



Engineering Solutions for the Base of the Pyramid

A report prepared for the Strategic Issues Committee
Strategic Management Sector
ASME
June 30, 2009



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Engineering Solutions for the Base of the Pyramid

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Executive Summary

Executive Summary

The 21st century can be characterized as an age of extreme inequities. In 2007, the two richest people in the world had more money than the combined GDP of the 45 poorest countries. Total consumption of coal, oil and gas has doubled since the early 1970s and electrical generation from all sources has nearly tripled – yet more than 1.5 billion people worldwide still live without electricity. Historically, we live in a period of unprecedented technological sophistication, yet nearly a billion people entered the 21st century unable to read a book or sign their names.

Nearly half the world's population lives in acute poverty. Worldwide, over four billion people form the “base of the economic pyramid” (BoP), a term coined to represent those earning less than \$4 per day (\$3,000 per person/year in local purchasing power). While individual incomes of BoP consumers are low, however, in aggregate they have a cumulative buying power of \$5 trillion.

The 2008 ASME global summit environmental scan report, the Future of Mechanical Engineering, estimated that in the next twenty years globalization and new business models will shift the world's attention to BoP markets. Renewed civic and economic interest will increasingly drive the development of engineering projects that serve the BoP, primarily in the developing countries of Asia, Africa and Latin America. Engineers are likely to be called upon to devise cost-effective ways to increase access to food and clean water, effective sanitation, energy, education, health care, revenue-generating activities, and affordable transportation. ASME's Strategic Issues Committee chose to commission this year's environmental scan to:

- Understand the forces driving the BoP market generally and engineering solutions specifically
- Identify the products, business models and principles that are effectively serving the BoP market
- Identify potential ways ASME could engage in the BoP either directly or by offering services for its members.

Chapter 1 of this report provides an overview of the BoP market, including data on the size of the BoP population, the economic value they generate and the market characteristics and dynamics of the BoP. The section also identifies key driving forces impacting the BoP market:

1 GLOBALIZATION

The social and economic integration of the world's people and resources, creating new investment in social projects and product markets.

2 MICRO-FINANCE

The exponential rise in non-profit and for-profit micro-lending to entrepreneurs often based on trust without written agreements or collateral, that is providing much needed capital to individual entrepreneurs and jump-starting economic activity.

3 MOBILE PHONES

BoP markets have experienced a surge over the last ten years in mobile phone adoption, making it the most prevalent Information-Communication Technology device in BoP markets and spurring novel uses for information sharing.

4 RENEWABLE, OFF-GRID ENERGY

Just as mobile phones leapfrogged the wires, small renewable energy projects are beginning to proliferate, reducing the BoP market's reliance on energy grids and helping the world's poor climb the energy ladder.

5 SOCIAL ENTREPRENEURSHIP

A new class of entrepreneur, often trained in business practices, is attracting funding from foundations and corporations to develop market-based solutions to the problems of the world's poor.

6 CORPORATE SOCIAL RESPONSIBILITY

A majority of the world's largest corporations are now measuring the impact of their business activities on social and environmental issues as part of their performance, and funding products and projects that improve that performance.

7 NEW MODELS OF INNOVATION

Open source frameworks first pioneered in the software domain are increasingly being applied to hardware innovation. In addition, businesses are increasingly experimenting with “trickle up innovation” - products designed for the crucible of low-cost, low energy, low materials BoP market are being introduced into developed markets at disruptive price-points.

Chapter 2 presents examples and case studies of innovative technology and engineering solutions for the BoP in key market sectors including housing, energy, water, health, transportation, food and communications technology.

Chapter 3 looks at new models of engagement for the BoP market. It provides a review of how both private and public sector enterprises are participating in the base of the pyramid. In addition, it reviews the emerging set of best practices around Business Strategies and Design Principles which organizations can model when engaging in BoP activities.

The World Resources Institute identifies the following business strategies for the Bop:

- Focus on the BoP with unique products, services, or technologies that are appropriate to BoP needs and require completely re imagining the business
- Localize value creation through franchising, agent strategies that involve building local ecosystems of vendors or suppliers, or by treating the community as the customer
- Enable access to goods and services – financially (through single use or other packaging strategies that lower purchase barriers) or physically (through novel distribution strategies or deployment of low-cost technologies).
- Foster unconventional partnerships with governments, NGOs or groups of multiple stakeholders to bring the necessary capabilities to the table.

This report surveys and identifies five core design principles for the BoP. These include:

- Develop appropriate solutions, not technologies
- Consider the context
- Create transparent technology
- Embrace the market
- Design for DIY (Do It Yourself)

Chapter 4 considers opportunities for ASME, concluding that there is a strong alignment of Engineering Solutions for the Base of the Pyramid with ASME’s Vision and strategic priorities. Given such congruence, high level opportunities that ASME might choose to participate are suggested. Opportunities were formed by applying ASME’s core assets, capabilities, and strategic priorities to BoP market needs. Options for pursuing these opportunities were grouped by their distance from current ASME products, services, and markets. High-level opportunities are grouped in three options: Low Hanging Fruit, Strategic Impact, and Big Bets.

Option 1: Low Hanging Fruit

The first category, “Low Hanging Fruit”, includes opportunities that require the least amount of investment and risk because they leverage existing ASME products to move into new markets, or introduce new products to markets in which ASME already has a presence. Pursuing these opportunities would allow the organization to quickly impact engineering solutions for the BoP, gain experience with BoP markets, and grow the products and services offered to current customers.

Opportunities in this option include:

- Create opportunities for ASME members to participate specific to their career levels
- Develop Engineering Solutions for the BOP Knowledge Hub
- Develop and support local engineering talent in BoP regions
- Make technical publications more accessible and locally relevant through mobile access and dot

sub translations

Option 2: Strategic Impact

Because they require some combinations of simultaneously entering new markets with new products or services, opportunities in this category require greater investment and focus on the BoP. However, they also promise a higher impact on engineering solutions for the BoP and advancing the organization's three strategic priorities of Energy, Globalization, and Workforce Development to a significant degree.

Opportunities in this option include:

- Engage in unique partnerships and collaborations
- Targeted engineering applications and support workshops
- Develop an open innovation platform
- Organize Engineering for the Developing World conference
- Sponsor project trips and learning journeys to understand local BoP markets.
- Make ASME affordable to potential members by

creating tiered membership schemes.

Option 3: Big Bets

Furthest out in degree of impact and risk are the "Big Bet" opportunities. Pursuing these opportunities would require a choice by the organization that by investing in them, they would accomplish significant portions of their strategic priorities or organizational mission and vision.

Opportunities in this option include:

- Create a venture fund or micro-finance pipeline to fund BoP R&D engineering specific initiatives
- Place major investment in solving global energy poverty

Strategic focus is critical to the success of any initiative; therefore it is not recommended that the society pursue all of these suggestions at once or even all of them over time. ASME's leadership will weigh these investments of time and money against all of the priorities of the organization. However, these opportunities do highlight the strong alignment of ASME's vision, strategic initiatives, and assets and capabilities with developing engineering solutions for the BOP. Following some or all of the business strategies and design principles will result in improved lives for many of the world's poor, increased global reach and influence for ASME and professional opportunities for its members.



Photo credit: www.whiteafrican.com

Chapter 1

Overview of the Base of the Pyramid

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“ In 2007 the two richest people in the world had more money than the combined GDP of the 45 poorest countries. ”



Photo credit: Michele Bowman

Introduction

Ipuli is a small, rural village in the east Rift Valley of Tanzania set amidst a stunning landscape filled with endless hills and soil that is a deep, rich red. Home to the Wanyiramna tribe for generations, life in Ipuli is simple but challenging. The village has no electricity or running water; during the dry season, small ground holes are the only water source for both people and their animals.

At the local school there are no books and only a handful of classrooms have chairs for the nearly 500 students. Medical care is almost non-existent in Ipuli; the nearest hospital is over 80 kilometers away, reachable only by oxcart, bicycle or on foot.

The dream of the village elders is to build a hospital, the name of which reveals its ambitions: the Ipuli Ru-



ral Center of Excellence. The hospital is being developed by a diverse team of supporters: land was donated by a local family spearheading the project; Architecture for Humanity provided the building design and site plans; engineering consultation and funds have been donated by Haley & Aldrich, Inc., a U.S. engineering firm; a grant from the Izumi Foundation, a Japanese non-profit will provide for materials and medical supplies; the PopTech Institute offers project advice and fundraising help; and a global network of family and friends offers advice and support.

Yet even with all this help, making the hospital a reality is harder than it looks. Bricks to build the hospital must be made by hand: the village men draw water from the local pond and shovel sand from the

dry riverbed, mixing them together with cement and hand-cranking the mixture into concrete blocks. The bricks then take a day or more to dry in the sun, a process that grinds to a halt during the rainy season. Over the last two years the men have made thousands of bricks, and the foundation for this future hospital is slowly becoming a reality.

Ipuli village lies at the “base of the pyramid” (BoP), a term coined to represent the nearly four billion people globally that live on less than \$4 a day. Collectively, the term refers to a picture of global poverty that’s staggering: more than 1 billion people on Earth - about one sixth of the global population – lack access to dependable, safe drinking water; 2.4 billion lack adequate sanitation; 1.2 billion don’t have

tential for worldwide impact – to provide clean water, food, shelter, and income – than any other development approach.”¹ A solar-powered light can allow a child to study at night and continue their education. A simple, human-powered treadle pump can supply a community with drinking water and irrigate crops during the dry season. Engineers have an increasingly critical role to play in meeting the challenges of global poverty and creating a sustainable, equitable future.

A Changing Paradigm of Poverty

In 2000 world leaders convened and adopted the Millennium Development Goals (MDGs), committing the international community to achieving eight

“Base of the pyramid” (BoP) is a term coined to represent the nearly four billion people globally that live on less than \$4 (USD) a day.”

adequate housing. Of the approximately 2.2 billion children in the world, nearly half live in poverty; more than one million of these die each year as a result of diarrhea.

Read poverty statistics long enough and after a while, the numbers start to become meaningless. It’s in rural villages like Ipuli that the challenges of global poverty are most apparent: where women and children spend hours walking each day to collect water; where a reliance on subsistence farming means the availability of money and food is unpredictable; where after the sun sets each night, the smell of burning kerosene wafts from the households that are lucky enough to afford it, as the others sit quietly in darkness until morning.

Improving the lives of the world’s poor is impossible without the full input of engineering. Heather Fleming, founder of Catapult Design notes “One inexpensive, effective product or technology has more po-

targets including reducing poverty and hunger by half, combating the spread of HIV/AIDS and malaria, providing universal primary education, promoting gender equality, reducing child mortality, improving maternal health, ensuring environmental sustainability, and developing global partnerships for development, by the target date of 2015. The MDGs focused global attention and galvanized efforts around meeting the challenges of global poverty.

In 2004 professor CK Prahalad at the University of Michigan published *“The Fortune at the Bottom of the Pyramid”* which argued for the need for market-based approaches of poverty alleviation. Prahalad’s work reframed the picture of the global poor by revealing the economic nuances of poverty, suggesting an economic pyramid of relative poverty. In doing so, he reframed the challenge of global poverty as an opportunity to apply market-based approaches to poverty alleviation. The market-based approach

starts from the recognition that being poor does not eliminate commerce and market-processes: virtually all households trade cash or labor to meet their basic needs.² Accordingly, this approach focuses on seeing the poor at the “base of pyramid” as consumers and producers, rather than simply as aid recipients. The concept of the “BoP market” captured the attention of business and sparked a global interest in developmental economics.

Base of the Pyramid by the Numbers

The 21st century can be characterized as an age of extreme inequities. In 2007, the two richest people in the world had more money than the combined GDP of the 45 poorest countries. Total consumption of coal, oil and gas has doubled since the early 1970s and electrical generation from all sources has nearly tripled – yet more than 1.5 billion people worldwide still live without electricity. Historically, we live in a period of unprecedented technological sophistication, yet nearly a billion people entered the 21st century unable to read a book or sign their names.

Nearly half the world’s population lives in acute poverty. Worldwide, over four billion people form the “base of the economic pyramid” (BoP). Earning less than \$4 a day (\$3,000 per person/year in local purchasing power) they are largely excluded from the global economy. However, while individual incomes of BoP consumers are low, in aggregate they represent a \$5 trillion global market.³

The BoP can be divided into three income segments.

