

From the Lab to the Land: Social Impact Technology Dissemination in Rural Southern India

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ABSTRACT

Despite their growing popularity, bottom-up, innovation-based development efforts are failing to make a significant social impact at the Bottom of the Pyramid (BOP). Merely inventing widgets for development – like affordable solar lanterns, improved cookstoves, and bicycle-powered machines – is not enough. They must move from the lab to the land, into the hands of the people they are intended to benefit. Innovations in scalable, sustainable models for social impact technology dissemination are desperately needed, lest these technologies be designed in vain.

In this thesis, I first discuss previous failures in social impact technology dissemination, beginning with the Appropriate Technology movement and continuing with the efforts of multinational corporations that have tried selling into the BOP. Through field research in southern India, I then analyze the current efforts and experiments of small and medium enterprises. Although there are pockets of relative success in the field, there is no truly outstanding scalable and financially sustainable model for dissemination. There are multiple reasons for this, including the expenses taken on by manufacturers when they attempt to establish and operate their own distribution channels and the lack of technology aggregation, which has the potential to lower dissemination costs.

Finally, I describe my experiences co-founding Essmart, a rural distributor of social impact technologies. This effort is based directly on my field research. Essmart's goals are to bridge the gap between global manufacturers of social impact technologies and rural end users. The venture gives rural retail stores access to technologies that improve their customers' lives.

Through months of reflective practice, I have come to recognize the importance of building mutually beneficial and mutually dependent relationships with BOP stakeholders. This is one of the most important ways to create and ensure social impact at the Bottom of the Pyramid through innovation.

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Commonly Used Abbreviations

AT.....	Appropriate technology
BOP.....	Bottom of the Pyramid
FMCG.....	Fast-moving consumable goods
HUL.....	Hindustan Unilever
iDE.....	International Development Enterprises
MFI.....	Microfinance institution
MNC.....	Multinational corporation
NGO.....	Nongovernmental organization
SME.....	Small and medium enterprise
UN.....	United Nations
UCID.....	User-Centered Innovation Development
UNDP.....	United Nations Development Programme
RENE.....	Rural Energy Network Enterprises
SHG.....	Self help group
SSF.....	Sri Siddhanta Foundation
VLE.....	Village level entrepreneur
WEF.....	World Economic Forum

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1 Introducing the Problem of Social Impact Technology Dissemination for Bottom-Up Development

When I was an undergraduate student at MIT, “doing international development” meant participating in the following process. First, register for D-Lab, an academic program that introduces engineering students to technology design for development. Then, invent an ingeniously simple new technology for the rural poor. Next, apply for a fellowship or grant from the MIT Public Service Center or the MIT International Development Initiative. Use the money to visit an international field site and attempt to implement a short-term service learning project over the summer and winter vacations. After testing your technology in the field, return to MIT and build a team around your new invention. Compete for cash prizes in the MIT IDEAS Global Challenge or the MIT \$100K Business Plan Contest to further prototype development. If dedicated enough, start a nonprofit organization or for-profit social enterprise to finally implement your technology upon graduation.

This university-initiated pipeline encouraged budding engineers to apply their technical skills to address issues of global poverty and environmental sustainability. Over time, MIT students have produced an diverse array of compelling, innovative technologies for development, including a bicycle-powered corn sheller, an off-terrain wheelchair that uses levers to shift gears, multiple non-electrified household water filters, a solar-powered parabolic cooking stove, and many more.

MIT’s world of international development may sound unique, but it is really just a microcosm of a larger technology, business, and social movement for innovation-based initiatives aimed at poor communities, households, and individuals at the Bottom of the Pyramid (BOP)¹. Since the early 2000s, there has been an explosion in innovative technologies and business models for low-income end users.

Evidence of bottom-up, innovation-based development is seen in a globally lauded incentive and support structure for it. International competitions such as the Dell Social Innovation Challenge focuses on product design for low-income users. Business plan competitions hosted at academic institutions boast “emerging markets” or “social business” tracks. Organizations like Echoing Green fund fellowships for social entrepreneurs. Philanthropies like The Rockefeller Foundation award money to ventures that specifically innovate to achieve social missions. “Social impact investment funds” now evaluate companies’ fiscal and social bottom lines. The World Bank Institute and

¹ The “Bottom of the Pyramid” (also known as the “Base of the Pyramid,” the “BOP,” the “Next Billion,” or the “Next 4 Billion”) has been relabeled and redefined by multiple authors. Despite the semantics, the shared concept of the global poor as a market for new technologies remains constant.

USAID offer grants for innovation-based solutions to development. In 2010, the Indian government even established the National Innovation Council, which seeks to “discuss, analyze, and help implement strategies for inclusive innovation in India” (National Innovation Council, 2010).

Obviously, there is a growing commotion around bottom-up, technology-based, entrepreneurial-driven development efforts. However, as the late Alice Amsden noted, investment in grassroots innovation does not align with economic development at the grassroots level (Amsden, 2012). There is a gap between number of technology-based solutions for the BOP and the amount of social impact these solutions are actually having. I witnessed this divergence through my experiences with MIT’s D-Lab and my research in rural southern India: while D-Lab was creating technologies designed for the poor, in the field these technologies are not known, not available, and not making an impact.

Technological invention is not enough. Technologies must get into the hands of end users, or else they are designed in vain. Previous efforts were not good enough. In the early days of designing technologies for development, dissemination was driven by charities and nongovernmental organizations (NGOs). Their efforts were project-based, limited in scale, and limited in funding. Many nonprofits fail to sustainably impact poor communities through technologies because they cater to donors, not end users. It was not uncommon to hear anecdotes about hosting well-publicized ribbon-cutting ceremonies for new technology programs but failing to train users or provide long-run maintenance due to the lack of incentives and funding scarcity.

Afterward, multinational corporations (MNCs) tried a heavy-handed selling approach, but their inappropriate business models and lack of community-level connections did not result in successful technology dissemination either. Now, small and medium enterprises (SMEs) are attempting to commercialize life-improving technologies for the BOP in a way that is scalable, financially sustainable, and embedded at the local level. They are still having problems. Players in the innovation-for-development space are just now beginning to recognize the need to innovate *how* they get new technologies into the hands of the people they were designed for.

My research addresses the following questions: First, *why* have previous attempts to disseminate technological innovations to the BOP been unsuccessful? Second, *what* business models for dissemination for social impact technologies are being tried, and how are they faring? Third, based on what is learned from earlier efforts, *how* can technology dissemination be done in a scalable, financially sustainable way at the BOP?

I explore these questions through looking at business models for technology dissemination at India's BOP. These examples were collected through qualitative research methods, including interviews and field visits, and secondary research. I then attempt to address the problems of technology dissemination with Essmart, a rural distribution start-up that I co-founded with Jackie Stenson upon my return to MIT. In this process, my team and I progressed through MIT's innovation-for-development pipeline and learned about the necessity of mutually beneficial community-level relationships to build scalable and sustainable business models at the BOP.

Chapter I continues explaining the problems of social impact technology dissemination. Chapter II introduces prior attempts through the Appropriate Technology movement and multinational corporations' BOP 1.0 efforts. Chapter III describes the emergence of small and medium enterprises in this space and explains examples from India. Chapter IV introduces Essmart, a business model innovation for social impact technology dissemination that grew out of this Master's thesis research. Its goals are to bridge the gaps within the innovation-for-development community through relationships with technology manufacturers and rural retail shops at the BOP. Chapter V concludes with reflections about technology dissemination and the global community that incentivizes and supports innovation for BOP development.

Great technologies for the poor in developing countries have emerged and are still emerging from a diverse group of players in the global innovation-for-development community. For these technologies to achieve their intended social impact, they must be disseminated through business models that are scalable, financially sustainable, and based on relationships that are mutually beneficial and mutually dependent at the Bottom of the Pyramid.

1.1 The Hype: So Many Widgets for Development

After decades of failed grassroots-level poverty alleviation initiatives, players at the BOP are still trying to devise successful, scalable, and sustainable solutions for bottom-up development. Innovative social impact technologies for the poor have been given the limelight. These technologies – sometimes called “appropriate technologies,” “frugal innovations,” “BOP innovations,” or a myriad of other names – include treadle pumps and drip irrigation systems for low-income rural farmers, bicycle and solar powered mobile phone chargers, fuel-efficient smokeless cookstoves, non-electrified water filters, and affordable solar lanterns, among others. These technologies have been the focus of philanthropic organizations worldwide, and they are now being promoted through

design competitions. Universities have adopted them as the core of new programs' curricula. Mainstream media has even given social impact technologies a nod. In 2010, Amy Smith, the founder of MIT's D-Lab, was named as one of Time Magazine's 100 Most Influential People. Celebrities and politicians like Julia Roberts and Secretary of State Hillary Clinton announced a national commitment of \$50 million to the United Nations Foundation's Global Alliance for Clean Cookstoves, which plans to distribute 100 million clean-burning stoves for rural areas by 2020 (Broder, 2010).

The idea of designing technologies for use at the BOP is not new. Its beginnings can be tracked to the 1950s, when conventional post-World War II development schemes were not creating new jobs as expected. Around that time, British economist E.F. Schumacher began thinking about new technologies for non-agricultural job creation in rural areas. The concept of these technologies for low-income populations morphed considerably over time. Their social missions have extended far beyond income-generation to poverty alleviation, environmental sustainability, healthcare, energy, and education. Today, the idea of "design for the other 90%" has been described as a "growing movement." Paul Polak, founder of International Development Enterprises (iDE) and author of *Out of Poverty*, describes the current product design situation as: "The majority of the world's designers focus all their efforts on developing products and services exclusively for the richest 10% of the world's customers. Nothing less than a revolution in design is needed to reach the other 90%." This revolution has begun.

Unsurprisingly, academic institutions are a popular source of technology design. In India, the government-funded Rural Technology Action Group operates on multiple university campuses. Its mission is to involve faculty and students in projects that address the scientific and technological needs of rural organizations. Additionally, nonprofit and nongovernmental organizations focus specifically on technology design for development. Design that Matters, an MIT seminar launched by MIT Media Lab graduates in 2001, is now a full-fledged nonprofit organization that engages in low-cost design for social enterprises in developing countries. The Oregon-based Aprovecho Research Center designs improved biomass cookstove and hosts the annual Stove Camp, a weeklong gathering for cookstove enthusiasts around the world to share knowledge and build stoves.

Other organizations organize or identify grassroots technology innovators from the developing world. For example, The Lemelson Foundation, based in Portland, Oregon, established Recognition and Mentoring Programs in India, Indonesia, and Peru to address these issues by

discovering innovations and providing support for inventors and entrepreneurs, such as design prototyping and business incubation. Anil Gupta's Honey Bee Network in Gujarat, India attempts to acknowledge local geniuses and increase the informal knowledge network through a database of over 100,000 locally produced ideas, innovations, and knowledge practices.

There are hundreds of organizations designing or identifying innovative, social impact products for the poor around the world. The appeal of technology-based solutions for the BOP is understandable. Compared with the slow, nontransparent interventions of public policy and community mobilization, these technologies are tangible manifestations of hope that can, in theory, have an immediate social impact. Their design processes are inclusive of do-good designers, engineers, and students who want to become involved in grassroots development projects. As a result, these widgets for development are easy to generate buzz around in the Western world of aid, philanthropy, and public service.

1.2 The Failure: Technological Innovations Fail to Impact Lives Because They Do Not Move from the Lab to the Land

There is a very distinctive problem with social impact technologies for bottom-up development. No matter how well-designed they may be, there is no guarantee that these social impact technologies will reach the millions of people for whom they were designed. Technology dissemination, not technology invention, is the real challenge to impacting lives of the BOP through innovation.

As of yet, no organization – public, private, or nonprofit – has painted the big picture of how to move these technologies out of the lab and into the land. Globally, philanthropic and government-funded initiatives have failed to disseminate technologies in ways that are sustainable, scalable, and replicable. For example, the Indian Institute of Science's Centre for Sustainable Technologies has been developing clean-burning cookstoves for the past 35 years. From 1983 to 2002, the government embarked on the unsuccessful National Programme on Improved Chulhas (Cookstoves). The program was considered a failure. The custom-built stoves were not appropriate for customers' energy needs or cooking habits, and scalable dissemination was impossible because stoves were made on-site by local artisans and entrepreneurs. Quality control and user education were nonexistent, program administration was cumbersome, monitoring was nil, and government subsidies for the stove seemed to decrease use and maintenance. Plus, there was no accountability

for poor program performance (Barnes, et al., 1994; Jagadish, 2004). Who is to say that the UN's Global Alliance for Clean Cookstoves will not suffer from many of the same problems?

Technology-designing organizations are only recently beginning to recognize dissemination as a significant problem. Programs like the MIT International Development Initiative began offering Technology Dissemination Fellowships in 2010 to allow for “targeted dissemination and transfer of appropriate technologies developed at MIT in recent years” (MIT IDI, 2012). Afterwards, MIT D-Lab's Technology Dissemination Program was established in 2011 “as a response to key issue within international development and social entrepreneurship: despite a high level of excitement, engagement, and talent among academic and research communities, too many development technologies still fail to reach their potential for social impact at scale” (MIT D-Lab, 2012). In Spring 2012, MIT D-Lab offered its first D-Lab: Supply Chain class to encourage undergraduates to design ways to make D-Lab technologies available to end users.

Outside of MIT, there are even more proponents of innovations in technology dissemination. For example, Daniel Schnitzer, founder of a company dedicated to creating clean energy supply chains in Haiti, reiterated the problem statement in his November 2011 TEDxTalk in Pittsburgh. He explained that “inventing is the easy part” but “getting your product to people who can benefit from it the most” is the real challenge (TEDxTalks, 2012). The simple concept is gaining traction; Schnitzer's talk has received over 175,000 views on the TEDx website. Another influential supporter of innovations in dissemination is iDE founder Paul Polak. In September 2010, he wrote on his blog:

“Over the past 30 years, I've looked at hundreds of technologies for developing countries. Some provided elegant solutions for challenging technical problems. Some were big and clumsy. Some were far too expensive. Some of were beautifully simple and radically affordable. But only a handful were capable of reaching a million or more customers who live on less than two dollars a day. If you succeed, against all odds, in designing a transformative radically affordable technology, you still have addressed only 25% of the problem. The other 75% is marketing it effectively, which requires designing and implementing an effective **branding, mass marketing and last mile distribution strategy.**”

1.3 A Possible Solution and its Limits: Business Model Innovations for Last-Mile Dissemination

As engineers tinker away at their newest widgets for development, for-profit companies are attempting to apply business acumen to the BOP. Quoting Vinod Khosla, a billionaire venture capitalist and co-founder of Sun Microsystems: “There needs to be more experiments in building sustainable businesses going after the market for the poor. It has to be done in a sustainable way. There is not enough money to be given away in the world to make the poor well off” (Bajaj, 2010). Since the early 2000s, MNCs have been viewing the poor as tremendous market opportunities. This idea, popularized by C.K. Prahalad in his 2004 book, *The Fortune at the Bottom of the Pyramid*, has received support from other scholars like London and Hart (2004), Anderson and Markides (2007), Arnould and Mohr (2005), Seelos and Mair (2007), and Vachani and Smith (2008).

When seen as potential consumers, the BOP is a “latent market” (Prahalad, 2004) for affordable and innovative products that satisfy unmet needs. Market-based activities serve a dual purpose. First, they benefit the BOP by increasing this population’s access to new products. Second, companies profit from serving this vast, untapped market (Chatterjee, 2009).

Designing technologies for the poor and selling technologies to the poor go naturally hand-in-hand. If executed properly, their melding would address many problems with charitable-based efforts of technology design and dissemination. If technologies are sold to poor end users through market mechanisms, incentives are aligned so that technology suppliers are accountable to end users.

A market-based model also generates profits that can be reinvested into the company or returned to investors. The potential to generate profits leads to increased investment sums and the eventual scaling up of a company’s technology-based development efforts. This is something that nonprofit organizations could never achieve unless they solicit donations.

Thus, companies have seen that the prospect of selling innovative technologies can, in theory, be win-win for all involved parties. Low-income populations have a large number of unmet needs. If someone designs low-cost products addressing these needs, then latent demand will be brought out. Selling the products at scale is relatively easy because there are an incredible number of poor people.

This approach has been attempted, but most have fallen terribly short. Doing business in the BOP is not that easy! A February 2012 New York Times’ article about technologies for development raised the following questions: “How do you build a market for a technology focused on people

with no money? How do you physically get it to where it needs to be? How do poor people acquire it? How can it be adopted on a wide scale? How do you make it last?” (Rosenberg, 2012).

These are questions that companies have been trying to answer. MNCs led the first wave of marketing social impact products to the BOP, but they failed because of their sell-at-all-costs mentality that alienated them from local communities. SMEs are now leading the second wave of social impact technology dissemination. Organizations that design technologies, such as academic programs and design-centered nonprofits, have spun out small and medium enterprises to sell technologies in a manner that is theoretically more economically sustainable and scalable than donor-funded programs. Some SMEs call themselves “social enterprises,” which loosely means that they apply business principles to pursue social missions².

Social enterprises’ efforts are being recognized by international organizations as innovation-based, market-oriented solutions that hold the key to scaled social impact. The World Economic Forum’s Technology Pioneers of 2012 includes four startups that deliver some type of product or service for the Bottom of the Pyramid (WEF, 2011). Examples of these innovative SMEs include d.light, the small-scale solar LED designer that was born in Stanford’s Entrepreneurial Design for Extreme Affordability and KickStart (previously ApproTEC), the Kenyan manufacturer of the Super MoneyMaker, a treadle pump that can pull water from its ground source and push it uphill.

However wonderful this sounds, SMEs are struggling just like the MNCs that came before them. Achieving economies of scale and generating profits – or at least covering costs – is difficult but necessary to make a long-term, transformative, social impact. A prior winner of the MIT \$100K Business Plan Competition Emerging Markets Track has decided to disband all manufacturing of its technology to focus exclusively on sales and distribution, according to an internal employee. In a different example, EGG Energy a company that develops battery technologies, has shared its struggles with the marketing and pricing of its battery rental service. If the company fails to capture new customers, then its current estimates for growth, scale, and economic viability are useless.

Since profitability in the BOP is based on the low margin-high volume equation, scale is imperative for SMEs to achieve economic viability. Unfortunately, reaching more customers is immensely difficult for these firms, as they are generally not financially endowed. Financial bootstrapping from the startup phase is assumed, and there not much room for failure. SMEs’ social impact technologies are sold at a price that is low enough for target low-income end users to afford,

² Like nonprofit organizations, social enterprises have social goals. Like traditional commercial enterprises, social enterprises must achieve financial sustainability through profits from sales, even though their main objective is not to maximize profits (Yunus, 2007).

but the price and volumes need to be high enough to compensate for the firms' many costs: transactions costs of doing business with poor, fragmented markets, transportation costs of reaching rural areas, high costs of customer acquisition such as advertising for push-products, poor and nonexistent distribution systems, variable costs of capital and, sunk costs of research and development, and fixed costs of running a business. To stay financially viable, SMEs may cut important services like after-sales service, which sets up their own demise in the long-term by tarnishing their brand. Even competition between SMEs with similar offerings can result in driving down the price of their technologies. When this happens, no SME is able to scale.

