer itself is flawless. Because of a lack of governance and accountability, the local government failed to detect the poisoning early on and implement remedial procedures. The government knew of the possibility of pollution as early as 1984.[89] It also received a letter in 1993 from an international arsenic expert concerning the arsenic problem.[90] Yet, it took no action,[91] and instead, continued sinking wells.[92] When the WHO publicly acknowledged the poisoning in 1997, governmental remedial efforts were inadequate and slow.[93] Early detection followed by immediate relief might have reduced the number of people exposed to the contaminated water.[94]

In addition to government inaction, local factors such as a lack of public health education exacerbated the crisis. Among the poorest in the world, the Bangladeshis built their lives around tub wells after falsely assuming that the wells provided safe drinking water.[95] Although aid workers designated unsafe tub wells with red paint to warn villagers, warning efforts were ineffective because villagers did not understand the consequences of arsenic poisoning.[96]

This case suggests that an instrumental strategy to aiding developing countries is insufficient. Digging wells without engaging the local government and its citizens failed to improve conditions in Bangladesh. Nevertheless, the international community can harness nanotechnology to help provide safe drinking water. Learning the lessons of Bangladesh, however, is crucial to success.

Harnessing Nanotechnology in Developing Countries: A Mixed Strategy

Effectively harnessing nanotechnology for use in developing countries must proceed with a strategy that mixes the instrumental and contextual perspectives. Instrumental strategies alone are inadequate, because simply transferring nanotechnology without tailoring the technology to local needs will not create sustainability. A purely contextualized regime, however, is equally insufficient, because local action or inaction can nullify the benefits of technological transfers. A middle-of-the-road strategy is necessary to balance local needs and the need to create transparency and accountability. Before examining this strategy, however, it is helpful to review existing water nanotechnologies.

Nano-Products in Water Treatment and Remediation

Purification systems equipped with nanotube filters can provide safe drinking water[97] because they contain nanoparticles that degrade pesticides and pollutants.[98] Scientists have already developed filters that can separate petroleum hydrocarbons from crude oil and remove bacteria from water.[99] They are working now to incorporate nanomaterials with antibacterial properties on various kinds of substrates.[100] Their efforts show that a combination of nanotechnologies can treat water for a large population. For example, Hydration Technologies' forward-osmosis membrane can provide large-scale water purification despite its current use as a means of emergency water supply.[101] With more nano discoveries in progress,[102] easy access to safe drinking water is not far from reality.

As discussed, simply introducing nanotechnology for water purification purposes will unlikely produce positive results. The Bangladesh arsenic poisoning provides multiple lessons. If multinationals install nano-based purification systems without tailoring the products to local needs, unintended consequences may eradicate the technologies' benefits. For example, in the absence of a local campaign to educate the public about the benefits of nanotechnology, purification systems may not reach a broad segment of the population.[103] In addition to transferring nano-products, stakeholders, including local governments and multinational corporations, must devise a strategy to maximize the products' use and effectiveness. Thus, a purely instrumental regime in nano water remediation and treatment will unlikely succeed.

A purely contextualized strategy, however, is equally undesirable because local corruption and lack of governance, common in developing countries, can prevent access to the latest nano-products.[104] In Bangladesh, the local government could have contained the spread of arsenic poisoning if it had acknowledged the problem immediately upon receiving information about arsenic poisoning.[105] The lack of transparency led to millions of otherwise preventable deaths. This suggests that some guidance from foreign entities is necessary to ensure the viability of nano projects. However, a purely contextualized assessment of nanotechnology's potential is inappropriate because the view that technology will only widen the income gap between developing and developed countries is unwarranted. Successes of past and current products show that nanotechnology can play a role in sustainable development.

In Bangladesh, for example, scientists are now hopeful about arsenic treatment. Abul Hussam, a chemistry professor at George Mason University in Virginia, recently developed the SONO filtration system, which comprises of a composite-iron matrix.[106] For this creation, Hussam won the Grainger Prize for Sustainability, which the National Academy of Engineering founded to reward creators of affordable technologies.[107] Priced between $35 and $40 per five years of use, SONO is by far the most affordable water filter in Bangladesh.[108] Producing SONO requires only local raw materials and using it does not involve special maintenance skills.[109] The filter has already received recognition for its environmental friendliness and social acceptance.[110] SONO's popularity is evident in that at least half a million Bangladeshis have benefitted from the product.[111] The success of SONO is a clear example of the international community using technology to assist the poor. Contrary to the claims of some contextualists, nanotechnology can address critical needs.