According to a recent World Economic Forum report,⁴ the lowest level consists of approximately 1.0 billion people who earn less than \$1/day. The middle segment constitutes the largest group, made up of approximately 1.6 billion people, living on about \$2/day. The 1.1 billion who make up the top tier of the BoP earn between \$2 – 8/day, and have sufficient disposable income to purchase non-essential products. Those at the top tier live primarily in urban areas, whereas the majority of BoP markets are rural (68% globally) and poorly served by government and business.

BoP Income Segments

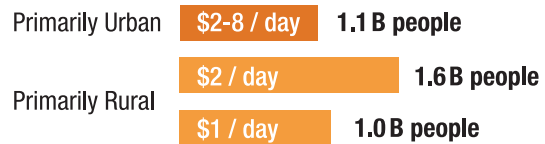


Figure 2 Source: the World Economic Forum

Geographically, the BoP makes up an over-

BoP Market - \$5 Trillion

Total by income segment

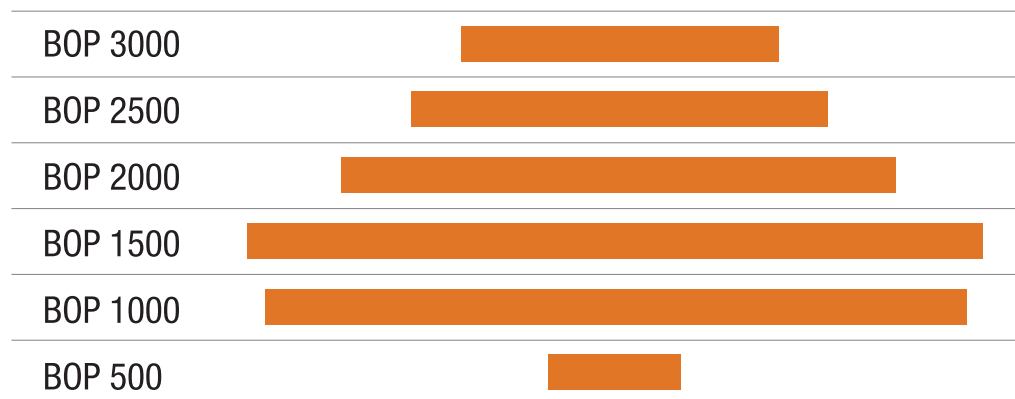


Figure 1 Source: The World Resources Institute

whelming majority of the population in the developing countries of Africa, Asia and Latin America. Research undertaken by the World Resources Institute (WRI) and International Finance Corporation (IFC) to quantify the market size of the BoP markets paints this picture of regional differences:

Asia

Asia (including the Middle East) is the largest BoP market by both population and income, representing 83% of the region's 2.86 billion people, with an aggregate income of \$3.47 trillion. Collectively, India and China account for 60% of the BoP market worldwide;

Africa

In terms of population, Africa is the second largest BoP market, comprised of 486 million people, although purchasing power (\$429 billion) is less than that of Latin America and Eastern Europe;

Latin America

In Latin America the BoP market is \$509 billion and includes 360 million people. In both Brazil and Mexico the BoP represents 75% of the population;

Eastern Europe

The BoP market in Eastern Europe is \$458 billion including 254 million people and 64% of the region's population.⁵

BoP Market Dynamics

Purchasing Power of the BoP



Source: The World Resources Institute

BOP Population and Income

Population (millions), BOP share of total population (%)



Figure 3 Source: WRI/IFC

Although there are regional, societal and cultural differences among BoP markets, people living at the base of the pyramid share some similarities. On a macro-level, BoP markets tend to have dramatically underdeveloped Infrastructure. Lack of access to adequate housing and sanitation are the predominant challenges in urban markets, while in rural areas the main constraints are transportation (due to lack of roads), lack of energy infrastructure and access to clean water.

BoP markets overwhelmingly operate as ‘informal economies’ that are not regulated or integrated into wider national and regional economies. Business environments in these markets often lack effective regulatory frameworks, making rules and contracts difficult to enforce. The International Labour Organisation estimates that more than 70% of the workforce in developing countries operates in the informal economy; that is, they are largely self-employed or work outside the bounds of legally organized businesses.⁶

In its landmark report *The Next 4 Billion*, the World Resources Institute suggests that BoP markets characteristically suffer from a “poverty penalty” – higher priced goods and services. People in the slums of Jakarta, Manila and Nairobi pay 5 – 10 times more for water than people in high-income areas of those cities – and more than consumers in London or New York.⁶ The “poverty penalty” is similar in credit, health care and electricity supply.

Another limiter in BoP markets is restricted access to credit and other forms of financial products and services. Credit is often difficult (or exorbitantly expensive) to obtain, especially as many BoP workers experience fluctuating and unpredictable incomes. Lacking credit, poor producers and consumers can’t finance investments or large purchases.

Finally, while base of the pyramid markets are often characterized by their inherent barriers and constraints, what’s often overlooked is that BoP markets are also extraordinarily entrepreneurial and innovative. Whether selling their crops at market or goods

on the side of the road, most of the world’s poor work for themselves. For those living at the base of the pyramid, subsistence often requires finding innovative solutions to constraints. The ingenuity of those living at the BoP shouldn’t be discounted; instead, it should be recognized and tapped as an invaluable resource.

Driving Forces In The BoP

Globalization

The overwhelming force shaping the Base of Pyramid market is the continued economic and cultural integration of the global economy. The large, developing countries of Brazil, Russia, India, and China (known as the ‘BRIC countries’) have benefitted from globalization, exhibiting significant and extended growth rates. These BRIC economies will account for 40 percent of global economic growth through 2020. Due to resource and trade imbalances, emerging markets now hold 77%, or \$7 trillion, of the world’s cash reserves.⁷ Given this amount of growth and wealth, companies that have focused on mature markets within US, Europe and East Asia now recognize that their primary growth opportunities will occur in emerging economies with significant BoP populations. This includes participating in building the civic infrastructure to support that level of growth, and establishing a market for goods and services that while less profitable, are growing at much higher rates than developed economies.

According to a report by Goldman Sachs, economic growth will drive \$4.35 trillion in infrastructure investment over the next decade in the BRIC countries and the “Next 11” countries of Bangladesh, Egypt, Indonesia, Iran, Korea, Mexico, Nigeria, Pakistan, Philippines, Turkey, and Vietnam. Figure 4 shows Goldman Sachs’s projections for growth in selected infrastructure for these countries through 2017.⁸

The World Bank finds a direct correlation between infrastructure investments and Gross Domestic Prod-

The world's emerging markets are projected to surge in growth in the next five to 10 years - at four times the growth rate of the U.S. GDP.

Projected Infrastructure Growth in Emerging Markets, 2009 - 2017

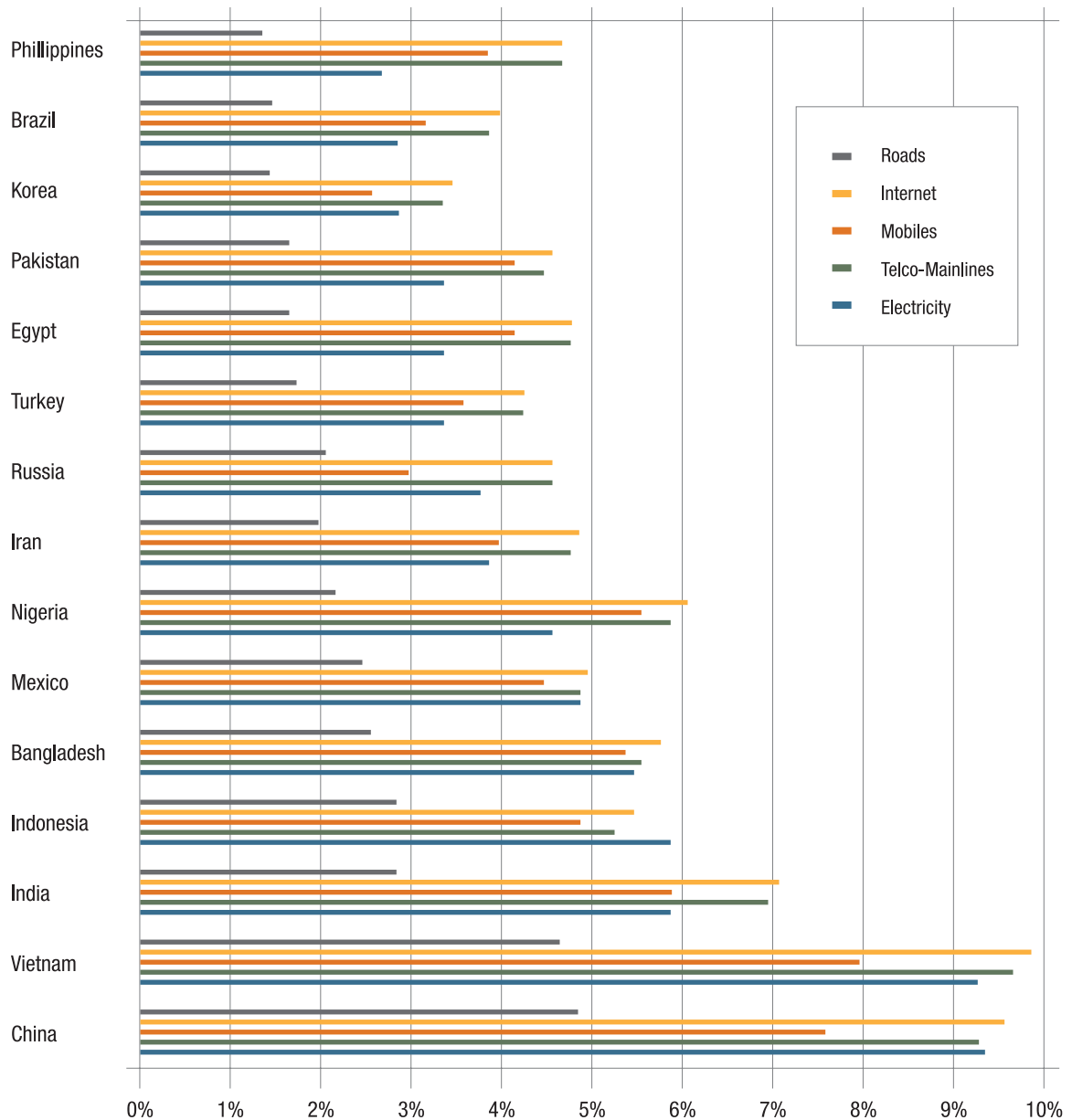


Figure 4 Source: Goldman Sachs

uct (GDP) growth. A 1% investment in infrastructure can be predicted to result in a similar rise in GDP. As investment in infrastructure rises it will spur continued economic growth.

Multi-national corporations are recognizing the growth potential of these markets and investing in them. The top 1000 global companies in R&D spending invested \$43.7 billion on innovation in these countries in 2007.⁹ Before the current global recession, Ernst & Young found that private equity investment in BRIC countries was up 17% through the first five months of the year to \$91 billion.

Credit Models: The Growth of Microfinance

Access to capital and credit is a basic ingredient to economic growth, yet BoP markets have traditionally lacked access to formal credit institutions. In recent years these markets have benefitted from the expansion of ‘micro credit’, popularized by the Grameen Bank model started in Bangladesh during the 1970s.

Microfinance services provide small loans and insurance to underserved populations previously ignored by traditional banks. Microfinance enables entrepreneurs to start small businesses, and can empower previously non-participating populations. Women have especially benefitted, making up an estimated 65% of micro-finance borrowers. As shown in fig-

ure 5 below, the microfinance model has now been replicated in rural and urban communities around the globe based on efforts led by both public and private sector entities. Initially a non-profit activity, the high payback rate (less than 1% of loans are written off) and low administrative costs have attracted for-profit entities, which now make up 34% of the total micro-finance market.¹⁰ Although the market has grown 80% per year since 2004, the total assets of \$35 billion are just 11.6% of an estimated \$300 billion potential market.¹¹

The microfinance industry in key BoP markets is gradually becoming more formalized. In 2008 Kenya passed a Microfinance Act which provides a legal framework for regulating microfinance institutions (MFIs), which lend to entrepreneurs. In May 2009, the Central Bank of Sudan directed its banks to allocate a minimum of 12% of their portfolios to microfinance, as well as issued a directive encouraging the development of loans with a focus on social needs such as housing and agriculture, and a deepening of Islamic banking.