Needless to say, failure is a very real possibility for a new SME entering the BOP space, no matter how well intentioned they are. This is especially true if they do not consider how to overcome or are ignorant of the very real, very costly on-the-ground challenges to doing business at the BOP. The consequences of failure can also be costly to society; every entrepreneurial failure is a waste of the limited global investment that is set aside for international development purposes. In reality, despite the hype, only a handful of companies have successfully disseminated social impact technologies to BOP markets. These initiatives are, in Prahalad's words (2004), "but islands of excellence in a sea of deprivation and helplessness."

1.4 The Context: Rural India, Where Difficulties and Social Innovation Abound

To explore the innovation-for-development space, I turn my attention towards the environment and examples in India. Statistics about India's Bottom of the Pyramid are both delightful and frightful. On one hand, the numbers can be read as a gigantic opportunity. India's BOP is defined as households in the bottom four expenditures quintiles that spend less than US\$75 per month on goods and services. This represents a whopping 114 million households (CDF-IFMR, 2004). The future holds even more promise. Analysts predict that consumers earning over US\$5 a day will increase from 50 million to 150 million by 2020, and the dynamics of rural consumption are changing rapidly in the favor of businesses. As a market, India's rural BOP market in India is huge and growing quickly.

On the other hand, India's BOP is highly fragmented and riddled with obstacles. There are 627,000 Indian villages spread over 3.2 million square kilometers (Anderson and Markides, 2007). Commonalities across villages include financial hardships, domestic constraints, difficult living

conditions, and lack of basic information for making informed decisions. Income levels are low and volatile, and ready access to financial institutions and services is unavailable. Restricted mobility and limited travel patterns slow the dissemination of knowledge. Language and literacy variations across regions prevent cost-effective marketing and communication materials. Because of variations in settlement type, income levels, expenditure, and culture, households at the BOP have unique preferences. Therefore, successful marketing to the BOP requires a high degree of expensive product customization (Shukla and Bairiganjan, 2011).

Financial hardships and difficult living conditions understandably shape the attitudes that households at the BOP have about new products. Compared to “pull” products like fast moving consumer goods that require little demand stimulation, socially useful products offered in BOP markets are “push” products. These require enormous effort and resources to scale demand and communicate the added benefits to potential consumers. It is of no help that there are currently no prominent mass media communication channels to reach the BOP and no brands targeting rural consumers across multiple product categories. BOP consumers may deny or not recognize their latent needs. They pursue fulfillment of more tangible needs because of historical purchasing decisions, product associations, conventional wisdom, and limited, volatile budgets. They also avoid making independent purchasing decisions for new products when the products have no social backing from trusted opinion leaders or social circles (Shukla and Bairiganjan, 2011).

Not only do customers shape the challenges of working in the Indian BOP space, but the operating environment – the “sea” in which firms swim – also creates obstacles for companies. In some cases, ill-planned, poorly executed, and intermittent government schemes have adversely affected BOP customers, priming them to avoid market-based initiatives. Experiences with shoddy products and government subsidies have skewed customers’ perceptions about the quality and price-points of new cooking stoves, making the implementation of a long-term market-based solution difficult. Rural markets’ lack of infrastructure, such as roads, water channels, electricity and communications, also creates barriers to entry for all products in terms of the physical flow of goods and information about new products. Geographical challenges like extreme weather conditions and hostile terrain present transportation and storage requirements, and sparse population density of India’s hinterland prevents easily attainable economies of scale.

This is the context where bottom-up, innovation-based development efforts are now being pursued. These initiatives are bolstered by the nation’s long history with technologies for rural development and a robust social sector, which is possibly the world’s largest and encompasses about

3.3 million nongovernmental and nonprofit organizations (Shukla, 2010). Social businesses have found a home in India, which has been deemed a “hotbed” for social enterprises that pursue social missions through their offered products, services, or supply chains (Clinton, 2010). Furthermore, the President of India declared that 2010 to 2020 would be the “Decade of Innovation” (National Innovation Council, 2010).

Because of the incentives and support around innovation-for-development, India seems like an environment where SMEs would succeed in commercializing social impact technologies. However, although every Indian technology-based SME includes a plan for scaling up, they typically lag far behind their goals. For instance, SELCO India has only installed 120,000 solar home energy systems, and improved cookstove companies Envirofit and First Energy have only sold 300,000 and 475,000 stoves, respectively. This is in a nation where there are over 140 million rural households. Although these SMEs offer innovative technology-based solutions for local populations, they face difficulties reaching more customers, scaling up their businesses, and creating financially sustainable ventures.

1.5 The Methodology: Qualitative Research and Action Research in India

My research addresses the following questions: My research addresses the following questions: First, *why* have previous attempts to disseminate technological innovations to the BOP been unsuccessful? Second, *what* business models for dissemination for social impact technologies are being tried, and how are they faring? Third, based on what is learned from earlier efforts, *how* can technology dissemination be done in a scalable, financially sustainable way at the BOP? Successful bottom-up, innovation-based development initiatives defined as scalable, financially sustainable, and are built on quality, mutually beneficial relationships with other BOP players.

To answer my research questions in the Indian context, I plunged into development efforts in both India and the US. First, I collected examples of Indian SMEs that disseminate social impact technologies to poor end users. I studied these companies’ social and economic goals, strategies for dissemination, and successes and failures. These examples were gathered through qualitative research methods: interviews with social entrepreneurs across urban and rural India; lab visits to social impact technology designers at academic institutions, NGOs, and SMEs; conferences that congregate the major players in India’s burgeoning field of social entrepreneurship; field visits to rural retailers and villages that model themselves after Gandhi’s ideals of village self-sustenance;

presentations given by BOP-targeting entrepreneurs; and secondary research of recent academic papers, published case studies, magazine articles, and more current blog posts.

My second goal was to address the technology dissemination problems that I saw in the field. Upon returning to MIT from my research in India, I co-founded Essmart, a rural distribution start-up that addresses problems in current technology dissemination practices. Essmart aims to bridge the gap between technology suppliers and rural retail stores. Through this process, I entered funding competitions, conducted surveys, ran pilots, wrote business plans, created financial models, raised capital, and essentially became one of the entrepreneurs that I was studying. These activities gave me a unique perspective on entrepreneurs working in the BOP, such as the tension of what they face from the field, where their business operations occur, and what they confront in the lab/boardroom/auditorium, where they are propelled by a funding environment that is disconnected from their target customers. Personal reflection from this eight-month (and continuing) experience has proven crucial to formulating my ideas about social impact technology dissemination and the innovation-for-development space.

This research began as a means to understand the world of international development that I experienced as an MIT undergraduate. Throughout my three-year research and writing process, this thesis has become a reflection on technology dissemination and the increasingly popular movement of innovation-based development efforts. Although it sometimes has the qualities of a passing fad – filled with buzzwords and media hype – there is something substantial here that will leave its mark on the field of economic development, for better or for worse. Significant sums of money are already being poured into inventing new technologies for billions of lives at the Bottom of the Pyramid. However, for this money to not be wasted, these technologies must reach their intended beneficiaries through innovative models for dissemination that are scalable, financially sustainable, and based on mutually beneficial and mutually dependent relationships between different actors at the BOP.

2 Learning from Failed Innovation-for-Development Efforts: The Appropriate Technology Movement and Multinational Corporations

Although the phrase “innovation-for-development” sounds hip and cutting edge, the concept of intentionally inventing technologies for grassroots-level international development is anything but new. For the past 60 years, nonprofit organizations have been designing “appropriate technologies,” which are small-scale, decentralized, labor-intensive, energy-efficient, environmentally-friendly technologies that are “appropriate” for local conditions. In the early 2000s, multinational corporations began designing products and technologies for the Bottom of the Pyramid, too.

In this section, I discuss the background of two innovation-based efforts: the Appropriate Technology movement and BOP 1.0 – the first wave of multinational corporations that attempted to market goods to the BOP (Simanis and Hart, 2008). Their failures are able to provide insight into what can work for social impact technology dissemination for the BOP.

2.1 Inventing Technologies for Development: The Appropriate Technology Movement’s Limited Dissemination Efforts

The Appropriate Technology movement was formulated in the 1950s, produced countless widgets for development from the 1960s to 1980s, and died in the 1990s. Despite its eventual death, the movement did leave a legacy for today’s bottom-up technological innovations and produced lessons for modern-day innovators – namely that scalable, financially sustainable models for technology design and dissemination are required to affect bottom-up change at the BOP.

2.1.1 E.F. Schumacher’s Post-World War II Ideological Beginnings

After World War II, top-down economic growth was the conventional development strategy for newly independent countries. Economic growth required the structural transformation of an economy from a rural, agrarian base to an urban, industrial base. Under ideal circumstances, the new industrial sector would create enough new jobs to absorb the unproductive, surplus agricultural labor that was resulting from fast population growth. The industrialization process was to occur through the mass importation of advanced technologies and the implementation of large-scale,

capital-intensive production methods, and the shift from rural to urban would bring about a net improvement in productivity for the entire economy.

By the 1970s it had become evident that efforts to achieve economic growth through capital-intensive methods of import substitution were failing in these developing countries. In developing countries that attempted ambitious industrialization, the growth of non-agriculture and urban employment had not matched the total economic growth rate or the growth in surplus rural labor (Willoughby, 1990). In certain contexts, only a handful of new jobs were created, and this resulted in emerging urban islands of high productivity but neglected agricultural peripheries (Akubue, 2000).

The mass poverty created by industrialization deeply moved economist E.F. Schumacher. The situation, coupled with Gandhi's visions of *Gram Swaraj*³ and the *Sarvodaya*⁴ movement, encouraged Schumacher's thinking about alternative forms of development that would occur alongside industrialization. He advocated for the creation of non-agricultural jobs in rural areas, which would ameliorate unemployment and reverse rural-to-urban migration.

To support production in rural areas, Schumacher came up with a new breed of technologies called "intermediate technology." Intermediate technology would be labor-intensive, suitable for small-scale operations, and accessible to agricultural sector workers, in the sense that it would be relatively simple to use and easy to finance. Compared to expensive, imported, capital-intensive technology that replaced jobs, intermediate technology would create more jobs. Consequentially, intermediate technology would jumpstart a sustainable process of income generation and wealth accumulation in rural areas through small-scale production.

In a 1965 issue of the *Sunday Observer*, Schumacher popularized intermediate technologies by arguing for a shift in aid policies toward them. In the same year, he founded the Intermediate Technology Development Group (Practical Action, 2011), now called Practical Action, and the Appropriate Technology (AT) movement was underway.

2.1.2 The Rise and Fall of the Appropriate Technology Movement

The AT movement was an ideological, social, and technology movement that developed and promoted "appropriate technology" – the new name for intermediate technology. Appropriate technology was characterized as "appropriate" for local environmental, economic, political, social, and cultural conditions. The idea of appropriate technology was cemented in 1973 by the

³ Self-sufficient but inter-linked village republics with decentralized small-scale economic structure and participatory democracy.

⁴ Literally meaning "universal uplift" or "progress for all," this became the term for Gandhi's ideal political philosophy.

publication of Schumacher's seminal work, *Small is Beautiful*. By the mid 1970s, the average number of appropriate technology organizations created every three years almost quadrupled from the prior decade. The umbrella of appropriate technology was broadened to more fields, including energy, agriculture, and urban renewal (Leland, 2011). International organizations and government departments emerged as appropriate technology inventors, indicating the progression of a small-scale movement to a legitimate technological choice.

However, by the time the 1980s rolled around, the AT movement was already dying down. Funding from governmental organizations had never been much, and donor money was drying up because of the debt crisis and developing countries' push for an export-orientation that neglected the poor. Additionally, because of its small scale and focus on collaboration with local groups, the AT movement was being seen as a disfavored, "passive" method of aid. After the Vietnam War, the American public had a particular distaste for such measures (Pursell, 1993).

The movement was also dying down because technology development, not dissemination or implementation, was the primary focus. Engineers were designing "better mousetraps," but no one was using them (Smillie, 2000). Participants of the AT movement naively assumed that appropriate technology would be readily adopted once end users saw the technology's utility. By not realizing that appropriate technologies, despite their simple designs, benefited from support like training, maintenance, and administrative assistance, organizations were setting up their own demise (Leland, 2011).

In the early 2000s, at the tail end of the AT movement, some organizations attempted to address technology dissemination by practicing aspects of participatory development. This gradually morphed into participation by co-creation, where community members became involved in idea generation, concept evaluation, technology design, fabrication, testing, and evaluation (D-Lab, 2009). The hope was to ensure technology adoption and effectiveness by involving end users in the design process. While these efforts resulted in benefits for the involved communities, the decentralized, small-scale design and production processes were not easily scalable. Neither were they sustainable, as they required larger amounts of donor funding and volunteer work to operate.

2.1.3 Why the Appropriate Technology Movement Failed

By the end of the 1990s, there existed a network of AT organizations, a modest track record of successful projects and field experiments, and an academic literature about appropriate

technology. Major development players were still funding appropriate technology projects, but these efforts existed at the margins.

Ultimately, the AT movement had failed to influence the pattern of industrialization and technological choice in mainstream society, policy, and development initiatives. Today, the AT movement as a historical event is regarded to have been “dead” since the end of the 1990s, although the term “appropriate technology” is still confusingly used with regard to technology-based development. The AT movement failed for many reasons, some of which are included here:

- Technology designers largely focused on technology design, ignoring the processes of technology implementation and dissemination.
- Appropriate technology production processes were small in scale, intensively using local rural labor and materials. Because they used localized technical knowledge and operated at a very small level, the economic opportunities created by the technologies reached too few people to affect widespread poverty.
- Local and international efforts to develop technologies were fragmented, and the wheel was constantly reinvented. Amsden identified the similarities between small-scale technologies for development that were developed in the late 1950s and today (Amsden, 2012). In the popular novel entitled *The Ugly American* (1958), an engineer named Atkins offers his technical assistance with small-scale projects that include a simple bicycle-powered water pump. Similar bicycle-powered technologies are still designed by young engineers today.
- The small-scale, decentralized localized production of technologies led to poor quality control. This led to low-quality, short-lived, unreliable products.
- Related to the issue of quality control: appropriate technologies were seen as inferior, undesirable products for “poor people.”
- Although appropriate technologies were designed to not require elaborate trainings, the lack of holistic support systems for technologies still contributed to their lack of widespread use.
- In an effort to manufacture technological marvels, financial self-sustainability was never a goal. Paul Polak uses the Animal-Drawn Wheeled Tool Carrier as an example. He writes, “... It cost far too much to be affordable to small African

farmers and it relied heavily on donor subsidies for distribution. It eventually died after wasting millions of dollars” (Polak, 2010).

- The AT movement’s funding mechanisms were not financially sustainable in the long run. The movement was led by volunteers from faith-based organizations, engineers, doctors, and students, mostly from developed countries.
- AT movement participants thought that technological change could occur without challenging the established power structures and that people would readily utilize appropriate technologies if they were obviously less expensive and better. Describing the AT movement, Winner writes that “by and large most of those active in the field were willing to proceed as if history and existing institutional technical realities did not matter” (Winner, 1986).
- Some in the field thought that appropriate technology was a “utopian technology” that could “only be successfully applied on a large scale once an alternative form of society had been created” (Dickson, 1974).

2.2 Seeking Fortune at the Bottom of the Pyramid: Multinational Corporations’ Clumsy Attempts at Technology Dissemination

Soon after the AT movement died, an influx of multinational corporations began entering the development space. Although these companies are rooted in a history that is far from the AT movement, they still shape our thinking about technological and business model innovation for bottom-up development. In particular, these MNCs demonstrate how business models can be inappropriate for the BOP.

2.2.1 Tapping C.K. Prahalad’s Fortune at the Bottom of the Pyramid through New Innovations

In 1998, management professors Stuart Hart and C.K. Prahalad were beginning to articulate the idea that low-income populations worldwide could be viable markets. Serving them would not only be profitable ventures but would also create social value for these populations. At the time, the idea of simultaneously generating money and social impact was met with skepticism. According to Hart, the *Harvard Business Review* neither rejected nor accepted his and Prahalad’s introductory article about the Bottom of the Pyramid for three years (Mahajan, 2007).

It was not until after 9/11 did issues of worldwide inequality and poverty become important to business people. In 2002, the journal *Strategy+Business* finally published Hart and Prahalad's article in a special issue that explored the relationship between security and sustainability. In their article, the Hart and Prahalad point to the growing income gap between the rich and the poor, reinforcing their view that the poor cannot participate in the global market economy, even though they make up two-thirds of the world's population⁵. These four billion poor people represent a multitrillion-dollar market but have "remained largely invisible to the corporate sector." The authors write, "Most MNCs automatically dismiss the bottom of the pyramid because they judge the market based on income or selections of products and service appropriate for developed countries."

Prahalad and Hart recognize that "doing business with the world's 4 billion poorest people ... will require radical innovations in technology," and in his seminal work, *The Fortune at the Bottom of the Pyramid*, Prahalad proposes 12 principles of innovation in BOP markets. His recommendations for technological innovations incorporate financial, social, environmental, efficiency, and cultural goals. For instance, Prahalad writes that "product development must start from a deep understanding of functionality, not just form" and that "marginal changes to existing products in Western markets will not work." He encourages innovators to "design products to work in hostile environments" and to "focus on (quantum jumps in) price performance." In 2006, Prahalad slims down his recommendations for technological innovations and focuses on affordability and scalability (Prahalad, 2006).

While Prahalad argued that money can be made by doing business at the BOP, he was not simply encouraging MNCs to squeeze the poor for money. Prahalad was genuinely concerned about economic development, wealth creation among the global poor, and poverty alleviation in low-income communities. His 2004 book includes chapters about reducing corruption and large-scale social transformation through the involvement of the private sector in traditionally social activities. He was trying to marry large-scale social change with the for-profit business world – something that MNCs would have never considered before and that the nonprofit world thought was vulgar.

2.2.2 Creating New Markets with Clayton M. Christensen's Disruptive Technologies

Around the time when Prahalad was publishing, Clayton Christensen, a Harvard Business School professor, was contributing his ideas about technological innovation for the BOP.

⁵ The annual per capita income of this "Tier 4" – based on purchasing power parity in US dollars – is less than US\$1,500, the minimum considered necessary to sustain a decent life.