A strategy that combines contextual and instrumental elements will likely bring developing countries one step closer to sustainable development. This strategy must target the bottom of the pyramid (BOP), develop native capability, implement emergency protocols in projects, create an accountability system, and engage the public. This daunting task is not impossible, but it will require a collaborative effort from multiple stakeholders: scientists, non-governmental organizations (NGOs), multinational corporations, local and foreign governments, and local citizens.

The BOP constitutes the world's four billion people living on less than two dollars a day.[112] Originally a business idea developed by C. K. Prahalad, targeting the BOP is profitable because, collectively, the world's poor have immense buying power.[113] Targeting the BOP using nanotechnology is particularly a win-win proposition because it can make addressing critical needs of the poor a profitable enterprise.[114]

This strategy calls for the cooperation of the rich and the poor to create a global interdependency that enriches all stakeholders.[115] This seemingly paradoxical situation is not unattainable, but multinationals must lead the way by creating nano-products not just consistent with, but based upon, local values and needs. Here, contextualized problem-solving is critical. Because multinationals must treat the BOP as a primary market with unique needs, simply repackaging existing Western-style nano-products or selling them unchanged at a discount is insufficient.[116] To succeed, marketing and segmentation strategies must take into account differences across and within developing countries. Professor Hussam's SONO filters succeeded because they were cheap, easy to use, and socially acceptable. This is evident in that hundreds of schools across Bangladesh have already installed SONO filters and many children carry home bottles of filtered water at the end of the school day.[117] Women are also receptive to the product because they no longer have to trek long distances to find arsenic-free wells.[118]

Developing native capability is equally important to ensure the success and viability of water treatment nanotechnologies. A corollary to targeting the BOP, developing native capability means acquiring skills and competencies necessary to truly understand and serve local needs and aspirations. Here, like targeting the BOP, a contextualized strategy will surpass its instrumental counterpart.

To promote native capability, multinationals must deploy local talent and manufacture nano-products using mostly locally accessible, simple materials. A nano-product made with exclusively imported materials and complex technologies is unsustainable. The use of exclusively imported materials and complex components can raise production costs and the price of end products. It can also make long-term water treatment and remediation less than viable, if access to supplies becomes unpredictable because of price volatility.[119]

Developing native capability, in contrast, can lower costs and facilitate the production and dissemination of water treatment products. Although this will initially require multinationals to set up local facilities and train local talent, the cost represents an investment that can generate handsome rewards if managed well. Also, deploying local talent can cut administrative costs and help garner the trust of local end

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users. Developing native capability is thus a two-way street.[120] Water treatment and remediation, when appropriately implemented, can generate profits for multinationals and provide both safe drinking water and new jobs for locals.

All nanotechnology projects must have built-in emergency protocols. This is important because the risks of many nano-products remain unknown.[121] Also, because of ecological differences between developing and developed countries, extrapolation from nano laboratory experiments conducted on foreign soil can lead to unintended consequences.[122]

Here, a middle-of-the-road strategy is particularly important. On one hand, risk analysis and planning for nano water treatment and remediation should be contextual, laying out potential local disaster scenarios and developing the best possible responses to alleviate these crises. If possible, the plan should maximize the use of local resources because of their immediate availability. On the other hand, immediate relief may call for an instrumental injection of existing technologies from foreign countries. Governments, multinationals, and outside agencies may have to provide some guidance and control to ensure that relief technologies reach the affected population quickly and effectively. Local governments should coordinate with other stakeholders to formulate a step-by-step procedure that all parties must follow in the event of a disaster. Although it is impossible to predict every detail of a disaster, it is crucial that all nano projects incorporate, at the bare minimum, a skeletal emergency plan that stakeholders can pursue.

Creating accountability and transparency is perhaps the biggest roadblock in harnessing nanotechnology to provide safe drinking water. Corruption and the absence of a political infrastructure and governance can hinder product dissemination and regulation.[123] They can also obstruct or delay efforts to provide emergency relief. Here, a more instrumental approach is appropriate. Guidance from foreign organizations and governments can help reduce local corruption and alleviate its adverse effects.[124] One solution is to modify existing WHO guidelines to incorporate water treatment nanotechnologies. Another is to set up international committees comprised of local and foreign experts to annually review compliance. These guidelines should include reporting procedures to carefully document the distribution and use of new nano-products and any ensuing incidents of illnesses. The guidelines should also lay out standards to assist experts in determining when a product withdrawal is necessary, particularly if the risks of a product's continued use outweigh its benefits.