The ‘Mobile’ Revolution

Total Assets of Micro-Finance Institutions, in millions USD

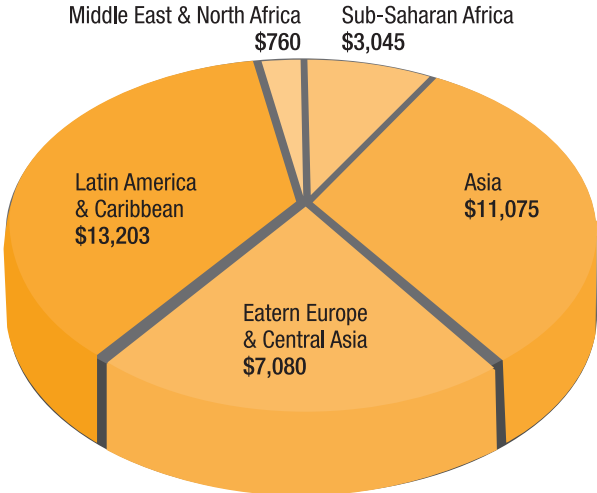


Figure 5

Over the past ten years the number of mobile phones bought in emerging economies has grown exponentially, from close to zero to 49.5% penetration rate at the end of 2008.¹² There are now more mobile phones in these emerging economies than there are in mature economies, making mobile phones the first telecommunications technology in history to have more users in developing countries than in developed ones.¹³

While internet access is extremely limited in most BoP markets, the ubiquity of the cell phone is creating entirely new applications with business and social value. Mobile phones are used for a wide variety of tasks, including sending money to family members to buying fish at market.¹⁴ For example, e Choupal allows rural Indian farmers to check the price of key commodities before selling their products on the market. Healthcare workers are able to send critical messages to patients in remote locations. Microsoft has created a database that uses text messages to track patient adherence to HIV/AIDS retroviral treatments.

In addition, the development of mobile banking has enabled millions of people access to banking services for the first time. In many developing countries mobile telephone credits are used for such services as remittances, retail purchases and bill payments; in effect, airtime credits function as cash, replacing the need for traditional banking services.

As the price and capacity of smartphones continues to drop, applications using GPS and internet services targeted to low broadband access will thrive. These applications, unlike most computer software, will be appropriate for the user, developed in local languages, and open sourced for rapid innovation. In short, mobile phones will provide the best communication and applications platforms for business in the BoP, allowing these markets to leapfrog the traditional “wired” computer model.

Growing Off-Grid Options

The International Energy Agency regards access to energy as an “indispensable element of sustainable human development.” Energy poverty is directly correlated to conditions of poverty such as low education, subsistence living, and conflict. Many popu-

lations in the BoP depend on traditional biomass forms of energy such as wood or dung that create significant indoor air pollution. The World Health Organization estimates this dependence causes over 2 million deaths each year, especially among women and children.

BoP market countries do not have the capacity to build out traditional grid-based electricity or natural gas pipelines to alleviate energy poverty. Instead, just as mobile phone technology leapfrogged landline telephony, there is significant growth in the number of projects that design, manufacture and install power generation systems that enable off-grid energy production. These systems include passive solar water heating, solar electricity, clean biofuels, and onsite wind power generators. While this market is not as mature as micro-finance or mobile phones, installations of wind and solar power generation is growing, and products that utilize wind and solar power are increasing in the BoP.

The Rise of Social Entrepreneurship

For years people assumed that if they wanted to ‘do good’ globally, they must either volunteer for a traditional ‘non-profit’ or NGO (non-governmental organizations.) Today they are going to business school or being trained to become ‘social entrepreneurs’. This new breed of business leaders applies entrepreneurial strategies to social and environments problems.

This approach has enjoyed significant growth over the past ten years. There are 33 universities in the United States offering social entrepreneurship programs. The Ashoka Foundation, the first organization supporting social entrepreneurs, has grown from a budget of \$50,000 to over 2000 network fellows in 60 countries with an annual budget of \$30 million. Its example has been adopted by other funders, including the Skoll Foundation, Omidyar Network, and the Schwab Foundation for Social Entrepreneurship. Social entrepreneurs often lead the first companies into new BoP markets around innovative applications in the areas of health, energy, food/agriculture and education. Tri Mumpuni, Ashoka Fellow and executive director of IBEKA, is installing micro-hydropower plants in more than 50 villages in Indonesia. Ciu-

dad Saludable, founded by Skoll Foundation recipient Albina Ruiz, creates local enterprises to collect and process garbage and recycling materials through 3000 informal recyclers in Bolivia and Peru. Social entrepreneurs like these are bringing business acumen to social ventures, accelerating their efficiency and impact.

'Good' Business: Corporate Social Responsibility (CSR)

Since the 1990s transnational companies have come under increasing pressure to release Corporate Social Responsibility (CSR) reports that measure the impact of their business activities on social and environmental issues. Today, 59 of U.S. Fortune 100 companies have embraced the operational transparency required by CSR accounting as a way to define their role as global citizens. The percentage grows to 90% for top European companies. CSR has become a platform for companies seeking to engage populations in emerging markets in a positive way that also contributes to their long-term success abroad. This foundation in CSR philosophy serves as an entrance point to local markets within emerging economies.

The rise of Socially Responsible Investing (SRI) has also driven the adoption of CSR activities and reporting by public corporations. These investment funds allow individual investors to only invest in a range of companies that have significant positive social or environmental impact. They now account for \$2.7 trillion out of the \$25 trillion U.S. investment marketplace, a large enough percent of the market that many companies are trying to court their investors.¹⁵

New Models of Innovation

Historically, innovation has been the main driver of economic growth. BoP markets, however, have had limited ability to innovate or take advantage of developed world innovation, mainly due to the lack of credit models, information communication technologies, and energy access. As investment in these platforms is increasing, the capacity in BoP markets to take advantage of innovation has grown significantly. New models of innovation are impacting the BoP including open source and trickle-up innovation.

Open Source The Open Source movement emerged from the software and programming community. It refers to an approach to the design, development, distribution and licensing of products and service models that are collaboratively and transparently co-created. In recent years Open Source models have been applied to policy making, education and training systems as well as collaboration-based work platforms.

The Open Source model is spurring innovation at the base of the pyramid. For example, to advance the reach of its work in developing countries, Architecture for Humanity established the Open Architecture Network, an online database and platform which enables architects, designers, engineers and builders to share plans, details, experiences around sustainable housing and building projects. It now has more than 8,000 registered users and 1000 projects. In addition, many of the designs developed on OAN are freely distributed under Creative Commons license, ensuring a broad and open platform for continued innovation.

Trickle Up Innovation Multinational corporations used to create products in developed economies then sell cheaper or outdated models to developing markets. Recently they have instead co-created products specifically designed for the needs and constraints of the BoP that in some cases offer significant cross-market advantages. For example, General Electric's health-care division recently released a first-of-its-kind electrocardiograph (ECG) machine in the U.S. The battery-powered device weighs just six pounds, half as much as the smallest ECG machine currently for sale, and retails for \$2,500, an 80% markdown from products with similar capabilities. The model was first developed in India and China in 2008. This new model of "trickle up" innovation - creating entry-level goods for emerging markets and then repackaging them for sale in developed markets at disruptive price points - represents a new paradigm in innovation that offers competitive advantages in both emerging and developed markets.



Photo credits www.afrigadget.com

Chapter 2

Innovative Solutions

Chapter 2

Innovative Solutions

“ One inexpensive, effective product or technology has more potential for worldwide impact to provide clean water, food, shelter, and income than any other development approach.

Heather Fleming, Catapult Design



Photo credit: www.afrigadget.com

Introduction

As challenging as it is to create and deploy engineering solutions in the BoP, examples of success abound. From multi-national corporations employing high level research, to NGOs deploying camels to deliver healthcare, to university programs saving the lives of premature babies with a cheap incubator, innovative solutions are being developed that have the potential to improve the lives of the world's poor in significant ways. This chapter will review the existing challenges as well as examples of innovative solutions in several market sectors including healthcare, energy, transportation, food and water, and housing.



Healthcare



Energy



Transportation



Food



Housing



HEALTH

“Talk to people in the rural communities of southern Mexico, in the new urban communities on the southern edge of Bogota, or in almost any village in rural Africa about getting decent access to healthcare, and their answer is the same: it usually costs more to get to a clinic, a doctor’s office, even a pharmacy, than the cost of the service itself.”

Allen Hammond
Taking BoP Strategies to Scale

Challenges

In February 2009, philanthropist Bill Gates gave a speech about the widespread prevalence of malaria in the developing world. During the talk, he opened a container and released a swarm of mosquitoes into the audience, telling the stunned crowd “There’s no reason only poor people should have the experience.” The stunt was designed to get the attention of the audience (and the press) about the urgency of the malaria crisis in developing countries, which claims more than one million lives each year.

Gates’ plea to eradicate malaria raised public awareness of just one piece of a complex puzzle that characterizes the health challenges of the developing world. Of the eight UN Millennium Development Goals three address health issues, underscoring the critical link between poverty and health care in the developing world.

Access to public health resources is just one of the many issues facing the healthcare market in the BoP. A lack of trained professionals and adequately equipped clinics (especially in rural areas), poor sanitation as well as ineffective and high costs drugs all combine to create a complex myriad of challenges.

Innovative Solutions

Embrace Incubator

20 million premature and low birth weight babies are born each year in developing countries. 80% of these are born outside of hospitals and 450 of these die every hour. Mortality rates for these infants is particularly high because traditional incubators are extremely rare. New incubators are extremely expensive, and donated machines are confusing to operate and are difficult to maintain and repair.¹⁶

Originally designed by students in Stanford’s Design for Extreme Affordability class, the Embrace Incubator is designed to work in a rural healthcare center or at home. It’s portable, uses no electricity and has no moving parts. The sleeping bag-like design incorporates a phase change materials to regulate a premature or low birth weight baby’s temperature. The device works for over four hours at a stretch without intervention, after which it can be reheated. The device is easy to sterilize, and thus reusable across babies. Embrace will sell for \$25 in India later this year.¹⁷



Embrace Incubator www.embraceglobal.org

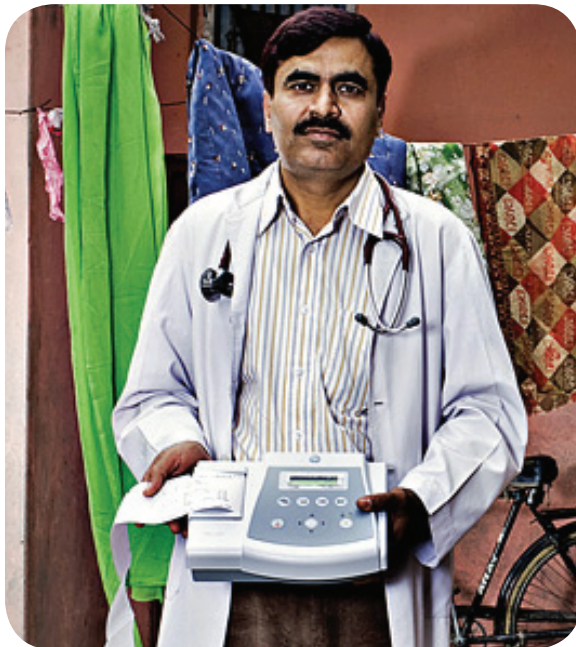




Insect Repellent Lamp (Philips Design concept)
photo: Design for Emerging Markets,
Delft University of Technology

Insect Repellent Lamp

Each year there are 15 million cases of malaria in India alone. To address this endemic problem, Philips Research Asia is prototyping a low-cost lamp for the Indian market that integrates an insect repellent ability with a typical household light bulb by using the waste-heat dissipated by the lighting device to vaporize a liquid-based mosquito repellent. Under the initial design, the Insect Repellent Lamp (IRL) is portable, uses a 14W compact fluorescent bulb and has two operating modes to allow the lamp and repellent to be used separately or together. ¹⁸



GE Health's Portable ECG machine
photo: GE: Reinventing Tech for the Emerging World,
www.businessweek.com

GE's Portable ECG

Remote diagnostic tools are invaluable in the developing world, especially in rural areas where health care visits are infrequent. The new MAC 400 developed by GE Healthcare is the first portable ECG designed in India for the fast-growing local market. The machine weighs less than a laptop (compared to a traditional ECG which weighs 15 lbs), can fit comfortably into a backpack for easy portability and runs on a rechargeable battery. ¹⁹

ENERGY

Challenges

1.6 billion people - one in four people on the planet - lack access to electricity. For those in the base of the pyramid, energy poverty is the biggest limiter to improving living conditions. Energy sources such as kerosene and firewood are inefficient, unhealthy, scarce and expensive. Pollution from indoor use of fuels such as kerosene lead to significant health risks; the World Bank estimates that burning a kerosene lamp indoors is the equivalent of smoking two packs of cigarettes a day.