Christensen is famous for establishing the theory of “disruptive innovation” (Bower and Christensen, 1995). A disruptive innovation is a new technological innovation, product, or service that creates a new market and a new value network while eventually surpassing and disrupting a dominant paradigm. In contrast with “sustaining” innovations, which provide better quality or additional functionality to a company’s most demanding customers, disruptive innovations do not meet existing customers’ needs as well as currently available products or services⁶. Over time and through continuous innovation, disruptive innovations surpass currently available products and services and disrupt the existing market. The theory explains why new firms with relatively simple, straightforward solutions can beat powerful incumbents by creating new markets and without competition. For incumbents to maintain their growth rates and remain competitive in their current markets, diverting money and resources to disruptive innovations is irrational.

In 2001 and 2002, Christensen and Hart began applying the concept of disruptive innovation to the BOP. Christensen argues that BOP markets are in a prime position to incubate disruptive technologies, as they are typically characterized by non-consumption and have been ignored by MNCs (Hart and Christensen, 2002). They write, “In much of the world, people’s basic needs go unmet. In these circumstances, new waves of disruptive technology deployed by companies making a great leap down the pyramid have an extraordinary potential to generate growth.”

By stating this, Christensen provides a framework around technological innovation for the BOP that Prahalad never fully articulates. In their 2002 article in the *MIT Sloan Management Review*, Christensen and Hart put forth the fundamental conditions that lead to the success of a disruptive innovation, which also results in greater social good by creating jobs, generating revenues and market capitalization, and raising standards of living by making available cheap, high-quality products. In 2006, Christensen broadened his idea of disruptive innovation to “catalytic innovation,” defining them as “low-cost and simple but useful services for people whom traditional social sector organizations ignore” (Christensen et al., 2006).

Both Prahalad and Christensen encourage technological innovations that target a previously ignored market. Since Prahalad also cares about creating social benefits through market mechanisms in the BOP, his technology recommendations focus on affordability and scalability. His target customers are the true BOP and earn less than US\$1,500 per year. Christensen’s recommendations are slightly different. They focus on differentiation, not affordability. He assumes that customers have the money to pay for a product that will satisfy previously unmet needs in an unconventional

⁶ One popular of a disruptive innovation was Southwest Airline’s budget airline tickets.

way. As a result, companies that take his advice do not innovate for the poorest of the poor. They often target the economic band that is slightly above the very bottom, which some have labeled the Emerging Middle. This is a viable business strategy that many MNCs are moving into, since no company has figured out how to successfully market to the Bottom of the Pyramid.

2.2.3 Clunky Business Models for Technology Dissemination at the Bottom of the Pyramid

Prahalad and Christensen's theories about the fortune at the Bottom of the Pyramid and the potential of disruptive technologies at the BOP have encouraged many companies to design and sell products to the poor. This has been attempted so much that academics and entrepreneurs in rural areas have begun to lash out against MNCs' efforts. Aneel Karnani of the Ross School of Business has argued that the Prahalad's fortune is just a mirage and that MNCs' BOP initiatives exploit the poor (Mahajan, 2007). Harish Hande, the managing director of SELCO, a solar home lighting company working in rural southern India, has said, "I am shocked, to say the least, that people are looking at the BOP in a very unidirectional way... Sell, sell, sell to the BOP, large markets, high potential growth... As a friend of mine said, many people live in poverty while a few live off poverty" (Karnani, 2005).

While there are high-level concerns of ethics and social impact, there are also have very practical concerns of financial feasibility. The first wave of MNCs' initiatives to sell products – especially goods with a purported a social impact – is considered by many to be a failure. The literature cites multiple reasons⁷, but for the purposes of this research, I highlight MNCs' difficulties with product dissemination.

Because rural distribution channels for social impact products do not exist, MNCs have created self-owned and operated networks. This is harder than imagined. MNCs are accustomed to de-integrating their activities to focus on core competencies (e.g. manufacturing), and they find themselves ill-equipped and floundering when trying to create a distribution network in a foreign environment (Eyring et al., 2011). All of this money and effort is invested in selling just a single product, too. Garrette and Karnani state the distribution problem well:

⁷ Garrette and Karnani (2010) have brought up issues like: 1) MNCs see BOP needs as a market opportunity, even though many BOP individuals are not willing or able to pay for products to meet their needs and 2) BOP initiatives fail to take into account the opportunity cost of capital, which prevents them from attracting capital market investments that can be used to scale up. Thus, only companies with patience and deep pockets can have a chance to be successful at the BOP. Money that is currently invested in companies attempting to work at the BOP is charitable (grants) or "patient" capital from social impact investors.

“In many BOP initiatives, creating efficient and viable marketing and distribution support networks is an even bigger challenge than reducing the manufacturing cost of the product ... Creating socially responsible distribution is essential for the success of market-based solutions to poverty. At the same time, creating a distribution network to reach the poor might be too expensive and contribute to the commercial failure of the project ... Proprietary, exclusive, one-product distribution channels do not enjoy economies of scope and are very expensive, and unlikely to be the solution to the distribution challenge.” (Garrette and Karnani, 2010)

Examples of MNCs’ distribution initiatives that have failed to reach scale include those for Essilor’s low-cost eyeglasses and Grameen-Danone’s enriched yogurt. Essilor sells glasses through its “refraction vans,” mobile optician shops that travel to villages and prescribe and sell eyeglasses to individuals. Eyeglasses cost about US\$4. The company considered scaling up its operations from four vans to 1,000 to reach India’s hundreds of thousands of villages, but in 2010 the MNC was operating only eight vans. Even with donations and sponsorships, the project barely earns its cost of capital.

In Bangladesh, Grameen-Danone embarked on an Avon-like, door-to-door, direct sales model for Shoktidoi, its enriched yogurt to alleviate child malnutrition. The MNC believed that female entrepreneurs, the Shokti ladies, were the only relevant distribution channels. Now, executives now acknowledge this strategy as a failure. Grameen-Danone began with 60 Shokti ladies in February 2007 but was left with only 37 ladies by December 2008. The best-performing Shokti ladies only sold 100 packages a day, which was half the expected sales level. Selling Shokitdoi was not a full-time job, and Shokti ladies are not incentivized to push for more. The company moved its target market away from rural areas and toward more organized retail in urban areas to remain sustainable.

Hindustan Unilever Ltd.’s (HUL) Project Shakti is an oft-cited example of a relatively successful rural distribution network. Established in 2001 with a whopping \$23 million in seed capital, Project Shakti (roughly translated to “empowerment”) uses a female sales force of door-to-door Shakti ladies to sell small packages of personal products like soaps, lotions, and detergent at about a 10 percent margin. Internet kiosks advertise HUL’s product selection at the community level, and through a separate program, Shakti Vani, trained female communicators are sent to

schools and public areas to train and educate villagers. By 2007, Project Shakti covered over 80,000 villages through a network of 30,000 entrepreneurs (Rangan and Rajan, 2007).

However, despite these relative successes, MNCs selling technologies for development cannot learn too much from HUL's Project Shakti. Shakti ladies sell products that already have a considerable amount of demand from the community. They sell a suite of products, not just one, so the costs of customer acquisition are lowered. Additionally, critics have noted that the turnover rate for Shakti ladies is incredibly high – at one point, the rate reached 50 percent within three months (Simanis and Hart, 2011). This could be due to a number of reasons, including the social stigma attached to women selling door-to-door and the limited incomes (about US\$15 per month) brought home by the saleswomen.

Project Shakti's scale was not the consequence of organic growth. In hopes of being the first mover for consumer products at the BOP, HUL followed a resource-intensive push strategy. The company is crossing its fingers, waiting for increases in rural consumption for the long term. Project Shakti has not yet broken even, and few other companies, if any, are incentivized, willing, and able to commit so many resources to a rural distribution effort. Even under the best conditions that include pull products, large amounts of seed funding, and patience, it may not be financially viable.

The nature of BOP 1.0 business models and relationships may have also led to dissemination failures. MNCs have been criticized for using business models that are based on an overly simplified, consumption-based understanding of the rural poor. They aim to “discover” latent markets by picking products that are either super cheap or super different and packaging them properly so that they will sell (e.g. in sachets). By focusing on merely selling to the BOP, MNCs fail to create mutually beneficial, mutually dependent income-increasing relationships with individuals at the BOP. These foreign business models that lack quality relationship building will lead to shallow commitments with the poor, which is not a good long-term strategy at the BOP.

2.3 Thoughts: Settling on the Right Type of Technology and the Right type of Business Model for Dissemination

The Appropriate Technology movement and BOP 1.0 efforts give us some insight into how to improve technological and business model innovations for bottom-up development. On the technology front, improvements have already been made. Today's technological innovations for development are known by different buzzwords (e.g. “frugal innovation,” “inclusive innovation,”

“BOP innovations” “catalytic innovations,” “innovation under constraint,” “reverse innovation,” etc.). At their core, these technologies are similar to appropriate technologies because of their emphasis on financial accessibility and utility to rural end users. However, in contrast with the original notion of appropriate technologies, today’s technologies for development may focus on poverty alleviation instead of income generation, and they are probably mass-produced and not made at the village level. They are also likely designed for scale, which is something that even engineers steeped in the AT tradition have begun to realize as necessary.

Today, most social impact technologies are produced by SMEs. These companies are currently experimenting with different strategies for technology dissemination, and they do not want to fall into the same traps as Appropriate Technology organizations or multinational corporations. Compared with AT organizations, SMEs need to be scalable and financially sustainable to stay in business. Compared with MNCs, SMEs have fewer financial resources but possess the innovative qualities of a start-up, are more adaptable to the local context, and are willing to embed themselves next to their customers, interacting directly with them instead of through an intermediary like a nongovernmental organization. Successful business models for social impact technology dissemination may be found among the current efforts of these SMEs.

3 Innovating Business Models for Technology Dissemination: The Examples of Small and Medium Enterprises in India

The Appropriate Technology movement is dead, and BOP 1.0 is a failure. Although some academics look forward to a BOP 2.0 reboot (Simanis and Hart, 2008), I believe that more attention should be paid to the small and medium enterprises working at the BOP instead. At this moment, these SMEs are experimenting with a plethora of diverse business models and strategies for social impact technology dissemination. This is particularly true about SMEs in India, which is a nation that has been deemed a hotbed for social entrepreneurship and for technological, social, and business model innovation (World Bank Institute, 2012).

In this section, I write about the SMEs that are innovating for bottom-up development. First, I discuss the emergence of these SMEs – a brief history of bottom-up development, the recently coalescing ecosystem that incentivizes and supports innovation, the innovators who establish companies, and the transformative process of ideas to businesses. Then, I describe and reflect upon the many examples of social impact technology dissemination that SMEs are furiously testing out in India. No one has discovered the silver bullet of technology dissemination at the BOP, but there is much to be learned along the way.

3.1 Calling All Innovators: How Innovation-Based Small and Medium Enterprises Come Out of the Woodwork

SMEs that work at the Bottom of the Pyramid do not appear out of nowhere. It is nearly cost prohibitive for MNCs to do business at the BOP, so how much more difficult must it be for less-endowed SMEs! Through my interviews with entrepreneurs working in India, it became evident that the innovation-for-development ecosystem plays a significant role in establishing, supporting, and growing these businesses. Because their relationships affect their scalability and financial sustainability, it is necessary to understand the ecosystem in which SMEs develop.

3.1.1 Starting the High-Level Development Dialogue

Development experts have long debated the effectiveness of bottom-up/small-scale/marginal interventions, which come from decentralized entrepreneurs, creative inventors, and political reformers, versus the effectiveness of top-down/large-scale/transformational interventions,

which emanate from the policies and recommendations of an elite of political leaders and outside experts. There were multiple turning points in the debate, which dates back to the 1940s and 1950s, when the investment-heavy “Big Push” was advocated as the way to get countries out of poverty by permanently raising growth. In the 1950s, Hirschman’s theory of “unbalanced growth” partially endorsed marginal transformation, while P.T. Bauer in the 1960s criticized “Big Push,” centralized planning, and extreme government interventions. In the 1980s, structural adjustment programs revived the debate about top-down reform, and recently post-Communist countries in the 1990s were confronted with the choice between shock therapy and gradualism (Easterly, 2008).

In the 2000s, the “Big Push” mentality resurfaced with the United Nations Millennium Development Goals. Some development economists, led by Jeffrey Sachs (2005), emphasized foreign aid to governments as the single solution to achieve them. But this was in direct contrast with the development literature, where there was a new focus on rigorously evaluating small-scale interventions. Randomized evaluations have pointed to the relative success of bottom-up, often technology-based interventions for poverty alleviation. These small-scale initiatives could bypass the “necessary conditions” like “good institutions” that seem to be required for top-down interventions to be effective. They could bypass corrupt bureaucracies altogether.

According to Easterly, there are two types of development practitioners: the “planners” and the “searchers” (Easterly, 2006). Central planners cannot end poverty. Only economic and political searchers can end poverty through trial and error, getting feedback on what works, and expanding ones that work in an unplanned way. Easterly mentions C.K. Prahalad’s book, *The Fortune at the Bottom of the Pyramid*, as an example of how “the searchers in a free market do much better than aid agencies in solving specific problems of the poor.” Other searchers include Hindustan Unilever, which brought antibacterial soap and hand washing education programs to rural India, and Muhammad Yunus, who invited microcredit in Bangladesh. Easterly advocates for NGOs, private firms, and social entrepreneurs to become involved in the development space, providing more endorsement of bottom-up, potentially technology-based development initiatives.

3.1.2 Creating an Ecosystem of Incentives and Support for Bottom-Up Innovation

Searchers and their bottom-up, innovation-based development efforts have been gaining traction. But where will these searchers come from? What would draw them out of the woodwork? Why would they choose to focus their innovativeness on development if their outside options are more lucrative and respectable? The innovation-for-development community has offered two

responses. The first is awarding cash prizes for the “best” innovative solutions to global problems. The second is creating a broader ecosystem of support from programs and partners. Both contribute to incentivizing innovators and legitimizing their work by bringing them attention and money to support themselves.

3.1.2.1 Awarding Cash through Competitions

In a 2003 workshop report entitled “Invention and Innovation for Sustainable Development,” which was sponsored by the MIT School of Engineering’s Lemelson-MIT Program, participants make the following short-term recommendation:

“Awards and prizes with large cash sums should be established to motivate inventors and innovators everywhere to focus on sustainable development. Prizes could be sponsored by well-known institutions, and should be given high visibility through media channels. Prizes should focus on serving as incentives for solutions to large problems, and the prize money should also be applied to the commercialization and dissemination of the new solution.” (Lemelson-MIT Program, 2003)

There are now many awards for aspiring innovators that come in the form of competitions, challenges, grants, and fellowships. Multilateral institutions and governmental organizations have gotten into the act. For example, the World Bank Institute hosts the Global Development Marketplace, a grant program that “supports the testing and scaling up of innovative ideas” (World Bank Institute, 2012). USAID hosts Development Innovation Ventures, which “aims to find and support breakthrough solutions to the world’s most important development challenges – interventions with the power to change millions of lives at a fraction of the usual cost” (USAID, 2012).

Educators at academic institutions have also organized competitions to incentivize student innovation for real-world problems. Case in point is the MIT IDEAS Global Challenge, which completed its 11th year in the spring of 2012. The competition has awarded over \$400,000 to over 74 teams (MIT IDEAS Global Challenge, 2012). Another example is the Indian Institute of Technology, Madras (IIT-M), which hosts Genesis, a business plan competition that is about “initiating innovations that combine enterprise with social responsibility” and offers Rs. 4 lakhs (US\$7,500) as cash prize money to winners (Genesis, 2012).

Philanthropies have also spun their typical grant programs into competitions. For example, the Rockefeller Challenge will award up to nine \$100,000 grants in 2012. The Rockefeller Foundation recognizes that “innovation in its modern forms is the key to solving many of today’s problems” and states that “finding and supporting innovations that will make an impact over the next 100 years will be the central component of all ... [its] activities” (Rockefeller Foundation, 2012). The Deshpande Foundation, spearheaded by Indian-born Gururaj Deshpande, supports emerging social enterprises by giving them money and the chance to test their ideas in the “Hubli Sandbox,” a rural area in northwest Karnataka (Deshpande Foundation India, 2012).

Highly competitive awards are also available for individual entrepreneurs. These include the Echoing Green Fellowship, which provides more than \$2 million in seed support to emerging social entrepreneurs each year. Typically just less than one percent of applicants are selected to receive up to \$90,000 over two years to support the launch of their new organizations (Echoing Green, 2012). Echoing Green has funded inventor-entrepreneurs like Jodie Wu, the MIT mechanical engineer who founded Global Cycles Solutions in Tanzania.

As participants of the 2003 Lemelson-MIT Program predicted, competitions, cash prizes, and grants have incentivized innovation for development, drawn attention to such pursuits, and given more credibility to individuals who choose to become inventor-entrepreneurs. The seed funding and media exposure that innovators receive from these competitions is helpful for getting started, but companies often find themselves in need of more follow-on funding to scale.

3.1.2.2 Supporting Innovators through Programs

Cash prizes are just one way to incentivize innovation-for-development. On their own, the monetary amounts are too small to make a significant impact. Additional funding and non-financial support are needed as long-term support for innovators working at the Bottom of the Pyramid.

Business incubators help a great deal. One example is Villgro, which incubates, funds, and supports early-stage, innovative social enterprises in southern India. Since 2001, Villgro has supported 55 enterprises and secured Rs. 200 million (US\$3.7 million) in follow-on funding. Its portfolio has included Servals Automation Ltd, a Chennai-based company that invented a kerosene and plant oil cooking stove, and a bamboo mat-weaving machine that mechanizes the weaving process for rural artisans⁸ (Villgro, 2009).

⁸ Villgro is supported by the Lemelson Foundation, which has a specific mission to support technologies. Hence, its portfolio is mostly filled with inventions, as opposed to other organizations’ portfolios.

Social impact investing is another emerging sector that supports bottom-up innovators and entrepreneurs. Social impact investors are “interested in the pursuit of *both* financial and social/environmental returns together” (Goldmark, 2011). One social impact investor is Gray Ghost Ventures. It has invested in companies like Promethean Power Systems, which makes solar-powered refrigerators to cool milk at remote collection centers throughout India (Gray Ghost Ventures, 2012). Another example is the Omidyar Network, which has invested in d.light (Omidyar, 2012).

India’s academic institutions are also supporting innovation-for-development through new programs. For example, IIT-M established the Centre for Social Innovation and Entrepreneurship (CSIE) in 2010. The CSIE offers a social entrepreneurship minor to students and encourages faculty to create socially conscious projects around their research interests (CSIE, 2011). In an interesting move, MIT and Tata Trusts have joined forces to create a new university in India called the Tata Centre for Technology and Design. Its mission will be “to create a new discipline, and a new breed of engineers and faculty trained to overcome severe resource and cost constraints to create compelling, affordable new products and services delivered to underserved markets” (Foley, 2012).