Creating sustainable development requires engaging the public in ongoing dialogue. As Professor Hussam conceded, the SONO filters cannot alone alleviate the arsenic crisis in Bangladesh. It takes a "sustainable, progressive, integrated program," plus intensive training and cultural agendas, to succeed.[125] Similarly, harnessing nanotechnology will require active public participation. A good starting point is to create localized educational programs about public health in general. Another is to use indigenous experts to disseminate information on the costs and benefits of nano-products. Relying on young women to educate others in the community, for example, will likely generate more success than sporadically flying in corporate experts. Also, running a public health campaign in schools can expose locals to the benefits of nanotechnology at a young age. The educational component is crucial to the success of nanotechnology in the developing world.

Conclusion

Billions of people live in poverty, with no access to safe drinking water and solutions for other critical needs. With the advent of nanotechnology, however, scientists are hopeful about harnessing the technology to create sustainable development. This ambitious goal, while not impossible, requires a strategy that incorporates both instrumental and contextual elements. To target the bottom of the pyramid and develop native capability, the international community must cater nano-products to local needs. Marketed products must be socially acceptable and accessible. To ensure the viability of these products, the international community should create emergency protocols for all nano-related projects and an accountability system. Lastly, engaging the public in ongoing dialogue is crucial for the products' continued success. Creating sustainable development is a collaborative effort. Managed well, both developing and developed countries will benefit.

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93. See Zaman, *supra* note 89 (describing how workers at a community hospital were accused of attempting to create public panic when they contacted agencies about the poisoning).
94. *Id.*
95. *Id.*
96. See A. H. Smith et al., "Contamination of Drinking-Water by Arsenic in Bangladesh: A Public Health Emergency," *Bulletin of the World Health Organization* 78, no. 9 (2000): 1093-1103, at 1100.
97. See Burgi and Pradeep, *supra* note 2, at 655.
98. *Id.*
99. *Id.*
100. *Id.*
101. *Id.*
102. *Id.*
103. See Smith et al., *supra* note 96, (arguing that a single visit to the village will not change the villagers' behavior).
104. See Garrett, *supra* note 18 (describing country mismanagement and outright corruption in Ukraine and Uganda).
105. See Flores, *supra* note 76.
106. See Hussam and Munir, *supra* note 73.
107. J. Thomas, "Arsenic Filter for Water Offers Hope to Millions," U.S. Department of State, *available at* <http://www.america.gov/st/foraid-english/2008/June/20080608151007xjyrreP0.2713892.html> (last visited September 3, 2009).
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109. *Id.*, at 1875.
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111. *Id.*, at 1876.
112. C. K. Prahalad, *The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits* (Upper Saddle River, NJ: Wharton School Publishing, 2004): at 3.
113. *Id.* at 10.
114. See *id.*
115. See *id.*, at 4 (calling for the collaboration between "the poor, civil society organizations, governments, and large firms"); S. L. Hart, *Capitalism at the Crossroads: Aligning Business, Earth, and Humanity* (Upper Saddle River, NJ: Wharton School Publishing, 2004): at 195 (arguing that companies must treat the poor as partners and colleagues in order to succeed in an increasingly globalized market).
116. *Id.* (Hart), at 195 (emphasizing the importance of understanding needs and aspirations of local inhabitants).
117. See Hussam and Munir, *supra* note 73, at 1877.
118. *Id.*
119. See ETC Group, *supra* note 69.
120. S. L. Hart and T. London, "Developing Native Capability: What Multinational Corporations Can Learn from the Base of the Pyramid," *Stanford Social Innovation Review* 3, no. 2 (2005): 28-33, at 30.
121. See, e.g., The Royal Society & The Royal Academy of Engineering, *supra* note 4.
122. See Schummer, *supra* note 11, at 294 (arguing that locals could become guinea pigs for risky technologies because of weak regulations in developing countries).
123. See Garrett, *supra* note 18.
124. But see *id.* (pointing out that important players are stepping on each other's toes, creating "architectural indigestion").
125. A. Hussam et al., "Arsenic Filters for Groundwater in Bangladesh: Toward a Sustainable Solution," *The Bridge* 38, no. 3 (2008), *available at* <http://www.nae.edu/Publications/TheBridge/Archives/V38N2/ArsenicFiltersforGroundwater-inBangladeshTowardaSustainableSolution7722.aspx> (last visited September 3, 2009).