Off-grid solutions such as solar photovoltaics, hydro-power and wind turbines are becoming more widespread and offer the opportunity to leapfrog traditional energy infrastructure in developing countries.

Innovative Solutions

Humdinger Windbelt

The Humdinger Windbelt is a turbine-less generator that harnesses energy from the rapid-wind induced vibration of the device's ribbon-like vane. At a cost of \$2 per watt, the Windbelt is three to four times cheaper than solar power, making it almost cost competitive with coal. Developed by Honolulu-based Humdinger Wind Energy, a single 1-meter Windbelt can charge multiple cell phones at once or provide LED lighting for a home. In theory, a series of windbelts, chained together like cell in a larger array, could potentially be used for large-scale power generation.²⁰



People without Electricity, 2005

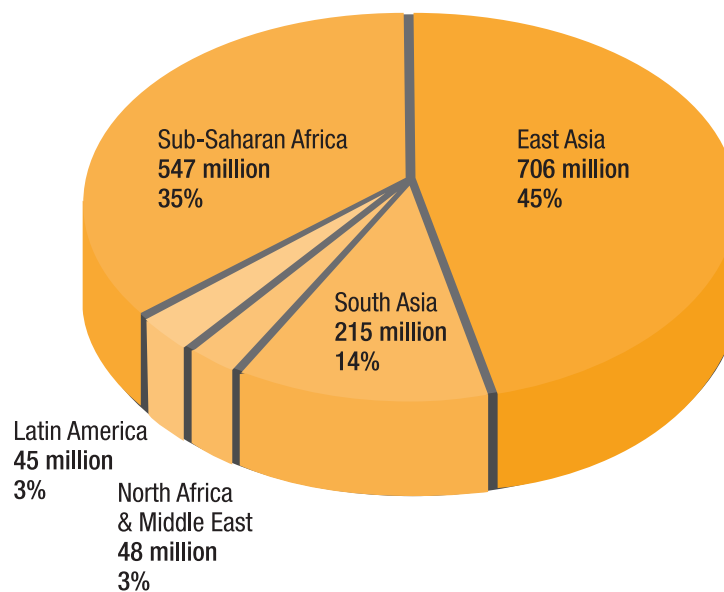


Figure 6 Global Issues.org



Biomass Charcoal

Sugarcane Charcoal

In Haiti nearly 90% of homes use wood and wood-derived charcoal as the primary sources for indoor cooking. As a result the country is now 98% deforested and the remaining forests are nearing complete depletion largely due to mismanagement of resources. In an effort to find a new fuel source, Amy Smith, director of the MIT Development Lab experimented with bagasse, the waste product from extracting sugar from sugarcane stalks. Smith and her students created a charcoal replacement by burning, compressing and mixing the material with a binding agent.²¹ The sugarcane charcoal has economic benefits as well: bagasse briquettes are about a third of the cost of wood charcoal; in addition, villagers are able to sell the charcoal within their communities, creating a local business that benefits the entire community.²¹



Portable Light Project
www.portablelight.org

Portable Light Project

The Portable Light Project is a non-profit initiative that's creating new ways to deliver renewable power and light to the developing world by embedding flexible photovoltaic materials, digital electronics and solid state lighting in textiles, enabling people in the developing world to create and own energy harvesting textile blankets, bags and clothing using local materials and traditional weaving and sewing techniques in an open source model. Each textile generates electrical power to charge cell phones and other small devices.²²



TRANSPORTATION



Challenges

For many in the BoP the lack of transportation – or the high financial and opportunity cost of available options – is a constant obstacle to looking for work, getting goods to and from markets, or obtaining health care.

The lack of functioning roads is a primary limiter in developing countries; the 53 countries classified as low-income by the World Bank have just over 240 kilometers of roads. When CelTel, the African continent's largest telecommunications company, deployed its network in the Democratic Republic of Congo, only one of the country's ten provincial capitals was accessible by road.



Solar Camel-back Clinic

www.artcenter.edu/designmatters

Innovative Solutions

Integrated Mobility: Solar Camel-Back Clinic

One of the most interesting transportation innovations developed recently as a result of a joint effort between a Kenyan community group and engineering and design students at The Art Center College of Design and Princeton University. The Solar Camel-Back Clinic is solar-powered refrigeration system for medications, carried by camels. The project serves the health needs of people in two of the poorest and most remote districts in Kenya, where many of the people who live there are nomadic, making it difficult to provide health care.

Camels are equipped to carry a lightweight 70-watt unisolar multi-junction panel that generates enough energy to cool medicine in a 12-volt dc-powered refrigeration unit. The multi-junction solar panel is unique and practical for the camel clinic system: it is flexible, lightweight, unbreakable and made of a foldable canvas material. The design centers around the concept of integrated mobility: vehicles transport supplies to camels, and camels transport supplies to remote areas, where local health staff travel by bicycle and foot between camel camps and communities, providing “door-to-door service.”²³ The Camel-Back Clinic exemplifies a core design principle when developing solutions for BOP markets: innovate on existing platforms.²³



Big Boda Bike

www.worldbike.org



IDEO's Aquaduct Bike (concept)

www.ideo.com/work/featured/aqueduct

Bicycle Innovations

One of the simplest and most effective transportation solutions in the developing world is the bicycle. Bicycle innovations are ubiquitous throughout the BoP, particularly in rural areas where public transport is non-existent.

Innovations include the Big Boda, a load-carrying bicycle designed to carry extra cargo. Developed by WorldBike, the design allows micro-entrepreneurs and bike-taxi professionals to carry two adults, three children, or bulky cargo such as bread crates lower and with better stability.²⁴

Aqueduct is a concept tricycle developed in response to a design competition at IDEO, a U.S.-based design consultancy. Resembling a cross between a child's toy and a low-tech motorcycle, the Aquaduct features a 20-gallon water tank in the back of the bike's wide, blue frame. As the user pedals, the energy expended is used to filter the water into a removable two-gallon tank that rests in front of the handlebars.²⁵



FOOD & WATER

“

Each day in a mountain village on Negros Island in the Phillipines, Minda Bulosan, a 47 year-old mother and farmer glides through a bushy steep slope down to a river nearly a mile away; here she does her laundry, then climbs back with 5-6 kilos of laundry strapped to her back, leaving her hands free to carry two containers with 20 gallons of drinking water. She repeats this routine every day for nearly half a day, and then spends the afternoon tending to farm work.²⁶

”

Edwin G. Ombion

Challenges

Food and water are basic human necessities, and access to both represents the most significant challenges facing those living at the base of the pyramid. Nearly two million children die each year from water-borne diseases - roughly one child every 15 seconds. In addition, a lack of water, particularly during the dry season, threatens the food source in many rural areas of the BoP where villagers are typically subsistence farmers.

Food production and distribution represents a large market with an extended supply chain, much of which is open to innovation. Inefficient farming processes create limited opportunities for farmers; poor transportation systems constrain the effective distribution of food products; and a lack of refrigeration technologies creates challenges to food freshness and safety.



Play Pump water system

www.playpumpa2p3.org

Innovative Solutions

PlayPump

The PlayPump water system incorporated into a children's merry-go-round. As kids play and the merry-go-round spins, water pumps into a 660-gallon storage tank. In addition to providing access to water and playground equipment, the storage tank displays advertising, helping to offset the cost of the system.²⁷

Universal Nut Sheller

Peanuts are a valuable cash crop in BOP markets, but the hard shells are extremely difficult to shell by hand. The Universal Nut Sheller is an inexpensive, open-source hand crank that allows an operator to shell nuts 40 times faster than by hand. Use of the sheller has spread to 15 countries, including the Philippines where it is used for dehusking jatropha, a local biofuel. Jock Brandis, creator of the sheller and founder of the Full Belly Project that distributes the tool is also developing a briquetting system to recycle the waste from the peanut shells.²⁸

Nutrient recycling

Cuadritos, a Mexico-based milk, cheese and yogurt company, has developed a technique to reprocess the protein from discarded milk, yogurt and vegetables. Turned into a powder, the reprocessed protein²⁰ can be added to a variety of food products such as dairy and soy milks, cookies and other baked goods. Nutrient recycling may be the 21st century version of the pulp and aluminum recycling of the 20th century – profitable and beneficial.²⁹

Hippo Roller

In many countries traditional water collection is the responsibility of women and children, who often spend hours each day transporting water in 5-gallon bucket resting on their head. The time spent collecting water is a significant opportunity cost, keeping children out of school and preventing women from earning additional income. The Hippo Roller is a simple drum designed to carry and “roll” 24 gallons of water with an effective weight of 22 pounds.³⁰



Hippo Roller

www.hopporoller.org



Digital Green

www.DigitalGreen.org

Digital Green

Digital Green (DG) is a research project sponsored by Microsoft that seeks to disseminate targeted agricultural information to small and marginal farmers in India through digital video. The Digital Green system includes a digital video database, which is produced by farmers and experts. The content within this repository is of various types, and sequencing enables farmers to progressively become better farmers. The DG system provides structure to a traditional, informally-trained vocation. The system improves the efficiency of extension programs by delivering targeted content to a wider audience and enabling farmers to better manage their farming operations with reduced field support.³¹



HOUSING

Challenges

Today about one third of India's population live in towns and cities across the countries. This is nearly double the amount who lived in urban areas in 1947 when the country received its independence. Over the last fifty years the total population of India has grown two and half times, but urban India has grown nearly five times.

India's exploding urban growth represents a humanitarian challenge that is playing out worldwide: the need for adequate housing and shelter. The United Nations Center for Human Settlements estimates that over one billion people currently live in squatter communities worldwide; that figure is expected to double by 2030. Approximately 35 million new housing units are required each year in developing countries to accommodate this growth.

Shelter is more than a basic human need; it protects us from the physical elements but also provides security and a sense of belonging. Architects and designers are exploring innovative materials and building methods to provide temporary, transitional, or permanent structures for those in the BOP. New lightweight materials for temporary shelters are improving distribution and implementation of relief to people and regions devastated by natural or man-made disasters. Striking in their simplicity of use, emergency shelters serve a most urgent need for survival for those left without any protection. Meanwhile, architects and designers are exploring the use of local construction techniques and materials to build affordable permanent structures.³²

Innovative Solutions

Kickstart MoneyMaker Block Press

Over 2,200 KickStart MoneyMaker Block Presses have been sold to East African block-making and construction businesses to build cost-effective homes, schools, and commercial buildings. The press makes strong and durable building blocks from soil mixed with a small percentage of cement, compressed at high pressure and cured for ten days. It accommodates operators of different sizes and strength, allows for high-compaction blocks, and includes a built-in variable volume batch box to allow for different types of soils, with the resultant block always having maximum density and standard dimensions. Five to eight workers can produce 400 to 800 blocks a day using the press.³³



photo: Michele Bowman





Global Village Shelter

www.other90.cooperhewitt.org/Design/global-village-



Abod House

www.inhabit.com

Global Village Shelters

Global Village Shelters, made from biodegradable laminated material, are low-cost temporary emergency shelters that can last up to eighteen months. Prefabricated, shipped flat, and requiring no tools to assemble, they are easy to deploy. The first prototypes were sent to Afghanistan and Grenada, and later used in tsunami-hit countries in Asia; Pakistan's Azad Kashmir Province, which was devastated by an earthquake, and to Gulfport, Mississippi, after Hurricane Katrina.³⁴

Abod Houses

The Abod house is a low-cost community housing unit being developed in South Africa for use in squatter's camps, informal settlements or where large numbers of families lack homes of any substance. The assembly of the entire Abod single unit structure can be completed in one day by 4 people, using only two hand tools (a screwdriver and an awl, included in the original "home in a box"). Abods are easily expandable – units fit together in various shapes to create a larger home structure – as well as portable: they can be quickly disassembled and relocated with relative ease. Each is projected to last 20 – 30 years, with an estimated cost of approximately \$1500.³⁵



photo: Michele Bowman

Chapter 3

New Models for New Markets

Chapter 3

New Models for New Markets

“

*The old saying goes: 'Give a man a fish; you have fed him for today.
Teach a man to fish; and you have fed him for a lifetime.'
I say, teach [the locals] to catch fish, skin fish, put fish in a can,
sell it at market and make a business out of it.*

”

*Bernard Amadei
Founder, Engineers Without Borders*

Introduction

According to locals, the clock tower that sits in the busy downtown square of Arusha, Tanzania represents the “center” of Africa - geographically, the midway point between Cairo and Capetown. But look closely: the clock face on this cultural icon is adorned with the Coca Cola logo. The message is clear - business has arrived.