Finally, India’s national government has also become a proponent of innovation-for-development efforts. The most telling manifestation of support is the National Innovation Council (NInC), which was approved by the Prime Minister in 2010. NInC exists to “discuss, analyze, and help implement strategies for inclusive innovation in India and prepare a Roadmap for Innovation 2010-2020.” The NInC put forth this statement that relates to technological innovations:

“We need to create a new model of Inclusive Innovation for India which can provide solutions for the people at the Bottom of the Pyramid. India needs more ‘frugal innovation’ that produces more ‘frugal cost’ products and services that are affordable by people at low levels of incomes without compromising the safety, efficiency, and utility of the products. These innovations should also have ‘frugal’ impact on the environment to be sustainable in the long term. This model can lead the way in solving the challenges of development, demography and disparity for developing economies the world over.” (National Innovation Council, 2010)

The NInC incentivizes innovators for bottom-up development in two ways. The first incentive is an Innovation Challenge. In 2011, the NInC challenged innovators to “reduce drudgery for the working class population” (Planning Commission, 2012). An IIT-M team was one of the winners. The NInC’s second incentive is “risk funding, with which to seed early-stage ideas and

expand successful ones.” One of NInC first initiatives is the India Inclusive Innovation Fund, which will be capitalized to an eventual Rs. 50 billion (US\$940 million). Presently, the Fund’s proposal is under discussion with the Ministry of Finance (National Innovation Council, 2011).

As seen from these examples, a support system for innovators is being built on the ground in India. Through the cross-sector integration of financial and non-financial support, these are even more reasons to innovate for bottom-up development at the BOP.

3.1.3 Drawing in New and Old Innovators for the BOP

The incentives and support systems seem to be working. The 2012 Dell Social Innovation Challenge received over 1,700 entrants, and the MIT IDEAS Global Challenge grows in participation and funding each year. These new innovators, equipped with a sense of idealism, a post-9/11 disillusionment, an increasing global awareness, a worldwide grumbling over economic inequality, a difficulty in finding conventional jobs, a desire to “be the change they wish to see in the world,” and a knack for creating a ruckus through social media are acting at the forefront of the movement for bottom-up, technology-based development initiatives at the BOP.

These new players enter the international development community through different means. Due to egging on from their educators and the availability of funding for their projects, university students are designing affordable, low-tech tools for the BOP while being exposed to grassroots development. Designers and engineers fill the social sector’s technological innovation gap by applying the design process to solving social problems. Leading design firms are now working with community organizations to design new technologies for the poor⁹. Business students who are excited about creating simultaneous social and economic value find themselves entering business plan competitions that target social ventures.

Innovators come from developing countries, too. Indian inventors and entrepreneurs are known for their *jugaad*, which is the Hindi word that has been loosely translated as “the gutsy art of overcoming harsh constraints by improving an effective solution using limited resources” (Radjou et al., 2012). While inventors are often nurtured in the country’s top-notch technical and management universities, there are also programs dedicated to recognizing rural inventors. One example is Anil Gupta’s HoneyBee Network, which is a database of over 100,000 locally produced ideas, grassroots innovations, and traditional knowledge practices (SRISTI, 2004).

⁹ The contribution of designers to bottom-up, technology-based development efforts was recognized by the Cooper-Hewitt Design Museum, which opened an exhibit in 2007 called “Design for the Other 90 Percent” (Cooper-Hewitt, 2007).

3.1.4 Progressing from Innovation to Enterprise

There is a certain path that innovators travel as they progress from having an idea to establishing and running an enterprise. For many, the journey starts at a university, where student-innovators have access to funding opportunities and resources. From here, innovators start with a seed of an idea, build a team, visit their field site, enter competitions, win small pots of money from these competitions, gain press, win fellowships, and raise follow-on funding from investors.

After they win competitions and before they raise more significant funds, innovators begin operations in the field. Their work likely begins with pilots and small experiments – activities of true searchers as they figure out what is effective on the ground. For SMEs that design and manufacture a technological innovation for development, the field is where they learn that dissemination is much more difficult than invention. This where most of the real innovation happens: on the ground, away from the funding world. Business models for dissemination are what make or break a technology-based SME for development.

3.2 From the Lab to the Land: Current Technology Dissemination Efforts of Indian SMEs

Now that we know where these businesses come from and how they are incentivized and supported, I can describe Indian SMEs' technology dissemination efforts at the BOP. To describe what I have seen and learned, I identify four elements of technology dissemination: 1) marketing and education, 2) credit and financing, 3) distribution, and 4) after-sales service.

Each element is important. Technological innovations for bottom-up development are typically push products that require demand creation. They are durable products that are typically affordable but require some type of financing scheme to align with the ebbs and flows in income of low-income end users. Making these technologies available in rural areas is also a challenge, as is ensuring that they will remain functional in the long run. Broken technologies are worse than having no technologies; not only do they become money sinks and village garbage, but they create distrust around new products in rural areas.

There is still an experimental nature to creating business models for technology dissemination at India's BOP. This is evidenced by the popularity of starting small through pilots or geographically confined operations before scaling up. SMEs create their business models for

technology dissemination from a mix and match of different elements, adjusting over time as they see fit, and dropping elements that do not work for them.

The following sections describe different options for the steps of technology dissemination based off of existing examples in the field. In some cases, it was difficult to tease these elements apart; some business models for dissemination are so integrated that there is little differentiation between, say, financing and distribution, or the choice for one step is heavily dependent on the choice of another. However, I believe that this is a good scheme for understanding the options available to SMEs attempting to disseminate technological innovations for development at the BOP.

3.2.1 Marketing and Education

For many of these social impact technologies, raising awareness and generating demand are the biggest obstacles to scalable and sustainable dissemination. This is particularly true for technologies that target health, which is not as tangible a need as food or shelter. As a result, the costs of customer acquisition are incredibly high. The following are examples of efforts that SMEs have tried to market their social impact technologies, to various successes.

3.2.1.1 Village-Level Demonstrations

In-person, village-level demonstrations are, by far, the most common way to market social impact technologies to the BOP. As I discovered during my surveys of rural retail shop owners as part of my research, just seeing a picture and hearing a description of a new technology is not enough. A demonstration and trial run are required.

Demonstrations occur in different settings. For example, International Development Enterprises India (manufacturer and distributor of its own irrigation technologies) and ONergy (distributor of existing solar lighting technologies) have permanent demonstration centers where technologies are stocked, users are trained, and demonstrations are held. For ONergy, these Rural Energy Centers cover a 10 km radius and reach 30 to 50 villages (CSTS/Ayllu Energy Map, 2011). In another example, organizations like Frontier Markets, a distributor of solar lanterns in Rajasthan, India, set up temporary demonstration centers in commercial areas to draw public attention to their new technologies. Demonstrations may also occur without public fanfare and on a peer-to-peer (often female-to-female) basis, through rural entrepreneurs or sales forces. These types of demonstrations happen in households or at group meetings organized through nongovernmental organizations, microfinance institutions, self-help groups, or farmers groups. Marketing through pre-

existing relationships – or at least, through relationships where the buyers and sellers consider the others as equals – establishes trust among customers who have already been exploited through sales of low-quality new products.

I had the privilege of visiting customers, interacting with rural sales agents, and witnessing rural demonstrations in Thanjavur with the Institute for Financial Management and Research Rural Energy Network Enterprises Green Power Private Ltd. (RENE). Due to organizational issues, RENE shut down in 2011. However, in 2010, the start-up was primarily selling and distributing fuel-efficient, lesser-polluting commercial cookstoves for small roadside restaurants. The company was experimenting with a last-mile distribution channel in villages around the state of Thanjavur, Tamil Nadu.

One RENE demonstration that I attended was a true public spectacle, much to the pleasure of the company's Operations Head. The technology under consideration was an improved tea stove, and it was directed at a restaurant owner whose work consisted of 70 percent tea. He was already using biomass to fuel his stove, as evidenced by the massive pile of timber outside his shop and a nearby pile of coconut husks. RENE's all-male field staff decided to set up the tea kettle against a tree, and the kettle's tall pipe attracted a crowd of 40 to 50 people.



*Figure 1: RENE tea kettle stove demonstration.
(Photo by the author.)*

The water was supposed to require just 20 minutes to boil, but it actually took about 40 minutes. The RENE staff immediately recognized that the wood pieces had to be cut smaller than the restaurant owner had lying around. Someone brought out the machete, and RENE workers sweat as they tried to make the fire burn hotter. Although the demonstration did not appear terribly successful, the salesmen knew that the true decision-making process would occur over the next few days, away from the RENE sales team, and away from the eyes of the public.

A significant amount of time (about two to three hours to make the trip and set up the demonstration), manpower (four RENE

workers), and money (especially on transportation, as these restaurants are far removed from busy commercial areas) was required to conduct a single stove demonstration. The sale was far from being guaranteed, as well. In two months of selling three models of commercial use stoves, RENE had sold 10 stoves through this marketing and demonstration method.

Prior to embarking on selling commercial use stoves, RENE was selling household cookstoves. Because household cookstoves were used in the home, they required a different marketing model. Rural sales agent would conduct a live demonstration with a woman who personally knew 10 to 15 potential customers. The goal was to have these ladies promote the stove among their friends. Using very old-fashioned method of word-of-mouth and demonstrations, RENE was able to sell about 50 household stoves in three months.

Nearly every rural technology dissemination model I witnessed or inquired about included an aspect of in-person village demonstration, regardless of the product or the distributor. As demonstrated from the field visit with RENE, demonstrations require time and human resources, and they are difficult to scale. However, they establish in-person trust relationships, which are essential to the buying decision for new products.

3.2.1.2 Mass Media

Among small and medium enterprises working at the BOP, the use of mass media (television commercials, radio commercials, and newspaper advertisements) is not very common. This is not to say that mass media is ineffective; on the contrary, because it is so effective, it is very expensive. For SMEs that manufacture a single social impact technology, the cost of customer acquisition through mass media is sky high. Additionally, all advertising mediums must be adapted to the regional language, which is another headache that suppliers have to consider when deciding to invest in it.

I came across only one technology-based SME that experimented with mass media to market its product. This company was Envirofit, the manufacturer of improved biomass cookstoves that is headquartered in Bangalore, Karnataka. Envirofit offers a basic and premium cookstove, which are priced at Rs. 850 (US\$17) and Rs. 1,400 (US\$28), respectively. Through interviews with the company's General Manager of India Operations and Senior Manager of Sales and Marketing, I learned that Envirofit's sales strategy is to target the top of the BOP first, where households are aspiring for middle class and would be more willing to buy an alternative to a traditional stove¹⁰.

¹⁰ Envirofit had tried targeting lower income segments, but these customers had to invest 20 to 25 percent of their annual incomes to buy the stove, even though they liked the technology.



Figure 2: Envirofit newspaper advertisement that bundled a cookstove with a phone. (Vijay Karnataka newspaper, July 2010.)

These are households that make Rs. 7,500 to 35,000 per month (about US\$150 to US\$700) – relatively high on the national income scale (Adappa et al., 2010).

Envirofit is trying to reach these households through the existing rural trade network. However, the company has found that for cookstoves to sell through rural retail stores, demand for the cookstoves must be generated so that customers arrive at the stores’ doorsteps. Hence, in the summer of 2010, Envirofit embarked on a mass media campaign. The supplier pulled out a color print advertisement in the Vijay Karnataka, a Kannada newspaper that reaches 70 million people in the state of Karnataka. The advertisement advertised the cookstove as part of a cookstove-mobile phone-mobile minutes bundle,

which was offered through partnerships with telecommunications companies Reliance Mobile and Idea Cellular. The immediate goal was to provide a “carrot” to catch the attention of the household male, who is in charge of the family purse, and offer the cookstove as a “gift” for his wife. The long-term goal was to generate word of mouth around the cook stove.

The newspaper advertisement cost Rs. 250,000 (US\$5,000) to run, which is a considerable sum of money for a new company. On the day that the advertisement was published, there were about 600 calls by the early afternoon. Ninety-five percent of the calls were from men. By the end of the day, there were about 2,000 calls. People had begun to inquire about cookstoves (and not just the mobile phone), and they were redirected to rural retailers.

On July 22, 2010, Envirofit aired a television commercial. The television has about a 50 percent penetration rate into rural Karnataka, which equals about 10 million households. It opens with a father cleaning his tractor (indicative of a higher income household with middle class aspirations). A boy comes back from school and sees his mother coughing as she is cooking above a smoky traditional stove. The boy pretends to cough to get his father’s attention. The father acknowledges that there is a problem with the stove but that he does not know what to do about the problem. His son tells him about the Envirofit cookstove, and the father and son hop onto a

motorbike to purchase the stove. Afterward, there is a 10-second spot about “health and happiness in the home,” which is Envirofit’s call to action against indoor air pollution. Finally, there is a 5-second spot announcing the mobile phone package deal. Similar to the newspaper ad that was run a few days prior, this advertisement targets the household male in both the skit and the cookstove-mobile phone-mobile minutes bundle.

According to the Envirofit’s managing director, Harish Anchan, the product isn’t the problem for sales, but rather the message is. Thus, creating awareness about health benefits from the Envirofit cookstove and generating demand are Envirofit’s main goals. Mass media is the best tool to reach people at scale, and Envirofit hoped to sell between 50,000 to 100,000 stoves in three months because of the advertisement. However, mass media is also costly, and it is not guaranteed to be effective. The Senior Manager of Sales and Marketing was able to cite one inspirational, commercially successful improved cookstove: the BP (now First Energy) Oorja. But when the product launched, BP evidently spent between Rs. 60 to 80 crore (US\$12-\$16 million) on mass advertising and its commercial distribution network. Although the company sold over 400,000 by the summer of 2011 (larger than any SME to date, but still a small quantity in absolute terms), no SME can copy its activities because they lack the funds available to an MNC (Joshi, 2011).

3.2.1.3 Product Co-Identification and Trial-Based Evidence

While Envirofit took the large scale, mass media route for education and marketing its social impact technology, other companies have taken a bottom-up approach that involves future end users in identifying potential products and validating the effectiveness of new products. Take, for example, Villgro Stores, which is the for-profit retail arm of Villgro, the technology-based social enterprise incubator in Chennai, India that is supported by the Lemelson Foundation.

In a short case study written with Villgro Stores’ CEO, Ashutosh Sinha, and Head of Operations, Suresh Shanmugam, I explain how Villgro Stores puts considerable resources into convincing farmers to purchase new, organic agricultural inputs (Jue et al., 2011). Instead of blasting potential customers with advertisements (which they could not do even they wanted to because of the cost), Villgro Stores works with User-Centered Innovation Development (UCID) to identify and validate new technologies before introducing them to stores. This step protects farmers’ economic interests and supports Villgro Stores’ marketing.

Farmers are involved with the co-development of Villgro Stores’ portfolio through problem definition, field-testing, and feedback. Villgro Stores stays up to date with farmers about their

agricultural problems, household and farming needs, and purchasing power and habits. UCID intervenes by searching for appropriate, affordable, and environmentally sustainable products through agricultural exhibitions, print media, and the Internet.

Once a product is discovered, UCID selects experienced farmers to test new products on control and test plots. UCID then captures data like crop height or yield to demonstrate or debunk a new technology's effectiveness. The results are relayed to suppliers as feedback, and successful products are incorporated into Villgro Stores' portfolio.

One obstacle to selling new technologies is convincing end users that they are worthwhile investments. Farmers are wary of products that could reduce crop yields. The UCID trial process provides two unique forms of information for farmers: 1) quantitative data demonstrating the benefit of organic products and 2) testimonials from respected local farmers. In addition to the trial process, Villgro Stores staff and rural sales agents spend significant time explaining their products' economic benefits with farmers face-to-face. Selling proven products in such a personal way under the Villgro Stores brand builds trust, recognition, and loyalty.

The marketing process is long, and it is unique to the business model adopted by Villgro Stores. The company is an aggregator and distributor of new agricultural inputs. In contrast with manufacturers that push their single technology into the BOP, Villgro Stores works with rural end users to understand what farmers need. Villgro Stores' partner, UCID, actively searches for products to solve the problems that farmers already know they have. UCID tests these products to see how well they solve farmers' problems. These solutions have tangible economic benefits, and sales are easier when end users have reason and confidence to invest in them. As a distributor of income-increasing agricultural inputs, Villgro Stores can take on activities that technology manufacturer cannot.

3.2.1.4 Thoughts: Reduce Costs through Aggregation, Educate through Technology, and Market as Aspirational Products

Demand generation is one of the biggest obstacles to commercializing social impact technologies. Most efforts, with the exception of mass media, require in-person contact and serious relationship-building, which sinks time and resources but builds trust and a solid brand. This type of marketing is not cost-effective for single-product distributors, which makes wholesale aggregators able to lower the costs of customer acquisition. Although this complicates logistics (learning about one product is hard enough; try learning about 100), technology has the potential to plan an

important role here. For example, rural sales agents of multiple technologies can be equipped with videos that explain and answer common questions about their vast product catalogue. This would lower costs significantly while maintaining a personal face for the brand.

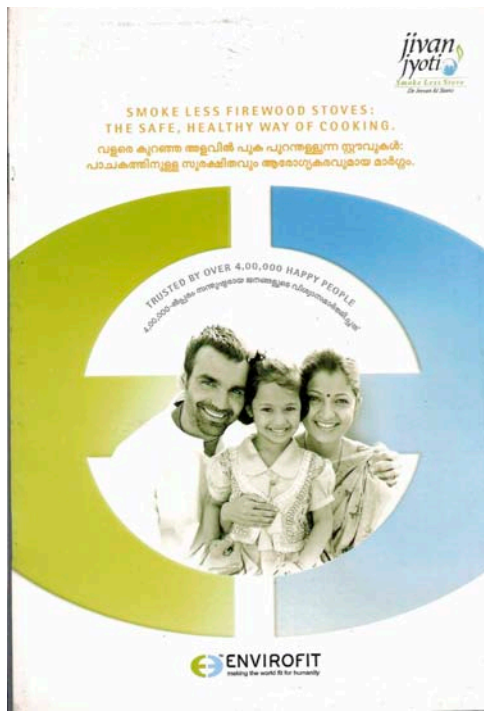


Figure 3: Envirofit's brochures advertise families that appear to be middle-income. (Brochure provided by Envirofit India Headquarters, Bangalore.)

Although I did not personally encounter any technology-based efforts for marketing social impact goods and technologies, many well-known ones are currently operating in the field. For example, Digital Green, a Microsoft research initiative, seeks to “disseminate targeted agricultural information to small and marginal farmers in India through digital video” by using participatory practices for content development and creating a repository of videos that are made by farmers, for farmers (Digital Green, 2008). There exist other potential avenues for marketing, such as via mobile phones, which are ubiquitous even in rural India.