CK Prahalad's seminal publication “*Fortune at the Bottom of the Pyramid*” ignited public and private sector interest in serving low-income people as consumers. Today merging markets are brimming with activity as business is waking up to the enormous purchasing power of the BoP. In addition, a robust community has risen from think tanks, NGOs and academia, contributing to a nascent, but growing set of best practices regarding business strategies and design principles to serve the BoP.

Private Sector Approaches

For many years, alleviating poverty and meeting the needs of the poor was the nearly exclusive domain of the development community, a complex myriad of non-profits, government agencies and NGOs. Today, with markets in the developed economies experiencing slow growth, business is beginning to realize the potential of the BoP as a viable and essential mar-



photo: Michele Bowman

ket. Much of this is driven by a shift in understanding about who the customer is. Traditionally, companies have operated under the assumption that the world's poor majority were simply a non-market. Today, more and more companies now see the possibilities of undertaking value creation activities – from materials sourcing to production distribution and sales – in low-income markets.

Some, like Unilever, have been there awhile. In 2003, in the wake of growing competition from new market entrants, Unilever's Indian subsidiary refocused its efforts on the country's rural poor. It developed a range of products for low-income households; it repackaging products like shampoo and soap in sachets and sold them door-to-door using local saleswomen known as 'shakti' ladies. In doing so, the company successfully expanded the reach of its products to an additional 60,000 villages, and the 'shakti' reportedly constitutes nearly 15 percent of company revenue.³⁶ By relying exclusively on women as their frontline sales force, it also created a significant source of income to a traditionally marginalized group. Nestle is another example. Since World War II, Nestle's milk has been produced by thousands of small farmers in developing countries. They've also provided the technology, training and supply-chain investments to make it possible for small farmers to produce, transport and sell good-quality milk to the company.

More companies are taking a similar approach by designing products specifically for the BoP. Philips, for example, has introduced a UV light purification system that kills bacteria and viruses that can be built into more traditional water purification systems. Similarly, Hewlett-Packard's e-Inclusion Program is developing a suite of "sustainable information solutions" to market that are designed for the special needs of developing countries, including solar-powered, satellite-connected kiosks and telecenters for villages; easy-to-use, low-cost appliances that are largely funded by the content that flows through them.³⁷

Other companies are entering the BOP market through corporate social responsibility (CSR) activities. For example, AMD's 50x15 Initiative aims to "enable affordable, accessible Internet connectivity and computing capabilities for 50 percent of the world's

population by the year 2015." Since its launch at the World Economic Forum's 2004 annual meeting, 50x15 partners have implemented dozens of Learning Labs around the world, including South America, Africa, Eastern Europe and Asia to gain insight and knowledge on how best to foster digital inclusion worldwide. The Learning Labs are designed to be the first step in building digital inclusion centers: sustainable locations that provide life skills training and services such as education, e-healthcare, job skills, and business development.³⁸

Public/Non-Profit Sector Approaches

In 1974, Muhammed Yunus, an economics lecturer in Bangladesh began a research project to explore the possibility of providing banking services to the rural poor by lending \$27 to a group of impoverished villagers. He went on to set up Grameen Bank to ensure that the poor had access to loans, and over the next three decades, it disbursed over six million dollars in tiny loans to those living in poverty. Last year it served 7.4 million borrowers, 98% of whom were women.



Maker Faire AFRICA

The first annual Maker Faire Africa, planned for August 2009 in Ghana, is a three-day conference and exhibition focusing on locally-generated, bottom-up prototypes of technologies that solve immediate challenges to development. The conference aims to identify, spur and support local innovation by showcasing the wealth of manufacture and fabrication expertise across the African continent, and bring new products to market.

www.makerfaireafrica.com

The microcredit model of providing small loans to the very poor has been copied across the world and is now a mainstream business practice.

While non-profits have traditionally been active in the BoP, many are following the lead of Grameen Bank, creating social enterprises that rely on traditional business revenue models rather than donor funding to ensure financial sustainability. The Acumen Fund is one such example. A non-profit venture fund whose mission is to fight global poverty, Acumen has drawn attention for its entrepreneurial approach to development. Its goal: invest \$100 million in new companies in developing countries and make an impact on the lives of 50 million people by 2011.³⁹ Its investments include A to Z Textile Mills, a manufacturer of long-lasting insecticide-treated bed netting in Tanzania which is now that country's second largest employer; and Water Health International, which distributes potable water to over 100 Indian villages using a UV purification technology.

Finally, the increased proliferation of individual wealth over the last decade has created a new generation of venture philanthropists who are willing to make big bets to in developing countries. For instance, the Bill and Melinda Gates Foundation has pledged \$170 to help develop a malaria vaccine, and it recently announced 81 grants to explore "bold and largely unproven" ways to improve health in developing countries. The Foundation's Grand Challenges Explorations Initiative aims to develop a pipeline of creative ideas that have the potential to change the face of global health.

Academia

The number of academic research programs focused on the BOP has steadily increased in recent years, providing a broad intellectual foundation for studying the dynamics of global poverty and developing business frameworks and strategies for successful market interventions.

For instance, Cornell University's Center for Sustainable Global Enterprise, created by Stuart Hart, has led the development of the Base of the Pyramid Protocol, an entrepreneurial process that guides companies in

developing business partnerships with income-poor communities. Cornell also hosts the Base of the Pyramid Learning Lab, multidisciplinary consortium of business leaders and academics focused on understanding the role of business models and technological innovation in the BoP. Ted London, another BoP thought leader from the University of Michigan, has developed the BoP Assessment Framework which focuses on measuring the impact of BoP ventures.

Within the engineering community, the number of academic programs focusing on developing solutions for BoP markets is also on the rise. Some offer a number of classes in "developmental engineering" along with opportunities for field work which provide capacity-building and knowledge transfer with BoP communities. Schools offering programs with a focus toward creating appropriate technologies specific to the developing world include:

- MIT Development Lab ("D-Lab") and MIT D-Lab Health
- Stanford Design School
- University of Colorado-Boulder - Engineering for Developing Communities (EDC) program
- DELFT University of Technology - program in industrial Design Engineering
- Princeton University – Institute for the Science and Technology of Materials
- MIT/University of Nairobi/Kigali Institute of Science and Technology (Rwanda) - EPROM Entrepreneurial Programming and Research on Mobiles (EPROM)
- Ateneo School of Government (Philippines) - Science and Technology Innovations for the Base of the Pyramid in Southeast Asia program.

Academic programs such as these are a critical source of innovation. While private sector initiatives in the BoP tend to be risk-sensitive and focused primarily on scalability, engineering programs in particular are offering students the opportunity to develop riskier, more experimental designs and solutions. Fueled by a growing interest from the "millennial" generation for more socially-conscious careers, these schools

are developing the next generation of humanitarian engineers.

“Design like you give a damn” A Growing BoP Community

In 1999 Cameron Sinclair and Kate Stohr, two young architects barely out of school co-founded Architecture for Humanity (AFH), a nonprofit that helps architects apply their skills to humanitarian efforts. Starting with just \$700 and a simple web site AFH has grown into an international hub for humanitarian design, pairing architects with communities in need to develop innovative solutions to housing problems in all corners of globe. In addition to hosting open design competitions focused on systemic issues of poverty, such as transitional housing for returning refugees in Kosovo and a mobile health clinic for sub-Saharan Africa, AFH hosts the Open Architecture network (OAN), a global, open-source network where architects, governments and NGOs can share and implement design plans to house the world.

Sinclair’s mantra, “Design like you give a damn” has become the rallying cry for a movement towards socially conscious design in architecture, mobilizing a generation of architects to consider the mission and social impact of their industry. In doing so, AFH – and Sinclair in particular – has placed the challenges facing those living at the BoP in the public eye, spurring a growing community of practitioners and academics to rethink solutions to global poverty.

The engineering community has responded in kind. Dr. Bernard Amadei, a civil engineering professor at University of Colorado-Boulder, has been advocating for what he calls “engineering with heart” - small scale engineering that improves the lives of the world’s poorest. To realize that vision, in 2002 he founded Engineers Without Borders-USA, a nonprofit group that partners with disadvantaged communities to improve the quality of life by implementing environmentally and economically sustainable engineering projects, most of which are done almost entirely by student engineers. EWB has grown to over 12,000 members, with 300 chapters on 180 college campuses throughout the U.S. and has completed approximately 350 water, renewable energy, sanitation and

other projects in partnership with local communities and people around the globe.

EWB’s strong university presence has been the catalyst for a new movement to educate the next generation of socially conscious and “internationally responsible” engineers that are deeply aware of the needs of the rest of the world. Amadei’s vision is having an impact. Last year Heather Fleming and Tyler Valiquette, two members of EWB’s San Francisco chapter, led the development of a small wind turbine for rural Guatemala as part of EWB’s Appropriate Technology Design Team. The project inspired them to quit their jobs and create Catapult Design, a non-profit design consultancy providing “engineering and implementation support to organizations...in need of igniting social change.”⁴⁰

ASME is launching its own effort, Engineering For Change, an online network that will bring together volunteer engineers from across professions to work as virtual teams with local organizations and communities around a common goal of providing solutions that will improve the quality of life in underserved communities. In addition, the site will act as a content aggregator, hosting an open source database of technical solutions and ideas voluntarily contributed and re-purposed throughout the engineering community.

Business Strategies and Design Principles

A number of research initiatives have emerged recently to document and analyze the rapidly changing BoP business landscape. Think tanks and NGOs have initiated broad-based multi-year BoP research programs, including UNDP’s Growing Inclusive Markets Initiative; the World Resources Institute (WRI) Development Through Enterprise project (which includes NextBillion.net, a research and news portal dedicated to exploring base of the pyramid ideas). In addition, organizations such as the World Economic Forum and global consulting firm Monitor Group have undertaken extensive research exploring business strategies and developing case studies for doing business

in base of the pyramid markets.

Thanks in part to this growing body of empirical research, business has come to realize that while BoP individuals may have only tens of dollars to spend each year, that income, multiplied several billion times over, represents significant purchasing power. However, the promise of emerging markets depends on adopting the right business models which must be tailored to the unique economic and social conditions of local markets.

As business activity in the BoP is increasing, a set of best practices for engaging with potential customers is emerging. In the business sector, best practices around business strategies and models have been more formalized; however, the development of engineering and design principles is still somewhat informal, based on the anecdotal experience of those developing products in the field.

Business Strategies

A number of reports have been published recently which identify successful business strategies and models for accessing BoP markets. WRI's 2007 report *"The Next Four Billion: Market Size and Business Strategy at the Base of the Pyramid"* provides empirical data regarding BoP markets in eight key sectors including purchasing power, market segmentation and purchasing preferences of customers. In addition, the report suggests that successful enterprises use four critical business strategies when operating in BoP markets:⁴¹

Focus on the BoP with unique products, services, or technologies that are appropriate to BoP needs and require completely reimagining the business.

It may sound obvious, but not all poor people are the same. The most common mistake among unsuccessful market-based solutions is to confuse what customers ostensibly need versus what they actually want.⁴² Products and services should be designed, packaged, priced and offered in a way that recognizes that BoP consumers are customers, not ben-

eficiaries. For example, rather than sell down-market used or low-quality mobile phones, Motorola sells a \$30 mobile phone designed in India with rural users in mind. The phone can give instructions to a user in audio rather than text form (in case the user isn't literate). It also has a reflective display that people can easily see when outdoors and a battery stand-by time of two weeks.⁴³

Localize value creation through franchising, agent strategies that involve building local ecosystems of vendors or suppliers, or by treating the community as the customer.

Involving BoP customers in multiple parts of the supply chain creates increased income for a customer. An example of this strategy is CFW, a microfranchise system of drug stores and clinics in Kenya; its franchisees are typically nurses or other health care workers from the communities the franchises serve. The franchise provider, HealthStore Foundation, supports franchisees with drug supplies, start-up financing and on-going professional development serving over 400,000 patients annually throughout Kenya.⁴⁴

Enable access to goods and services – financially (through single use or other packaging strategies that lower purchase barriers) or physically (through novel distribution strategies or deployment of low-cost technologies).

For example, the development of mobile banking applications exemplifies how the unique challenges of BoP markets can be transformed into paradigm-changing opportunities. For instance, in 2003 in the aftermath of the postwar conflict in the Democratic Republic of Congo, CelTel, an east African telecommunications company, started offering a service called Celpay, which uses SMS technology (text messaging) to allow its customers to wire funds across in the country. An effective way to make payments in a war-torn country, Celpay proved so efficient that the government now uses it to pay its soldiers.⁴⁵

Foster unconventional partnerships with governments, NGOs or groups of multiple stakeholders to bring the necessary capabilities to the table.

BoP markets are characterized by significant constraints such as ineffective regulatory environments, inadequate infrastructure and limited market information. Successful BoP enterprises rely on a network of public and private sector partners who can offer experience and insight regarding local conditions.

For example, Project Masiuleke is a mobile health project in South Africa that is using mobile phones to spread information about public health crises such as AIDS and tuberculosis. The successful development of the project involved a multitude of partners including i-Teach, a local health care clinic, the Praekelt Foundation (a South African non-profit), MTN Telecommunications Company, Nokia-Siemens, Frog Design, and the PopTech Institute, a U.S.-based non-profit social innovation incubator. (Note: The project is described in detail in the case study at the end of this chapter).

DESIGN PRINCIPLES

Engineers have an important role to play in meeting the needs of those living at the base of the pyramid, and in ensuring a more sustainable, equitable future for future generations. Doing so requires co-creating innovative solutions with the world's poor that are appropriate, affordable and reliable. Towards that end, a set of five design principles is slowly emerging based on the experiences of engineers and designers working on the ground in developing countries.

1 **Develop appropriate solutions, not technologies.**

Design “in” developing countries, rather than design “for” developing countries. Understand the social and cultural context of the specific need or problem. Amy Smith, director of the MIT Development Lab requires all students taking her class to spend a week living on \$2 a day to begin to understand the trade-offs that must be made when one has very limited resources.

2 **Consider the context.**

Understanding user needs isn't just about individuals but also the economic environment, infrastruc-

ture and culture in which products and services will be used. Ethan Zuckerman, founder of Global Voices suggests “Don't fight culture; if people cook by stirring their stews, they're not going to use a solar oven, no matter what you do to market it.”⁴⁶ In addition, the best solutions innovate on existing platforms, rather than importing new systems and technologies. For example, a project called PlayPower is developing a \$12 computer which is based on cheap, 8-bit computers that are ubiquitous throughout the developing world. The designers aren't creating a new machine, rather building on existing parts and materials.

3 **Create transparent technology.**

Products should be simple to make, to use and to understand. Open source the design whenever possible to encourage continued innovation. For instance, the Open Architecture Network (the community design portal of Architecture for Humanity) uses Creative Commons licenses to promote several of their building designs.

4 **Embrace the market.**

Solutions should be designed for price, not created then priced at cost. For a technology or tool to be truly effective in the BoP, it must be affordable. For example, AIDFI, a Philippine non-profit, manufactures a water pump for local villages capable of pushing water from a concrete reservoir up a hill at a 40% slope. The basic pump technology isn't new, but AIDFI enhanced the design by using cheap and locally available materials such as door hinges. The bottom line: to reduce costs, remove unnecessary materials and source locally.

5 **Design for DIY (Do It Yourself).**

The most successful products and designs are those that are co-created with the end users. Involving the community in the design process provides skills, not just products. Peter Haas, founder of the Appropriate Infrastructure Design Group notes “There are geniuses in every village ready to make significant changes to their environment; they just don't

have the access to tools, resources or time.”⁴⁷
The end goal should be to build local capacity, skills, knowledge, experience and expertise that allows societies to meet their own needs.

Frameworks for successful business strategies and design principles share a common theme; namely, that base of the pyramid markets are fundamentally different, both from developed economies as well as from each other. Whether selling to or designing products for the BoP, success requires understanding the cultural and social context, infrastructure constraints and unique expectations of BOP customers. In short, the cornerstone of successful BOP

Case Study

approaches means rethinking “business as usual.”

Project Masiuleke

Zinny Thabete's story begins in an all-too-familiar way. In 2001 the 36 year old South African was diagnosed with HIV. She was promptly fired from her job; her doctor predicted that she wouldn't survive through the year; and as her health quickly declined her life became what she describes as “a journal of opportunistic infections” including pneumonia and multiple cases of TB.

South Africa has more HIV positive citizens than any country in the world – nearly six million. In some provinces, more than 40% of the population is infected. Yet only 2% of South Africans have ever been tested for HIV. Of those who are HIV positive, a mere 10% are receiving anti-retroviral therapy – leaving 90% untreated, infectious and likely to die. HIV/AIDS carries a huge social stigma in South Africa, preventing many from getting tested or pursuing treatment, and there is wide-spread misinformation about how the disease is contracted.

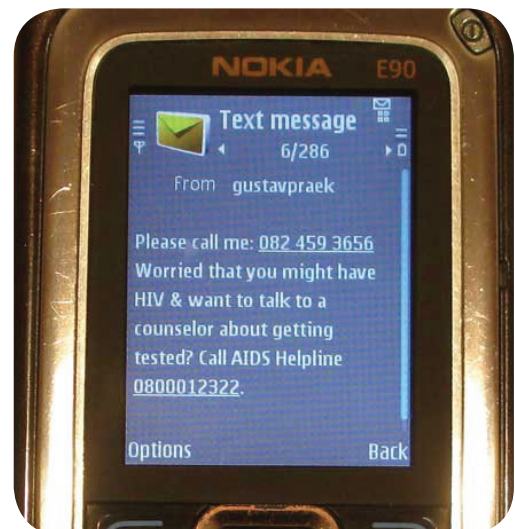
For years, public health officials and philanthropies have poured millions of dollars into the developing countries in an effort to inform and educate people about the causes, prevention and treatment options of HIV. Many of these public health efforts have centered around low-tech advertising: road-side signs, pamphlets and worker outreach. All have met, arguably, with minimal success.

Today, alive and healthy seven years after her life-changing diagnosis, Zinny Thabete is at the forefront of an effort to combat the public health threat crisis in her country by leveraging a rapidly growing technology trend – namely, the explosive adoption of mobile phones. She is one of the architects of a new program called Project Masiuleke -- Zulu for “wise council” - which involves sending out free text messages to

millions of people every day urging them to call a confidential phone line if they have any concerns about HIV. The messages connect mobile users to existing HIV and TB call centers; trained operators provide callers with accurate healthcare information, counseling and referrals to local testing clinics.

Because nearly four-fifth's of South Africans have access to a mobile phone, the project has seen immediate results, including a four-fold increase in the number of calls to the country's National AIDS Helpline. Future plans still under development include offering free home HIV testing kits, and using text messages to remind patients about their hospital appointments and keep them informed about their medical treatment.

For more information on Project Masiuleke, see www.poptech.org/project_m



text message, Project Masiuleke
www.poptech.org/project_m



photo: Michele Bowman

Chapter 4

Opportunities for ASME

Chapter 4

Opportunities for ASME

“ To serve our diverse global communities by advancing, disseminating and applying engineering knowledge for improving the quality of life; and communicating the excitement of engineering. ”

ASME Mission

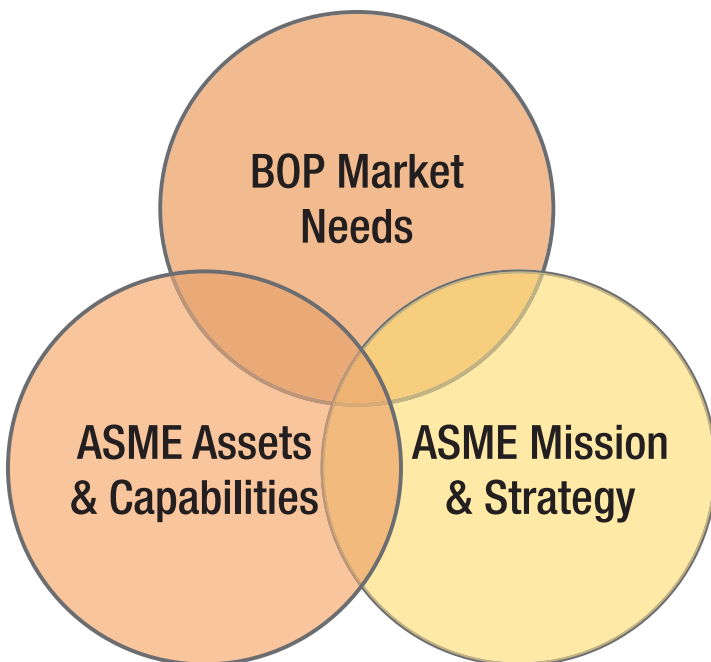
Introduction

The 2008 ASME global summit environmental scan report, *The Future of Mechanical Engineering*, estimated that in the next twenty years globalization and new business models will increasingly drive the development of engineering projects that serve the base of the pyramid, primarily in the developing countries of Asia, Africa and Latin America. It concluded that engineers are likely to be called upon to devise cost-effective ways to increase access to food and clean water, effective sanitation, energy, education, health-care, revenue-generating activities, and affordable transportation. This year, ASME's Strategic Issues Committee chose to commission this environmental scan to further understand the rapidly changing base of the pyramid market and the potential ways the organization could enter it, directly or by offering services for its members.

A traditional approach to determining the strategic focus for new products, services or initiatives is to find the opportunity for action formed from the intersection of three factors: market needs, the organization's ability to meet those needs with existing or new assets and capabilities, and the extent to which those initiatives serve the vision, mission, and broader strategy of the organization. This section will explore this intersection by reviewing the fit between ASME's Vision, Mission, and Strategic Priorities, the set of ASME's unique assets and capabilities, and the market needs of the base of the pyramid. The section will conclude with sets of opportunities for ASME.

Engineering Solutions for the Base of the Pyramid: Fit with ASME's Vision and Mission

The link between engineering solutions for the base of the pyramid and ASME's stated vision and mission is direct and compelling. New approaches to helping the world's poor that combine more traditional government/NGO aid programs with business opportunities have the potential to lift billions out of poverty by building societies with an indigenous ability to provide improved health, civic infrastructure, housing transportation, energy, and access to food and water. As the focus of helping the world's poor has shifted from direct aid, to creating markets, to sustainably developing the local capacity for social and economic growth, ASME's vision of empowering mechanical engineers and other technical professionals is in line with the new best practices in the BoP market.



ASME Assets and Capabilities

Since its founding in 1880, ASME has built a set of assets and capabilities that has moved it beyond a professional society in the United States into a global organization with over 127,000 members in 135 countries worldwide. Today ASME's products and services are far-reaching and include codes and standards, journal and reference publications, technical conferences, risk management tools, government/regulatory advisory, continuing education and professional development programs. This diverse portfolio is supported by a core set of assets and capabilities, including:

- Brand leadership in technical publications
- World-class standards, certification and technical programs
- Large and global membership
- University partnerships and programs targeted to student and professional continuing education
- The power to convene stakeholders around mechanical engineering topics
- ASME.org website for organizing and distributing society knowledge
- ME Magazine communication channel.

These assets and capabilities can all play a significant role in meeting the challenges inherent in the BoP market, if utilized according to the business strategies and design principles in chapter three. They place ASME in a very strong position to take a leadership role in serving this market.