Finally, I noticed all new SMEs advertise their technologies as aspirational products – desirable products for an aspiring middle class, not products for poor people. This is a great first step for encouraging end users to invest in them.

3.2.2 Credit and Financing

For households at the Bottom of the Pyramid, 30 dollars a month may be expensive, but one dollar a day is affordable. One of the greatest takeaways from microcredit and pay-per-use shampoo sachets is that pricing and financing innovations are required to sell anything at the BOP. If an SME requires a low-income customer to buy a solar lantern in full with cash, the solar lantern may not sell. A financing scheme that allows customers to pay back over time is much more appropriate for rural customers’ income streams.

If low-income end users cannot pay for the lanterns in full up front, then where does the financial burden lie? This is the question that SMEs are now wrestling with as they seek ways to finance their customers so that they can sell technologies.

3.2.2.1 Microfinance Institutions

The main purpose of microfinance institutions (MFIs) is to provide financial services in rural areas, where people generally lack access to them. How organizations do this varies from MFI to MFI, but the larger ones have also been called upon as distribution (and customer financing) channels for goods. Many MFIs have already experimenting with leveraging their networks and loaning capabilities to push products like mobile phones, solar lanterns, improved cookstoves, and white goods like televisions, washing machines, and refrigerators (Shukla and Bairiganjan, 2011). For example, the solar lantern company THRIVE has sold roughly 50,000 lights through four MFIs in Northeast India (McAteer, 2011).

One example of a social impact technology supplier that distributes through MFIs to take advantage of their financing capabilities is Envirofit, which distributes through MFIs in addition to distributing through traditional retail networks and large organizations. Envirofit promotes and sells its improved cookstove by partnering with Grameen Koota (GK), an MFI in Karnataka. MFI customers who are interested in purchasing an Envirofit stove can redeem a “stove coupon” for an Envirofit cooking stove at a local retailer. This coupon is worth the deeply subsidized price of Rs. 500 (US\$10). Over time, the MFI offers the customer financial product bundling to help her pay back the Rs. 500 cost. The role of the retailer is limited to redeeming the coupon from Envirofit at pre-fixed rates (Shukla and Bairiganjan, 2011).

Ujjivan is an MFI that is active in urban and semi-urban India – a bit of a different market than most of the organizations discussed here. But still, lessons can be learned from their attempts to push products like Nokia mobile phones, Unilever water purifiers, and solar flashlights. Because of Ujjivan’s reach and rapport with low-income clients, manufacturers actually began approaching the MFI about offering loans with the technologies. When I had talked with someone at the organization in the summer of 2010, Ujjivan was exploring viable business models for financing these technologies. Even though they had not settled on a model, they were learning. For example, Ujjivan saw how loan officers would not push hard on nonfinancial products. Their reason was that they (and Ujjivan as an organization) did not want to be responsible for these products if and when they break. The end user will always associated the product with Ujjivan because of their existing relationship, and maintaining the Ujjivan brand is a must.

There are a few additional issues related to using MFIs to finance social impact technologies. For example, there is little incentive for MFIs to offer loans for technological innovations. The ticket price is very low compared with the other loans that MFIs are accustomed to offering. For

example, Ujjivan was experimenting with loans for Rs. 2,000 (US\$40) solar lanterns and Rs. 1,400 (US\$28) water purifiers. Additionally, these technologies do not generate income for loan receivers. This does not assist customers in paying back their loans with interest, which could be as high as 25 percent per annum¹¹. This high interest rate makes products seem expensive, which is another deterrent to wide technology dissemination.

MFIs have been experimenting with financing end users' purchase of new technologies. However, a more sustainable approach for MFIs that also supports technology dissemination is lending to rural entrepreneurs who sell these types of products. This has already been experimented. Loans are used as working capital and contribute to rural entrepreneurs' larger and more varied inventories. MFIs are more willing to support these loans because they want to be repaid fully with interest, and in theory, income-enhancing loans should facilitate this process.

3.2.2.2 Rural Banks

In addition to microfinance institutions, rural banks can also help finance technological innovations for the BOP. Rural banks exist to provide financial services to populations in rural areas, where most people still borrow from informal sources. However, these banks have traditionally focused on the agricultural sector, which is why they were/are not very open to making loans for new, life-improving technologies.

This mindset can change, though, with the compelling case of solid technological innovation and a forward-thinking SME. SELCO, the company that installs solar home energy systems in Karnataka, India, is famous for innovating customer financing. SELCO is already able to lower the cost of a solar home lighting system by customizing it to the basic needs of a rural household. But the company's core financing innovation is actually "building financing relationships" with different financing organizations, including primarily rural banks (Yale University School of Management, 2010).

When SELCO was founded in 1995, the biggest challenges was convincing rural banks to finance solar home energy systems for poor BOP households, as none of the banks had been in the business of financing any solar lighting technologies. SELCO's first breakthrough was in 1996, when the company convinced Mlabhraba Grameena Bank, a subsidiary of state-owned Syndicate Bank, to offer the nation's first solar consumer-loan program. Loan terms were set at 15 percent down payment, with repayment over 60 months at a 13.5 percent interest rate. Before giving out loans,

¹¹ This interest rate seems high, but the rate varies by MFI. For example, ONergy, a solar energy solution distributor, offers 12.5 percent of diminishing interest (McAteer, 2011). This rate could still be considered too high, though.

SELCO arranged for bank employees to be trained about the company's solar products. The training was to build local branch managers' trust in the reliability of solar technology and to help bank managers help customers seeking a loan. In this model, the bank would send payment directly to SELCO once installation and inspection of the solar lighting system were complete. Bank managers would be responsible to monitor debt repayment, and SELCO could focus on its core strengths of product design, installation, and after sales servicing. Although finding credit institutions to partner with was a high upfront cost, it had a snowball effect on financing for India's entire solar industry.

Altogether, SELCO's financing network includes four commercial banks, nine rural banks, numerous farmer cooperatives, and MFIs. In some cases, SELCO arranged third party guarantors who underwrote loans for SELCO clients without sufficient collateral. Through this network, the SME has installed over 120,000 solar home lighting systems in India (Yale University School of Management, 2010).

3.2.2.3 Technology-Enabled Financing

Much more rarely seen in the field are examples of technology-enabled financing. One up-and-coming company is Simpa Networks, which is headquartered in Bangalore. Simpa, which stands for "simple payment," sells energy solutions on a "Progressive Purchase" basis. Simpa's pay-as-you-go model helps the rural poor buy solar home energy systems, which cost somewhere between US\$200 and US\$400. The technology lowers the system's initial upfront cost and allows the customer to pay for the system in a flexible manner over the course of three to five years. This opens the doors for ownership opportunities.

In the customer paying process, the customer first makes a small initial down payment on a small-scale solar home energy system, pre-pays for the energy service, and then tops up their system in small user-defined increments with their mobile phones. Each payment adds toward the final purchase price, and the system will not work unless the user pre-pays for the energy. This is similar to the pre-paid mobile phone system that most end users are already used to. Finally, when the system is fully paid for, it unlocks permanently and produces energy for free (Simpa Networks, 2012).

In an interview, Michael Macherg, Simpa's Co-Founder, describes that Simpa addresses many issues for commercializing more expensive durable technologies for the BOP. First, many companies that try to provide solutions for lighting end up competing on cost, which results in less

expensive design. However, if cheaper design is pursued, then it's difficult to achieve the aspired amount of energy. The difference between a single solar lantern and an entirely lit-up house demonstrates the point. Solar home energy systems provide higher quality lighting than solar lanterns, and the upfront cost should not prevent rural customers from investing in one. Additionally, the current financing schemes from rural banks for solar home energy systems require customers to pay on a fixed repayment schedule, but this might be hard for some customers to keep up with. Simpa provides more flexibility, and customers can pay back at a rate that suits them (Macherg, 2011).

Simpa is working with SELCO because the Simpa model has the potential to help SELCO scale to different geographies faster. Because SELCO systems are currently financed through partnerships with local financing institutions, it cannot enter an area until those relationships are established. Simpa is a technological innovation that removes the need for these partnerships, and it helps quicken the dissemination of solar home lighting systems offered by SELCO. Simpa has a sales agreement with SELCO to sell 1,000 solar home systems in 2012, growing to over 5,000 systems through SELCO and other distributors in 2013. Simpa plans to have sold 25,000 solar home energy systems with their technology by 2014 (Menon, 2012), but this requires establishing partnerships with other solar home system suppliers. SELCO operates in Karnataka, but other states lack a local analog to SELCO.

3.2.2.4 Crowd-Sourced Funding

With the rise of organizations like Kiva, which allows anyone in the world to make small loans to individuals in developing countries over the Internet, there has been a movement in crowd-sourced funding for initiatives at the Bottom of the Pyramid. New social impact technology distributors have taken advantage of philanthropy by setting up organizations that get their money from everyday donors, not huge foundations, grants, or governments.

Crowd-sourced funding for technology can be strictly charity. One organization that is known on the Boston scene is Kopernik, a nonprofit organization that is “an on-line marketplace of innovative, life-changing technologies designed for the developing world” (Kopernik, 2012). The organization's website showcases about 40 of the latest technologies, and nongovernmental organizations choose which technologies are useful for their geographical areas. The NGOs apply online for funding, and Kopernik vets the request and posts it to the website. Donors can choose which projects to fund, and total funding for a project is around US\$5,000. When funding is

complete, Kopernik ships the products directly to the NGO. The NGO sells the products at a highly subsidized rate to its clients, and this money returns to Kopernik to be reinvested into more projects. Finally, the NGO writes a report about how the technology is being used, and this report is made available to the donor.

Crowd-sourced online funding is also used to fund loans for the purchase of technological innovations for development. This is how Milaap, an MFI, funds its end users. Milaap uses crowd-sourced funding to fund individual borrowers for more expensive ticket items that range from US\$100 to US\$1,000. This includes larger technologies like entire solar home energy systems and entrepreneurial pursuits like the sales of smaller solar lanterns and smokeless cookstoves. After these loans are funded, field partners disburse them to individual borrowers and collect repayments at 12 to 18 percent to their and Milaap's operational costs. Milaap makes monthly deposits of the repaid loan installments into the donor's Milaap account, and at the end of the loan cycle the donor can choose to withdraw the repaid loan amount or relend it to another borrower (Milaap, 2012).

Finally, online donors can support the distribution of technological innovations through the consumption of products that are made in rural areas. This fills the supply chain gaps both into and out of villages. Boond, a distributor of technologies like solar lanterns, water filters, and mosquito nets, uses this model. Online Boond supporters buy handicrafts made by rural artisans at market price (e.g. jewelry and bags), and this money pays for the upfront costs of manufacturing and transport of technological innovations to rural entrepreneurs. Rural entrepreneurs sell the technologies to end users and collect small, low-interest installments. Boond emphasizes that this process is not charity, as online donors purchase a handmade product and can get their money back in one year if dissatisfied or if desired (Boond, 2012).

In these examples, crowd-source funding has been used as charity, microloans, and seed funding through the purchase of rural-produced goods. They are similar in that they all rely on the mercies of people donating their own money. Kopernik and Milaap operate on a project basis, which begs questions about scalability, financial sustainability, and long-term maintenance. Boond operates on a revolving basis, and its model is well thought. However, its operations are overly complex, which may lessen the involved players' profit margins.

3.2.2.5 Rentals

Finally, daily rentals are another way to make technologies available to end users at an affordable price. This can only apply to certain technologies, though – it does not make sense to rent out a cookstove to housewives, but it does make sense to rent out solar lanterns to street vendors.

SELCO realized this and began identifying entrepreneurs to invest in solar lanterns that could be rented out daily to street vendors. These entrepreneurs were able to provide doorstep financing and doorstep service to street vendors, a group of people generally ignored by traditional banking. The same model has been applied to renting out solar headlamps for midwives or flower pickers on a daily or hourly basis. Harish Hande, Managing Director of SELCO, recounts this case:

“This guy (the entrepreneur) in Hasan started with 30 lamps and put the solar charging station on the roof of his house that would charge the batteries used in these lamps. He would charge the batteries daily and rent the lamps to the vendors at 5:30 pm. Then around 9:30-10:00 pm, he would collect the lamps back and INR 12 per lamp that was rented out. The vendors this way would save INR 2-3 per day since they were earlier paying INR 15 to buy kerosene. Soon he purchased another 30 and then another lot of 30.” (Mukherji, 2011)

In 2011, SELCO Incubation Lab, which falls under the organization’s nonprofit arm, began experimenting with its Solar Energy Center. The Solar Energy Center is a solar charging and clean



Figures 4a & Figures 4b: SELCO's Solar Energy Center in Dharmasthala offers solar lantern rentals and mobile phone charging. (Photos by the author.)

water demonstration center. One is located in a low-income area of Bangalore, and another is located in Dharmasthala, which is in rural western Karnataka. Inside the energy center, which is right now a used shipping container, entrepreneurs rent out solar lanterns and batteries. They also offer to charge mobile phones for Rs. 5 (US\$0.10). Drinking water is filtered and offered for free.

3.2.2.6 Thoughts: The Quality-Cost Trade-off, Financing Partnerships, and Technology-Based Financing

The previous examples are just a handful of strategies that SMEs are financing social impact technologies in India. Some of the most successful examples depend on SME partnerships with financial institutions, not the capabilities of the SMEs themselves. Other unmentioned examples include subsidies provided by government programs or bulk sales to institutions.

One takeaway point is this decision between designing mediocre-quality, affordable technologies and providing financing for better, more expensive technologies. This is the difference between a solar lantern, which can sometimes be purchased in cash upfront, and a solar home energy system, which requires some type of financing. To a rural end user, solar lanterns are more affordable, but solar home lighting systems are more powerful, more robust, and more aspired toward. To an SME, a solar lantern is easier to sell, since financing schemes can be risky.

Another takeaway point is that new technology, like that created by Simpa Networks, has the potential to radically change financing for technologies in rural areas. At the moment, though, it only works for solar home energy systems. Mobile phone-based money transfer services also have the potential to shake up this realm. These financial services are successful in places like Kenya and the Philippines, but tight regulations and the lack of a business model have made take-up difficult elsewhere. At the moment, there is no successful, widely used operator in India.

3.2.3 Distribution

In addition to innovating marketing and financing strategies, SMEs have to consider how to cost-effectively make their products physically available in rural areas. Some SMEs organize proprietary distribution channels to sell directly to end users. Others work through the traditional trade network or through small rural distributors whose social mission is to commercialize technologies for development. Still others establish institutional partnerships with organizations that have pre-existing relationships at the BOP.

3.2.3.1 Piggybacking on Existing Rural Networks

Networks that snake through India's rural areas currently exist. They include the existing rural trade network, the national postal service, Coca Cola distribution lines, and milkman routes that could be potential distribution channels for social impact technologies.

The rural trade network seems to be the most obvious to piggyback on, as rural stores are already physically and technically capable of storing and selling products. Companies like Envirofit and d.light have attempted to sell their cookstoves and solar lanterns through the traditional rural retail network of distributors and shops. However, they faced obstacles of demand generation and after-sales service. Shop owners have limited space and a limited attention span. They must attend to customers' quick and immediate needs, and when they push a product they feel like they are ignoring their other customers. As previously explained, mass advertising can be expensive for an SME to pursue. The consequence of no demand generation is that the technology ends up sitting on the shelf. This is particularly harmful in the case of solar lanterns, which lose charge over time. When a customer finally shows interest in a now discharged lantern, she thinks that all lanterns are poor quality. The product then gets pushed to the back of the shelf. Additionally, after-sales service is rarely available to retail shop owners. Retail shop owners will not invest in a product if they believe the quality is bad because they do not want to deal with customers' returns.

Godrej has attempted to sell its Chotukool, a US\$69 low-energy refrigerator, through India Post, the national postal service. Since Chotukool requires demonstrations, the company did not want to distribute through the rural trade network. As part of their four-district pilot, kiosks were set up in post offices for demonstrations. Orders were booked through the post office, and paid for through the post office's e-payment system. A postal van arrived with the product in one week (Jugaad to Innovation, 2011). Although it is innovative, the impact of using the postal service as a distribution network is yet to be seen. At least, the Chotukool does not seem to be reaching its expected target market of India's emerging middle households. According to Hari Nair, Vice President at Innosight, a consulting firm to Godrej, most of Chotukool's buyers are small retail shop owners.

There are still other attempts to piggyback on existing rural networks. Multi Commodity Exchange of India Limited (MCX) started Gramin Suvidha Kendra (GSK) to bring futures information to farmers through the postal service's hub and spoke model. Local youths staff rural post office branches, which are equipped with office equipment and an Internet connection to get updates on latest futures information. In 2007, GSK expanded its offerings to include seeds, water

purifiers, micronutrients, and solar lanterns. ColaLife is a company that wants to distribute social goods like oral rehydration salts, high-dose vitamin A, and water purification tablets to rural India through AidPods. AidPods are wedge-shaped containers that fit between Coca Cola bottles in their crates, taking advantage of the wide distribution network that reaches into India's rural hinterland (Callard, 2011). Finally, Drishtee identifies and creates "milkman routes" that connect 20 to 25 villages in a given rural district. Along this route, Drishtee creates a rural supply chain network to sell products and services (Drishtee, 2012).

3.2.3.2 Rural Retail Shops/Local Centers



*Figure 5: Villgro Store in Gobichettipalayam.
(Photo by the author.)*

Since selling through existing rural retail stores has been difficult, some SMEs have tried establishing their own shops. This is the case for Villgro Stores, a for-profit enterprise that is building a chain of decentralized, brick-and-mortar stores in rural Tamil Nadu. In 2010, most of Villgro Stores' 45 offerings were agricultural, but others fall into the categories of animal husbandry (e.g. animal feed), energy (e.g. cookstoves), water, and personal care (e.g. affordable reading glasses). Villgro Stores' flagship field office is located in Gobi, and 10 Villgro Stores are located within 15 km of the head office. Each Villgro Store has three staff members and five to six village level entrepreneurs, a door-to-door salesman who source products from Villgro Stores and extend them into rural areas that are within eight kilometers of the store. In essence, the store serves as a hub for the village level entrepreneurs (Jue et al, 2011).

Some companies choose not establish a brick-and-mortar store, but rather establish a brick-and-mortar rural branch or local center to sell and service its technologies at the rural level. As of July 2010, SELCO had 23 branches in the state of Karnataka. These branches are located in far-off rural areas, which gives end users direct access to SELCO employees. Take, for example, the Puttur branch, which is located about an hour away from SELCO Incubation Lab in rural western Karnataka. The branch has been operating for the past 15 years, and there are six people working there. The branch employees take care of both new sales and after-sales service for installed systems.

Its technicians install three to four new lighting systems each month and provide service for about 4,000 solar systems in Puttur's catchment area.

Although it makes sense to have a rural presence and space to store inventory, maintaining a store, paying rent, and hiring staff to man it are additional costs that must be covered.

3.2.3.3 Rural Entrepreneurs

Using "rural entrepreneurs" or "village level entrepreneurs" (VLEs) is by far the most common way for SMEs to distribute their social impact technologies. Rural entrepreneurs are both used as a proprietary distribution channel and the main distribution channel for small-scale aggregators. One reason for the overabundance of these Avon-style salespeople is possibly because SMEs are copying Hindustan Unilever's Project Shakti initiative. This could be a poor idea in the long run; Project Shakti is only financially feasible for a company blessed with nearly unlimited wealth and patience.

Villgro Stores has over 40 village level entrepreneurs, and they are so important to the organization that they are called "sales and change agents." Compared with traditional retailers who sell from stores in town, VLEs are advantageous because they have personal connections with customers, know farming (and hence their agricultural products), physically bring products to end users at their farms, and provide services like training. VLEs also bear the economic risks of going the last mile. They purchase products from their associated Villgro Store, store the goods at their own premises, and slowly distribute the goods to their 60 to 100 customers. If a customer fails to pay, VLEs shoulder the burden. An average VLE sells about Rs. 40,000 (US\$800) of products each month. He is paid through a monthly profit-sharing model, profiting about Rs. 2,000 to 3,000 (US\$40 to \$60) (Jue et al., 2011).

Greenlight Planet (GLP) began its Direct-to-Village (DTV) model in 2008, which relies heavily on rural entrepreneurs. When GLP enters a village, it creates awareness until at least one person buys its lantern at market price. This first buyer typically becomes the village's go-to solar lantern person, and GLP offers him the opportunity to become its spokesperson and sell lanterns to other villagers. As a saathi (which means "friend" or "partner"), he earns a commission on sales. As a member of the Greenlight Planet Saathi Network, the saathi does not have to pay any upfront fees, make any initial investments, and does not have to quit his job. His investment is limited to purchasing a small quantity of products to resell to his community members. All saathis are working

for GLP on the side, but the top 30 percent of salesmen make more revenues selling solar lanterns than through their day jobs (Planete d'Entrepreneurs, 2010).

Rural entrepreneurs often come from partnerships between manufacturing SMEs and NGOs/self help groups (SHGs). For example, the field staff members of ONergy's rural energy centers train rural entrepreneurs made available through local NGOs. On commission, these rural entrepreneurs advertise ONergy's energy solutions to the NGOs' other clients. ONergy's field staff provides installation and after-sales service. SHGs similarly provide rural entrepreneurs. SHGs are groups of 10 to 15 women who voluntarily come together to save regular amounts of money individually while contributing to a common fund. In a different example, Adharam Energy Private Limited identifies potential rural entrepreneurs through SHGs. These women give live demonstrations of First Energy Oorja cookstoves and sell them door-to-door by collecting monthly intents of purchase from customers (Kumaresh, 2010). This distribution channel has been widened to sell other products, such as groceries and soaps. HUL also identifies its Shakti ladies through SHGs.

Small social impact technology aggregators like Sakhi Retail and the Shell Foundation-supported Project Dharma also use rural entrepreneurs as their primary distribution channels. Although rural entrepreneurs can reach India's hinterland, they can become difficult to work with if improperly incentivized. Finding quality rural entrepreneurs is not an easy feat. Through my field visit with RENE, I watched as rural entrepreneurs failed to show up at meetings and failed to collect payments on time. I have heard stories of rural entrepreneurs who stop selling in the middle of the month because they are already satisfied with their level of sales. A single rural entrepreneur can only reach a limited number of customers, so achieving scale on the order of millions of customers would require identifying tens of thousands of high-quality rural entrepreneurs. In short, scaling up distribution through rural entrepreneurs is hard.

3.2.3.4 Piggybacking on Existing SMEs

If an SME manages to be somewhat successful at its core competencies, it can become a platform for other technologies. This is what has happened with SELCO, which began expanding its catalogue to include other energy technologies like cookstoves. SELCO recently partnered with Prakti Design, a relatively young enterprise based in Pondicherry, Tamil Nadu, to distribute its biomass cookstoves. The Prakti cookstoves would be co-branded as SELCO cookstoves and sell for Rs. 800 (US\$16) and Rs. 1300 (US\$26), depending on the model (Biswal, 2010).



Figure 6: A Prakti cookstove that is co-branded under SELCO. (Photo taken by the author.)

Similarly, Envirofit began selling lighting solutions, including a hand-cranked LED flashlight. In addition to providing light in non-electrified rural areas, the small flashlight boxes fit into the gaps of Envirofit's shipping containers. Thus, they make every shipment more profitable.

The main difficulty with using an existing SME's distribution network is that its sales agents may be unaccustomed to selling a different technology, or the existing distribution channel

for one technology is not appropriate for another type of technology. Even after two years, SELCO sales agents have not figured out the best way to sell cookstoves.

3.2.3.5 Thoughts: If You Generate Demand for Technologies and Make them Affordable, Technologies Will Get to Customers

The previous examples are the primary models that SMEs use to distribute social impact technologies into India's hinterland. Other rural distribution-related examples include business-to-business sales, which Envirofit switched to after working through the rural trade network, distribution with fast moving consumable goods (FMCGs) distributors, and new technologies that ease distribution logistics. Envirofit's business-to-business sales now include deals with local governments, large corporations, and the state-level forest departments (Joshi, 2011). United Villages, an MIT alumnus-founded company that has established a distribution network for very rural stores in the state of Rajasthan, has shown interest in moving social impact technologies through its FMCG network. And another MIT alumnus-founded company, Logistimo, has developed mobile phone software to support rural distribution and supply chain management.

One important lesson from these examples is that a distribution channel is just a channel. Many products already make their way into rural India without a unique distribution process. The two main differences between these products and social impact technologies are that they are in high demand and they are financially accessible (e.g. mobile phones and Coca Cola). Therefore, SMEs should establish marketing and financing first and then choose a distribution channel that makes sense for them. It would be unwise to invest in a fleet of vans or motorbikes to move social impact technologies without ensuring that they have paying customers.

Lastly, any innovations in the physical distribution of goods must be radically different than what is currently being practiced. One potential innovation is crowd-sourced delivery, which is a concept that has been experimented with by courier companies like DHL. However, translating that model to a rural setting with limited technological capabilities carries a lot of risk.

3.2.4 After-Sales Service

When an SME sells a social impact technology but does not provide after-sales service, it actually negates the technology's potential benefit to end users. Broken technologies take advantage of poor end users' already limited budgets, and they become village litter. This is one reason why the selling into the BOP has been criticized: companies seek to sell products, which end up breaking, instead of providing long-term solutions, which last.

Providing after-sales service is expensive at the BOP, where there are few trained technicians and a limited widespread availability of spare parts. However, after-sales service is important because it maintains long-term benefits to end users and an SME's brand.

3.2.4.1 Manufacturers' Warranties

Some of the lower-cost social impact technologies, like solar lanterns and cookstoves, come with manufacturers' warranties. For example, the d.light S10 comes with a six-month warranty, and the more expensive d.light S250 comes with a one-year warranty. If needed, d.light will replace the lantern at no cost if the warranty is still valid, the warranty card is properly filled out, and the product seal is unbroken. When the six months to one year have passed, the rural entrepreneur or dealer that sold the lantern can order spare parts to repair the lantern – given that there is a local technician who knows how to do this (Ashden, 2010). Likewise, Greenlight Planet's lanterns come with a one-year warranty, and Envirofit's G-Series cookstove comes with a five-year warranty on the combustion chamber and a two-year warranty on all other components (Shell Foundation, 2012).

The difficulty with warranties is making sure that end users keep and fill out their warranty cards. The rural end user or dealer/retailer needs to ensure that this happens. Other than through them, there are no ways to enforce the warranties.

3.2.4.2 Service Centers

Since its beginnings, SELCO has provided a service and not a product. In its mission to provide a holistic solution for rural lighting, after-sales service became a major activity. Now, there is a rural branch/service center within a 50 to 60 km radius of any Karnataka village. All of SELCO's

solar home lighting systems are sold with a one-year service contract, which covers two panel and battery cleanings and one emergency call. Customers can buy an annual maintenance contract when this expires, or they can pay for service on a case-by-case basis. SELCO's products also come with warranties; there is a three-year warranty for the battery, an eight-year warranty for the panel, and a one-year warranty for the light. The company will not sell anywhere where it cannot provide service within 24 hours. (CSTS/Ayllu Energy Map, 2011)

According to SELCO's Manager of Innovations, the actual servicing is very simple. During the first year of free servicing, the technicians can instruct households on basic maintenance (Biswal, 2010). For example, the systems' most common problem can be fixed by simply filling the battery with distilled water. However, despite the simple repairs, providing service is expensive. Traveling to rural homes to check on the home lighting systems and transporting spare parts are huge costs to SELCO.

3.2.4.3 Thoughts: A Necessary Cost with Room to Innovate through Aggregation

Most companies only care about the initial sales, pocketing the cash immediately, and moving on to the next customer. Even among rural consumers, the mindset is one of buy, break, throw away, and buy again – a vicious, costly cycle. Providing high-quality service for geographically dispersed customers is expensive, and SMEs that want to serve the rural poor take on after-sales service as an additional cost that aligns with their social mission.

Some designers and manufacturers have thought about after-sales service in alternative ways. Those with a foot in the AT movement advocate for transparent design that is simple to understand, easy to fix in rural areas, and does not require fancy parts. However, more recent technological innovations for development have taken advantage of high-tech solutions, such as solar lighting panels and patent-pending combustion chambers. It would be unfair to deny low-income end users of these great technologies. Additionally, after-sales service helps brand these technologies as high-quality, aspirational products.

The costs of customer acquisition can be lowered through aggregation, and the same idea can be applied to the costs of after-sales service. This may look like service centers with technicians who can fix multiple technologies and a small stock of spare parts for a variety of technologies. The technology manufacturers can train the technicians, and customers can pay for a customer protection plan or on a per-repair basis.

3.3 Thoughts: Assessing SMEs' Current Technology Dissemination Efforts

As evidenced from this short list of examples, SMEs are experimenting with many different business models and strategies for social impact technology dissemination in rural India. No company has figured out the perfect dissemination model. I have never heard of any technology-based SME disseminating more than 400,000 quantities of their particular product, even though there are millions upon millions of households to reach. Since this is the case, I have the following thoughts about SMEs and social impact technology dissemination:

- **Proprietary distribution channels are too expensive to establish and operate.** Social impact technology manufacturers should focus on their core competencies: technology design and manufacturing. Their funds are already limited, and it is better to stick what they are best at doing instead of thinly spreading their resources over multiple activities.
- **Manufacturers should establish partnerships with like-minded organizations to cover non-core tasks.** This could mean partnering with financial institutions to provide credit for end users or handing off distribution altogether. Partnerships allow organizations to utilize their comparative advantages to the fullest and improve upon their core competencies. It is best to keep operations simple.
- **SMEs' relationships with the BOP should be built on mutually dependent building/economic development.** MNCs built the wrong types of relationships at the BOP, why their business models for dissemination failed. Whereas MNCs used NGO or SHG staff as intermediaries between them and their customers, successful SMEs embed themselves in the local context and grow their businesses hand-in-hand with their BOP customers. The SMEs need the BOP, and the BOP need the SMEs. This is a mutually beneficial relationship.
- **Technologies should be aggregated to lower dissemination costs.** This is particularly true for lowering the costs of customer acquisition and lowering the costs of after-sales service. Information and communication technologies can enable training for both marketing and after-sales service.
- **Marketing and financing must be established before physical distribution channels.** Unless an SME comes across a radically innovative way to distribute

products, it should focus on demand generation and making its technologies affordable to end users. Once the products are pull products versus push products, then distribution channels are easier to establish and effective models exist that can be replicated.

- **Avon-style, door-to-door rural entrepreneurs are not scalable.** Many SMEs are defaulting to using rural entrepreneurs to sell their technology. However, rural entrepreneurs are not a scalable solution. It is difficult to properly incentivize and accurately identify high-quality entrepreneurs.
- **SMEs should use enabling technologies where possible to lower transactions costs.** This includes mobile phone software that eases supply chain logistics and mobile phone payments.
- **Scale is essential to attain to become financially viable, but financing is required to achieve scale.** This is a classic chicken-egg problem, and it is due to the ecosystems that incentivize and support SMEs. Innovation-based competitions award very small pots of funding of US\$5,000 to US\$100,000. Most BOP financial projections rely on rapid scale to break even within a reasonable amount of time, but to reach this scale, SMEs need upwards of a few millions of dollars. There is a huge financing gap that no one – not even the social impact investors – is filling. And unfortunately, social enterprises do not look particularly appealing to commercial investors.

All of these were issues that I had in mind when embarking upon Essmart. I cannot say that we have fully addressed every concern listed here, but we did our best to create a new business model for social impact technology dissemination that is both scalable and financially sustainable at the Bottom of the Pyramid.

4 Essmart: Giving Rural Retail Shop Owners Access to Products that Improve Their Customers' Lives

After conducting my first round of field research in India, I returned to MIT with a lot to think about. Technology dissemination was the biggest barrier to innovation-for-development, not technology design. No company, big or small, had figured out how to reach individuals at the Bottom of the Pyramid as either customers or beneficiaries of technological innovations. It was not to point out the problems that I saw in each model. For me, a more interesting – and perhaps more impactful – project was to address some of these issues through a different model for technology dissemination at the BOP.

In October 2011, my journey with Essmart began. Essmart is a for-profit technology distributor that gives rural retail shops access to technologies that improve their customers' lives. Our work will begin in the third-tier southern Indian city of Pollachi, Tamil Nadu. Essmart's business model is based on the research and experiences that my Co-Founder, Jackie Stenson, and I acquired in the field. Like me, Jackie's original interest in technology for development was born in MIT's D-Lab. As an engineer trained at Harvard, she wanted to be a technology designer. But after spending two years in Africa working for technology-based organizations, Jackie also saw that dissemination of technologies was a bigger problem than their invention. She pursued her Master's degree at the University of Cambridge, focusing on rural sales, marketing, and distribution strategies in Eastern Africa.

Over the course of eight months, Jackie and I have worked through multiple iterations of Essmart's business model, assembled a team, reached out to advisors, applied for funding, surveyed and piloted in India, wrote business plans, given pitches, and competed in competitions. The experience has taught me much about Boston's innovation-for-development ecosystem, which before I had only observed as an outsider. Because of Essmart, I had the opportunity to go through the social entrepreneurship pipeline, taking advantage of the resources provided by this local ecosystem. This network of supporters and funders continues to propel Essmart forward on the US side, through money and through public recognition, which we hope will be beneficial in the long run.

Despite the recent positive feedback in the US, I recognize that our true measure of success is found on the ground, where we must match the momentum that we experience here. We will return to the field this summer to continue what I believe is most important for us, as non-Indians

working in rural India: building relationships with our partners working at the Bottom of the Pyramid and strengthening our relationships with our India-based team.

4.1 Essmart: Company Overview

4.1.1 Problem: Disconnect Between Essential Technology Manufacturers and Rural Retail Shops

The technology manufacturer d.light, based in Delhi, northern India, designs high quality solar lights that cost on average US\$15 and are sold to low-income customers in rural, off-grid areas. d.light's exclusive use of door-to-door salesmen has failed to achieve their desired market penetration and social impact. As most of their human and financial resources are invested in product design and manufacturing instead of distribution, it is difficult for d.light to independently overcome the fragmented distribution lines that snake across the nation. Similar to d.light, there are hundreds of organizations that make essential life-improving technologies but struggle to ratchet up their scale and grow their customer base.

Meanwhile, 1,500 miles away in Pollachi, Tamil Nadu, Southern India, Javid owns a 400 square meter shop on a main road with 10 other local retail shops. His shelves are crammed full with Coke bottles, toiletries and other consumable goods. Javid's store gives him a yearly profit of

US\$2,500, and every week he spends minimum US\$5 and nearly a full day traveling to Coimbatore to restock his shelves. His customers are local farming households that spend US\$1,000 on retail per year. Javid is looking for ways to distinguish his business from local competition and increase his income. There are 14 million shop owners like Javid in India, and for 90 percent of India's population, these local retail shops are their lifeline to consumer products.



Figure 7: There exists a gap in the global supply chain between technology retailers and local retail shops.

There is a gap between d.light and Javid – a rift between the suppliers of essential technologies and local retail shops that could sell their products. Javid does not know about these essential technologies, where to find them, or how to service them. Essmart offers a solution. Essmart delivers the goods.

4.1.2 Solution: Essmart Bridges the Technology Gap

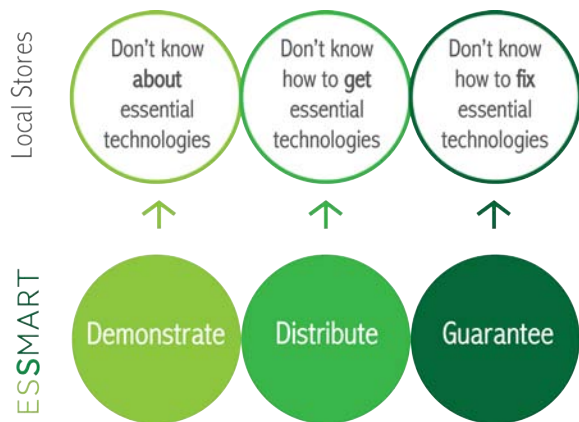


Figure 8: Where Essmart fills the gaps.

Essmart is an essential technology distributor with an embedded retail presence in India’s rural shops, beginning in Pollachi, Tamil Nadu. Our model focuses on the marketing, distribution, and after-sales service gaps by combining process innovations that lower costs in rural areas. We reach end users through the extensive retail shop network that services local communities.

Essmarts’ sales agents establish relationships with rural stores that carry our products, leveraging an existing network and trusted buying relationships. During the first three months after entering a village, our sales agents demonstrate and help retailers sell Essmart products at the rural retail store. This helps establish demand from end users and buy-in from the retail shop owner.

After demand is established, Essmart switches to a traditional hub-and-spoke distribution model. Essmart incentivizes shop owners to stock our catalogue and demonstration products through opportunities to differentiate themselves, higher profit margins, and skills training.

Within stores that are typically smaller than 500 square feet, shop owners keep a catalogue and demonstration products in an Essmart-branded section. End users flip through Essmart’s catalogue and try out demonstration products. When an end user wants to purchase an Essmart technology, she notifies the shop owner. The shop owner then places the order with Essmart via mobile phone. This “virtual inventory” is appropriate for rural shop owners who can spare little room in their shops, and it minimizes Essmart’s inventory and risk.