Fit with ASME's Strategic Priorities

A BoP strategy for ASME would strongly correlate to the three strategic priorities adopted in 2008. Appropriate investments in providing a platform for members to participate in BoP projects, and positioning ASME to be involved directly, will greatly advance ASME's ability to meet these "grand challenges" for the organization – energy, globalization, and engineering workforce development (see sidebar).

As previously discussed, access to clean, dependable, and affordable energy is a major component to creating BoP markets that have the capacity to move people out of poverty in a sustainable and long-term fashion. Any role that ASME or its members play in responding to this need will impact lives of people in BoP markets and drive progress where it is needed the most and will make the greatest impact.

In a recent ASME member survey, 20% of respondents, the highest percentage, pointed to energy solutions as the point of entry for ASME when asked "Please describe the specific Base of the Pyramid project that you would like to bring to ASME's attention. Twenty percent of surveyed members also recommended Education/Technical Training opportunities as a way for ASME to become involved in the BoP market. Educating and engaging professionals in the BoP regions were seen as significant points of leverage for ASME to build sustainable, long-term engineering solutions to enhance the quality of life. This dovetails with the organization's second and third strategic priorities on Globalization and Engineering Workforce Development. Creating a more global presence for technical publications and engaging young, international engineers can both serve the needs of the BoP engineering market and meet the strategic challenges of ASME.

ASME's Strategic Priorities



ENERGY

To be a leading force for the advocacy and development of a balanced U.S. energy policy and support development of balanced energy policies in other areas of the world where ASME has influence.



GLOBALIZATION

To be recognized as the world leader in mechanical engineering and multidisciplinary technology.



ENGINEERING WORKFORCE DEVELOPMENT

To expand the capacity and effectiveness of the engineering workforce by: actively promoting inter-engineering society collaboration to increase public awareness of the engineering profession; increasing the value of ASME student and early career participation through project-oriented education and practices; and offering professional development programs to prepare a global engineering workforce to meet the challenges of tomorrow.

Market Needs and ASME Opportunities

There are a number of BoP market needs that provide opportunities for ASME to leverage the organization's core assets and capabilities.

1

Market Need: **Lack of centralized information**

While there are a wealth of projects and initiatives in the BoP, information is often anecdotal and spread across multiple online platforms and websites. Among ASME members, the need and desire for more information about engineering opportunities in the BoP is significant: in a recent ASME member survey only 22% of respondents replied that they had previously heard about the “Base of Pyramid” (or another term describing the development needs of the poorest four billion people), while 85% believed that part of ASME's mission should “definitely or “probably” be “to develop opportunities for its members to participate in developing engineering solutions for these markets.

Opportunity: **Develop Engineering Solutions for the BoP Knowledge Hub**

Create a centralized online knowledge hub on the ASME website to inform and promote engineering activities, projects and people in developing countries. At a minimum, an online portal could be created as a section of the ASME website and would include links to organizations, websites, videos, podcasts and conferences. Updated on a regular basis, the portal could become a first-stop for engineers of all disciplines looking for information about projects, people and technologies relevant to the BoP.

Strategic Fit: 

2

Market Need: **Lack of local engineering capacity**

In much of the developing world the available pool of engineering talent is typically well below critical mass, and economic development is hampered by a lack of technical talent to address basic needs that rely on engineering such as energy infrastructure and a clean water supply.

Opportunity: **Develop and support local engineering talent**

In line with ASME's strategic priority on workforce development, the society can make a major impact in base of the pyramid regions by developing and supporting local engineering talent. The Entrepreneurial Programming and Research On Mobiles (EPROM) program provides an excellent example of one path to increase local engineering capacity in developing markets. Run jointly at MIT and the University of Nairobi, EPROM focuses on the creation of a mobile phone programming curriculum for African computer science students. The program builds on the premise that while subscribers in developing countries now represent the majority of mobile phone users worldwide, today's mobile phones are designed to meet Western needs. As such, there is a need to equip African computer science students with the skills to develop mobile applications specifically for African users.⁴⁸

In addition to developing technical expertise, engineering education in the BoP, programs should support the development of entrepreneurship skills – how to start, operate, and grow a small business – thus, ensuring that engineering graduates will be equipped to take a path of creating jobs rather than simply seeking one.

Strategic Fit:  

3

Market Need:

Lack of access to engineering knowledge and resources

The lack of access to engineering and technical resources is a significant barrier in implementing and maintaining technological solutions in the BoP. Across the developing world there are thousands of examples of discarded machinery and devices, artifacts installed by well-meaning NGOs who came into a village or township with a technological fix such as a solar panel installation or a centrifuge for a hospital – but with no means or plan for repair once the machine eventually breaks down.

Opportunity:

Make ASME technical publications more accessible and locally relevant

ASME can make a significant impact in this area by making its technical publications more accessible and culturally relevant. In pursuing this strategy, ASME should consider alternative platforms for access such as mobile phones and devices. There are over 1.4 billion mobile phone subscribers in BoP markets; by leveraging this growing trend ASME could increase access to technical materials exponentially. In addition, open-source language translation platforms are emerging which could significantly reduce the economics of translating materials. For instance, dotSUB is a free, web-based tool enabling subtitling of videos on the web into and from any language. The tool gives anyone the ability to translate video content into multiple languages via subtitles rendered over the bottom of the video. dotSUB is structured around a “wiki” community of volunteers (similar to Wikipedia); once a video is uploaded (for instance, a demonstration of how to repair a solar panel), dotSUB community members can voluntarily translate the content into multiple languages. Translating technical content and making it available on existing platforms such as mobile phones could have a world-changing impact.

Strategic Fit:



4

Market Need:

Engineers of all generations seek ways to participate in BoP solutions

Creating sustainable solutions that help improve the lives of the world's poor is impossible without engineers. The complexity and scale of the solutions can only be addressed by a multidisciplinary approach that involves both technology and knowledge transfer between engineers in developed and developing countries. While the concept of “humanitarian” or “BoP Engineering” is gaining ground, particularly among younger engineers, there is still a lack of critical mass within the engineering community to commit the resources and experience necessary to develop large-scale impacts.

Opportunity:

Create opportunities to engage ASME members at all levels of career experience in “BoP Engineering”

ASME's global, multi-generational membership uniquely positions it to lead a revolution in engineering practice by focused on creating solutions for the world's poor by supporting the development of a next-generation of globally responsible and socially conscious engineers. In particular, ASME can engage members at multiple touch points both demographically and geographically to support engineers at all levels of their careers.

Student and entry-level engineers (often referred to as the “Millennial” generation demographic) are most eager to embrace this new concept of engineering. By nature, Millennials have shown more interest in careers that offer the opportunity to create social good, rather than simply a paycheck. The success of Engineers Without Borders reinforces this theory: in the last seven years EWB has grown to over 8,000 in 45 countries, and 235 established university and professional chapters throughout the U.S.

In addition, initiatives like Project H are targeting young, entry-level professionals by supporting the development of local chapters in which design “troops” of engineers and designers working on projects in

their local communities, delivering pro bono design services to individuals, organizations, and groups in need.

ASME can leverage its own extensive network of student chapters to create similar successes by engaging student engineers, but the organization needs to consider how it can inspire and motivate young professionals to engage in humanitarian projects past college and throughout the life of their career; for instance, expanding design challenges such as the ASME Innovation Challenge to include young and mid-level engineers is one potential pathway.

Finally, ASME should consider how to involve its growing number of older and retired engineers in BoP initiatives, possibly through expanding mentoring or advising opportunities. For example, a number of retired engineers act as program advisors and informal teachers to the International Development Design Summit (IDDS). IDDS is a collaboration with MIT's Development Lab class which brings dozens of people from around the world together for four weeks for intensive brainstorming and prototyping of solutions to local problems from different regions of the developing world. IDDS emphasizes the development of prototypes, focusing on co-creating solutions to provide communities with the skills and tools to become innovators and develop new technologies themselves than to simply providing the technologies.

Strategic Fit:



5

Market Need: Thought Leadership for Engineering Solutions

While the community of BoP practitioners from academia and business has grown significantly in the last five years the focus of conferences to date has been almost exclusively on business strategies, and there has not been a meeting to discuss the role of engineering in the application of technologies and infrastructure to help the BoP. Within the engineering community, no single entity or group has emerged as a leader to provide thought leadership and catalyze industry collaboration regarding the development and scalability of engineering solutions for BoP markets. While several engineering associations are considering strategies for activities in developing countries, to date there is little collaboration across groups and disciplines to coordinate activities and initiatives.

Opportunity: Organize Engineering for the Developing World conference

ASME could establish a significant thought leadership position within the engineering community by holding a foundational Engineering for the Developing World conference in Kenya or India which would bring together key stakeholders in engineering, academics, corporations, and NGO/government to explore the role of engineering in BoP solutions. Important topics where thought leadership is needed include: Scalability of solutions; Training of local talent; Assessments of appropriate/most needed technologies; Creating robust communication networks and communities of practice.

Strategic Fit:



6

Market Need: **Need for innovation to be more accessible**

Organizations interested in developing and implementing engineering solutions in developing countries face a number of significant obstacles, including a lack of access to technical resources as well as the inability to identify, share information and collaborate on workable solutions. As a result, many solutions are created in isolation, resulting in sub-optimal, localized, projects that are extremely difficult to bring to scale.

Opportunity: **Create an open innovation platform**

To increase accessibility and develop more robust solutions, ASME could create an open innovation platform that leverages ASME's large and globally diverse membership to collaborate on developing technical solutions to address BoP needs. A leading example of an open source innovation platform is the Open Architecture Network (OAN) a free, online network that leverages its members' expertise around the common goal of improving living standards throughout the world. OAN includes a database of architectural projects and design tools, as well as a robust and active community forum where members can share ideas and collaborate on projects.

ASME's own effort, EngineeringforChange.Org, is a promising platform. Currently under development, it is envisioned as an online network that brings together volunteer engineers across professions to work as virtual teams with local organizations and communities. In addition, as a content aggregator, EngineeringforChange.org will host an open source database of technical solutions and ideas voluntarily contributed and re-purposed throughout the engineering community. An online platform such as this would allow users to post engineering and project specs could help engineers share knowledge, and avoid technical mistakes and cultural misunderstandings that could undermine a project.

Strategic Fit:



7

Market Need: **Integrated, cross-disciplinary approaches**

Given the complexity of the BoP, designing solutions for impact requires a cross-disciplinary approach. For instance, developing a water filter – no matter how inexpensive – won't solve the problem of clean drinking water if it doesn't address the more basic issue of water access portability – a challenge which often requires women and children to walk for several miles per day carrying heavy containers. Creating sustainable solutions and bringing them to scale requires the integration of multiple disciplines and approaches.

Opportunity: **Engage in unique partnerships and collaborations**

A key element to a successful BoP strategy for ASME will be the establishment of strong working partnerships both within the engineering and design community as well as the private sector. The Art Center College of Design ("Art Center"), one of the leading design schools in the United States, is an interesting example of an organization that has successfully leveraged unique partnerships in its BoP efforts. Art Center's International Initiatives program 'DesignMatters' develops student and corporate collaborations that focus on the links between design and issues of social and humanitarian importance. DesignMatters' partners – which include corporations such as GE Healthcare and General Motors, and a range of non-profit agencies - provide fees for supplies and related costs, while partner representatives contribute their expertise throughout the project.

Within the engineering community, ASME can leverage its relationships with other professional societies including Engineers Without Borders, Engineers for a Sustainable World, Builders without Borders and Grameen Bank's Bankers without Borders.

Strategic Fit:



8

Market Need: Technologies and engineering solutions that are appropriate to BoP regions

As mentioned above, many BoP countries are littered with well-intentioned products that sit unused, unrepaired, and unenergized. These products were given or sold into the region with no understanding of the challenging constraints imposed by energy poverty, cost of parts or technical skill of the local users. Additionally these solutions may be culturally impossible to implement. It is clear that there is a profound disconnect between the innovators and designers of many developed countries with the reality of life on the ground in the BoP.

Opportunity: Sponsor project trips and learning journeys to understand local BoP markets

As seen in this report, innovative and powerful engineering solutions are multiplying across the BoP. These solutions use some or all of the design principles mentioned in the previous chapter. Foundational to the creation and distribution of any of these solutions is a thorough understanding of the context within which it will be used. Increasing the exposure of interested engineers to the constraints and opportunities present in BoP countries will result in better, more appropriate solutions being designed and deployed. ASME can use its strengths in conferences, continuing education and university partnerships to provide opportunities for its members to embed themselves in the cultures and understand these constraints.



Strategic Fit:

9

Market Need: Build stronger links with engineering communities in BoP regions

Engineers who live and work in BoP regions are often paid significantly less than engineers in developed countries. Additionally, these engineers may not have the need or ability to take advantage of the full portfolio of member benefits of a professional society. As a result, engineers in the BoP are often isolated with few opportunities to increase their knowledge or skill-set through ASME or other professional engineering professional association.

Opportunity: Make ASME affordable to potential members by creating tiered membership schemes

A tiered member model, in which certain benefits of membership are offered at different pricepoints, can both increase ASME's presence in BoP countries, and address the need for stronger engineering communities in the BoP who can network and learn from each other. These different member models could be based on regional specific engineering community needs; alternatively, a "pay as you go" approach could deliver only the content and benefits most critical to the engineers on the ground in developing countries.



Strategic Fit:

10

Market Need: Specific applications knowledge

The need for engineering know-how in BoP regions outstrips any ability for new engineers to be trained in the near term to address them. With 4 billion people across the globe needing access to clean water and energy, healthcare solutions, and transportation, there simply is not enough qualified engineers to build, install, and maintain engineering solutions in the BoP

Opportunity: Targeted engineering applications and support workshops

The approach of Barefoot College and others is to use the local population by teaching a very specific set of skills. Residents can be taught to install and maintain small solar power plants, or ways to build sustainable housing or rainwater harvesting facilities. By targeting specific areas of needs, ASME can use its strengths in continuing education and certification programs to increase the number of people able to build and support life-changing engineering solutions in the BoP in a sustainable and scalable way.

Strategic Fit:  

11

Market Need: Lack of R&D funding & targeted technology investment

BoP regions suffer from a chronic under-investment in R&D to create engineering solutions for their unique needs. While some broader social funding organizations such as Grameen Bank or the Acumen Fund support social entrepreneurs and individual business owners who develop engineering-based businesses or solutions, significant R&D resources are critically lacking.

Opportunity: Create venture fund or microfinance pipeline to fund BoP engineering solutions

A dedicated venture fund or micro-finance solution to support engineering solutions could make a major impact on the current dearth of scalable innovation investments. By focusing on engineering initiatives and R&D, such a fund would allow ASME to fill a major gap in the creation and scaling of solutions. Such a fund also fits the paradigm shift of moving from simple aid, to economic market participation, to local capacity building.

Strategic Fit:   

12

Market Need: Lack of large-scale global investment to eliminate energy poverty

As mentioned previously, energy poverty sits at the core of many social and economic problems experienced by BoP populations. However, eliminating energy poverty is not a UN Millennium Development Goal, and lacks the organized approaches that water, hunger, and disease initiatives have benefited from.

Opportunity: Lead the initiative to eliminate energy poverty

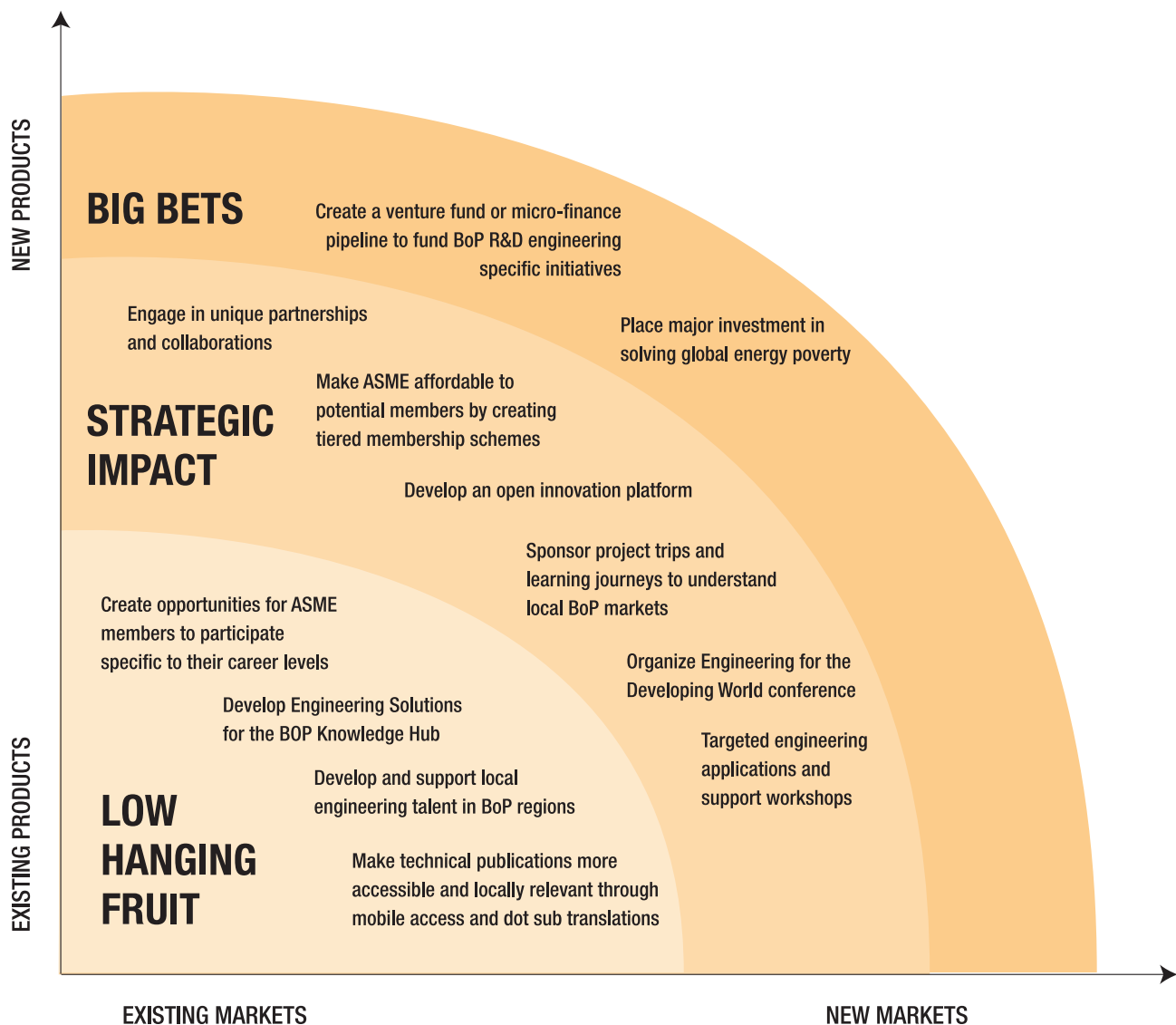
Solving energy poverty can enable significant outcomes throughout the BoP. Creating clean, affordable, renewable energy at a cost and scale to impact global energy poverty would create business models and technologies that would “trickle up” to the developed economies and greatly shift the energy debate. ASME would emerge as a leading player in energy policy formation and technology development and deployment. However, such an initiative would require a large and coordinated development of products, services, activities, partnerships, and investments. To engage this “Big Bet” opportunity, ASME would need a significant strategic planning process to develop the entry points, roadmaps, and time frames.

Strategic Fit:   

Three Strategic Options for ASME

Based on ASME's level of commitment and investment, these opportunities fall into three categories: **Low Hanging Fruit**, **Strategic Impact** and **Big Bets**. These categories are based on the extent to which they utilize existing products and services or require new product development, and the ability to leverage existing market presence or build new market relationships.

It is important to note that these options are not sequential, but based on the level of risk and focus ASME decides to devote to an organizational BoP strategy. As such, these options do not represent a "roadmap", although they may be grouped to create a long-term step-out strategy.



Option 1: Low Hanging Fruit

The first category, “Low Hanging Fruit”, includes opportunities that require the least amount of investment and risk because they leverage existing ASME products to move into new markets, or introduce new products to markets ASME is already in. Pursuing these opportunities would allow the organization to quickly impact engineering solutions for the BoP, gain experience with BoP markets, and grow the products and services offered to current customers. These opportunities also begin to position ASME as a thought leader in the space. However, by themselves, they have limited long-term sustainable competitive advantage. If the organization meets with success, it will need to step out to more substantial investments in BoP market opportunities to continue that success. It will not be as simple as moving to the next category of opportunities, since other organizations may have recognized the market needs and delivered their own solutions ahead of ASME. Opportunities in this category will also not significantly impact the three strategic priorities of Energy, Globalization, and Workforce Development, though they may accomplish specific objectives under them.

Opportunities in this option include:

- Create opportunities for ASME members to participate specific to their career levels
- Develop Engineering Solutions for the BOP Knowledge Hub
- Develop and support local engineering talent in BoP regions
- Make technical publications more accessible and locally relevant through mobile access and dot sub translations

Option 2: Strategic Impact

Opportunities in this category require greater investment and focus on the BoP, because they require some combinations of simultaneously entering new markets with new products or services. However, they also promise a higher impact on engineering solutions for the BoP and advancing the organization’s three strategic priorities of Energy, Globalization, and Workforce Development to a significant degree. Establishing leadership positions in these opportunities

would offer ASME longer-term, systemic success. Some of these opportunities would require and build on appropriate “low hanging fruit” projects, which would further increase the level of focus of the organization specifically on BoP engineering solutions.

Opportunities in this option include:

- Engage in unique partnerships and collaborations
- Targeted engineering applications and support workshops
- Develop an open innovation platform
- Organize Engineering for the Developing World conference
- Sponsor project trips and learning journeys to understand local BoP markets.
- Make ASME affordable to potential members by creating tiered membership schemes.

Option 3: Big Bets

Furthest out in degree of impact and risk are the “Big Bet” opportunities. Pursuing these opportunities would require a choice by the organization that by investing in them, they would accomplish significant portions of ASME’s strategic priorities or organizational mission and vision. Additionally, they would require investment in targeted “Low Hanging Fruit” and “Strategic Impact” options. Eliminating Energy Poverty and the creation of a BoP Venture Fund are clearly long-term goals that would extend beyond the current planning environment, even if begun on a regional basis. However, they can serve as a major rallying cry and motivation to inspire current and new members to participate in ASME activities to a greater degree, create membership models that are extremely “sticky” due to the commitment of members to a long-term, stretch goal with the potential to change billions of lives.

Opportunities in this option include:

- Create a venture fund or micro-finance pipeline to fund BoP R&D engineering specific initiatives
- Place major investment in solving global energy poverty

Market Need
ASME Opportunity

Fit with
Strategic Priority

1	Lack of centralized information <i>Develop engineering solutions for the BoP knowledge hub</i>	
2	Lack of local engineering capacity <i>Develop & support local engineering talent in BoP regions</i>	 
3	Lack of access to engineering knowledge & resources <i>Make technical publications more accessible & locally relevant</i>	  
4	Engineers of all generations seek ways to participate in BoP solutions <i>Create opportunities for members to participate at specific career levels</i>	 
5	Thought leadership for engineering solutions <i>Organize Engineering for the Developing World conference</i>	
6	Need for innovation to be more accessible <i>Create an open innovation platform</i>	  
7	Integrated, cross-disciplinary approaches <i>Engage in unique partnerships and collaborations</i>	  
8	Technologies & engineering solutions that are appropriate to BoP regions <i>Sponsor project trips & learning journeys to understand local markets</i>	 
9	Build stronger links with engineering community in BoP <i>Make ASME affordable to BoP members with tiered membership schemes</i>	 
10	Specific applications knowledge <i>Targeted engineering applications & support workshops</i>	 
11	Lack of R&D funding and technology investment <i>Create a venture fund or microfinance pipeline to fund BoP engineering initiatives</i>	  
12	Relatively little global resources mobilized to solve energy poverty <i>Place major investment in solving global energy poverty</i>	  

Conclusion

Strategic focus is critical to the success of any initiative; therefore it is not recommended that the society pursue all of these suggestions at once or even all of them over time. ASME's leadership will weigh these investments of time and money against all of the priorities of the organization. However, these recommendations do highlight the strong alignment of ASME's vision, strategic priorities, and assets and capabilities with developing engineering solutions for the BoP. Following some or all of the business strategies and design principles will result in improved lives for many of the world's poor, increased global reach and influence for ASME and professional opportunities for its members.

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