Essmart then purchases products in bulk from suppliers, who ship the products to our centralized storage facility in the town nearest to the rural retailers. Shop owners can pick up

products at this facility, since they already travel to the city to procure other goods. Alternatively, we can transport the products to rural stores via truck or motorbike.

If a product breaks, end users can bring it back to the rural shop where it was purchased. The shop owner notifies Essmart of the broken product, and on the next delivery cycle we deliver a new product and take the broken product. We are able to deliver the new product by facilitating manufacturers' warranties, which come with all of the technologies that are in our catalogue.

4.1.3 Market Analysis: Huge Potential at the Bottom of the Pyramid

India has an estimated 14 million mom-and-pop retail shops that reach the farthest-flung, rural interior. These local retail shops stock a limited selection of mostly fast moving consumer goods and maintain tight community relationships. They are the portal of commerce for this market segment, as they are the only places where 90 percent of India's 1.2 billion citizens – about 192 million households – purchase all of their goods. According to a report by Corporate Catalyst India, retail is one of India's fastest growing sectors, with an annual growth rate of about 46 percent. Unorganized retail, which primarily consists of local retail shops, is the largest source of employment after agriculture and has deep penetration into rural India. They generate more than 10 percent of India's GDP.

The National Council of Applied Economic Research, India splits rural retail shops' customers into two segments: Aspirer (annual income of US\$2,000 to US\$4,000; typically small shop keepers, farmers, and low-skilled workers in industry and services) and Deprived (annual income of

less than US\$2,000; typically low-skilled to unskilled workers, seasonal or part-time employees). According to Indicus Analytics, rural households spend about 8 percent of their income on fuel and light and 3 percent of their income on durables. Essmart distributes technologies that are designed for these households and fall into these categories. With prices between US\$10 and US\$30, Essmart's technologies fit within rural households' current budgets.

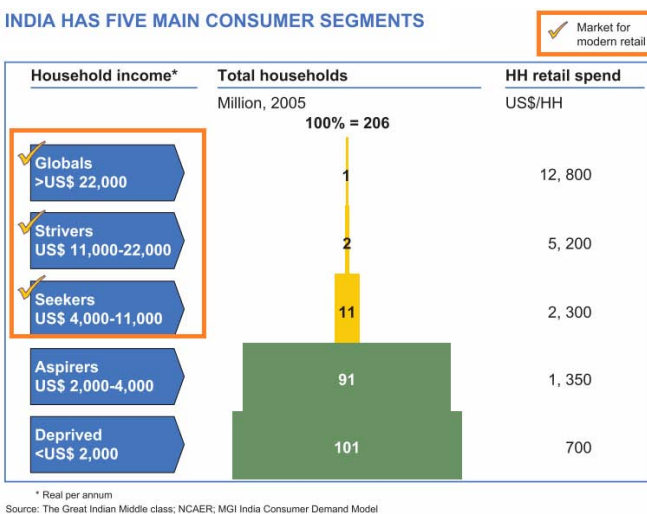


Figure 9: India's consumer pyramid (Mathur, 2011).

4.1.4 Competitive Analysis and Advantage: Essential Technology Retailing through Local Rural Shops

Most competitors in rural distribution push fast moving consumer goods (FMCGs), focus on a specific technology sector, use or use door-to-door village level entrepreneurs (VLEs), or work through nongovernmental organizations for distribution. Unlike Essmart, none of these is a scalable or holistic option for making essential technologies available in rural communities. Compared to these competitors, Essmart has multiple competitive advantages:

1. **Essmart is scalable.** We leverage an existing network of small business owners who already have tight connections with rural communities.
2. **Essmart is specialized.** We focus on technology dissemination, as opposed to manufacturers whose core competencies are in design and manufacturing.
3. **Essmart aggregates many existing essential technologies.** This lowers the cost of customer acquisition, appeals to a wider customer base, utilizes scope to minimize saturation, and gives end users a choice of brands for different product types.
4. **Essmart has internal knowledge about essential technologies.** This gives us the ability to manage our risks by selecting high-quality products.
5. **Essmart has connections with technology designers in the US and in other countries.** This gives us access to innovative products before other distributors know about them.

4.1.5 Social Impact Indicators, Measurement, and Five-Year Projections

Essmart has three main goals: 1) To make essential, life-improving technologies available to rural Indian households, 2) To create a sustainable and scalable distribution model for essential technologies, and 3) To bring new, innovative essential technologies out of the labs and into the land.

Essmart's social impact indicators focus on achieving our first two missions. Indicators for achieving our third mission will be developed once distribution channels are established and we start expanding our catalogue. Our current social impact indicators are:

1. **Number of products sold (indicative of reach):** This indicator directly measures the number of end users that are accessing and therefore benefiting from Essmart’s catalogue. Each Essmart product has its own social value proposition, and each product sold improves the lives of an end user according to that product’s purpose.
2. **Number of Essmart retailers (indicative of scalability):** This indicator directly measures the number of villages in which Essmart products are available and accessible to end users.
3. **Economic improvement of retail shops (indicative of lift):** This is measured by comparing a shop’s average monthly profits before and after becoming an Essmart retailer. Essmart relies on its customers, local retail shops, to make essential technologies available. One of Essmart’s key value propositions for shops is economic improvement. This both improves the lives of Essmart’s customers and also ensures Essmart’s customer base.

Table 1: Five-year project of Essmart’s key social impact metrics.

Essmart’s Key Metrics	2012	2013	2014	2015	2016
Aggregate Facilities	1	9	23	43	71
Products Sold	2,300	105,395	660,445	2,034,050	4,415,200
Retailers Covered	65	1,305	4,500	10,180	18,575
Total Additional Retail Revenue	6	253	1,585	4,882	10,596
Per Retailer Revenue Increase (\$s)	106	400	580	689	757
Per Retailer Revenue Increase %	4.2%	16.0%	23.2%	27.6%	30.3%

Projections are based on Essmart’s analysis and assumptions. Revenue increases are calculated based on Essmart’s profit margins and an assumed US\$2,500 annual income based on January 2012 survey results.

4.1.6 Financial Plan

Essmart expects three revenue streams, with the later two developing after our distribution infrastructure takes place:

1. **Sales of essential technologies:** Products are purchased from manufacturers at a bulk discounts. Essmart sells to retailer shop owners at ~20 percent mark up, who then sell to end users at ~20 percent mark up. In our January 2012 pilot, shop owners received an eight percent margin and were satisfied with this amount, so we assume a 20 percent mark up (or even something slightly lower)

to be more than sufficient. For a product that retails to end users at US\$15, Essmart keeps US\$2 to cover costs and generate profits.

2. **Last-mile transportation for products:** Currently, many shop owners travel to the nearest city to pick up most of their goods, and they have expressed an interest in purchasing more expensive goods from urban centers. Shop owners can therefore pick up essential technology orders from Essmart’s nearest city warehouse, or we can provide delivery to their rural shop for a small fee.
3. **Sales of rural market data to manufacturers and other interested organizations:** Essmart will sell rural market data, including consumer preferences and technology failure reports, to manufacturers. This valuable information is currently not available, and our diverse technology catalogue and tracing of sales allows us to collect this data.

The following table summarizes our economic growth and scale for the next five years. Based on this model, Essmart breaks even after year three (2014). It should be noted that our financial model currently only includes revenues from product sales.

Table 2: Essmart’s pro-forma financial metrics.

(\$000s)	2012	2013	2014	2015	2016
Revenue	28	1,353	9,074	29,902	69,449
EBIDTA	(57)	(244)	(610)	1,040	5,067

4.2 Essmart’s Rationale and Differences from Current Business Models for Dissemination

Essmart’s business model is a distributorship+, with the + indicating demonstrations for demand generation and warranty facilitation to ensure long-term impact. From the viewpoint of someone in the US, Essmart’s operations are nothing new; we are basic our model on a standard hub-and-spoke distribution system, with a few additional changes. However, for people who know the extent of technology dissemination as a problem in developing countries, where most retail is still disorganized, Essmart’s technology dissemination process is noticeably different. Although distributors for social impact technologies currently exist, no one has aggregated multiple

technologies, put them in a catalogue so shops could sell through virtual inventory, and enforced manufacturers' warranties before.

As mentioned earlier, Essmart is a response to the thoughts and concerns that I had about SMEs' social impact technology dissemination efforts. In the following table, I summarize my original thoughts and describe how Essmart addresses each one.

Table 3: Addressing social impact technology dissemination with Essmart.

Concerns with SMEs' Technology Dissemination Efforts	How Essmart Addresses these Concerns
<ul style="list-style-type: none"> Proprietary distribution channels are too expensive to establish and operate. 	<ul style="list-style-type: none"> Essmart fills in the distribution gap so that manufacturers do not have to.
<ul style="list-style-type: none"> Manufacturers should establish partnerships with like-minded organizations to cover non-core tasks. 	<ul style="list-style-type: none"> Essmart takes on the tasks of demand generation, distribution, and guaranteeing that warranties are enforced.
<ul style="list-style-type: none"> SMEs' relationships with the BOP should be built on mutually dependent building/economic development. 	<ul style="list-style-type: none"> Essmart establishes these relationships with BOP retailers.
<ul style="list-style-type: none"> Technologies should be aggregated to lower dissemination costs. 	<ul style="list-style-type: none"> Essmart aggregates technologies in its catalogue.
<ul style="list-style-type: none"> Marketing and financing must be established before physical distribution channels. 	<ul style="list-style-type: none"> Essmart works with retailers to demonstrate technologies in their shops before switching to a hub-and-spoke model.
<ul style="list-style-type: none"> Avon-style, door-to-door rural entrepreneurs are not scalable. 	<ul style="list-style-type: none"> Essmart does not use door-to-door rural entrepreneurs.
<ul style="list-style-type: none"> SMEs should use enabling technologies where possible to lower transactions costs. 	<ul style="list-style-type: none"> Essmart uses mobile phone software to lower supply chain management costs (See 4.2.4).
<ul style="list-style-type: none"> Scale is essential to attain to become financially viable, but financing is required to achieve scale. 	<ul style="list-style-type: none"> Essmart is seeking larger amounts of funding after the innovation-for-development competitions.

In addition to addressing my own concerns, I also want to address the concerns of others. The following are questions that people frequently ask us at networking events, pitching events, and competitions. I answer them to provide a rationale for Essmart's business model and to demonstrate how we are different from current social impact technology dissemination efforts.

4.2.1 How Does Essmart Choose its Technologies?

We choose technologies based on a local area's demand, our team's internal knowledge of their quality (team members have experience working with these technologies and personal connections to technology innovators), their current availability in India (so as to avoid paying international shipping and import fees), and whether the technologies come with manufacturers' warranties.

Our partners, MIT's D-Lab and the Cambridge-based Technology Exchange Lab (TEL), will also help us assess and select which technologies to include in our catalogue. As part of its new Technology Dissemination Program, D-Lab has been developing assessment metrics for different social impact technologies. This information will be useful for us to determine which solar lantern is built best for the local conditions, although we also plan to offer multiple models in our catalogue to get market-based feedback. TEL is a nonprofit organization that provides an online platform where the global community can share and discuss innovative, locally implemented solutions to problems of poverty and sustainability. The organization's database gives Essmart knowledge about technologies that we may have otherwise not known about. We are also beginning discussions about Essmart-TEL technology demonstrations.

4.2.2 Why is Essmart a Distributor and not a Retailer?

We choose to work with instead of against rural retail shops because we want to support rural entrepreneurs, whose revenues will increase by 30 percent in five years if they distribute Essmart's products. This has macroeconomic effects on the nation, as India's unorganized retail sector contributes to 10 percent of the nation's GDP (Corporate Catalyst India, 2009). Additionally, we feel that it is easier to sell products through an existing relationship with rural end users than to create a brand new one. It is also easier for us to work with individuals who are also entrepreneurs, instead of having to train new entrepreneurs with business skills. This retail network already reaches all rural areas in some form, so our model will not be as difficult to scale as the door-to-door retail model, which requires identifying and training new entrepreneurs.

Lastly, there are legal rules in India regarding foreign direct investment in multi-brand retailing. This is currently a hot topic in the political realm, as it is feared that big box stores like Walmart will displace mom-and-pop stores. The US Consulate in Kolkata stated that even US Secretary of State Hillary Clinton and West Bengal Chief Minister Mamata Banerjee discussed FDI

in multi-brand retailing during their May 2012 meeting (Mustafa, 2012). Currently, the Indian government does not allow FDI in multi-brand retailing. However, the industry is quickly changing. In November 2011, the Cabinet approved to open up India's multi-brand retail sector to 51 percent, but there was so much opposition across multiple stakeholders that the decision was suspended and put on hold. The same November 2011 decision removed the 51 percent cap on FDI into single-brand retail outlets (Press Trust of India, 2012). If Essmart eventually wants to open up retail stores, it would be beneficial to establish a rural brand as soon as possible to become first movers.

4.2.3 How Does Essmart Select its Retailers?

Even though there are 14 million rural retail stores in India, we do not want to distribute to every one. Our goal is to only work with entrepreneurial retailers who see the economic and social benefits of working with Essmart. Per village, there will only be one or two Essmart stores. We will identify them through surveys and word of mouth, as well as observations. More entrepreneurial retail shop owners will likely have a storefront with many product advertisements, for example.

Harvard's Center for International Development's Entrepreneurial Finance Lab has been developing new screening technologies for entrepreneurs in low-income countries. These tools, which include psychometric testing (Entrepreneurial Finance Lab, 2012), could also be useful to Essmart for selecting retailers.

Essmart is currently in discussion with the Sri Siddhanta Foundation (SSF) as a potential retail partner. SSF is a Chennai-based nonprofit organization that focuses on village development. Its recent initiative, Gramothan, includes chapters in Bangalore, Delhi, Calcutta, and Mumbai. Gramothan Resource Centers are located throughout India, in the states of Tamil Nadu, Jharkhand, Maharashtra, Orissa, West Bengal, and Uttar Pradesh. Managers within SSF are presently very interested in bringing essential technologies to villages, which is why the organization serves as a potential collaborator. Essmart would work with SSF to run product demonstration and to retail Essmart's catalogue through their for-profit arm in their Gramothan Centers. In the future, we may seek to work with SSF to train rural youth for servicing broken technologies.

4.2.4 How Does Essmart Lower Advertising, Distribution, and Transportation Costs?

We recognize that these are real costs that are difficult to decrease in rural areas, especially when it comes to physically moving products. For advertising, we will be working with all of our

technology suppliers to train Essmart's sales agents about the technology. This information will be stored in digital format (e.g. video) for sales agents to share with rural shop owners and end users. The manufacturers will also provide Essmart with publicity materials to hand out in shops. Because we aggregate technologies, it may be cost-effective for Essmart to run a television, radio, or newspaper advertisement since the cost of customer acquisition per technology is relatively low.

For distribution, we are partnering with Logistimo, an MIT alumnus-founded company that develops mobile phone-based logistics software that can be applied to small retail outlets in India. Logistimo's software will assist with placing orders, managing and tracking inventory, and reducing overall transaction costs with rural distribution. The software works on any Java-enabled phone, which is most of the phones in India. Essmart is exploring the potential of an exclusive contract with Logistimo for rural retailing.

For transportation, we offer retailers the option of picking up technologies from the nearest-city warehouse, since they already go there to purchase non-Essmart goods. We may also work with Logistimo to test a different type of transport scheme in the summer of 2012.

4.2.5 How Does Essmart Manage its Cash Flow?

Distribution is risky because Essmart has to invest in inventory that may not sell. Having working capital tied up in inventory is a frightening prospect. Ultimately, the goal is to collect money from our shop owners before we have to pay back our suppliers. From our January 2012 surveys, we learned that distributors' golden standard is 15 days of credit after delivery. Since we do not have a lot of working capital, we will attempt to incentivize shop owners to pay in full on delivery, or even a partial amount when shop owners place orders by mobile phone (although this payment will be logistically difficult to collect). Meanwhile, we are asking suppliers to give us 30 days of credit. Also, we are experimenting with different supply chain models and purchasing contracts to address this problem:

- *Pre-orders:* This is the model that is described in our business plan. Retailers only keep a catalogue and demonstration products, which is helpful because they have limited space. After reading through the catalogue and testing the demonstration products, end users place orders with shopkeepers. Shopkeepers place orders with Essmart as they come in, and every set time period, Essmart places orders in bulk with suppliers. When the products reach the warehouse, they are sorted

and shipped to rural shops on a fixed schedule. Although end users will have to wait between one and two weeks for their goods, Essmart's risk is minimized because we know that the inventory will sell. However, this model is only feasible when we are operating at scale, since we need to collect enough orders from retailers to place orders in bulk from suppliers.

- *Consignment:* In this model, Essmart owns all of the goods until they are sold to end users. After they are sold to end users, the retailers pay Essmart and keep a cut of the profits. The consignment model removes the risk from retailers, who would then be more likely to experiment with selling them at first. However, it is incredibly risky to Essmart, who must invest in the inventory and will not earn money until the inventory is sold to end users. Additionally, the retailer has little incentive to push the product, and it is often shoved to the back of the shelf.
- *Retailer-owned:* This is the standard distribution model in which retailers pay for and keep inventory in their shops. Essmart keeps inventory in a warehouse so that technologies can be shipped out on a fixed delivery schedule at a quantity defined by the retailer. In this model, retailers are incentivized to purchase a lower quantity of goods because they do not want to take on the risk. Essmart may have to negotiate buy-back contracts with them to increase their purchases.

Essmart will be experimenting with different models beginning in the summer of 2012 and extending throughout the fall. The ultimate supply chain will likely combine different aspects of these models, and it will depend on end user demand for these technologies, actual locations of Essmart's warehouse and the retail shops, actual transportation costs, willingness of retailers to pay on time, and willingness of suppliers to offer credit. We also recognize that we must be careful as we scale to more stores, more warehouses, and more products, since each of these moves will result in purchasing an as of yet unknown amount of inventory.

4.2.6 Why is Essmart Starting in a Peri-Urban Area, as Opposed to a Rural Area?

Essmart is starting in a peri-urban area because technology adoption diffuses outward from urban areas. It only reaches commercial adoption in rural areas after it becomes popular in urban areas. This is something we learned in January 2012, when we talked with end users who felt more

comfortable purchasing expensive goods from upscale urban showrooms as opposed to very rural shops.

Thus, we are beginning in Pollachi, Tamil Nadu, which is a third-tier city with a small urban center. Our warehouse will double as a showroom, and we will partner with a local retailer to sell our goods. Due to its better infrastructure and higher income levels, Tamil Nadu is an easier market to begin in. We hope to demonstrate successes early on before expanding to more challenging areas.

4.2.7 What is Essmart Doing to Finance End Users?

During our January 2012 pilot, we worked with two retail shops to sell 17 items. These items sold out within one week, and there were no issues about products being too expensive. Thus, because of our target market, direct financing for low-income end users is not yet within the scope of Essmart's activities.

We recognize that in the future, we will have to partner with other institutions and organizations for financing. When we do make that transition, we plan to facilitate relationships between microfinance institutions or rural banks and rural shop owners, not end users. If rural shop owners have access to credit to invest in inventory or to offer credit to their customers, then they can support the sales of Essmart's products to end users.

We have come across individuals in the US who are developing financing schemes for end users that could be implemented through retail shops. These include a layaway scheme in which customers pay for durable items in installments and do not receive the goods until they are paid off in full. This is something that can be experimented with once Essmart lays its foundations as a distribution network, but it is not something that we plan to include in our core activities.

4.2.8 Why is Essmart even Bothering with Guarantees?

It is inevitable that working technologies will fail. When a social impact technology fails, there can be consequences. First, the technology ceases to bring social benefits. Second, it sucks money out of a population that is already poor. Third, it becomes garbage – thrown out onto the road. I have seen improved cooking stoves sit broken in the corners of rural Indian kitchens. Fourth, it wrecks Essmart's brand, shakes customer confidence, skews perceptions around new technologies, and distorts the market for new entrants. For example, I learned that solar lanterns are gaining a bad reputation in Chennai's peri-urban areas because too many low-quality, quick-to-break

lanterns have been imported from China. If Essmart wants to sell higher-quality lanterns there, we will have difficulty convincing potential customers of their improvements.

After-sales service is just as important as initial sales because it sustains the long-term impact and sales of social impact technologies. It also gives us an opportunity to interact with our technology end users, allowing Essmart to collect data on why technologies fail (e.g. user error or poor quality?) and creating a bi-directional learning experience (and monetized data) that we can pass on to our suppliers. This relationship will improve product design and quality and would be a huge improvement on the current situation.

4.3 A Timeline of Essmart's Progress in Boston's Innovation-for-Development Space

Essmart's current business model took over eight months to develop. It has received input from new teammates, advisors, surveys with rural retail shop owners, and a pilot that we ran on the ground in Pollachi, Tamil Nadu. The process of Essmart's development from a vague idea to a more refined idea to an almost-funded reality has been simultaneously exciting, grueling, and rewarding. Much of our recent successes – that is, our recent competition wins – can be attributed to the support system that we were nurtured in.

4.3.1 Fall 2011: Essmart's Beginnings

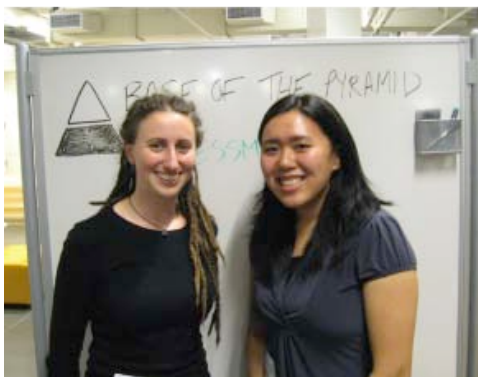


Figure 10: Essmart Co-Founders Jackie Stenson and Diana Jue. (Photo taken by the author.)

Essmart began upon my first meeting with Jackie in October 2011. Joost Bonsen, who teaches MIT D-Lab's Development Ventures and known on-campus connector, was the person who introduced us. After our first lunch meeting, Jackie and I spent the next few hours outlining what would become Essmart.

Over the fall semester, Jackie and I worked on Essmart as part of our assignment for Development Ventures. We met regularly for office hours with Joost, who put us in touch people who had experience in rural India and retail. These included Fellows from the MIT Sloan School of Management and Kopernik, the nonprofit organization that disseminates technologies to local NGOs. We also began meeting with Saida Benhayoune, who had

been recently hired to run MIT D-Lab's Technology Dissemination Program. She put us in touch with others involved in rural distribution around the world, such as Living Goods in Africa and Hapinoy in the Philippines. In addition to phone calls and in-person meetings, Jackie and I attended the Legatum Convergence Conference, which coins itself as "the global forum on entrepreneurship in emerging markets." It was there where we met the Technology Exchange Lab, who we are working with to select technologies.

The fall semester was also our first attempt at raising money for a January 2012 (MIT's Independent Activities Period, or IAP) trip to India. By mid-December, we had raised about US\$8,500 from multiple sources to conduct research and test our model in the field. These cash awards were a MIT Public Service Center and MIT D-Lab IAP Fellowship, MIT International Development Initiative Technology Dissemination Fellowship, MIT Legatum Center IAP Seed Grant, MIT IDEAS Global Challenge Development Grant, and MIT Department of Urban Studies and Planning Emerson Award. Jackie also competed in the MIT \$100K Elevator Pitch Competition. We made it to the finals with high marks from our first round judges, but we did not have the opportunity to pitch at the finals, in front of the large audience.

Around this time, our team also grew. Jackie and I attended and/or pitched at networking events, like Venture Café ("place-based social networking for Boston's start-up set"), MIT IDEAS Global Challenge Generator Dinner, and the Harvard Business School Business Plan Contest Social Venture Track Teambuilding Mixer. At the last event, an undergraduate from Harvard College and a graduate student from Tufts Fletcher School expressed their interest in Essmart. A graduate student from Harvard Kennedy School reached out to us on our MIT IDEAS Global Challenge profile page. These three students became members of our core team.

4.3.2 January 2012: Essmart's Field Work

In January 2012, I traveled around India to learn more about rural distribution, meet with potential collaborators, connect with India's development community, survey rural retail shop owners, and run a pilot in Pollachi. It was a jam-packed month that was also chronicled on the MIT Public Service Center blog.

To learn more about rural distribution, I talked with other rural distributors and listened to insights from others who have experience in the field. United Villages, another MIT alumnus-founded company, is distributing fast-moving consumable goods in villages around Jaipur. I visited its rural operations, which were impressive – the company is delivering basic goods to even the most

remote shops. Staff members at IIT Madras' Centre for Social Innovation and Entrepreneurship (CSIE) gave me their thoughts on rural distribution of durable goods, which were formed through 30 years of field experience. One of these staff members had worked for Villgro before moving to the CSIE, so he had been exposed to plenty of efforts that attempted to distribute technological innovations for the poor. Then I spoke with the CEO of Villgro Stores, who had worked with BP to distribute its Oorja cookstove. He spoke mostly about the design challenge, not the distribution challenge, and argued that financing was more important than distribution.

I also had the opportunity to attend the Deshpande Foundation's Development Dialogue (DD), which was held in Hubli, northern Karnataka. The Deshpande Foundation is headed by Gururaj Deshpande, who is a Life Member of the MIT Corporation, the Board of Trustees of MIT. I had met him at a poster conference in the fall, and he (and Joost Bensen) put me in touch with Anup Akkihal, who founded Logistimo. Anup Akkihal secured me an invitation to DD, where I listened to and chatted with well-known Indian social entrepreneurs like SELCO's Harish Hande and Mother Earth's Neelam Chhiber. In general, it was a great networking session that led to contacts with the Sri Siddhanta Foundation and the Centre for Public Policy at the Indian Institute of Management Bangalore.

Although it sounds rather unproductive, I spent a considerable amount of time talking with a number of other individuals and organizations that are actively involved in India's innovation-for-



*Figure 11: Surveying shop owners in Pollachi.
(Photo taken by author.)*

development space. These included social entrepreneurs from India and from abroad, university students who are deciding what career path to pursue, university professors who were roped into social entrepreneurship, and government organizations run out of universities.

Finally, Essmart team members conducted our 200 surveys and ran a pilot of our model with two retail shops. The surveys took place in different areas around southern India: rural northern Karnataka, rural western Karnataka, peri-urban Chennai, Tamil Nadu, and villages around Pollachi, southern Tamil Nadu. To conduct our surveys in western Karnataka, we worked with SELCO Incubation Labs, which is located at SDMIT in Ujire.

Our Pollachi activities were completed with the help of four graduate students from NGM College. The pilot, which involved purchasing products, driving them down to Pollachi, and moving them into local shops, was a success. We worked with two entrepreneurial peri-urban shopkeepers to sell 17 technologies in just one week. The items were given to shopkeepers on consignment, and the shopkeepers were very satisfied with keeping an eight percent margin – a percentage that is considerably lower than what we are planning to offer when we begin operations.

Table 4: General findings from surveys in Karnataka and Tamil Nadu, January 2012.

General Findings: Northern Karnataka and Southern Tamil Nadu	
Villages surveyed:	<p>Tamil Nadu: Kinathukadava, Udumalpet, Samathur, Anamalai, Meenakshipuram, Thamaraikulam, Kovilpalayam, Govundapuram, Ganapathipalayam, and Odayanulam.</p> <p>Karnataka: Benakanal, Mallapur, Anegundi, Sanapur and Gangawati.</p>
Technology preference findings:	<p>Over 40 shop owners expressed interest in carrying our products or catalogue, especially solar lanterns.</p> <p>Demonstrations and good branding are essential for customer buy-in.</p> <p>Retailers prefer to purchase products over US\$10 from a central Esmart showroom. This has motivated our decision to have a nearest-city service and demonstration center.</p>
Distribution findings:	<p>Retailers in villages generally purchased their products from bigger retail stores in urban centers 3 to 20 times a month.</p> <p>HUL's Shakti Retail only had a presence in one village, demonstrating that the other rural villages still need to be tapped.</p>



Figure 12: Esmart's first pilot of 17 items in two Pollachi shops. (Photo taken by the author.)

4.3.3 Spring 2012: Essmart's Competition Season

My return from India kicked off another round of team building and our first serious round of fundraising. Jackie and I participated in New Enterprises, a class offered by MIT Sloan's Martin Trust Center for MIT Entrepreneurship. In that class, we met another Tufts Fletcher student and a MIT Sloan student, who had also heard us pitch at a D-Lab and a Sloan Entrepreneurs for International Development networking event. These two students became core members of our team, bringing our core team to eight people – definitely sizeable for start-up.

For the spring of 2012, our goal was to raise as much money as possible to begin operations in the summer. Our first opportunity to win a prize was through the Harvard Social Enterprise Conference Pitch for Change Competition. We were finalists, and we had the opportunity to pitch in front of a 1,000-person audience. Although we were not one of the judges' top three picks, we did take home the Audience Choice Award. Knowing that the problem of rural distribution resonated with audience members was encouragement enough for us.

For the next few competitions, we came close but ended up not placing. We were third in the region for the Global Social Venture Competition, but we did not make it to the finals (top two travel to the finals). We made it to the finals for the Tufts \$100K Business Plan Competition and the Harvard Business School Business Plan Competition Social Venture Track, but we did not win any money. We were not even selected as MIT \$100K Business Plan Competition Emerging Markets Track Semi-Finalists. With every disappointment, we revamped our business plan and our presentation, making multiple versions for different audiences, and reframing the problem in words that business-minded people or people without experience in developing countries could understand. This was tricky – given the amount of input that we were receiving from judges and advisors, we had to discern what advice to take seriously, what advice to take with a grain of salt, and what is most important to us as Essmart. This is something that we are still struggling through.

Our first big break was becoming a finalist for the Harvard President's Challenge. Only 10 finalists were chosen from a pool of over 170 applicants, and we received US\$5,000 to use on a second pilot in Pollachi. Our next big break came with a US\$10,000 win from the MIT IDEAS Global Challenge – the highest prize amount that was offered. This was so encouraging, and we are thankful to all of the individuals at MIT who have supported us since Essmart's beginnings. Soon after this announcement, we learned that we were selected as finalists for the Dell Social Innovation Challenge, an international competition that had over 1,700 participants this year. In early June,

Jackie and I will be presenting at the finals in Austin, Texas. We are also meeting with Boston-based angel investors, whose support will help us invest in our first warehouse and batch of inventory.

4.4 Thoughts: Establishing Mutually Dependent Stakeholder Relationships with Shop Owners at Scale is Key to Essmart's Success

Finally, my experiences in India and in the innovation-for-development ecosystem at MIT have led me to seriously think about the types of relationships that are required for successful BOP business models. Ultimately, the key to Essmart's success depends on our mutually beneficial, mutually dependent relationships with BOP retailers.

Yes, shop owners are Essmart's "customers" due to the money exchange that happens between us. However, they are also Essmart's primary business partners and, eventually, mutually dependent stakeholders. Essmart's long-term relevance at the BOP depends squarely on the extent that rural retailers believe they have a stake in the company's growth. Essmart obviously needs these retailers to grow and will benefit from their economic success. But retailers must see that the reverse is true, too – that they will reap direct and indirect economic benefits as Essmart grows. The relationships that we establish with these rural shopkeepers must reflect these subtleties.

Most of the literature about BOP partnerships involves MNCs' relationships with local communities, NGOs, MFIs, other civil sector organizations, local governments, and research institutions. Some characteristics from these relationships apply to Essmart's relationships with local retailers. For example, scholars have pointed out that partnerships at the BOP exist to utilize partners' resources: access to technology end users, appropriate capabilities such as being able to retail technologies (London and Hart, 2004), enhanced legitimacy (Jenkins, 2007; Garrette and Karnani, 2010), and enhancing our "social embeddedness," which gives Essmart a competitive advantage that is based on retailers' local knowledge (London and Hart, 2004; Justin et al., 2010).

All of these rationales explain why Essmart should establish relationships at the BOP, but they do not explain why BOP retailers are incentivized to partner with Essmart. Inter-business alliances, like the partnerships that Essmart has with local shopkeepers, are not covered extensively in the literature. In rare occurrences, a WEF report (2009) and a UNDP report (2008) suggest that foreign and local ventures working in the BOP can benefit from aligning complementary investments, pooling resources, building the skills of entrepreneurs, sharing supply and distribution costs, and joining as stakeholders to negotiate with governments and other companies. The example

of International Development Enterprises India has demonstrated that partnerships with existing BOP companies can build supply chains and create positive spillover effects by generating competition and providing jobs (Samad and Swaraj, 2010). But beyond these examples, little has been documented.

Demonstrating Essmart's benefits to rural retail shopkeepers is something that our team has been struggling with. The incentive of increasing revenues is not enough. Entrepreneurial shopkeepers have plenty of other options to make more money, such as offering services like selling bus tickets or recharging mobile phones. These offerings are much less risky for rural shopkeepers to take on than Essmart's catalogue of new products.

Essmart needs to position itself as more than a distributor, and even as more than a distributorship+. Similar to the way that HP provides more to its small business customers than computer hardware, Essmart needs to serve rural retail shops in ways that they currently are not being served, thus enhancing their businesses. In practical terms, so far we have considered offering shopkeeper skills training sessions, as many indicated during our January 2012 surveys that they want to learn how to better manage their inventory and learn how to communicate more effectively. Additional ideas have also included leveraging shops' collective bargaining power to advocate for services from financial institutions (they currently operate independently, but we unite them into an Essmart retailer network), restocking their shelves, and even providing better signage so that they can differentiate themselves from other shops.

The difficulty will be establishing and maintaining these relationships at scale and in a cost-effective manner. One solution might be an extensive use of communication technologies, but we will need to see what is available in the field and appropriate for our retail shopkeepers.

The summer of 2012 will mark the start of an extended period of pilots. We still need to experiment with Essmart's supply chain options, implement Logistimo's mobile phone software with our retailers, and establish procedures with Essmart's sales agents, among many other tasks. Most importantly, we need to foster trust-based relationships with rural retail shop owners and communicate with them about how we can serve them better. Essmart needs shopkeepers' beliefs in its ability to build their businesses. This is the only way that we will have long-term business success at the BOP.

5 Final Thoughts

Today's bottom-up, innovation-for-development movement is not making a huge social impact at the Bottom of the Pyramid. This is not for lack of trying. However, most of the efforts are made in designing technologies, not in disseminating them. No matter how many fantastic widgets for development are created, they are designed in vain if they are not disseminated to end users at scale and in a financially viable way.

In this thesis, I have discussed previous failures in the dissemination of social impact technologies. The Appropriate Technology movement inspired technological design for development, but it barely considered scalable, financially sustainable dissemination. Multinational corporations' attempts to sell social impact products and technologies failed because they focused on selling their way into the BOP. Their relationship with the BOP was somewhat exploitative, and this did not lead to financial sustainability.

Then I took to the field in rural India, where I saw numerous examples of small and medium enterprises experimenting with business models for technology dissemination. No one has been able to achieve a scalable, financially sustainable model yet. There are multiple reasons for this, including the difficulties encountered by manufacturers when they try to create and operate their own distribution channels, the overreliance on door-to-door rural entrepreneurs, who are difficult to identify and scale, and the lack of technology aggregation, which has the potential to lower dissemination costs.

Based on these findings in the field, I co-founded Essmart, a rural distributor of social impact technologies. Its goals are to bridge the gap between global manufacturers of social impact technologies and rural communities. The company aggregates technologies, demonstrates them in partnership with rural retail shops, makes them available in these stores, and facilitates manufacturers' warranties to ensure their long-term social impact.

From my research and fieldwork with Essmart, I came to see the importance of building mutually beneficial and mutually dependent relationships with BOP actors. For a business to remain relevant at the BOP, its customers must have stake in the company's growth. They must *want* to see the company succeed because of the benefits it brings to them. Only then will they invest in a company's long-term presence and operations on the ground. This is why multinational companies failed to make inroads at the BOP, despite their very deep pockets. Their customers did not care whether or not they were there.

Naturally, this lengthy research process has raised more questions for further inquiry. The first question has to do again with the quality of relationships between companies and customers at the BOP. They will necessarily have to be built on trust, since economic returns are not immediate, nor are they enough to solidify a long-term relationship as other obstacles, like competitors, arise. But what does it take to develop trust? How does a foreign company develop trust with local companies? How do the qualities of being an outsider, applied to both an entire organization and to an individual, affect how trust is developed at the BOP? Of course, these questions take on much more color when directly applied to Essmart's relationships with rural retail shops and partnering organizations. I am coming to see my limitations – and possibly my assets – that come with being young, American-born, and female. As our team pursues this venture on the ground, I am aware that careful practice and reflection are required to build Essmart's relationships, which are foundational to the company's growth.

The topic of beneficial relationships can also be applied to the global innovation-for-development community, which could benefit from more collaboration between innovators. Due to the competition-based incentive structure that rewards individual innovators, similar projects compete independently instead of jointly for the same cash prizes. The lack of sharing and growth of egos contribute to the presence many small, similar efforts instead of a few large, concerted ones. How can incentives be shaped to encourage innovative, radical thinking for development while supporting collaboration between innovators?

Although this thesis marks the end of my research as an MIT student, I do not consider it to be the end of my work in technology dissemination and the innovation-for-development community. I look forward to experimenting and learning on the ground through Essmart, and I look forward to someday seeing billions of lives changed by technology innovation and dissemination for Bottom of the Pyramid development.

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